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The Role of Perceived Legitimacy in Understanding Traffic Rule Compliance: A Scoping Review.

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Authors' contribution

The authors confirm contribution to the paper as follows:

Funding acquisition, study conception and design, data collection, preliminary analysis of results: Granié Marie-Axelle, Carnis Laurent, Martinez Frédéric, Piermattéo Anthony. Formal analysis and interpretation of the results, drafting the manuscript: Varet Florent. Supervision, project administration: Piermattéo Anthony. All authors participated to reviewing and editing the manuscript and approved the final version.

1 **Abstract**

2 **Background**

3 Perceived legitimacy associated with rules and authorities is an important element for
4 understanding and encouraging compliance with rules in the field of road safety, often more
5 so than with a deterrence approach. Despite a growing interest in legitimacy in recent decades
6 and in the psychological field in particular, its definitions and measurements appear to be
7 heterogeneous, subject to debate and in need of a common theoretical framework. Therefore,
8 one can expect these limitations to also concern the definitions and measurements of
9 legitimacy in the field of road safety. However, no literature review related to this issue is
10 currently available. This contribution therefore aims to fill this void by proposing a scoping
11 review investigating, in the field of road safety, how legitimacy is defined, measured, related
12 to compliance and what are its main determinants.

13 **Methods**

14 A scoping review was conducted, based on research literature from eight databases and
15 concerned with the perceived legitimacy of traffic rules or traffic enforcement and rule
16 compliance or traffic violations. Twenty-six publications meeting inclusion criteria were
17 retained. The characteristics and content of publications were analyzed to identify the relevant
18 elements related to our research questions.

19 **Results and conclusion**

20 The main results revealed that perceived legitimacy in the field of road safety can be related
21 to different objects (i.e., traffic rules, traffic violations, traffic enforcement, institutions) that
22 should be better delineated and differentiated in future research. While perceived legitimacy is
23 generally associated with compliance with traffic rules, its theoretical definitions and
24 measures in the field of road safety are heterogeneous and present validity issues which limit
25 the comparability of studies and so the accumulation of knowledge for both theoretical
26 research and road safety applications. No empirical study investigating the outcomes of
27 perceived legitimacy beyond compliance was identified. Few empirical studies have
28 investigated the determinants of perceived legitimacy. Most identified empirical studies were
29 cross-sectional, which is a limitation to establishing causality in investigated relationships.
30 Theoretical implications and research perspectives to improve studies on legitimacy in the
31 field of road safety and develop a multidimensional model of the perceived legitimacy of
32 traffic rules are therefore proposed and discussed.

33 **Key-words:** legitimacy; compliance; traffic rules; acceptability; road safety

34

35 1. Introduction

36 Understanding why people comply (or not) with rules is an important issue for social
37 scientists, legal scholars and policy makers. This is particularly the case in the field of road
38 safety where traffic violations are an important factor for explaining the occurrence and
39 severity of serious and fatal accidents (Barraclough et al., 2016; Winter & Dodou, 2010).
40 These traffic violations usually consist of speeding, drunk-driving or using a mobile phone
41 while driving (Behnood & Mannering, 2017; ONISR, 2018; Taylor et al., 2000). Despite their
42 legal dimension, some traffic rules such as those related to speed limits are transgressed by a
43 large majority of drivers (Fernández-Dols & Oceja, 1994; Havârneanu & Havârneanu, 2012;
44 Lucas & Pérez, 2003; Pérez et al., 2002). As a result, worldwide, road traffic accidents
45 account for about 1.25 million deaths, representing the 9th highest cause of mortality, and 20
46 to 50 million injuries per year. They also represent a substantial economic cost for most
47 countries of almost 3% of their gross domestic product per year (World Health Organization,
48 2015). Therefore, understanding factors that explain compliance with traffic rules is an
49 important issue.

