



Research paper

Exploring the effects of sex category, gender roles, and gender stereotypes on one's own, women's and men's driving behaviour in Türkiye and France

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ABSTRACT

Sex category and gender-related constructs have been associated with driving-related outcomes and behavioural differences. This study investigated three research objectives: (1) *the differences in the perceived frequency of driving behaviours between sex categories and countries*; (2) *the differences in the gender stereotypes while driving between sex categories and countries*; and (3) *the mediating role of awareness and endorsement of gender stereotypes in the relationship between gender roles and the perceived frequency of driving behaviours in Türkiye and France*. Data were collected from 901 participants (486 from Türkiye and 415 from France). Results revealed significant cross-country differences, with participants from Türkiye generally being more aware and endorsing stereotypes, whereas participants from France associated this to a lesser degree. In both countries, a higher degree of femininity was associated with higher awareness of stereotypes concerning women drivers. This association was subsequently linked to a greater endorsement of gender stereotypes for women drivers and to more favourable perceptions of women's driving behaviour (i.e., higher positive behaviours and lower aberrant behaviours). These findings highlight the association of both individual and country differences on driving perceptions, suggesting that stereotype-driven biases in driving behaviour perceptions may contribute to gender-based inequalities in road safety.

1. Introduction

While driving can be regarded as a task that is neutral with respect to sex/gender, factors related to sex categories and socially constructed gender roles have emerged as significant topics of interest in road safety research. Globally, differences between sex categories have been reported in many aspects of transport research, from crash involvement (Cullen et al., 2021; Prati et al., 2019) to risky behaviours (Granié et al., 2021) and acceptance of automated vehicles (Torrao et al., 2024). However, these differences have been relatively inconsistent across countries or samples (e.g., Singh & Kathuria, 2021). For instance, crash risk profiles of men and women differ across various types of collisions. All other things being equal, while men are more frequently involved in most categories of crashes than women, women are more likely to be involved in crashes resulting in hospital admission than men (Cullen et al., 2021). These discrepancies underscore the necessity for further

research. In light of this, this study investigates the relationships between sex category, socially constructed gender roles, gender stereotypes associated with driving, and drivers' perceived frequency of their own behaviours, as well as those of women and men drivers. In this context, it is necessary to acknowledge that there is no consistency in the literature regarding the use of sex/gender-related terms. Throughout the manuscript, the following terms are employed: sex category (man, woman), gender roles (femininity, masculinity), and gender stereotypes (awareness, endorsement). In the context of binary sex categorisation, the terms "man" and "woman" were used, as they have been utilised and interpreted to encompass sociocultural dimensions beyond biological aspects (Schudson et al., 2019), including societal and cultural expectations (National Academies of Sciences, Engineering, and Medicine, 2022).

Research investigating sex categories and driving behaviour has revealed several significant differences between drivers (Granié et al.,

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2021). Studies have consistently demonstrated that men exhibit a higher propensity for engaging in risky driving behaviours (González-Iglesias et al., 2012; Karras et al., 2024; Sahu et al., 2024); including excessive speed, violating traffic signals, tailgating, and aggressive manoeuvres, in comparison to women. Conversely, women tend to display more errors (de Winter & Dodou, 2010), follow traffic rules more closely (Castro-Nuño & Lopez-Valpuesta, 2023) and show more cautious and defensive driving styles (Castro-Nuño & Lopez-Valpuesta, 2023; Taubman - Ben-Ari & Skvirsky, 2016), placing greater emphasis on safety and adherence to traffic regulations. These observed differences may be attributed to a combination of factors, from individual to cultural (Granié et al., 2021). For instance, societal expectations and gender roles may be associated with driving attitudes and behaviours (Deniz et al., 2021; Oppenheim et al., 2022; Sullman, Paxion, & Stephens, 2017).

Similar to variations in driving behaviour across different sex categories, studies focusing on gender role endorsement have reported associations between masculinity, femininity, and risky driving outcomes (Albentosa et al., 2018; Oppenheim et al., 2016). Gender roles refer to the socially constructed expectations, behaviours and attitudes that are associated with typical women and men (Bem, 1974). Specifically, they represent the feelings and behaviours that are socially expected from women (indicating femininity traits) or from men (indicating masculinity traits). In the context of driving, higher masculinity has been associated with being more angered while driving (Albentosa et al., 2018) and showing more aggressive behaviours (Deniz et al., 2021; Krahé, 2018), whereas femininity was associated negatively with aggressive behaviours and positively with adaptive anger expression (Sullman, Stephens, & Hill, 2017; Öztürk et al., 2021). While sex categories and gender roles are interconnected concepts, previous studies have demonstrated their effects to be separate and not exhibit interaction effects in road safety research (Özkan et al., 2006; Öztürk et al., 2021). These findings suggest that gender role endorsement may have a more nuanced relationships with driving behaviours than merely identifying with a specific sex category.

Whilst studies have reported meaningful patterns for different sex categories and gender role endorsement on driving behaviour, it is necessary to examine whether these findings are reflected in road users' perceptions of women and men drivers, thus establishing a connection to the stereotypical perception of women and men drivers. Gender stereotypes persist in perceptions of driving ability (e.g., Castro-Nuño & Lopez-Valpuesta, 2023; Degraeve et al., 2015; Kadulina, 2022; Özkan & Azik, 2022). These stereotypes can relate to attitudes and behaviours (Moè et al., 2015; Yeung & Von Hippel, 2008), potentially leading to biased judgements and discriminatory practices. For instance, stereotypes influencing perceptions of men and women drivers have been observed among adolescents (Granié & Papafava, 2011; Öztürk & Akay, 2023) and adults (Pravossoudovitch et al., 2015; Öztürk & Öz, 2025). Research has demonstrated that women are often stereotyped as more polite, risk-averse, and compliant with traffic rules, while men are perceived as more skilled (Pravossoudovitch et al., 2015; Öztürk & Akay, 2023). Özkan and Azik (2022) found that, in comparison to men participants, women participants perceive women drivers to possess better technical driving skills and higher safety motives and to exhibit fewer errors while driving. However, being reminded that women drivers are bad drivers leads women to make more mistakes while driving (Moè et al., 2015).

Notably, the endorsement of these stereotypes varies by sex category and age (Pravossoudovitch et al., 2015). For example, among adolescents, women tend to view women drivers as safer than men, while men perceive men drivers as more skilled than women (Öztürk & Akay, 2023). Furthermore, the endorsement of driving skills for men (i.e., the belief that men are more skilled drivers) decreases with age, while the perception of courtesy for women (i.e., the belief that women are more courteous than men when driving) increases among all participants as they grow older (Pravossoudovitch et al., 2015). This suggests that gender stereotypes associated with driving may be linked to personal

experiences and societal changes.

Differences in various driving-related outcomes across sex categories, as well as the effects of gender roles and gender stereotypes, underscore the importance of investigating these variables. Concurrently, aberrant behaviours, crash involvement, and gender stereotypes reveal a potential contradiction wherein men perceive themselves or other men as more skilled drivers (e.g., Degraeve et al., 2025; Pravossoudovitch et al., 2015; Xu et al., 2018; Yılmaz et al., 2022; Öztürk & Akay, 2023) while also exhibiting riskier behaviours (e.g., Xu et al., 2018) and experiencing more near-miss and crash situations (e.g., Cullen et al., 2021; Regev et al., 2018). This contradiction necessitates further research to enhance our understanding of drivers' perceptions and interactions with other drivers. Examining psychosocial factors related to sex/gender and driving could expand our knowledge in this context. In light of these, the study aims to investigate:

1. The differences in perceived frequency of one's own, women's and men's driving behaviour between sex categories and countries.
2. The differences in awareness and endorsement of gender stereotypes while driving between sex categories and countries.
3. The mediating role of awareness and endorsement of gender stereotypes in driving on the relationship between gender role endorsement and the perceived frequency of women's and men's driving behaviour across Türkiye and France.

Research across different countries is imperative to enhance our comprehension of the aforementioned research questions. Country-level factors, from cultural values to traffic-specific variables such as law enforcement, are known to be associated with driving-related outcomes (e.g., Solmazer et al., 2016; Üzümcüoğlu et al., 2018). Disparities between countries in areas such as road traffic fatalities (World Health Organization, 2023) underscore the necessity for focused cross-country comparisons in driving-related factors such as driving behaviour (Wallén Warner et al., 2011). This study explicitly focuses on Türkiye and France due to their notable fatality rates (6.5 in Türkiye and 4.7 in France per 100,000 population; World Health Organization, 2023) and the disparities evident in their driving populations across different sex categories. For instance, in Türkiye, only 29.4 % of license holders are women (Turkish Statistical Institute, 2021). In France, statistical data indicated that 76 % of women and 91 % of men above 18 years of age possessed a car driving license in 2008 (Demoli, 2014). Although the figures are not directly comparable, they highlight the lower participation of women than men in driving in both countries, a difference that is more significant in Türkiye. Furthermore, a study conducted in France similarly observed a gap in driving where a greater number of training hours have been allocated to women candidates (Anne et al., 2024).

