The Predictive Role of Achievement Goals Adoption on Sensation-Seeking and Risk Taking in Driving Transportation Research Part F: Traffic Psychology and Behaviour

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Highlights

- Achievement goal theory is a new theoretical framework in the driving domain
- Some achievement goals predict sensation seeking and ordinary/aggressive violations
- Performance-approach goal adoption positively predict sensation seeking/violations
- Mastery-avoidance goal adoption negatively predict sensation seeking/violations
- Relations between these two goals and violations is mediated by sensation seeking

Abstract

Risk taking in driving is a major road safety issue. Understanding the individual psychological differences that may influence risk taking may contribute to better overcome its negative consequences. Recently, four achievement goals were highlighted in the driving domain: striving to drive well or to improve as much as possible (mastery-approach goals), to avoid driving badly or to avoid being a worse driver than before (mastery-avoidance goals), to outperform other drivers (performance-approach goals), and to avoid being a worse driver than other drivers (performance-avoidance goals). The first purpose of the present study was to examine the predictive role of these achievement goals in driving on self-reported drivers' risk taking (ordinary and aggressive violations) and sensation-seeking. The second purpose of the study was to test the mediating role of sensation seeking between achievement goals adoption in driving and violations. A total of 341 French drivers voluntarily filled out the questionnaires assessing the variables of interest. The main results showed that performance-approach goals adoption was found to positively predict sensation seeking, ordinary and aggressive violations, whereas mastery-avoidance goals adoption was found to negatively predict these variables. The results also highlighted that sensation seeking was a significant mediator of the relationships between the two previous achievement goals (performance-approach and mastery-avoidance goals) and ordinary and aggressive violations. In conclusion, the achievement goal model may now be considered a relevant theoretical framework in the driving literature focusing on risk taking, sensation seeking, and road safety.

Keywords: Achievement goals; Sensation seeking; Risk; Violations; Driving behavior; 2 x 2 model

The Predictive Role of Achievement Goals Adoption on Sensation-Seeking and Risk Taking in Driving

1. Introduction

Risk taking is omnipresent and represents a major issue in the context of driving (de Winter and Dodou, 2010). In addition to the inherent risk induced by driving a car in a changing and uncertain environment, risk also depends on drivers' behaviors. For instance, aggressive driving behaviors are involved in 55% of fatal accidents (Du et al., 2018) which have a high human cost (i.e., 2.2% of the mortality rate in the world, Ramiani and Shirazian, 2020) and a high economic cost (Puttawong and Chaturabong, 2020). Previous traffic citation/violation are also related to the crash rate (Alver et al., 2014; Scott-Parker et al., 2009) and the likelihood of severe injuries is related to aggressive driving (Ma et al., 2018) and speeding (Neyens and Boyle, 2008). Consequently, examining the antecedents of risky behaviors quickly became a promising research question in the driving literature. Psychological differences may be of particular interest because risk-taking may diverge between drivers based on their demographic profile, but also based on their personality types and psychological differences.

Traffic violations are potentially dangerous for both oneself and others (Guého et al., 2014). Violations are intentional transgressions of official traffic rules and social codes between drivers (Reason et al., 1990). Two types of violations were investigated in the driving literature (Lawton et al., 1997). Ordinary violations are instrumental transgressions which are deliberate and related to practical considerations (e.g., saving time). They may result in exceeding speed limit or not stopping at the red light. Aggressive violations are more emotional transgressions of accepted social norms of driving (Guého et al., 2014). They are directed towards other drivers or other road users (e.g., cyclists, pedestrians). They may result in honking the horn to show annoyance with another driver or voluntarily refusing to yield at

an intersection. In the present study, we focused on aggressive and ordinary violations because they are characterized by the intentional character of risky or dangerous behavior (Parker et al., 1995), contrary to driving errors which are, by definition, unintentional (Reason et al., 1990). Highlighting the underlying psychological processes of aggressive and ordinary violations is a first step for purpose of changing drivers' attitude through the identification of the individual psychological differences that may influence these two self-reported variables.

For example, one of these psychological constructs is sensation seeking (Jonah, 1997), which is "the need for varied, novel, and complex sensations and experiences and the willingness to take physical and social risks for the sake of such experiences" (Zuckerman, 1979, p. 10). Drivers who have high sensation seeking scores enjoy driving on roads with narrow bends or have a daredevil driving. Sensation seeking was positively related to risky driving, especially aggressive driving (e.g., Dahlen et al., 2005) and violations (Schwebel et al., 2007). More specifically, other studies (Delhomme et al., 2009, 2012; Yagil, 2001) have applied a sensation-seeking measure to the specific domain of driving and have shown that driving sensation seeking was related to risky driving such as speeding. While we have detailed one of the validated psychological variables that may influence risk-taking in driving, many others have already been investigated in the literature, such as impulsivity (Dahlen et al., 2005) and anger (Ge et al., 2014). However, some fields of the psychological literature remain unexplored while they could potentially be of theoretical and practical interest in examining risk-taking in driving, such as achievement motivation. The main originality of the present study lies in the use of this theoretical framework, which has only recently been introduced in the driving literature.