50 Social science research on compliance with rules has notably focused on deterrence
51 approaches and more recently on legitimacy approaches. The deterrence perspective
52 postulates that individuals are motivated to avoid the negative consequences of rule
53 transgressions (when they are aware of them) and that this mechanism is an important trigger
54 for inducing rule compliance (Blumstein et al., 1978; Tittle, 1980; Zimring & Hawkins,
55 1973). From this instrumental perspective, people's behaviours are considered as being
56 particularly sensitive to tangible incentives and penalties associated with rule-breaking. Public
57 policies considering this approach as an efficient means of ensuring compliance tend to
58 promote strategies that lead people to perceive undesired behaviours as being extremely risky

59 legally (Harcourt, 2001; Kelling & Coles, 1996; McArdle & Erzen, 2001; Sunshine & Tyler,
60 2003). Several studies have shown that deterrence strategies are effective in controlling crime-
61 related behaviours (e.g., Blumstein et al., 1978; Nagin, 1998) and traffic violations (e.g.,
62 Høyve, 2014; Kergoat et al., 2017; Stanojević et al., 2013; Walter et al., 2011). Deterrence
63 effects rely on three elements which are certainty, severity and celerity of punishment.
64 Certainty of being caught was found to be more predictive of rule compliance than severity or
65 celerity of punishment for various offences (Decker et al., 1993; Nagin, 2013; Von Hirsch et
66 al., 2000; see Pratt et al., 2006, for a meta-analysis), including traffic violations (e.g., Briscoe,
67 2004; Homel, 1988; Kergoat et al., 2017).

68 However, several studies have shown that deterrence effects on compliance can be small
69 and of limited duration (e.g., Bottoms & Von Hirsch, 2010; Lipsey & Cullen, 2007;
70 Paternoster, 2010; Wright et al., 2004). Via a meta-analysis, Pratt et al. (2006) found that “the
71 mean sizes of the relationships between crime/deviance and variables specified by deterrence
72 theory are modest to negligible” and that this effect is “much weaker than those found in
73 meta-analyses of the relationships between criminal/deviant behavior and peer effects [...] and
74 self-control” (p. 383). Moreover, because deterrent effects rely on external pressure from the
75 subject, they do not allow self-regulated compliance with rules and require the probability of
76 being punished to be maintained, which is often costly (Tyler, 2006, 2009). Therefore,
77 deterrent strategies appear to be relatively limited in ensuring compliance with rules, although
78 their effectiveness in certain situations cannot be denied, while other social-psychological
79 factors such as perceived legitimacy are also at play and yield important effects for
80 behavioural compliance.

81 The legitimacy perspective¹ postulates that individuals voluntarily comply with rules
82 when they perceive them, as well as the authorities and institutions that enforce them, as just,
83 moral, fair, effective and consistent with their representations of reality and their system of
84 values and beliefs (Kelman, 1961; Tyler, 1990; Yagil, 1998). According to Tyler (1990),
85 people perceive rules as legitimate when they trust the authorities that enforce them and
86 consider that they have the right to make behaviours comply with them. According to Jackson
87 et al. (2012), legitimacy refers to situations where people recognize and justify the power of
88 authorities. From this normative perspective, people are intrinsically motivated to comply
89 with rules when they perceive them, as well as the authorities which dictate them, as
90 legitimate. This mechanism, which relies on self-regulated compliance, does not require the
91 presence of an external pressure and therefore ensures a long-lasting effect (Tyler, 2009).
92 Moreover, legitimacy appears to predict compliance with legal regulations to a greater extent
93 than deterrence factors in several studies (e.g., Hough et al., 2010; Jackson et al., 2012;
94 Sunshine & Tyler, 2003; Tyler, 2010, 2011; Van Damme, 2013). This effect is also found
95 regarding traffic rules (e.g., Bautista et al., 2015; Van Damme & Pauwels, 2016). Thus, an
96 intervention from a legitimacy perspective offers an interesting way of increasing compliance
97 with traffic rules as an alternative or a complement to deterrence-based strategies.

98 Despite a growing interest in legitimacy in recent decades and especially in the
99 psychological field (Jackson, 2018; Tyler, 1990), its definitions and measures appear to be
100 heterogeneous, subject to debate, and in need of a common theoretical framework (Hough et
101 al., 2013; Jackson, 2018; Jackson & Gau, 2016; Oceja et al., 2001). Objects concerned by
102 legitimacy are not always well differentiated, with some measurements for example confusing

¹ The legitimacy perspective on compliance is concerned with understanding perceived (or subjective) legitimacy, and not with what would be objective legitimacy (Anjuli Van Damme & Pauwels, 2016). Objective legitimacy could be defined as a characteristic which designates authorities which operate on the basis of certain objective criteria such as absence of corruption (Hinsch, 2010; Hough et al., 2013). Perceived legitimacy could be processed independently of objective legitimacy, as authorities that do not meet this criterion can be perceived as legitimate by citizens (Van Damme & Pauwels, 2016).