2. Method

2.1. Participants

The study was conducted with a total of 901 drivers, including 486 from Türkiye (249 men and 237 women, $M_{age} = 25.94$, $SD = 9.87$, $Min = 18$, $Max = 68$) and 415 from France (168 men and 247 women, $M_{age} = 41.18$ years, $SD = 13.80$, $Min = 18$, $Max = 75$). The average number of years that participants have held a driving license in Türkiye was 8.08 ($SD = 8.66$), while in France, it was 23.17 ($SD = 14.10$).

2.2. Measurements

2.2.1. Short driver behaviour questionnaire (S-DBQ)

The frequency of aberrant and positive behaviours among drivers was assessed using the S-DBQ (Ersan et al., 2020). This questionnaire included the most commonly occurring and representative driving behaviours from the original DBQ (Reason et al., 1990), the mini DBQ (Martinussen et al., 2013), and the Positive Driver Behaviours Scale

(Özkan & Lajunen, 2005a), and it measures errors, violations, and positive behaviours with 19 items. Participants were instructed to indicate the frequency of their behaviours on a 6-point Likert scale (ranging from 1: never to 6: always) and were required to complete the S-DBQ for themselves, for women, and for men. Although the DBQ is commonly utilised as a measure of self-reported driving behaviour, in this study, it is also employed to assess drivers' perceptions of men's and women's driving behaviour. While this application is not common, previous research has validated this approach by measuring drivers' perception of their own and others' behaviours (Wallen Warner & Åberg, 2014; Özkan & Azık, 2022; Özkan et al., 2011). For each DBQ format, participants were instructed whether they were completing the survey for themselves, women drivers, or men drivers. Higher scores indicate a higher frequency of the relevant behaviours for one's own, women's or men's. The reliability values and descriptive statistics are presented in Table 1.

2.2.2. Bem sex roles inventory (BSRI)

The study used the BSRI to assess masculinity and femininity (Bem, 1981). This measurement has been validated and employed in Turkish (Özkan & Lajunen, 2005b) and French (Gana, 1995) contexts, using a 7-point scale (ranging from 1: almost never true to 7: almost always true). The BSRI's Turkish adaptation comprised 20 items, while the French version featured 27 items. In the present study, the same 18 items were incorporated into the measurement of gender roles. Higher scores reflect a stronger self-identification with the traits categorised as masculine or feminine in the BSRI. The reliability values and descriptive statistics are presented in Table 1.

2.2.3. Gender stereotypes associated with driving

Gender stereotypes associated with driving were measured by adopting a short version of the sex stereotypes associated with driving (SSAD) measurement by Pravossoudovitch et al. (2015). To measure gender stereotypes, four items (compliance with traffic rules, risk avoidance, competence and courtesy) were used. To assess the personal and social dimensions of gender stereotypes, participants responded to four items presented in two distinct formats: awareness (social aspect) and endorsement (personal aspect) (e.g., Granié et al., 2020). For the **awareness** component, participants were requested to indicate their level of agreement with each of the four items, with the initial statement, "Usually, people believe that men/women ...". For the **endorsement** component, participants were asked to rate each of the four items using the initial statement, "Personally, I think men/women ...". Participants were instructed to rate each item on a 7-point scale (ranging from 1: do

not agree at all to 7: definitely agree).

The stereotype awareness and endorsement scores were calculated separately for women and men drivers. Given that the items (Section 3.1) reflect stereotypes commonly associated with women drivers, such as being cautious and respectful (Pravossoudovitch et al., 2015), it is imperative to interpret higher scores differently for women and men drivers. A higher score for **women drivers** signifies a greater endorsement or awareness of these stereotypical attributes—namely, perceiving women as particularly cautious and respectful—whereas a lower score suggests counter-stereotyping, indicating a perception that women are not especially cautious or respectful. Conversely, when evaluating **men drivers** on the same attributes, a higher score indicates a stronger endorsement or awareness of counter-stereotype, suggesting that men are perceived as cautious and respectful, traits traditionally ascribed to women. In contrast, a lower score for men aligns with the conventional stereotype that men are less cautious and respectful. In summary, a "higher" score may reflect either stronger stereotyping or stronger counter-stereotyping, contingent upon the group being assessed, as the trait itself is traditionally associated with women drivers.

Additionally, indices of stereotype endorsement and stereotype awareness were calculated using a delta value (e.g., Pravossoudovitch et al., 2015) which involved subtracting endorsement (or awareness) scores for those for men drivers from women drivers. Higher and positive scores indicate a stronger endorsement (or awareness) of gender stereotypes (i.e., the perception that women drivers are more respectful of traffic rules and behave more prudently than men drivers). Scores approaching zero suggest that participants do not endorse (or are not aware of) gender stereotypes associated with driving and perceive women and men drivers, similarly. This indicates that the endorsement (or awareness) of stereotypes is less pronounced. More negative scores suggest the presence of a counter-stereotypical belief, where men drivers are perceived as more respectful of traffic rules and behave more prudently than women drivers.

The confirmatory factor analysis (CFA) values are presented under Section 3.1, and the reliability values and descriptive statistics are presented in Table 1.

2.2.4. Sociodemographic and driving-related questions

Participants completed a separate section focusing on demographic questions (e.g., age, sex category) and driving-related questions (e.g., licensing status). Age and the length of driving license are requested as open-ended questions. Participants' sex category was measured with binary options (man and woman).

Table 1
Descriptives and reliability values of the study variables across Türkiye and France.

Measures	Variables	Türkiye				France			
		M (SD)	Cronbach's Alpha	Skewness	Kurtosis	M (SD)	Cronbach's Alpha	Skewness	Kurtosis
S-DBQ	Errors – Self	1.75 (.64)	.83	2.023	6.232	2.01 (.56)	.65	1.042	2.347
	Violations – Self	2.07 (.75)	.77	1.218	1.555	2.05 (.67)	.63	.753	.383
	Positive – Self	4.91 (1.09)	.87	−1.545	2.632	4.79 (.83)	.35	−.652	.257
	Errors – Women	2.59 (.82)	.88	.352	.432	2.69 (.70)	.82	.021	.025
	Violations – Women	2.13 (.72)	.84	.904	1.536	2.34 (.67)	.81	.278	−.003
	Positive – Women	4.06 (1.12)	.84	−.237	−.353	3.76 (.97)	.66	.130	−.092
	Errors – Men	2.86 (.83)	.86	.014	.295	2.89 (.69)	.82	.212	.310
	Violations – Men	3.96 (1.15)	.93	−.838	.383	3.80 (.94)	.92	−.182	−.113
	Positive – Men	3.23 (1.04)	.84	.710	.576	3.17 (.81)	.62	.418	.443
BSRI	Masculinity – Self	4.94 (.97)	.85	−.639	1.034	4.22 (.84)	.76	.167	.040
	Femininity – Self	5.48 (.89)	.85	−1.321	4.135	4.97 (.92)	.87	−.220	.196
Gender stereotypes	Awareness – Men	2.75 (1.08)	.83	.929	1.535	3.00 (1.14)	.77	.602	.542
	Awareness – Women	4.96 (1.31)	.77	−.692	.254	4.82 (1.22)	.78	−.491	.273
	Endorsement – Men	2.77 (1.17)	.86	.541	.144	3.28 (1.20)	.84	.077	−.400
	Endorsement – Women	5.22 (1.22)	.84	−.928	1.183	4.58 (1.23)	.89	−.305	.050
	Awareness index	2.38 (1.71)	–	−.642	1.048	1.82 (1.65)	–	−.296	.429
	Endorsement index	2.44 (1.57)	–	−.217	.610	1.30 (1.30)	–	.818	.726

2.3. Procedure

At the onset of the research, the questionnaire was crafted in English, as it is the common language of the research team. The final translated versions (in Turkish and French) were used during the data collection phase. Ethical approvals from Middle East Technical University (215-ODTU-2021) in Türkiye and Université Gustave Eiffel in France were obtained for data collection. Snowball and convenience sampling techniques were utilised to recruit participants, and the survey link was distributed through social media channels. Qualtrics was employed to gather data in Türkiye, while Limesurvey was used in France. To encourage participation, additional course credit was offered, whereby students could anonymously receive course credits upon completion of the survey through the university platforms in Türkiye. All participants were provided with informed consent, detailing the study’s purpose and their rights as participants, and including the contact details of the researchers. Participants were requested to complete a series of questionnaires in a randomly assigned order, with the demographic information form always serving as the final section. This approach was taken to minimise the potential impact of order effects. The data collection process ensured anonymity and protected the confidentiality of participants.