Achievement motivation triggers and directs the individual's behaviors toward demonstrating competence or avoiding demonstrating incompetence in a context in which his/her performance is evaluated, called achievement context. This type of context is

particularly prevalent in the driving domain because the driver's performance is continuously evaluated by other drivers, by passengers, by the driver himself/herself, by police authorities, by friends and family, and even by society at large (Mascret et al., 2020). In such an achievement context, achievement goals are "cognitive representation(s) of a competence-based possibility that an individual seeks to attain" (Elliot, 1999, p. 628). Since the first studies on achievement goals (e.g., Dweck and Elliott, 1983; Nicholls, 1984), several models were validated in different achievement contexts, such as education, sports, and work (for an historical retrospective, see Elliot et al., 2011). According to Van Yperen et al. (2014), the most used achievement goals model is currently the 2 x 2 model (Elliot, 1999), which crosses two valences of competence, approach (i.e., striving for success) versus avoidance (i.e., avoiding failure), and two definitions of competence, mastery (i.e., developing self-competence and task mastery) versus performance (i.e., demonstrating competence relative to others). To date, only one recent study has focused on achievement goals adoption in driving (Mascret et al., 2020). Based on other domains' literature, this research validated through confirmatory factor analysis a scale assessing achievement goals adoption in driving. Four achievement goals were highlighted in the driving domain: striving to drive well or to drive better and better (mastery-approach goals), to avoid driving badly or to avoid being a worse driver than before (mastery-avoidance goals), to outperform other drivers (performance-approach goals), and to avoid being a worse driver than other drivers (performance-avoidance goals). This study also provided promising initial results, showing that endorsing mastery-approach and performance-approach goals positively predicted interest in driving, while endorsing performance-approach goals positively predicted self-reported emergency maneuvers, and that endorsing mastery-avoidance goals negatively predicted self-reported accidents and at-fault accidents. While the adoption of some achievement goals in driving was related to emergency maneuvers and accidents, achievement goals are not conceptually

considered a form of risk-taking. They are rather conceptualized as “cognitive-dynamic aims that focus on competence” (Elliot & Murayama, 2008, p.614). Competence is considered a basic motivator of human behavior in many contexts, but it has not often been investigated in the driving domain. However, it is interesting to study the relationships between achievement goals adoption, self-reported risk-taking in driving (represented by violations) and driving sensation-seeking. Indeed, trying to demonstrate superiority over others (i.e., endorsing performance-approach goals) may lead to a lack of interest in the rules (Nicholls, 1989). The review of Biddle et al. (2003) in the sports domain clearly indicated that adopting performance-based goals was positively related to unsportspersonlike attitudes, rule violations, endorsement of aggressive acts, and aggressive behaviors. In domains including work, sports, and education, performance-based goals adoption had higher association with cheating (i.e., taking the risk of not respecting the rule) than mastery-based goals adoption (Van Yperen et al., 2011). Moreover, hypercompetitiveness was positively related to sensation seeking (Ryckman et al., 1994). In contrast, mastery goals were related to more positive attitudes and behaviours in the sport domain, for instance less tolerance for aggression and cheating (Kavussanu & Roberts, 2001) and respect for rules, officials, and social conventions (Dunn & Causgrove Dunn, 1999). All these patterns may be similar in the driving context, but they are hypothetical for now and remain to be demonstrated.

Consequently, the purposes of the present study were to examine (a) the predictive role of achievement goals adoption in driving on self-reported drivers’ aggressive violations, ordinary violations, and sensation seeking, and (b) the potential mediating role of sensation seeking between achievement goals and violations. Different assumptions can be made. Based on the literature presented above and based on the only study focusing on achievement goals adoption in driving (Mascret et al., 2020), we hypothesized that following performance-based goals may lead drivers to declare more ordinary violations, aggressive violations, and

sensation seeking. Since mastery-approach goals adoption was mostly linked to adaptive outcomes in the literature (e.g., Lochbaum et al., 2016) and since Mascret et al. (2020) showed that mastery-avoidance goals adoption in driving negatively predicted self-reported accidents and at-fault accidents, we hypothesized that mastery-approach and mastery-avoidance goals adoption negatively predicted self-reported ordinary violations, aggressive violations, and sensation seeking. Based on the previous hypotheses and since sensation seeking was identified as a predictor of risky and aggressive behaviors in driving (e.g., Dahlen et al., 2005; Delhomme et al., 2009, 2012), we hypothesized that sensation seeking was a mediator between achievement goals adoption in driving and violations.