103 the legitimacy of laws with the legitimacy of authorities (Jackson, 2018). Such a phenomenon
104 could serve to limit the ability to define and assess legitimacy appropriately. Therefore, one
105 can also expect these limitations to concern the definitions and measurements of legitimacy in
106 the field of road safety. However, no literature review on this issue is currently available. This
107 contribution therefore aims to produce knowledge on this issue through a scoping review
108 (Arksey & O'Malley, 2005; Munn et al., 2018; Sucharew & Macaluso, 2019) investigating (a)
109 how legitimacy is defined and (b) measured in the field of road safety; (c) how legitimacy is
110 related to compliance with traffic rules in order to verify its potential interest for road safety
111 issues; (d) what are the main determinants and outcomes of legitimacy (beyond compliance)
112 in the field of road safety, as acting on these variables could be a way to increase perceived
113 legitimacy. A better understanding of legitimacy issues could help in determining the impact
114 of legitimacy in the field of road safety and in increasing compliance with traffic rules and
115 thus prevent road accidents from an applied research perspective.

116 2. Methods

117 The review was conducted using the method of the scoping review (Arksey &
118 O'Malley, 2005; Munn et al., 2018). This method is particularly relevant for addressing the
119 way research has been conducted in a particular field (e.g., Reinders et al., 2019; Seidler et al.,
120 2018; van Haperen et al., 2019). Scoping reviews are well suited for purposes such as
121 clarifying key definitions of a concept, identifying key characteristics or factors related to a
122 concept, examining how research is conducted on a certain topic or field, and identifying and
123 analyzing knowledge gaps in the literature. In contrast, the classic systematic review method
124 is rather recommended for addressing a precise question about effectiveness, the
125 appropriateness of an intervention, or relationships between well identified and defined
126 constructs (Munn et al., 2018). In addition, the heterogeneity identified in definitions and

127 measures of perceived legitimacy and similar concepts in the field of road safety did not allow
128 a systematic comparison of statistical relationships to be made nor a meta-analysis as may be
129 presented in classic systematic reviews. The five incremental stages proposed by Arksey and
130 O'Malley (2005) for carry out our scoping review are presented and followed below.

131 *2.1. Identification of the research questions*

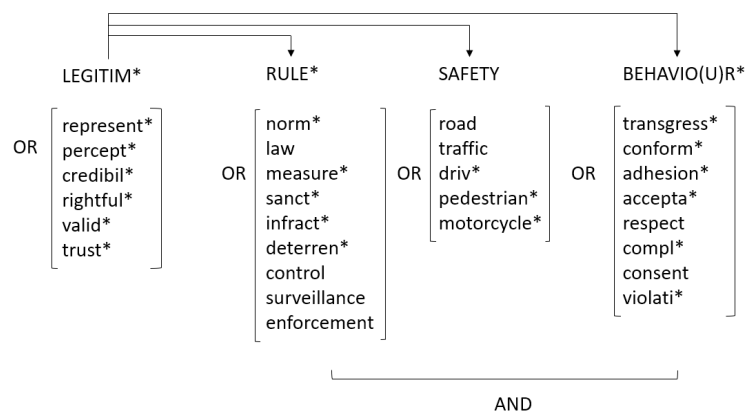
132 As stated by Arksey and O'Malley (2005), this step constitutes the starting point of
133 this scoping review. Given our aim to identify the key elements of definitions, measurement,
134 determinants and outcomes of legitimacy in the field of road safety, we address the following
135 research questions: (a) What are the main theoretical definitions of legitimacy in the field of
136 road safety? (b) What are the main measures proposed to address legitimacy in the field of
137 road safety? (c) Does legitimacy predict compliance in the field of road safety? (d) What are
138 the main determinants and outcomes (beyond compliance) of legitimacy in the field of road
139 safety?

140 *2.2. Identification of the relevant studies*

141 *2.2.1. Search Terms*

142 Key terms in both English and French were selected to identify studies pertinent to the
143 research questions (see Figure 1). On the basis of these questions, a multi-disciplinary team of
144 researchers (i.e., economists, psychologists, with expertise on road safety issues and/or norms
145 and rules concepts) first defined the main categories of keywords which should be used in the
146 search. They also specified the Boolean operators to use among these categories as part of the
147 search. As indicated in Figure 1, these four categories refer to the central investigated concept
148 (i.e., legitimacy), the object to which it applies (i.e., rules), the general field/context of
149 application (i.e., safety), and the behavioural consequences (i.e., behaviour). Each of these
150 keywords served as a basis for providing synonyms, antonyms, and close concepts. These

151 terms were chosen on the basis of the keywords which were collected from a first set of
 152 contributions focused on the issue of legitimacy and/or road safety and were used in the
 153 search with the Boolean operator “OR”. For instance, the term “rule” was not only
 154 exchangeable with close concepts such as “norms” or “law” but also with keywords related to
 155 rule enforcement (e.g., “deterrence”, “control”), as this issue is in general a key focus of the
 156 application of legitimacy. Finally, as indicated by the asterisks in Figure 1, all the terms were
 157 entered in the search in a truncated form in order to allow us to collect references where other
 158 forms of these terms, such as the plural form, are used.