2.4. Analyses

Before proceeding with the main analysis to address the research questions, a confirmatory analysis for aspects of awareness and endorsement of gender stereotypes for women and men in a total sample was conducted using Jamovi (v2.6.44) with the maximum likelihood estimation (Jamovi project, 2023; R Core Team, 2022; Rosseel et al., 2023). The model fit was evaluated using the χ^2 test for goodness of fit (χ^2 /degrees of freedom ratio between 2:1 and 5:1), the comparative fit index (CFI, $>.90$), the standardised root mean square residual (SRMR, $<.10$), and the root mean square error of approximation (RMSEA, $<.10$) within a 90 % confidence interval (CI) (Russell, 2002; Schermelleh-Engel et al., 2003).

Following the analysis of the results from the CFA (Section 3.1), cross-country comparisons of driving behaviours (Section 3.2) and gender stereotypes (Section 3.3) were examined by a series of 2 (sex category: men vs women) by 2 (country: Türkiye vs France) analysis of covariance (ANCOVA) while controlling for the effects of age and licensing year. Considering the sample size and the skewness and kurtosis values (Table 1), the data are deemed to be appropriate for ANCOVA (Kim, 2013; Zhou et al., 2023).

In the final step (Section 3.4), in order to examine the relationships of gender roles and awareness and endorsement of gender stereotypes with the perception of men’s and women’s driving behaviour, 24 serial mediation analyses were carried out using the bootstrapping method with 5000 resamples. For these analyses, the PROCESS macro model 6 (Hayes, 2022) was used. Fig. 1 illustrates the constructs that were entered into the model. During the analyses, the respective factors for men and women drivers (i.e., awareness and endorsement of gender stereotypes and driving behaviours) were taken into account separately. The analyses were repeated once for masculinity and once for femininity and separately for each country. For each analysis, age, sex category (0:

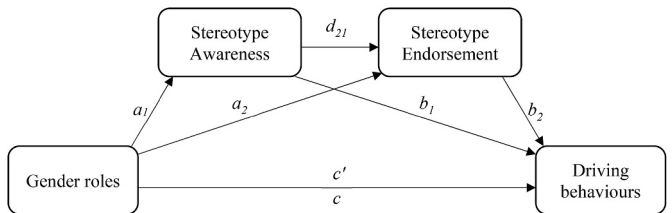


Fig. 1. Conceptual model tested.

Man, 1: Woman), and license year were entered as covariates (Pearson correlations are presented in the Appendix). Given that the mediation models concentrated on the perceptions of men and women drivers’ behaviours separately, the analysis were conducted on awareness and endorsement scores independently for each driver group, rather than using the index scores. The serial mediation model is considered the most appropriate model for testing due to its alignment with the contextual mediated model (Lajunen, 1997; Sümer, 2003), which delineates a hierarchical relationship between distal context and proximal context regarding their effects on the outcome variable in the traffic context. Distal factors (gender roles in the study) are expected to exert an indirect effect on the outcome variable (men’s and women’s driving behaviour) through their association with the proximal factors (awareness and endorsement of gender stereotypes while driving).

3. Results

3.1. Gender stereotypes in Türkiye and France

To examine the factor structure of gender stereotypes measurement, a single CFA was conducted for four factors (awareness and endorsement of gender stereotypes for women and men). Initially, “... have perfect driving skills” was also included in the gender stereotypes measures as the fourth item. However, the item significantly reduced the model fit in the total model and also in models examined for each country separately. Consequently, this item was removed from the final model (Table 2). This outcome may have been observed considering that the other three items are relevant to driving behaviours, whereas this item pertains to skills. The distinction has long been established as the two pathways leading to a crash (Lajunen & Özkan, 2021) and also in gender stereotypes in driving research (Pravossoudovitch et al., 2015; Öztürk & Öz, 2025). The CFA results for the final model in the total sample are presented in Table 2. The fit indices of the scale showed acceptable values ($\chi^2(48) = 454.089, p < .001$, CFI = .919, SRMS = .041, RMSEA = .098, 90 % CI: .090, .106). While the CFI, TLI, and SRMR values satisfy the established criteria for a good fit (e.g., Hu & Bentler, 1999; Russell, 2002; Schermelleh-Engel et al., 2003), the RMSEA value resides within the marginal range and approaches the upper limit of the acceptable threshold ($\leq .10$). This indicates that, although the model adequately captures the latent structure, there remains potential for enhancing the representation of the constructs.

3.2. Differences in driving behaviour across countries and sex categories

To analyse the differences between men and women participants from Türkiye and France in terms of the frequency of their own, women’s and men’s driving behaviours, eight separate analyses of

Table 2
Standardised factor loadings.

Items	Std. Estimate
Awareness (women)	
respect the traffic rules	.787
avoid dangerous behaviours	.742
show good behaviours to other users	.669
Awareness (men)	
respect the traffic rules	.775
avoid dangerous behaviours	.800
show good behaviours to other users	.712
Endorsement (women)	
respect the traffic rules	.888
avoid dangerous behaviours	.842
show good behaviours to other users	.778
Endorsement (men)	
respect the traffic rules	.836
avoid dangerous behaviours	.844
show good behaviours to other users	.779

covariance (Table 3) were carried out while simultaneously accounting for the effects of age and license year (covariates). Due to its low Cronbach's alpha reliability in France (Table 1), scores for drivers' self-reported positive behaviours were excluded from further analysis.

There were significant differences in participants' own violations, women's positive behaviours, and men's errors and violations scores across sex categories. Men reported a greater number of violations for themselves ($p_{\text{bonferonni}} = .001$, $d = .23$) and a lesser number of positive behaviours for women drivers ($p_{\text{bonferonni}} < .001$, $d = .34$), as well as a lower number of errors ($p_{\text{bonferonni}} = .002$, $d = .24$) and violations ($p_{\text{bonferonni}} < .001$, $d = .37$) for men drivers (Table 4) compared to women participants.

Significant country differences were observed in participants' own errors, as well as for violations and positive behaviours for women drivers. Participants in France reported a higher level of errors for themselves ($p_{\text{bonferonni}} < .001$, $d = .49$) and violation for women drivers ($p_{\text{bonferonni}} < .001$, $d = .44$), along with fewer positive behaviours for women drivers ($p_{\text{bonferonni}} < .001$, $d = .38$) than participants in Türkiye (Table 4).

The interaction between country and sex category was significant for participants' own violations and errors for men and women drivers. With regard to participants' own violations, men reported a greater frequency of violations compared to women in Türkiye ($p_{\text{bonferonni}} < .001$, $d = .38$, Fig. 2) but not in France.

Concerning the interaction effect of country and sex category on women drivers' errors, in Türkiye, men reported a greater frequency of errors for women drivers compared to women participants ($p_{\text{bonferonni}} = .017$, $d = .28$). Conversely, women participants in France reported a higher frequency of women drivers' errors than women participants in Türkiye ($p_{\text{bonferonni}} = .004$, $d = .41$, Fig. 3).

In regard to the interaction effect of country and sex category on men drivers' errors, women in France reported a higher frequency of men's errors than their men counterparts in France ($p_{\text{bonferonni}} = .005$, Fig. 4, $d = .42$).

3.3. Differences in the indices of gender stereotype awareness and endorsement across countries and sex categories

To analyse the differences between men and women participants from Türkiye and France in terms of their awareness and endorsement of gender stereotypes, two two-way analyses of covariance (one for

Table 4

Estimated marginal means (EMM) for driving behaviours.

Country	Sex category	Errors (self)		Violations (self)		Positive beh. (self)	
		<i>n</i>	EMM (SE)	<i>n</i>	EMM (SE)	<i>n</i>	EMM (SE)
Türkiye	Men	249	1.70 (.04)	249	2.20 (.05)	–	–
	Women	153	1.76 (.04)	153	1.93 (.05)	–	–
France	Men	237	1.98 (.05)	237	2.09 (.06)	–	–
	Women	209	2.07 (.04)	209	2.03 (.05)	–	–
		Errors (women)		Violations (women)		Positive beh. (women)	
		<i>n</i>	EMM (SE)	<i>n</i>	EMM (SE)	<i>n</i>	EMM (SE)
Türkiye	Men	248	2.69 (.05)	248	2.10 (.05)	248	3.87 (.07)
	Women	129	2.47 (.06)	128	2.09 (.05)	130	4.33 (.07)
France	Men	234	2.60 (.08)	234	2.32 (.07)	234	3.58 (.10)
	Women	157	2.79 (.07)	157	2.49 (.06)	157	3.83 (.09)
		Errors (men)		Violations (men)		Positive beh. (men)	
		<i>n</i>	EMM (SE)	<i>n</i>	EMM (SE)	<i>n</i>	EMM (SE)
Türkiye	Men	249	2.83 (.05)	249	3.81 (.07)	249	3.26 (.06)
	Women	119	2.87 (.06)	119	4.11 (.08)	119	3.25 (.07)
France	Men	237	2.71 (.08)	237	3.55 (.11)	237	3.21 (.10)
	Women	148	3.03 (.07)	148	4.03 (.09)	148	3.03 (.09)

awareness index and one for endorsement index) were carried out while simultaneously accounting for the effects of age and license year (Table 5).