In the following chapter 2, the methods used in this paper are firstly described. The sample of participants and measures are thus detailed, some definitions are given, and statistics methods are exposed. Then, in chapter 3, results are presented in three parts. The first one briefly presents the preliminary results which aims to validate the main variable choice by verifying the univariate normality. The second part deals with the direct effects by a first hierarchical regression analyze while the third part concerns the indirect effects. A large discussion is finally provided in chapter 4 to consider some limits to this work.

2. Method

2.1. Participants

A total of 341 French drivers (234 women, 107 men, M_{age} = 30.47 years, *SD* = 14.05, range = 18-73 years) having a category B driver's license for many years ($M_{years\ of\ driving\ license}$ = 11.63 years, *SD* = 13.81, range = 1-49 years), with an annual mileage of approximatively 14 000 kilometers (*SD* = 13 740 kilometers), voluntarily participated in the study. Concerning driving frequency, 48.09% of the participants declared that they drove every day. 27.86% drove at least three times per week and 24.05% drove less than three times per week. Participants individually completed a questionnaire package containing the focal constructs of

the study. The study was in line with the requirements of the institutional board of the first author's University and of the French *Commission Nationale de l'Informatique et des Libertés* (n°2004-801).

2.2.Measures

Confirmatory Factor Analyses (CFA) were conducted with the JASP software (version 0.10) on the covariance matrix of the items of the three questionnaires used in the present study. The solution was generated using maximum likelihood estimation. Comparative Fit Index (CFI) ≥ .95, Tucker-Lewis Index (TLI) ≥ .95, and Root Mean Square Error of Approximation (RMSEA) ≤ .05 were the criteria for a good fitting model, and CFI ≥ .90, TLI ≥ .90, and RMSEA ≤ .08 were the criteria for an acceptable fitting model (Byrne, 2010). A value less than .08 is generally considered a good fit for Standardized Root Mean Square Residual (SRMR, Hu and Bentler, 1999).

2.2.1. Achievement Goals in Driving

Achievement goals were assessed using the Achievement Goals in Driving Questionnaire (AGQ-D, Mascret et al., 2020) initially validated in the French language. Performance-approach goals (e.g., *"When driving, my goal is to outperform others"*), mastery-approach goals (e.g., *"When driving, my goal is to improve as much as possible"*), performance-avoidance goals (e.g., *"When driving, my goal is to avoid driving less well than others"*), and mastery-avoidance goals (e.g., *"When driving, I am striving to avoid driving badly"*) were measured using a 1 (completely disagree) to 5 (completely agree) Likert scale. Using McDonald's omega, internal consistency was also satisfactory for each subscale, above the .70 threshold (Dunn et al., 2014).

2.2.2. Sensation Seeking

The French translation (Delhomme, 2002) of the Driving Related Sensation Seeking Scale (Taubman et al., 1996) was used. Participants were instructed to respond to the seven

items (e.g., *"I often have the impression of driving like a race pilot"*) on a scale from 1 (*not at all*) to 5 (*very much*). Internal consistency was satisfactory.

2.2.3. Violations

The two corresponding subscales of the French version of the Driver Behavior Questionnaire (Guého et al., 2014) were used to assess two types of violations. Participants responded to the six items assessing ordinary violations (e.g., *"Ignoring the speed limit on the motorway"*, *"Driving after drinking"*) and the six items assessing aggressive violations (e.g., *"Getting angry with another driver and following him"*, *"Honking the horn to show annoyance with another driver"*) on a six-points scale (*never* to *nearly all the time*). Internal consistency was somewhat weak for aggressive violations and ordinary violations, but these results were not surprising because in the Guého et al.'s (2014) validation study of the French version of the Driver Behavior Questionnaire, Cronbach's alphas were similar for the same variables.