159
 160 *Figure 1. Keywords and Boolean operators used for the search of relevant contributions.*

161 The search was focused on the references which included these keywords in their title
 162 and/or abstract and/or own keywords. There was no restriction regarding the type of
 163 publications (articles, book chapters, proceedings, etc.), the date or the language. Thus,
 164 despite keywords in both French and English, contributions in other languages such as
 165 Spanish were also considered.

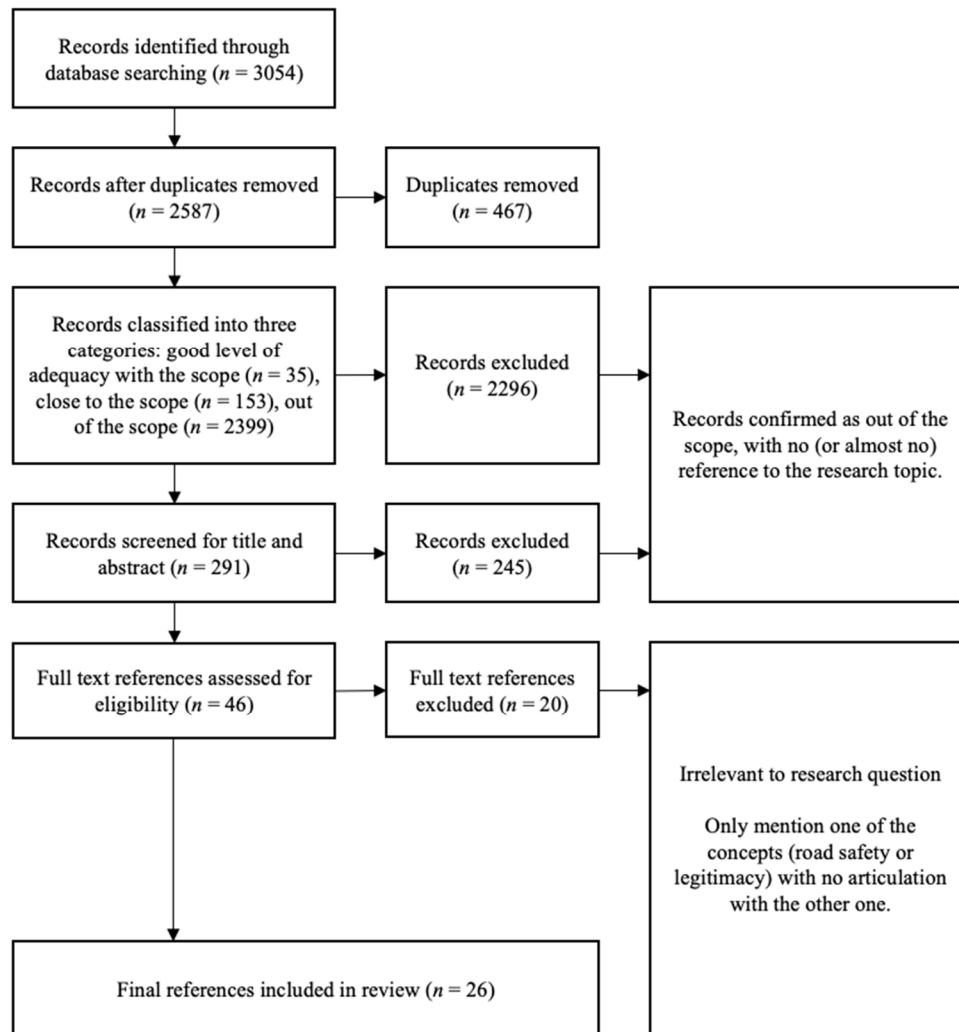
166 2.2.2. Databases

167 Nine databases were used (i.e., Academic Search Premier, ERIC, PsycINFO, SAGE,
 168 Science Direct, Taylor & Francis, TRID, Web of Science, Wiley). These databases were
 169 chosen on the basis of the combination of two criteria: (1) they had an “advanced search”

170 function, which allowed the search to be conducted according to the requirements we
171 previously mentioned; (2) they included references in the field of social and behavioral
172 sciences or specialized in transportation research. Moreover, most of these databases had been
173 used in previous scoping reviews (see for instance Van Haperen et al., 2019). Overall, 3,054
174 references were found. After a first manual removal of duplicate entries, 2,587 references
175 remained (see Figure 2 for a general presentation of the selection process).