In terms of the effects of sex category, women reported stronger

Table 3

ANCOVA results for driving behaviours by country and sex category.

	Errors (self)			Violations (self)			Positive beh. (self)		
	<i>F</i> (1, 842)	<i>p</i>	η_p^2	<i>F</i> (1, 842)	<i>p</i>	η_p^2	–	–	–
Country	33.058	<.001	.04	.001	.973	.00			
Sex category (0: Man, 1: Woman)	3.377	.066	.00	10.696	.001	.01			
Age	.601	.438	.00	17.873	<.001	.02			
License year	1.271	.260	.00	15.873	<.001	.02			
Country by sex category	.174	.676	.00	4.328	.038	.01			
	Errors (women)			Violations (women)			Positive beh. (women)		
	<i>F</i> (1, 762)	<i>p</i>	η_p^2	<i>F</i> (1, 761)	<i>p</i>	η_p^2	<i>F</i> (1, 763)	<i>p</i>	η_p^2
Country	2.636	.105	.00	22.767	<.001	.03	16.614	<.001	.02
Sex Category (0: Man, 1: Woman)	.066	.798	.00	2.391	.122	.00	20.314	<.001	.03
Age	6.187	.013	.01	.205	.651	.00	12.471	<.001	.02
License year	4.674	.031	.01	.183	.669	.00	8.703	.003	.01
Country by sex category	11.555	<.001	.02	2.904	.089	.00	1.965	.161	.00
	Errors (men)			Violations (men)			Positive beh. (men)		
	<i>F</i> (1, 872)	<i>p</i>	η_p^2	<i>F</i> (1, 872)	<i>p</i>	η_p^2	<i>F</i> (1, 872)	<i>p</i>	η_p^2
Country	.014	.906	.00	2.649	.104	.00	2.127	.145	.00
Sex category (0: Man, 1: Woman)	9.866	.002	.01	22.997	<.001	.03	1.664	.197	.00
Age	.695	.405	.00	.029	.866	.00	.982	.322	.00
License year	.570	.450	.00	.000	.992	.00	1.822	.177	.00
Country by sex category	5.068	.025	.01	1.043	.308	.00	1.261	.262	.00

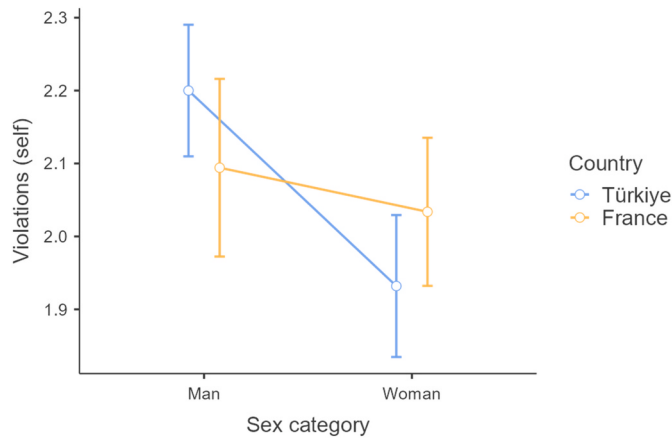


Fig. 2. The Interaction Effect of Country and Sex Category on Own Violations Note. The values are based on the estimated marginal means, and error bars represent the confidence interval.

indices of awareness ($p_{\text{bonferroni}} = .012$, $d = .18$) and endorsement ($p_{\text{bonferroni}} < .001$, $d = .31$) of gender stereotypes associated with driving than men (Table 6).

With respect to the effects of country, the indices of awareness ($p_{\text{bonferroni}} < .001$, $d = .33$) and endorsement ($p_{\text{bonferroni}} < .001$, $d = .88$)

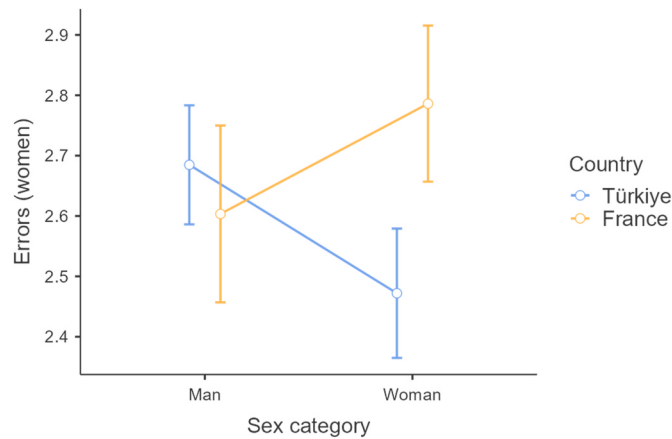


Fig. 3. The Interaction Effect of Country and Sex Category on Women's Errors Note. The values are based on the estimated marginal means, and error bars represent the confidence interval.

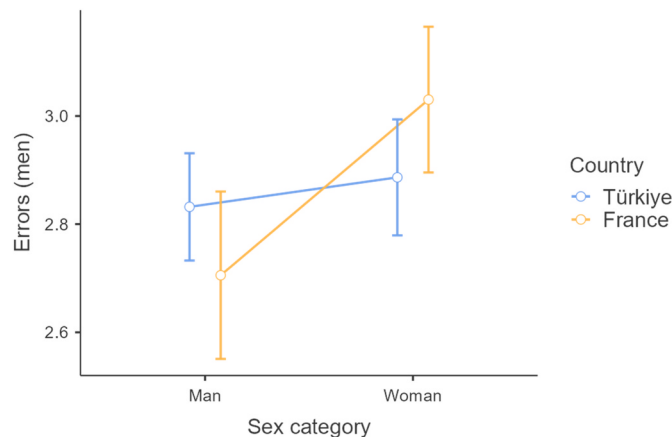


Fig. 4. The Interaction Effect of Country and Sex Category on Men's Errors Note. The values are based on the estimated marginal means, and error bars represent the confidence interval.

Table 5

ANCOVA results on the indices of gender stereotypes by country and sex category.

	Awareness Index			Endorsement Index		
	$F(1, 872)$	p	η_p^2	$F(1, 860)$	p	η_p^2
Country	15.58	<.001	.02	111.43	<.001	.12
Sex category (0: Man, 1: Woman)	6.36	.012	.01	19.78	<.001	.02
Age	2.34	.126	.00	1.34	.247	.00
License year	2.74	.098	.00	.53	.468	.00
Country by Sex category	.69	.406	.00	4.23	.040	.01

Table 6

Estimated marginal means (EMM) for the indices of gender stereotype.

Country	Sex Category	Awareness - delta		Endorsement - delta	
		n	EMM (SE)	n	EMM (SE)
Türkiye	Men	249	2.17 (.11)	249	2.16 (.09)
	Women	237	2.56 (.12)	237	2.82 (.10)
France	Men	157	1.72 (.15)	156	1.10 (.13)
	Women	235	1.92 (.12)	224	1.35 (.10)

Note. Standard errors are presented in parentheses.

of gender stereotypes associated with driving were higher in Türkiye compared to France (Table 6).

Regarding the interaction effect of country and sex category on the endorsement index, all pairwise comparisons were statistically significant ($p_{\text{bonferroni}} < .001$, $d > .46$), with the exception of the difference between men and women in France (Fig. 5). Specifically, women from Türkiye exhibited the highest level of stereotype endorsement, followed by men from Türkiye, and both women and men from France.

3.4. Mediating role of awareness and endorsement of gender stereotypes

Regarding the serial mediation results (Table 7), the explained variance ranged from 7.8 % to 20.2 % in Türkiye and 7.3 %–12.1 % in France for women drivers. For men drivers, the explained variance ranged from 4.6 % to 12.9 % in Türkiye and 8.6 %–21.1 % for France.

For women drivers, in both countries (Tables 8 and 9), higher levels of femininity were associated with higher awareness of gender stereotypes for women drivers, which subsequently associated with higher endorsement of gender stereotypes for women drivers. This, in turn, resulted in the reporting of fewer errors and violations, as well as more

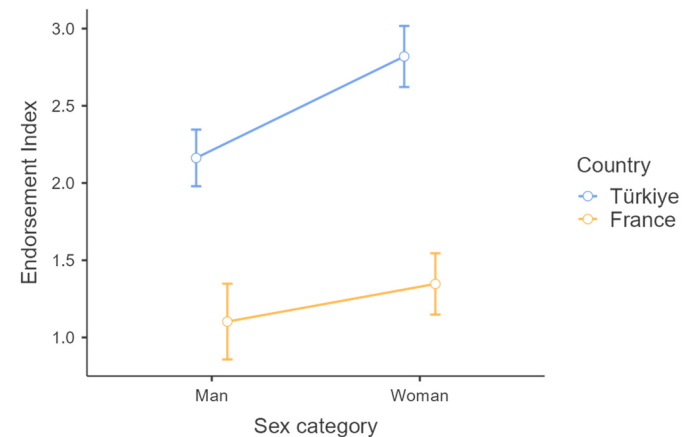


Fig. 5. The Interaction Effect of Country and Sex Category on the Endorsement Index

Note. The values are based on the estimated marginal means, and error bars represent the confidence interval.