2.3. Data Analyses

Preliminary analyses were conducted to examine missing values, to detect outliers (In'nami and Koizumi, 2013) using Mahalanobis distance at the multivariate level ($\chi^2(9) = 27.88$, $p < .001$), and to examine univariate normality of the main variables (Curran et al., 1996) through skewness which measures the distributions' lack of symmetry (values $\leq |2|$) and kurtosis which measures whether the data are heavy-tailed or light-tailed relative to a normal distribution (values $\leq |7|$). Then, hierarchical regression analyses were conducted to examine how gender (women = 0, men = 1), age, years of driving license, annual mileage, and achievement goals adoption in driving were predictors of sensation seeking, aggressive violations, and ordinary violations (Model 1). Gender, age, years of driving license, and annual mileage were entered in Step 1 to control these variables. Achievement goals were then entered in Step 2. A second set of hierarchical regression analyses was conducted to

examine how the four control variables (Step 1) and sensation seeking (Step 2) were predictors of aggressive and ordinary violations (Model 2). Regression analyses were conducted using the JASP software (version 0.10).

Finally, we tested the potential mediating role of sensation seeking between achievement goals adoption in driving and the two violations, following the procedure used in previous studies (e.g., Danthony et al., 2020; Madigan et al., 2017). We entered in Model 3 only the significant predictors from Model 1 and Model 2, including the same four control variables. According to Baron and Kenny (1986), a partial mediation may be envisaged if the significance of the main effect between achievement goals adoption and aggressive violations (or ordinary violations) decreases, and a full mediation may be envisaged if this main effect becomes non-significant, when the mediating variable (i.e., sensation seeking) is accounted for. These potential mediations were examined using the macro PROCESS (Hayes, 2003) for the SPSS software version 18 for Windows, running the mediational model with 5000 bootstraps. If the 95% confidence interval (CI) does not contain zero, the test is considered significant at $p < .05$ (Preacher and Hayes, 2008). Conducting separate hierarchical regression analyses substantively leads to results identical to structural equation modeling (Hayes et al., 2017).

3. Results

3.1. Preliminary Results

Only 0.14% of the data were missing, so they were replaced by the mean of the participant's sub-scale (Roth et al., 1999). No participants were detected as outliers. According to Curran et al. (1996), there were no issues with skewness (all values $\leq |2|$) and kurtosis (all values $\leq |7|$). Consequently, univariate normality of the main variables is validated. All the results of the CFAs are presented in Supplementary Materials and showed that the fit statistics met the criteria for an acceptable fitting model. Results of preliminary

analyses, descriptive statistics, internal consistency, and correlations between variables are presented in Table 1.

Please insert Table 1 about here

3.2. Direct Effects

The results of the first hierarchical regression analyses (Model 1) showed that endorsing performance-approach goals positively predicted sensation seeking, aggressive violations, and ordinary violations, whereas endorsing mastery-avoidance goals negatively predicted these variables. In other words, drivers who want to outperform other drivers (performance-approach goals) are more sensation-seeking drivers and commit more ordinary and aggressive violations. The pattern is reversed for drivers who want to avoid driving badly or to avoid being a worse driver than before (mastery-avoidance goals). Moreover, performance-avoidance goals adoption positively predicted aggressive violations only, whereas mastery-approach goals adoption was not found to significantly predict any variables. In other words, drivers who want to avoid being worse drivers than other drivers (performance-avoidance goals) commit more aggressive violations. Drivers who want to drive well or to drive better and better (mastery-approach goals) have no particular response pattern regarding sensation seeking and violations.

Model 1 explained 35.5% of the variance in sensation seeking, 18.6% in aggressive violations, and 32.7% in ordinary violations. The results of the second hierarchical regression analyses (Model 2) highlighted that sensation seeking was a strong positive predictor of both aggressive violations and ordinary violations. Model 2 explained 27.4% of the variance in aggressive violations and 34.4% in ordinary violations. The detailed results of direct effects are presented in Table 2. We can notice that age and years of driving experience are highly correlated (see Table 1). When terms in a model are highly correlated, removing one of these

terms may have a significant impact on the estimated coefficients of the others. We conducted the regression analyses again, removing either age or years of driving experience, and the results were not significantly impacted.

Please insert Table 2 about here

3.3. Indirect Effects

Following the procedure explained above, only the significant predictors from Models 1 and 2 were entered in Model 3. Because performance-avoidance goals adoption was not found to significantly predict sensation seeking (see Table 2), sensation seeking was not studied as a mediator between performance-avoidance goals and aggressive violations (Baron and Kenny, 1986). In Model 3a, performance-approach goals and control variables were entered in Step 1. Sensation seeking was then entered in Step 2. The predictive role of performance-approach goals, control variables, and sensation seeking on aggressive violations and ordinary violations was investigated. The model explained 28.9% of variance in aggressive violations and 36.2% of variance in ordinary violations. Moreover, the two effects of performance-approach goals adoption decreased when sensation seeking was added to the model. These results highlight the possibility of a partial mediation (Baron and Kenny, 1986), suggesting both that adopting performance-approach goals have a direct relationship with aggressive violations and ordinary violations, and that these relationships were partially mediated through sensation seeking. Using the PROCESS macro, the results highlighted that the partial mediation was effectively significant for aggressive violations (indirect effect = 0.02 [95% CI = 0.092 – 0.187], see Fig. 1a) and ordinary violations (indirect effect = 0.02 [95% CI = 0.093 – 0.185], see Fig. 1b).