176 *2.3. Study selection*

177 Two authors independently classified the 2,587 references into one of the three
178 subsequent categories as follows: (1) publications considered to have a good level of
179 adequacy with the scope ($n = 35$); (2) publications considered close to the scope, but which
180 did not fully correspond to it and required a more in-depth evaluation ($n = 153$); (3)
181 publications considered to be out of the scope ($n = 2,399$). On this basis, two other authors
182 evaluated this first classification by giving their opinion on all the publications of the first and
183 the second category and about 103 publications of the third category drawn at random. At this
184 level, the first rate of agreement was 75%. Then, the same two authors discussed the divergent
185 decisions in order to reach an agreement. In consequence, the second agreement rate was
186 99%. At this stage, the decision for the classification of the last three conflicting publications
187 was made by a third author. This process led to the selection of 46 references. Then, the same
188 multi-disciplinary team of researchers which was assembled to define the search terms,
189 collectively assessed each of these references on the basis of its abstract and a fast general
190 reading of its content. Following this step, 26 references remained. These references were
191 finally distributed among the members of the team for an in-depth reading (two members
192 were chosen for each reference).



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Figure 2. Flow diagram of the reference selection process.

196 2.4. Charting the data

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Data of interest from the selected publications were extracted and summarized in Table 1 considering for each publication: authors, year of publication, location of the study, article type (empirical, theoretical), design for empirical studies (qualitative, cross-sectional, quasi-experimental, experimental, longitudinal), sample size and percentage of males, mean age of the sample, origin of the sample (general population, university students, professional drivers), **main methodological elements (study design and measures) and main results relevant**

203 **to this review**. For each reference, the table was completed by each author who was assigned
204 to read it in depth. For empirical publications, the location was based on the country where
205 the participants were recruited. For theoretical publications, the location was based on the
206 affiliation of the first author. Samples based on participants from different countries were
207 considered in the counting method. For theoretical studies, the location was based on the
208 country of the authors' affiliations.

209 ***2.5. Collating, summarizing and reporting the results***

210 The results presented in the charting stage were summarized and critically reviewed to
211 determine the extent of identified contributions to the four main research questions. The
212 literature was organized and synthesized thematically in order to identify key elements for (a)
213 defining legitimacy, (b) the main measurements of legitimacy, (c) the main observed
214 relationship between legitimacy and compliance, (d) the main determinants and other
215 outcomes of legitimacy in the field of road safety. The results of the process are presented
216 below.

217 **3. Results**

218 In the first part, publication characteristics (publication year, location, article type,
219 study design, sample sizes and sample characteristics) are briefly presented and analyzed. In a
220 second part, we have detailed the identified results successively from each of the four research
221 questions.

222 ***3.1. Publication characteristics***

223 Article characteristics are summarized in Table 1. All selected references were
224 published between 1988 and 2018. The number of references by year since 1988 ranges from
225 0 to 4, increasing over the years, and references published since 2012 represent 58% of the

226 publications ($n = 15$). Most of the publications are from Europe ($n = 16$), and more
227 particularly from Spain ($n = 6$), the United-Kingdom ($n = 3$) and Romania ($n = 3$). Other
228 publications are from Australia ($n = 5$), North America ($n = 4$), South America ($n = 3$) and the
229 Middle East ($n = 2$). No studies were conducted in Africa, nor in Asia except for Middle
230 Eastern countries (i.e., Turkey and Qatar). Of the 26 selected publications, 24 (92%) are
231 empirical studies while 2 of them deal with theory and concepts (8%). Of the empirical
232 references, 12 (50%) are based on cross-sectional design, 8 (33%) on experimental or quasi-
233 experimental design, 3 on qualitative design (13%) and 1 on longitudinal design (4%).