Table 7

Explained variances across the two countries.

Stereotype Group	Model	Türkiye		France	
		Total effect R^2	Final model R^2	Total effect R^2	Final model R^2
Women	Fem→ M_1 → M_2 →Errors	.023	.078	.039	.073
Women	Fem→ M_1 → M_2 →Violations	.031	.075	.060	.121
Women	Fem→ M_1 → M_2 →Positive	.132	.202	.052	.107
Women	Mas→ M_1 → M_2 →Errors	.040	.088	.043	.078
Women	Mas→ M_1 → M_2 →Violations	.011	.090	.041	.113
Women	Mas→ M_1 → M_2 →Positive	.069	.174	.036	.101
Men	Fem→ M_1 → M_2 →Errors	.007	.049	.068	.167
Men	Fem→ M_1 → M_2 →Violations	.044	.129	.076	.211
Men	Fem→ M_1 → M_2 →Positive	.025	.067	.025	.086
Men	Mas→ M_1 → M_2 →Errors	.006	.046	.060	.156
Men	Mas→ M_1 → M_2 →Violations	.024	.102	.069	.202
Men	Mas→ M_1 → M_2 →Positive	.031	.075	.047	.100

Note. M_1 = Awareness of gender stereotypes for women or men, M_2 = Endorsement of gender stereotypes for women or men. Significant indirect effects are shown in bold.

positive behaviours for women drivers.

For men drivers (Tables 8 and 9), higher levels of self-reported femininity were correlated with a greater awareness of counter-stereotypes about men drivers (i.e., that men drivers can be cautious and respectful). This heightened awareness, in turn, was associated with stronger endorsement of those counter-stereotypes and, ultimately, with more positive behaviours.

For men drivers in France (Table 9), higher levels of masculinity were associated with a greater awareness of counter-stereotypes about men drivers (i.e., that men drivers can be cautious and respectful). This higher awareness was in turn associated with a stronger endorsement of these counter-stereotypes, which correlated with more positive driving behaviours and fewer aberrant behaviours (such as errors and violations).

4. Discussion

In this study, the relationships of sex category, gender roles, and gender stereotypes were investigated across a sample from Türkiye and France. Specifically, the first objective examined how the perceived frequency of one's own, women's and men's driving behaviour differed between sex categories and countries. The second objective focused on the country and sex category differences in relation to the indices of awareness and endorsement of gender stereotypes while driving across Türkiye and France. The final objective investigated the mediating role of awareness and endorsement of gender stereotypes while driving on the relationship between gender roles and the perceived frequency of women's and men's driving behaviour across Türkiye and France.

Regarding the first objective, the results substantiate that sex category exerts significant effect on perceived driving behaviours, with notable disparities observed between participants from Türkiye and France. Participants from Türkiye reported fewer errors in their driving in contrast to participants from France. Furthermore, men from Türkiye reported a higher frequency of violations for themselves compared to women participants, which aligns with previous research associating men drivers with higher instances of risky driving behaviours (de Winter & Dodou, 2010). In Türkiye, this may potentially reflect a cultural acceptance or even valorisation of risk in driving among men, considering the relatively younger sample. This phenomenon may be associated with societal constructs that link masculinity with risk-taking and

assertiveness (Coquelet et al., 2019; Özkan & Lajunen, 2006). Moreover, this observation may highlight a broader cultural and social context wherein risk-related behaviours may be perceived differently by men and women, potentially fostering higher tolerance of such behaviours among men (Kritsotakis et al., 2016; Poortinga, 2007).

While men in both countries and women in France reported similar levels of error for women and men drivers, women in Türkiye reported fewer errors for women drivers. Furthermore, perceptions of men's driving behaviour varied less significantly by country and sex category, where men participants generally reported lower levels of risky or aberrant driving behaviours for men drivers compared to women. Women participants also reported higher positive behaviours for women drivers compared to their men counterparts, with this positive bias being more pronounced in Türkiye than in France. In this context, in Türkiye, women may be perceived as more conscientious or rule-abiding drivers. This is in line with traditional societal norms that associate cautious behaviour with feminine traits (Özkan & Lajunen, 2006) and caution-focused narratives (Castro-Nuño & Lopez-Valpuesta, 2023).

These findings also suggest that women participants from Türkiye demonstrate greater ingroup favouritism (Turner et al., 1979), as evidenced by their lower error and higher positive behaviour ratings for women drivers. These observations can be interpreted as a reflection to the stereotypes and prejudice faced by women drivers in Türkiye (e.g., Kavaz & Akpolat, 2025). In general, these findings might suggest gender-based leniency in perceiving women's driving and men's driving. When men evaluate men drivers, societal expectations and stereotypes associating men with competence or technical skill in driving may be linked to a minimisation of risky behaviour. The differences between the countries highlights how country context can show the extent to which positive or negative stereotypes about women drivers are endorsed.

As for the second objective, for the first time in the literature, the study elucidated how country and sex category contexts relate to gender stereotypes associated with driving through the indices of awareness and endorsement. The observed differences between countries indicate that both awareness and endorsement of gender stereotypes associated with driving are more pronounced among participants from Türkiye compared to those from France. In line with previous research (Özkan & Azık, 2022), respondents from Türkiye were more inclined to endorse and perceive in others the stereotype that "women drivers are more respectful of traffic rules and behave more prudently than men drivers", whereas this difference was less pronounced among respondents from France. More specifically, women from Türkiye exhibited the highest endorsement index. This pattern may be attributed to social norms in Türkiye that emphasise traditional, protective roles for women, potentially reinforcing perceptions of women as risk-averse and compliant with safety norms in driving (Özkan & Lajunen, 2006). This difference may indicate that men may still be perceived as inherently less rule-obedient and more risk-takers.

Supporting the findings from previous studies (Degraeve et al., 2015; Granié & Papafava, 2011), who found that in-group favouritism was more pronounced for women, in this study, women participants in both countries endorsed gender stereotypes (both indices of awareness and endorsement) more strongly than their men counterparts. This may indicate an internalised belief or affirmation of women's cautious and positive driving behaviours. Such endorsement among women aligns with theories of in-group/inter-group relations (Tajfel & Turner, 1979). According to Social Identity Theory (Tajfel & Turner, 1979), individuals' identification with specific roles may affect their perceptions and behaviours through the dynamics of ingroup and outgroup

Table 8

The indirect effects of gender roles and gender stereotypes on driving behaviours in Türkiye.