In Model 3b, mastery-avoidance goals and control variables were entered in Step 1. Sensation seeking was then entered in Step 2. The predictive role of mastery-avoidance goals, control variables, and sensation seeking on aggressive violations and ordinary violations was

investigated. The model explained 27.7% of variance in aggressive violations and 35.2% of variance in ordinary violations. When sensation seeking was added to the model, the effect of mastery-avoidance goals adoption on aggressive violations became non-significant, indicating a potential full mediation (Baron and Kenny, 1986), and the effect on ordinary violations decreased, indicating a potential partial mediation. The results of the PROCESS macro showed that the relationship between mastery-avoidance goals adoption and aggressive violations was fully mediated through sensation seeking (indirect effect = 0.03 [95% CI = -0.192 – -0.067], see Fig. 1c) and that sensation seeking partially mediated the relationship between mastery-avoidance goals adoption and ordinary violations (indirect effect = 0.03 [95% CI = -0.188 – -0.070], see Fig. 1d). The detailed results are presented in Table 3.

Please insert Table 3 and Figure 1 about here

4. Discussion

While the only study based on the achievement goal model (Mascret et al., 2020) has previously highlighted some interesting relations with variables of interest in the driving domain (i.e., accidents, at-fault accidents, emergency maneuvers, interest in driving, self-efficacy in driving), the present study showed the predictive validity of this model on self-reported violations and sensation seeking. The achievement goal model appears to be a promising theoretical framework to examine other relevant variables usually investigated in the driving domain.

Performance-approach goals adoption was found to positively predict aggressive violations, ordinary violations, and sensation seeking. These results are difficult to compare with other results in the driving domain, as the only study focusing on achievement goals in driving was a study whose purpose was to validate the questionnaire assessing these achievement goals (Mascret et al., 2020). However, these results are in accordance with the other domains (sports, education, work) where performance-approach goals adoption is

positively related to rule violations, aggressive attitudes and behaviors, cheating, and sensation seeking (e.g., Biddle et al., 2003; Ryckman et al., 1994; Van Yperen et al., 2011). The results of the present study highlighted that it is also the case in the driving domain. Moreover, outperforming others is the key factor for drivers who adopt performance-approach goals. Committing voluntary Highway Code offences (i.e., ordinary violations) and being aggressive toward other road users (i.e., aggressive violations) are two ways to show one's superiority over other drivers. Our study also showed that adopting performance-avoidance goals (i.e., to avoid driving poorly compared to other drivers) positively predicted aggressive violations. This result confirms that endorsing performance-avoidance goals result in emotions with negative valence such as anxiety (Putwain et al., 2013), aggressive violations are mainly emotional transgressions of accepted social norms of driving (Guého et al., 2014). In sum, endorsing performance-based goals, especially performance-approach goals, predicted sensation seeking and self-reported risk taking in driving.

The potential protective role of mastery-avoidance goals adoption, surprisingly found in Mascret et al.'s (2020) study concerning accidents and at-fault accidents, was found again in the present study with risk taking and sensation seeking. Mastery-avoidance goals adoption negatively predicted aggressive violations, ordinary violations, and sensation seeking, highlighting that endorsing mastery-avoidance goals was related to adaptive outcomes in the driving domain. Because mastery-avoidance goals are based on avoidance motivation (i.e., avoiding failure), they should theoretically lead to more maladaptive effects (Elliot and Harackiewicz, 1996). But the meta-analysis of Baranik et al. (2010) showed that adopting mastery-avoidance goals was related to both adaptive effects (e.g., interest) and maladaptive effects (e.g., anxiety). Indeed, endorsing mastery-avoidance goals combines positive (mastery) and negative (avoidance) elements in a single goal (Senko and Freund, 2015). Consequently, the outcome depends on the most predominant component (Elliot, 1999). In

the driving domain, mastery-avoidance goals adoption may have a special status due to the context of driving itself. Because it is strongly related to fear of failure (Conroy et al., 2003; Elliot and McGregor, 2001) and because failure in driving may be related to injury, accident and/or death, mastery-avoidance goals adoption was found to negatively predict violations and sensation seeking in the driving domain. Endorsing mastery avoidance goals, namely avoiding failure in the driving task, avoiding driving worse than before, and striving to avoid driving badly consequently seems to have a protective role against self-reported risky behaviors and sensation seeking in driving.