234 The sample of empirical studies includes 12,954 participants, 54% of whom are male,
235 44% are female, while gender is not specified for 2% of the total sample. Sample sizes are not
236 detailed for 2 of the studies, and therefore cannot be taken into account. For the 12 cross-
237 sectional studies, samples include at least 293 participants, except for one study with $N=75$.
238 The 3 experimental and 5 quasi-experimental studies include at least 123 participants, except
239 for three studies with a sample size ranging from 39 to 72. For qualitative studies, sample
240 sizes are respectively 228 and 426 in two studies, while this is not specified in the third study.
241 Samples are mostly based on university students for 7 studies, on the general population for
242 13 studies, and one study on mixed participants from the general population and professional
243 drivers. Across all studies, the unweighted mean age is 37.50 years, ranging from 21 to 51,
244 and the mean age weighted by study sample sizes² is 43.67 years old.

² For one study, the sample size was not reported. The mean age for this study was therefore weighted by a factor of 1.

Table 1.
Characteristics of the selected publications.

References (following alphabetic order)	Location	Article type	Design	N (%males)	Mean age (years old)	Sample	Methods	Main results
Alonso, F., Esteban, C., Montoro, L., Useche, S. A., & Crowther-Dowey, C. (2017). Knowledge, perceived effectiveness and qualification of traffic rules, police supervision, sanctions and justice. <i>Cogent Social Sciences</i> , 3(1), 1393855. https://doi.org/10.1080/23311886.2017.1393855	Spain	empirical	cross-sectional	1100(62%)	n/a	n/a	Secondary data from a self-administered survey including measures of perceptions about traffic rules, traffic violations, traffic police, sanctions, and justice functioning.	The majority of drivers perceive traffic rules as effective but think that police officers are placed to catch offenders more than to make the place safer. Sanctions are perceived mainly as being either educational or tax-collections measures. Drivers evaluate traffic justice as poorly functioning.
Bautista, R., Sitges, E., & Tirado, S. (2015). Psychosocial Predictors of Compliance with Speed Limits and Alcohol Limits by Spanish Drivers: Modeling Compliance of Traffic Rules. <i>Laws</i> , 4(3), 602-616. https://doi.org/10.3390/laws4030602	Spain	empirical	cross-sectional	570(53%)	44.23	general population	Telephone survey measuring compliance with traffic rules, deterrence variables, social norms about traffic violations and perceived morality of traffic rules.	Compliance with traffic rules is not predicted by the perception of the severity in case of violation but is mainly predicted by the descriptive norm of the reference group and by the perceived morality of traffic rules.
Bradford, B., Hohl, K., Jackson, J., & MacQueen, S. (2015). Obeying the Rules of the Road Procedural Justice, Social Identity, and Normative Compliance. <i>Journal of Contemporary Criminal Justice</i> , 31(2), 171-191. https://doi.org/10.1177/1043986214568833	UK	empirical	quasi-experimental	816(63%)	50.7	general population	Drivers were stopped by police officers using either a routine approach (control group) or an approach based on the procedural justice model (treatment group). Drivers completed a self-administered survey including future traffic compliance, perception about road traffic stop procedural justice, police legitimacy and effectiveness, risk of sanction, personal morality and social identity.	Experienced procedural justice with police increases future traffic compliance and social identification with law-abiding citizen. Social identification - and not legitimacy - explain the effect of procedural justice on compliance. Both instrumental and normative factors predict future traffic compliance.
Chermak, S., McGarrell, E. F., & Weiss, A. (2001). Citizens' perceptions of aggressive traffic enforcement strategies. <i>Justice Quarterly</i> , 18(2), 365-391. https://doi.org/10.1080/07418820100094941	USA	empirical	quasi-experimental	420(32%)	51	general population	Two type of aggressive traffic enforcement were implemented in two areas in comparison with a control area. A pre and post-intervention telephone survey was proposed to residents in the three area, measuring perceptions about police practices, crimes and quality of life.	In overall, implemented aggressive traffic enforcements are strongly supported by the residents and not perceived as harassment. However, residents in the experimental areas did not perceived a decrease in crime nor an increase in quality of life.
Debnath, A. K., Haworth, N., & Rakotonirainy, A. (2017). Driver beliefs regarding the benefits of reduced speeds. <i>Journal of Transportation Safety &</i>	Australia	empirical	cross-sectional	3538(50%)	46.3	general population	Self-administered online survey measuring variables related to perceived benefits of reducing	Drivers under the age of 29 years perceive less benefits of reducing speed on emissions, stress and road

Security, 9(4), 470-488.
<https://doi.org/10.1080/19439962.2016.1241848>

driving speeds on emissions, safety, stress, road rage and related to drivers' characteristics.
 rage than the older drivers. Female, drivers of small cars, drivers of automatic car and bicycle commuters perceive more benefits on safety, stress and road rage than other drivers.