Stereotype Group	Model	a_1	a_2	b_1	b_2	d_{21}	c	c'	Indirect effect (a_1*b_1)	Indirect effect (a_2*b_2)	Indirect effect ($a_1*d_{21}*b_1$)
Women	Fem→ M_1 → M_2 →Errors	.213 (.001)	.333 (<.001)	.007 (.838)	-.176 (<.001)	.471 (<.001)	.040 (.348)	.115 (.009)	.002 [-.018, .021]	-.064 [-.101, -.033]	-.019 [-.039, -.003]
Women	Fem→ M_1 → M_2 →Violations	.213 (.001)	.333 (<.001)	-.002 (.939)	-.175 (<.001)	.471 (<.001)	-.041 (.279)	.036 (.351)	.000 [-.016, .013]	-.058 [-.092, -.032]	-.018 [-.034, -.002]
Women	Fem→ M_1 → M_2 →Positive	.213 (.001)	.333 (<.001)	.101 (.017)	.182 (<.001)	.471 (<.001)	.332 (<.001)	.231 (<.001)	.022 [.001, .051]	.061 [.023, .107]	.018 [.002, .039]
Women	Mas→ M_1 → M_2 →Errors	.135 (.028)	.035 (.459)	-.005 (.891)	-.151 (<.001)	.501 (<.001)	.117 (.002)	.133 (<.001)	-.001 [-.013, .011]	-.005 [-.021, .011]	-.010 [-.024, .001]
Women	Mas→ M_1 → M_2 →Violations	.135 (.028)	.035 (.459)	-.007 (.807)	-.168 (<.001)	.501 (<.001)	.047 (.169)	.065 (.049)	-.001 [-.012, .008]	-.006 [-.023, .011]	-.011 [-.025, .001]
Women	Mas→ M_1 → M_2 →Positive	.035 (.028)	.035 (.459)	.091 (.036)	.240 (<.001)	.501 (<.001)	.083 (.104)	.341 (.300)	.011 [-.001, .030]	.007 [-.013, .031]	.014 [-.001, .034]
Men	Fem→ M_1 → M_2 →Errors	.115 (.037)	.041 (.435)	-.002 (.960)	-.146 (<.001)	.519 (<.001)	.046 (.286)	.061 (.152)	.000 [-.013, .012]	-.006 [-.023, .011]	-.009 [-.020, .000]
Men	Fem→ M_1 → M_2 →Violations	.115 (.037)	.041 (.435)	-.047 (.369)	-.267 (<.001)	.519 (<.001)	.191 (.001)	.224 (<.001)	-.004 [-.018, .012]	-.009 [-.033, .012]	-.012 [-.027, .000]
Men	Fem→ M_1 → M_2 →Positive	.115 (.037)	.041 (.435)	-.023 (.643)	.193 (<.001)	.519 (<.001)	.161 (.003)	.144 (.006)	-.002 [-.015, .010]	.007 [-.010, .026]	.010 [.000, .022]
Men	Mas→ M_1 → M_2 →Errors	.023 (.652)	.025 (.608)	.002 (.967)	-.145 (<.001)	.522 (<.001)	.020 (.607)	.025 (.510)	.000 [-.006, .006]	-.004 [-.018, .010]	-.002 [-.010, .007]
Men	Mas→ M_1 → M_2 →Violations	.023 (.652)	.025 (.608)	-.034 (.528)	-.261 (<.001)	.522 (<.001)	.034 (.525)	.044 (.390)	-.001 [-.009, .004]	-.005 [-.015, .009]	-.003 [-.015, .009]
Men	Mas→ M_1 → M_2 →Positive	.023 (.652)	.025 (.608)	-.015 (.759)	.193 (<.001)	.522 (<.001)	.168 (.001)	.161 (.001)	.000 [-.006, .006]	.004 [-.013, .024]	.002 [-.008, .013]

Note. M_1 = Awareness of gender stereotypes for women or men, M_2 = Endorsement of gender stereotypes for women or men. M_1 , M_2 , and driving behaviours correspond to the stereotype group. For example, the first row indicates the effects of femininity on women drivers' errors through awareness and endorsement of gender stereotypes for women drivers. The total effect (c) is composed of the direct effect (c') and indirect effect (a_1*b_1) plus indirect effect (a_2*b_2) plus indirect effect ($a_1*d_{21}*b_1$). p -values are presented within parentheses, while 95 % confidence intervals are presented within squared brackets. Significant indirect effects ($a_1*d_{21}*b_1$) are shown in bold.

Table 9
The indirect effects of gender roles and gender stereotypes on driving behaviours in France.

Stereotype Group	Model	a_1	a_2	b_1	b_2	d_{21}	c	c'	Indirect effect (a_1*b_1)	Indirect effect (a_2*b_2)	Indirect effect ($a_1*d_{21}*b_1$)
Women	Fem→M_1→M_2→Errors	.306 (<.001)	.074 (.305)	-.010 (.815)	-.103 (.009)	.545 (<.001)	-.049 (.295)	-.021 (.661)	-.004 [-.040, .033]	-.010 [-.037, .009]	-.023 [-.050, -.004]
Women	Fem→M_1→M_2→Violations	.306 (<.001)	.071 (.326)	-.041 (.305)	-.116 (.002)	.545 (<.001)	-.109 (.014)	-.069 (.119)	-.017 [-.059, .015]	-.011 [-.040, .010]	-.027 [-.050, -.009]
Women	Fem→M_1→M_2→Positive	.303 (<.001)	.072 (.321)	.094 (.106)	.132 (.013)	.547 (<.001)	.163 (.011)	.103 (.108)	.027 [-.004, .068]	.009 [-.009, .033]	.021 [.004, .044]
Women	Mas→ M_1 → M_2 →Errors	.106 (.179)	.057 (.439)	-.011 (.793)	-.102 (.009)	.556 (<.001)	-.072 (.136)	-.059 (.216)	-.001 [-.017, .013]	-.007 [-.032, .013]	-.007 [-.025, .004]
Women	Mas→ M_1 → M_2 →Violations	.104 (.189)	.053 (.466)	-.016 (.715)	-.119 (.001)	.555 (<.001)	-.035 (.450)	-.016 (.715)	-.007 [-.029, .006]	-.008 [-.038, .015]	-.009 [-.027, .005]
Women	Mas→ M_1 → M_2 →Positive	.110 (.160)	.060 (.412)	.108 (.060)	.135 (.011)	.557 (<.001)	.086 (.196)	.058 (.372)	.011 [-.005, .039]	.008 [-.013, .034]	.008 [-.004, .025]
Men	Fem→ M_1 → M_2 →Errors	.163 (.035)	-.005 (.954)	-.011 (.769)	-.179 (<.001)	.369 (<.001)	.075 (.120)	.087 (.061)	-.002 [-.026, .020]	.001 [-.039, .038]	-.014 [-.031, .001]
Men	Fem→ M_1 → M_2 →Violations	.163 (.035)	-.005 (.954)	-.036 (.489)	-.279 (<.001)	.369 (<.001)	.093 (.156)	.115 (.063)	-.006 [-.029, .011]	.001 [-.034, .000]	-.016 [-.034, .000]
Men	Fem→M_1→M_2→Positive	.163 (.035)	-.005 (.954)	.054 (.257)	.147 (.001)	.369 (<.001)	.048 (.408)	.031 (.585)	.010 [-.009, .032]	-.001 [-.027, .028]	.010 [.000, .024]
Men	Mas→M_1→M_2→Errors	.333 (<.001)	.017 (.838)	-.003 (.936)	-.179 (<.001)	.365 (<.001)	-.022 (.657)	.004 (.935)	-.001 [-.041, .037]	-.004 [-.048, .039]	-.027 [-.051, -.011]
Men	Mas→M_1→M_2→Violations	.333 (<.001)	.017 (.838)	-.031 (.554)	-.280 (<.001)	.365 (<.001)	-.011 (.867)	.038 (.554)	-.009 [-.044, .021]	-.004 [-.056, .042]	-.031 [-.054, -.013]
Men	Mas→M_1→M_2→Positive	.333 (<.001)	.017 (.838)	.033 (.493)	.145 (.001)	.365 (<.001)	.153 (.009)	.122 (.040)	.012 [-.027, .047]	.003 [-.028, .033]	.019 [.004, .040]

Note. M_1 = Awareness of gender stereotypes for women or men, M_2 = Endorsement of gender stereotypes for women or men. M_1 , M_2 , and driving behaviours correspond to the stereotype group. For example, the first row indicates the effects of femininity on women drivers' errors through awareness and endorsement of gender stereotypes for women drivers. The total effect (c) is composed of the direct effect (c') and indirect effect (a_1*b_1) plus indirect effect (a_2*b_2) plus indirect effect ($a_1*d_{21}*b_2$). p -values are presented within parentheses, while 95 % confidence intervals are presented within squared brackets. Significant indirect effects ($a_1*d_{21}*b_1$) are shown in bold.

relationships. In other words, individuals often internalise or affirm traits attributed to their social groups, particularly when these traits align with broader societal expectations. Concurrently, the stereotype threat framework (Spencer et al., 2016) posits that individuals' awareness of societal stereotypes pertaining to their group can affect their performance (e.g., Song et al., 2024). This phenomenon might suggest that women endorse cautious behaviour as a strategy for affirming their driving competence within a stereotype-laden environment.

As for the third objective, gender roles emerged as a significant factor related to perceived driving behaviour. The results indicated that femininity was associated with greater endorsement of stereotypes concerning women's driving, which, subsequently, was correlated with perceptions of fewer errors and violations and more positive behaviours for women drivers. This pattern aligns with extant research suggesting that femininity is often linked to caution and rule-adherence (Coquelet et al., 2019; Özkan & Lajunen, 2006). Furthermore, femininity demonstrated a comparable pattern, being associated with more positive behaviours among men drivers through the awareness and endorsement of counter-stereotypes for men. Particularly noteworthy is the secondary nature of positive behaviours wherein drivers exhibit these behaviours not due to their necessity for safe driving or vehicle operation but rather due to alternative motivations such as increased protectiveness towards other road users (Özkan & Lajunen, 2005a). Furthermore, in France, higher masculinity was associated with favourable views of men's driving (strong awareness and endorsement of counter-stereotypes), including fewer aberrant behaviours and more positive behaviours. This tendency may indicate their efforts to project a favourable image of men drivers. Within the scope of this research, the relationship appears to persist by relating to the perception of positive behaviours for both women and men drivers.