Finally, the present study confirmed the results already found in the driving literature (e.g., Dahlen et al., 2005; Schwebel et al., 2007) concerning the positive predictive role of sensation seeking on ordinary and aggressive violations. But it was the first to examine the mediating role of sensation seeking between achievement goals adoption and ordinary and aggressive violations. The results highlighted that (a) sensation seeking partially mediated the relationship between performance-approach goals adoption and both ordinary violations and aggressive violations, (b) sensation seeking partially mediated the relationship between mastery-avoidance goals adoption and ordinary violations, and (c) the relationship between mastery-avoidance goals adoption and aggressive violations was fully mediated through sensation seeking. In sum, these results showed that the relationships between performance-approach and mastery-avoidance goals adoption were mediated by sensation seeking. This mediating pathway may explain how drivers' achievement goals adoption may influence ordinary and aggressive violations. Sensation seeking is more likely to occur with drivers who endorse performance-approach goals because they want to show that they control their vehicle in boundary conditions better than other drivers who have a smoother driving. Sensation seeking, in turn, increases ordinary violations (e.g., exceeding speed limit) and aggressive violations (e.g., honking the horn to show one's annoyance with another driver), and even

risky behaviors in general (Jonah, 1997). The pattern was reversed for mastery-avoidance goals adoption because drivers endorsing this kind of goals strive to avoid driving badly and, consequently, sensation seeking does not match the way they drive. Sensation seeking fully explained the relationships between mastery-avoidance goals adoption and aggressive violations, while it partially explained its relationship with ordinary violations. These results provided an original point of view on the extensive literature examining the relationships between sensation seeking and risky driving (Jonah, 1997).

Our study had several limitations, and directions for future research may also be envisaged. First, one potential limitation was common method variance, which may occur when the shared variance among variables is influenced by the method used to collect data (Richardson, Simmering, & Sturman, 2009). Based on the recommendation of Podsakoff, MacKenzie, Lee, and Podsakoff (2003), we have taken certain precautions to limit that possibility in the present study. Thus, validated instruments were used to reduce item ambiguity, the order of the instruments was always the same when participants completed the questionnaires. Then the first scale assessed achievement goals adoption in driving which are fewer sensitive issues than sensation seeking or violations, demographic information was provided at the end of the questionnaires. And finally, achievement goals were assessed in the present study as dispositional achievement goal orientations which are stable over time (e.g., Elliot, 2005; Elliot & McGregor, 2001). Despite all these precautions intended to decrease common method variance, this source of systematic error can not necessarily be ruled out with studies of this nature (Podsakoff et al., 2003).

Secondly, construct proliferation, which is “the accumulation of ostensibly different but potentially identical constructs representing phenomena” (Shaffer, DeGeest, & Li, 2015, p. 1), may also be discussed in the present study. Achievement goals adoption, sensation seeking, and violations were correlated in the present study, but achievement goals are

conceptually different from both sensation seeking and violations. Construct proliferation can therefore not be considered between these variables. But it is conceivable to wonder whether sensation seeking and violations measure different facets of self-reported driving behaviors or whether they are rather iteration of the same construct. However, the driving literature mainly considers that sensation seeking is an antecedent of violations (e.g., Dahlen et al., 2005; Delhomme et al., 2009; Jonah, 1997, Schwebel et al., 2007), which suggests they are different constructs.

Thirdly, cross-cultural differences may occur in ordinary and aggressive violations assessed with the Driving Behavior Questionnaire (Lajunen et al., 2004). The present study was conducted in one country only (France). So, it would be relevant to extend our results to other countries to highlight whether mastery-avoidance goals and performance-approach goals adoption is also prevalent in predicting self-reported risky driving behaviors and sensation seeking elsewhere.

Fourthly, comparing the influence of young, experimented, and old drivers' achievement goals adoption on their self-reported risky driving may be worthwhile because variations of driving style were identified among age subgroups (e.g., Lawton et al., 1997; Reason et al., 1990).

Fifthly, our study was conducted with car drivers only. Because sensation seeking and risk taking are integral parts of typical riders' behaviors (Wong et al., 2010), including two-wheeler drivers in a study examining the relationships between their achievement goals adoption and their self-reported risky behaviors is also a promising perspective.