Demir, M., Apel, R., Braga, A. A., Brunson, R. K., & Ariel, B. (2020). Body Worn Cameras, Procedural Justice, and Police Legitimacy: A Controlled Experimental Evaluation of Traffic Stops. *Justice Quarterly*, 37(1), 53-84.
<https://doi.org/10.1080/07418825.2018.1495751>

Turkey empirical quasi-experimental 624(96%) 40.76 n/a

Drivers were stopped by police officers with a body worn camera (treatment group) or without (control group). Drivers completed a survey measuring variables related to perceived procedural justice, general police legitimacy and traffic police legitimacy.

Drivers in the treatment group report a greater perception of procedural justice, general police legitimacy and traffic police legitimacy than drivers in the control group.

Elvik, R. (2006). Are individual preferences always a legitimate basis for evaluating the costs and benefits of public policy? *Transport Policy*, 13(5), 379-385.
<https://doi.org/10.1016/j.tranpol.2006.01.002>

Norway theoretical n/a n/a n/a n/a

Different types of traffic police interventions were analyzed and discussed through an ethical and economical perspective.

The cost-benefice ratio for different type of traffic police enforcements is less advantageous when benefits obtained from driving violations are included in analyses. Including benefits from driving violations can be considered as a legitimate societal benefit.

Fernández-Dols, J. M., & Oceja, L. V. (1994). Efectos cotidianos de las normas perversas en la tolerancia a la corrupción. *Revista de Psicología Social*, 9(1), 3-12.
<https://doi.org/10.1174/021347494763591762>

Spain empirical quasi-experimental 123(49%) n/a university students

Self-administered survey proposed to drivers and non-drivers presenting a vignette where someone allow a person to escape a fine due to speeding (very common transgression) or drinking and driving (less frequent transgression). The dependent measure was the tolerance of this situation.

Participant were more tolerant of the situation involving speeding than drinking and driving. Drivers were more tolerant of the situation involving speeding than non-drivers.

Gau, J. M. (2012). Consent Searches as a Threat to Procedural Justice and Police Legitimacy: An Analysis of Consent Requests During Traffic Stops. *Criminal Justice Policy Review*, 24(6), 759-777.
<https://doi.org/10.1177/0887403412464547>

USA empirical cross-sectional n/a 46.09 general population

Secondary data from a survey including measures of perception about perceived procedural justice and legitimacy of previous traffic stops by police officers.

Perceived procedural justice and legitimacy of previous traffic stops are lower when police officers conducted a consent search of the vehicle than when they did not.

Gaymard, S. (2009). Norms in social representations: Two studies with French young drivers. *European Journal of Psychology Applied to Legal Context*, 1(2), 165-181.

France empirical experimental study 1: 72(n/a) study 2: 61(n/a) study 1: 19.94 study 2: 20.08 university students

Self-administered survey with manipulation of the instructions, including measures of traffic violations and their personal acceptability in different situations.

Driving violations and their acceptability depend of the driving situation, and traffic rules can therefore be conditional. Speed limits are the most conditional traffic rules. Traffic violations can be normative.