These findings suggest a relationship wherein traditional gender roles may be associated with positive or negative perceptions based on the driver's gender, with masculine traits associated with competence and femininity with cautiousness (e.g., Özkan & Lajunen, 2006). The strong positive association between endorsement and the perception of positive behaviours, coupled with the negative association between endorsement and the perception of aberrant behaviours for both genders, suggests that endorsement is not merely a consequence of cultural and societal beliefs but is intricately linked with individuals' own perceptions and attitudes. On the other hand, in both countries, the explained variances (ranging from 4.6 % to 20.2 %) in driving behaviours indicate a significant effect, albeit one that varies greatly depending on the constructs and the country. For example, while masculinity in France is associated with a favourable stereotype awareness of men's driving (i.e., higher positive driving behaviours and fewer aberrant behaviours), the same effect was minimal in Türkiye. This may indicate cross-country variability. Thus, the effects of gender roles on driving perceptions reflect not only individual beliefs but are also shaped by how each society views and reinforces these gender roles.

Through the concurrent examination of sex category, gender roles, and driving-related gender stereotypes, this study provides a more comprehensive perspective on the intersection of these factors across two countries. This research demonstrates that social narratives and internalised stereotypes can significantly influence how drivers interpret others' behaviours. This perceptual dimension is crucial for understanding how biases might relate to real-world driving interactions (e.g., road rage, policy decisions). By testing awareness and endorsement of

gender stereotypes as serial mediators, for the first time in the literature, this study presents empirical evidence that these processes partially elucidate how gender roles relate to specific perceptions of men and women drivers.

The findings present a pathway by which broader social identities (masculinity/femininity) manifest in everyday judgements about driving behaviours. Although only two country contexts were examined, the findings illustrate that people's perceptions of driving can vary significantly. Such contrasts underscore the role of social norms, policies, or demographic factors (such as age and driving experience) in shaping how stereotypes and gender roles manifest on the road. Collectively, these contributions enhance our understanding of how socialised gender constructs interact with driving perceptions, offering a more nuanced perspective than simply attributing perceived differences to "men" and "women". The findings also present opportunities for interventions, such as developing educational programmes that challenge unwarranted stereotypes or encouraging safer interactions among drivers.

4.1. Limitations and future suggestions for research

Several factors warrant consideration when interpreting the results and designing future studies. First of all, this study relies on self-reported data, which is susceptible to bias, particularly social desirability bias (Yılmaz et al., 2022). Participants may have inaccurately reported driving behaviours, whether aberrant or positive, to conform to socially desirable norms or gender stereotypes. Moreover, measures of gender roles and stereotypes may be susceptible to socially desirable responding due to the sensitive nature of the topics. Variations in social desirability across different countries and cultures are conceivable. For instance, variations in horizontal and vertical individualism-collectivism may elucidate differences in socially desirable responding (Lalwani et al., 2006). This limitation may have influenced the study's findings. Countermeasures for social desirability should be implemented in future studies, particularly when gender stereotypes might affect responses differently in a cross-country context. For example, implicit measurements may serve a distinct function in this context by offering an alternative measurement approach to address this limitation (such as implicit attitudes toward women drivers by Tosi et al., 2024).

It is noteworthy that, subsequent to the factorial analysis, the item pertaining to competence in driving, which represents the stereotype of men behind the wheel, is not retained. Along with the RMSEA value being closer to the upper recommended level, this observation may indicate the multi-dimensional nature of gender stereotypes in driving and highlight areas for further investigation. Furthermore, low Cronbach's alpha reliability for S-DBQ factors, particularly with own positive behaviours, observed in France may necessitate further examination of the construct within the French context and its relationship to other driving-related outcomes. These low Cronbach's alpha values may also be attributed to items exhibiting low degrees of inter-relatedness within the traffic culture in France. Although values below .70 are often deemed borderline, research indicates that this threshold should not be rigidly applied (Cho & Kim, 2015) and should instead be assessed in relation to the constructs in question. We have retained this threshold to ensure comparability with previous DBQ research, particularly in cross-cultural studies where slightly lower reliabilities are commonly observed (e.g., Kaçan-Bibican et al., 2025; McIlroy et al., 2019; Özkan

et al., 2006). Nonetheless, interpretations of these subscales should be approached with caution, as lower internal consistency may weaken observed relationships.

While the BSRI has been utilised to measure femininity and masculinity aspects of gender roles for many years (Donnelly & Twenge, 2017), recent studies (Berger & Krahé, 2013; Kachel et al., 2016) have developed updated measures to refine these constructs. Consequently, replications of the findings with more contemporary measurements may yield additional insights. Furthermore, while the assessment of measurement invariance is advantageous in cross-country/cultural research, the demographic and sampling disparities between the cohorts in this study (e.g., age and gender composition) constrain the interpretability of such evaluations. Any detected invariance/non-invariance may be attributed to these compositional differences rather than genuine measurement bias. Due to this, we did not undertake comprehensive invariance testing. Future research employing more demographically balanced samples should incorporate a thorough evaluation of measurement invariance to enhance the robustness of cross-national comparisons.

The study employs a cross-sectional design, which limits the ability to establish causal relationships between sex category, gender stereotypes, gender roles, and driving behaviour. While significant associations can be observed, it is challenging to determine whether stereotypes cause certain perceptions or if pre-existing perceptions reinforce stereotypes. Future studies with a longitudinal design could provide more insight into how these relationships evolve over time, or experimental studies might further investigate whether reinforcing positive attributes for both men and women drivers can reduce biases in driving perceptions and ultimately contribute to safer driving environments.

The generalisability of these findings is limited by the employment of non-probability, convenience and snowball sampling in both countries, which may not accurately represent the broader national populations. Moreover, although age and years of driving experience were controlled, there is considerable age and sex category differences between the samples from the two countries. These demographic imbalances may therefore contribute to some of the observed differences between countries, and findings should be interpreted with this in mind. Furthermore, other potential confounding factors, such as socioeconomic status, education level, and regional driving culture, were not accounted for and may have influenced the results. These variables could potentially be associated with both perceptions of driving behaviour and the endorsement of gender stereotypes. Consequently, the findings should be understood as indicative of the specific characteristics of the participants in this study, rather than representative of the populations of Türkiye or France in their entirety. For this reason, we encourage the results to be interpreted with caution and recommend that future studies account for additional demographic variables and target more representative and comparable samples.

While this research focuses on gender stereotypes pertaining to women and men drivers in general, future research could address more specific age and sex category cohorts, such as novice men and women drivers. For instance, a study conducted by Gaymard et al. (2023) examined stereotypes associated with older women drivers. Although the group was found not to be affected by negative stereotypes, further research is warranted in the context of behavioural change and self-regulatory behaviours. Furthermore, although not directly elaborated in the context of this study, it is conceivable that sexism may also play a role in the driving content (e.g., Skinner et al., 2015; Tosi et al.,

2024). For instance, Skinner et al. (2015) observed distinctions between ambivalent and hostile sexism and their respective relations with stereotypes against women drivers. Future research could potentially incorporate this aspect into the driving content.

While Türkiye and France provide diverse cultural contexts, the study's findings may not be generalisable to other countries with differing cultural or socioeconomic backgrounds. Although the study and its methodology may not be suitable for asserting robust cross-cultural comparisons due to comparing only two countries, it is apparent that certain findings align with the cultural distinctions between the two countries. This observation is consistent with the general framework linking culture to traffic context, as delineated by Özkan and Lajunen (2011). Future research could encompass a broader range of countries to enhance cross-cultural generalisability. Understanding the interplay between actual gender-based driving patterns and societal perceptions could provide valuable insights for road safety initiatives and driver education programs. By acknowledging and addressing both the differences in driving behaviour between sex categories and societal perceptions, policymakers and educators can create more targeted and inclusive approaches to improving road safety.

5. Conclusion

This study provides a comprehensive examination of the relationships between sex category differences, gender roles, gender stereotypes, and the perceived frequency of driving behaviour in Türkiye and France. Through an examination of participants' perceptions of their own and others' driving, as well as stereotype endorsement, the study reveals the complex interplay between sex categories and gender roles in shaping beliefs about driving. The findings not only reflect gender-based disparities but also reveal underlying country differences that link to gender stereotypes in driving. This suggests a fertile area for further research and policy intervention. Finally, these findings underline that perceptions of driving behaviour are not just a reflection of individual beliefs but are deeply rooted in societal expectations and stereotypes.

CRediT authorship contribution statement

İbrahim Öztürk: Writing – original draft, Project administration, Investigation, Formal analysis, Data curation, Conceptualization. **Julie Devif:** Writing – review & editing, Data curation. **Brice Douffet:** Writing – review & editing, Data curation. **Seher Genç:** Writing – review & editing. **Marie-Axelle Granié:** Writing – review & editing, Supervision, Project administration, Methodology, Conceptualization. **Türker Özkan:** Writing – review & editing, Supervision, Methodology, Conceptualization.

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.