Finally, risk taking was assessed through self-reported measures only. New measures were recently included in the literature through Naturalistic Driving Studies which focus on drivers' performance and behaviors in the real world, using different data acquisition systems installed on vehicles to collect information about drivers' behaviors (Dingus et al., 2016,

Naude et al., 2017). These real-world drivers' behaviors were studied in relation to some personality traits or characteristics, such as trait anxiety (e.g., Oltedal & Rundmo, 2006). But achievement goals adoption was not hitherto investigated in relation to these new objective measures which may indicate some form of risk-taking in real-life conditions.

5. Conclusion

The achievement goals framework was recently adapted to the driving domain and provided promising initial results regarding self-reported accidents (Mascret et al., 2020). Consequently, studying sensation seeking and risk-taking in driving, which are related to accidents, appeared to be of great interest to extend these initial results. The present study highlighted that performance-approach goals adoption was found to be maladaptive, predicting positively sensation seeking, ordinary violations, and aggressive violations, whereas mastery-avoidance goals adoption was found to be the most adaptive goals in the driving domain, predicting negatively the three previous variables. While a large body of research was previously conducted on sensation seeking and violations, achievement goals were identified for the first time as predictors of these variables. Consequently, further examination of achievement goals adoption in the driving domain may be a relevant perspective toward a better understanding of drivers' psychological characteristics for purposes of increasing road safety, for instance by carrying out targeted prevention campaigns.

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Table 1

Descriptive statistics, psychometric properties of the scales, and correlation matrix.

Variables	***M***	***SD***	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
1. Mastery-approach	3.70	1.05	-										
2. Performance-approach	1.91	1.04	.19***	-									
3. Mastery-avoidance	4.45	0.61	.40***	-.05	-								
4. Performance-avoidance	2.80	1.18	.31***	.54***	.22***	-							
5. Sensation seeking	2.62	0.78	.08	.49***	-.22***	.27***	-						
6. Aggressive violations	1.95	0.75	.02	.36***	-.15**	.27***	.51***	-					
7. Ordinary violations	1.85	0.70	-.03	.41***	-.21***	.16**	.58***	.58***	-				
8. Gender	-	-	.06	.11*	-.07	.06	.24***	.02	.11*	-			
9. Age	30.47	14.05	-.01	-.13*	-.06	-.12*	-.12*	-.11*	-.08	.26***	-		
10. Years of driving license	11.63	13.81	-.01	-.13*	-.07	-.11*	-.09	-.11*	-.06	.28***	.98***	-	
11. Annual mileage	14174	13740	.05	.15**	-.06	.09	.21***	.15**	.21***	.23***	.32***	.32***	-
McDonald's omega	-	-	.87	.88	.72	.77	.77	.69	.67	-	-	-	-
Skewness	-	-	-0.587	1.083	-1.232	0.094	0.343	1.133	0.877	-	-	-	-
Kurtosis	-	-	-0.312	0.307	2.030	-0.908	-0.245	1.570	0.651	-	-	-	-

Notes. *$p < .05$, **$p < .01$, ***$p < .001$, *M* = Mean, *SD* = Standard Deviation, Gender (men = 1, women = 0).

Table 2

Summary of hierarchical regression analyses predicting sensation seeking, aggressive violations, and ordinary violations.

	Sensation seeking		**Aggressive violations**		**Ordinary violations**	
	R^2	β	R^2	β	R^2	β
Model 1: Achievement goals						
Step 1	.147***		.053**		.079***	
Gender[1]		.17***		-.03		.04
Age[1]		-.71**		-.17		-.40
Years of driving license[1]		.55*		.06		.30
Annual mileage[1]		.15**		.13*		.17**
Step 2	.355***		.186***		.327***	
Mastery-approach goals		.07		-.01		-.04
Performance-approach goals		.37***		.24***		.38***
Mastery-avoidance goals		-.23***		-.17**		-.16**
Performance-avoidance goals		.06		.15*		-.03
Model 2: Sensation seeking						
Step 1	-		.053**		.079***	
Gender[1]		-		-.10		-.04
Age[1]		-		.14		.00
Years of driving license[1]		-		-.20		-.04
Annual mileage[1]		-		.08		.12*
Step 2	-		.274***		.344***	
Sensation seeking		-		.51***		.56***