Appendix A. Correlations

Appendix A1: Pearson correlation matrix for the sample from Türkiye

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1.Age	Pearson's r	–																		
	p-value	–																		
2.License year	Pearson's r	.954***	–																	
	p-value	<.001	–																	
3.Masculinity	Pearson's r	.094*	.090*	–																
	p-value	.039	.048	–																
4.Femininity	Pearson's r	.107*	.112*	.375***	–															
	p-value	.018	.013	<.001	–															
5.Awareness for men	Pearson's r	.039	.054	.061	.126**	–														
	p-value	.392	.235	.180	.005	–														
6.Awareness for women	Pearson's r	.115*	.085	.103*	.166***	.101*	–													
	p-value	.011	.060	.024	<.001	.027	–													
7.Awareness index	Pearson's r	–.009	–.035	.052	.062	–.546***	.689***	–												
	p-value	.848	.443	.254	.172	<.001	<.001	–												
8.Endorsement for men	Pearson's r	.125**	.132**	.068	.110*	.482***	.276***	–.154***	–											
	p-value	.006	.004	.134	.015	<.001	<.001	<.001	–											
9.Endorsement for women	Pearson's r	.057	.041	.042	.345***	.189***	.538***	.342***	.236***	–										
	p-value	.208	.369	.360	<.001	<.001	<.001	<.001	<.001	–										
10.Endorsement index	Pearson's r	–.020	–.035	.018	.207***	–.189***	.237***	.423***	–.549***	.620***	–									
	p-value	.666	.440	.696	<.001	<.001	<.001	<.001	<.001	<.001	–									
11.Errors for self	Pearson's r	–.104*	–.118**	–.097*	–.178***	.082	.000	–.117*	.064	–.045	–.134**	–								
	p-value	.022	.009	.032	<.001	.072	.993	.010	.156	.320	.003	–								
12.Violations for self	Pearson's r	–.007	.020	.116*	–.081	.077	–.041	–.113*	.022	–.166***	–.126**	.563***	–							
	p-value	.879	.654	.011	.076	.090	.364	.013	.628	<.001	.005	<.001	–							
13.Positive for self	Pearson's r	.174***	.168***	.183***	.364***	.055	.127**	.114*	–.018	.148**	.184***	–.219***	–.081	–						
	p-value	<.001	<.001	<.001	<.001	.223	.005	.012	.694	.001	<.001	<.001	.074	–						
14.Errors for women	Pearson's r	.006	.031	.147**	.032	.029	–.107*	–.103*	.047	–.256***	–.214***	.359***	.397***	–.001	–					
	p-value	.898	.500	.001	.487	.526	.019	.024	.299	<.001	<.001	<.001	<.001	.980	–					
15.Violations for women	Pearson's r	–.086	–.085	.055	–.059	.001	–.098*	–.154***	.095*	–.231***	–.322***	.461***	.389***	–.136**	.561***	–				
	p-value	.059	.064	.231	.196	.987	.031	<.001	.037	<.001	<.001	<.001	<.001	.003	<.001	–				
16.Positive for women	Pearson's r	.099*	.066	.062	.290***	.028	.274***	.218***	–.011	.362***	.298***	–.046	–.077	.418***	–.328***	–.257***	–			
	p-value	.030	.146	.173	<.001	.544	<.001	<.001	.815	<.001	<.001	.310	.090	<.001	<.001	<.001	–			
17.Errors for men	Pearson's r	.025	.006	.023	.053	–.107*	.006	.055	–.219***	–.013	.122**	.318***	.304***	.091*	.402***	.344***	–.049	–		
	p-value	.586	.891	.615	.248	.018	.903	.227	<.001	.775	.007	<.001	<.001	.044	<.001	<.001	.284	–		
18.Violations for men	Pearson's r	–.063	–.077	.012	.151***	–.087	.035	.155***	–.262***	.070	.276***	.035	.165***	.255***	.299***	.095*	.089*	.679***	–	
	p-value	.162	.090	.784	<.001	.055	.438	<.001	<.001	.126	<.001	.435	<.001	<.001	.037	.050	<.001	–		
19.Positive for men	Pearson's r	.061	.075	.160***	.143**	.108*	.132**	.043	.220***	.142**	–.055	.015	–.036	.208***	–.162***	.003	.296***	–.343***	–.410***	–
	p-value	.177	.099	<.001	.002	.017	.004	.344	<.001	.002	.230	.735	.432	<.001	<.001	.946	<.001	<.001	<.001	–

Note. *p < .05, **p < .01, ***p < .001.

Appendix A2: Pearson correlation matrix for the sample from France

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1.Age	Pearson's r	–																		
	p-value	–																		
2.License year	Pearson's r	.962***	–																	
	p-value	<.001	–																	
3.Masculinity	Pearson's r	.142**	.163***	–																
	p-value	.004	<.001	–																
4.Femininity	Pearson's r	.034	.011	.178***	–															
	p-value	.485	.824	<.001	–															
5.Awareness for men	Pearson's r	.098	.103*	.196***	.161**	–														
	p-value	.051	.041	<.001	.001	–														
6.Awareness for women	Pearson's r	.181***	.162**	.057	.296***	.127*	–													
	p-value	<.001	.001	.256	<.001	.012	–													
7.Awareness index	Pearson's r	–.034	–.044	–.148**	.134**	–.577***	.637***	–												
	p-value	.501	.388	.003	0.008	<.001	<.001	–												
8.Endorsement for men	Pearson's r	–.025	–.030	.109*	.075	.421***	.274***	–.050	–											
	p-value	.631	.564	.034	.142	<.001	<.001	.328	–											
9.Endorsement for women	Pearson's r	.094	.066	.099	.265***	.231***	.522***	.234***	.475***	–										
	p-value	.067	.201	.054	<.001	<.001	<.001	<.001	<.001	–										
10.Endorsement index	Pearson's r	.084	.070	–.016	.177***	–.176***	.252***	.304***	–.468***	.521***	–									
	p-value	.102	.174	.757	<.001	<.001	<.001	<.001	<.001	<.001	–									
11.Errors for self	Pearson's r	.014	–.006	–.113*	–.019	–.028	–.027	.001	–.077	–.118*	–.023	–								
	p-value	.784	.906	.031	.720	.596	.602	.985	.144	.024	.663	–								
12.Violations for self	Pearson's r	–.051	.008	.092	–.194***	–.023	–.144**	–.087	–.013	–.069	.006	.231***	–							
	p-value	.333	.885	.080	<.001	.667	.006	.098	.810	.193	.911	<.001	–							
13.Positive for self	Pearson's r	–.021	–.041	–.032	.150**	–.014	.060	.128*	–.055	.013	.054	–.145**	–.215***	–						
	p-value	.690	.440	.541	.004	.784	.258	.015	.297	.799	.305	.006	<.001	–						
14.Errors for women	Pearson's r	–.106	–.078	–.102	–.048	–.003	–.139*	–.052	–.150*	–.200***	–.020	.350***	.289***	–.097	–					
	p-value	.073	.186	.084	.420	.965	.019	.380	.011	<.001	.740	<.001	<.001	.102	–					
15.Violations for women	Pearson's r	–.147*	–.153**	–.069	–.107	–.055	–.163**	–.087	–.120*	–.250***	–.112	.316***	.219***	–.136*	.639***	–				
	p-value	.013	.010	.243	.070	.355	.006	.144	.043	<.001	.059	<.001	<.001	.022	<.001	–				
16.Positive for women	Pearson's r	.005	–.027	.072	.194***	–.003	.229***	.194***	.040	.272***	.198***	–.081	–.071	.289***	–.265***	–.271***	–			
	p-value	.934	.649	.222	<.001	.958	<.001	<.001	.502	<.001	<.001	.170	.233	<.001	<.001	<.001	–			
17.Errors for men	Pearson's r	–.025	–.027	–.029	.161**	–.111	.060	.117	–.303***	–.013	.232***	.250***	.107	.053	.554***	.405***	–.116	–		
	p-value	.684	.659	.632	.008	.069	.327	.056	<.001	.837	<.001	<.001	.081	.386	<.001	<.001	.058	–		
18.Violations for men	Pearson's r	–.014	–.011	–.010	.157*	–.107	.082	.161**	–.292***	.096	.391***	.135*	.218***	.006	.467***	.253***	.062	.649***	–	
	p-value	.824	.864	.865	.010	.081	.184	.008	<.001	.117	<.001	.027	<.001	.919	<.001	<.001	.311	<.001	–	
19.Positive for men	Pearson's r	.018	.042	.160**	.001	.157*	.067	–.073	.231***	.071	–.148*	–.010	–.024	.176**	–.188**	.041	.332***	–.214***	–.239***	–
	p-value	.768	.494	.009	.986	.010	.276	.234	<.001	.249	.015	.871	.693	.004	.002	.508	<.001	<.001	<.001	–

Note. *p < .05, **p < .01, ***p < .001.

Data availability

Data will be made available on request.

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