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

[1]The β coefficients from the final regression equation

Table 3

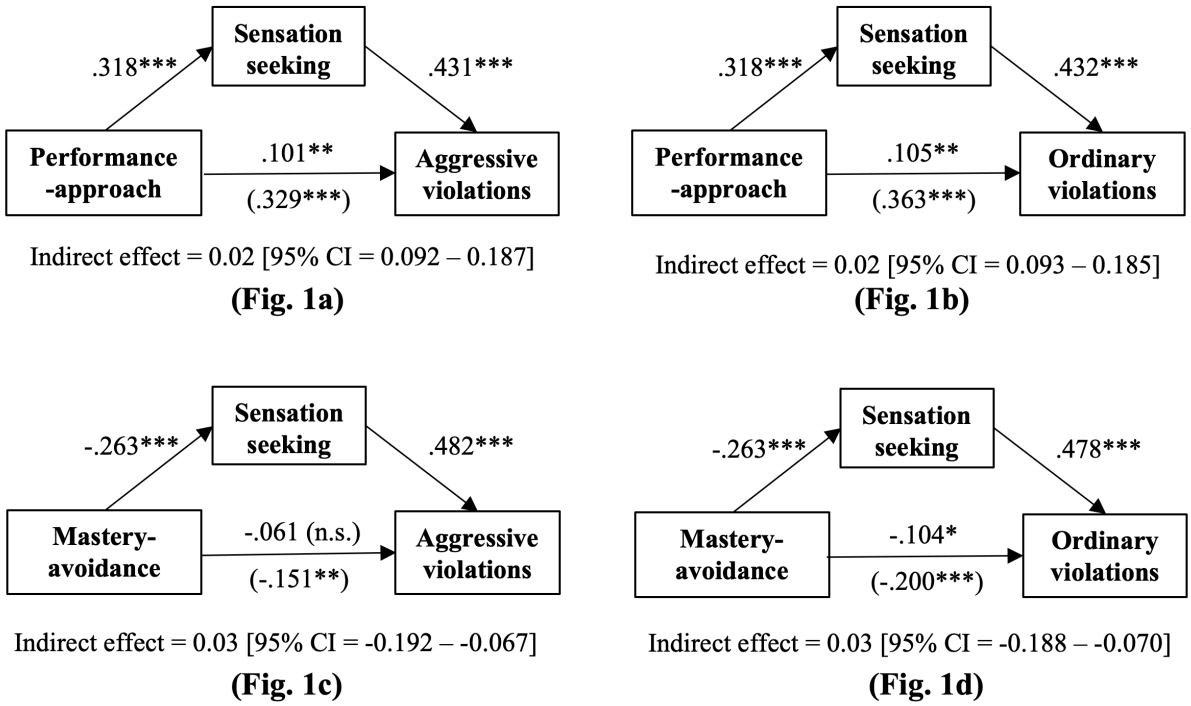
Mediation tests for performance-approach goals / mastery-avoidance goals and aggressive violations / ordinary violations

	Aggressive violations		**Ordinary violations**	
	R^2	β	R^2	β
Model 3a: Performance-approach goals				
Step 1	.153***		.202***	
Performance-approach goals		.33***		.36***
Step 2	.289***		.362***	
Performance-approach goals		.14**		.16**
Sensation seeking		.45***		.48***
Model 3b: Mastery-avoidance goals				
Step 1	.075***		.120***	
Mastery-avoidance goals		-.15**		-.20***
Step 2	.277***		.352***	
Mastery-avoidance goals		-.05		-.09*
Sensation seeking		.50***		.54***

Note. *$p < .05$, **$p < .01$, ***$p < .001$, results of the control variables (gender, age, years of driving license, annual mileage) are not included in the table.

Figure 1.

Sensation seeking as a mediator between performance-approach goals / mastery-avoidance goals and aggressive violations / ordinary violations



Note. Standardized regression coefficients, *$p < .05$, **$p < .01$, ***$p < .001$, CI = Confidence Interval, Fig.1a represents the partial mediation of sensation seeking between performance-approach goals and aggressive violations, Fig.1b represents the partial mediation of sensation seeking between performance-approach goals and ordinary violations, Fig.1c represents the full mediation of sensation seeking between mastery-avoidance goals and aggressive violations, and Fig.1d represents the partial mediation of sensation seeking between mastery-avoidance goals and ordinary violations.

Supplementary material

Results of the confirmatory factor analyses.

Variables	χ^2	***p***	**CFI**	**TLI**	**SRMR**	**RMSEA**
Achievement goals in driving	152.80	< .001	.943	.922	.054	.080
Sensation seeking[1]	29.68	.003	.969	.947	.048	.066
Violations[2]	108.35	< .001	.927	.906	.052	.057

Notes. [1]After adding an error covariance between the items 4 and 5 and between the items 5 and 7 to improve model fit, [2]After adding an error covariance between the items 1 and 6 and between the items 5 and 6 of the ordinary violations subscale to improve model fit.