Havârneanu, M. G., & Havârneanu, C. E. (2012). When norms turn perverse: Contextual irrationality vs. rational traffic violations. <i>Transportation Research Part F: Traffic Psychology and Behaviour</i> , 15(2), 144-151. https://doi.org/10.1016/j.trf.2011.12.003	Romania	empirical	cross-sectional	605(48%)	43.51	general population	Self-administered survey including measures of violations in perverse situations, perceived irrationality of traffic rules, perceived risk in traffic, usual deviant behaviour and respect for the law.	Perceived irrationality of traffic rules, low risk perception, little respect for the law and frequent usual deviant behaviour are linked with more frequent traffic violations.
Havârneanu, M. G., & Goliță, A. (2010). Traffic norms between safety and perversity. <i>Annals of the "Al. I. Cuza" University, Psychology series</i> , 19(1), 65-82.	Romania	empirical	cross-sectional	75(100%)	36.21	general population & professional drivers	Self-administered survey including measures of traffic violations in specific perverse situations, perceived irrationality of traffic rules, experience with police and traffic violation justifications.	Previous accident involvement, negative experience with police and fear of police control are linked with more frequent traffic violations.
Holman, A. C., & Popusoi, S. A. (2018). Avoiding blame when violating traffic rules: The development and validation of the justifications of traffic violations scale. <i>Psychology, Crime & Law</i> , 24(9), 873-894. https://doi.org/10.1080/1068316X.2018.1442450	Romania	empirical	cross-sectional	study 1: 382(50%) study 2: 325(48%)	study 1: 39.27 study 2: 39.06	general population	Interviews and self-administered survey used to create and validate the justifications of traffic violations scale. Measures also include driving styles, traffic violations and accidents.	Traffic violations are mostly justified through four types of strategies. The use of each of these justifications is positively associated with maladaptive driving styles, traffic violations and accidents.
Lacalle, M. a E., & Oceja, L. V. (1996). Efectos perversos de normas incumplidas en la percepción de las autoridades. <i>Revista de Psicología Social</i> , 11(1), 83-91. https://doi.org/10.1174/021347496763336637	Spain	empirical	quasi-experimental	225(39%)	21,98	university students	Self-administered survey proposed to drivers and non-drivers presenting a vignette where someone allow a person to escape a fine due to three different traffic violations. Measures include tolerance of the situation, the amount of the fine considered as reasonable and the likelihood of being able to escape this type of fine.	Participant are more tolerant, advocate a lower fine and estimate a greater likelihood of being able to escape fine for the situation involving the most usual traffic violations. Drivers are more tolerant of the three situations than non-drivers.
Lanza-Kaduce, L. (1988). Perceptual deterrence and drinking and driving among college students. <i>Criminology</i> , 26(2), 321-341. https://doi.org/10.1111/j.1745-9125.1988.tb00844.x	USA	empirical	longitudinale	139 (n/a)	n/a	university students	Longitudinal self-administered survey including measures of recent and past drinking and driving, prior perceived risk of punishment, moral evaluations and legal interventions for drinking and driving.	Subsequent drinking and driving are predicted by prior moral tolerance, past drinking and driving and previous legal intervention, but not by prior perceptions of risk of arrest nor severity of punishment.
MacQueen, S., & Bradford, B. (2015). Enhancing public trust and police legitimacy during road traffic encounters: Results from a randomised controlled trial in Scotland. <i>Journal of Experimental Criminology</i> , 11(3), 419-443. https://doi.org/10.1007/s11292-015-9240-0	Australia	empirical	experimental	816(63%)	50.7	general population	Drivers were stopped by police officers using either a routine approach (control group) or an approach based on the procedural justice model (treatment group). Participants completed a pre and post intervention self-administered survey including measures of trust and satisfaction associated with the officers who made the stop, trust and legitimacy associated with	The results are opposed to the authors' hypothesis: In the treatment group, the intervention decreased trust in officers who made the stop and satisfaction with their conduct and did not have significant effect on trust in the police nor police legitimacy.

							police.	
McKenna, F. P. (2007). The perceived legitimacy of intervention: A key feature for road safety. <i>Improving traffic safety culture in the United States: The journey forward</i> . Washington, DC: AAA Foundation for Traffic Safety, 165-175.	UK	theoretical	n/a	n/a	n/a	n/a	Principles guiding interventions to reduce road accidents are discussed with consideration for philosophical arguments and psychological processes, with special attention to perceived legitimacy and the harm principle.	The perceived legitimacy of speeding could be reduced by emphasizing the consequences for potential victims. Education and improving trust in authorities should be used to reduce the perceived legitimacy of speeding and increase the perceived legitimacy of speed limits.
Musselwhite, C., Avineri, E., & Susilo, Y. O. (2014). Legitimising risk taking: Articulating dangerous behaviour on the road. <i>Transportation Planning and Technology</i> , 37(1), 62-82. https://doi.org/10.1080/03081060.2013.844905	UK	empirical	qualitative	228(55%)	n/a	general population	Six focus groups met three times, exploring social and environmental factors linked with risky driving and traffic violations. Responses were analyzed through the theory of planned behaviour and the ecological system theory.	Drivers can be aware and critical of many of the determinants of their risky behaviours. Their explanations of their risky behaviours allow them to legitimize them. Younger drivers are more influenced by the symbolic role of the car.
Oceja, L. V., Fernández-Dols, J. M., González, A., Jiménez, I., & Berenguer, J. (2001). ¿Por qué cumplimos las normas? Un análisis psicosocial del concepto de legitimidad. <i>Revista de Psicología Social</i> , 16(1), 21-41. https://doi.org/10.1174/021347401317351189	Chile	empirical	cross-sectional	298(44%)	21.39	university students	Self-administered survey including measure of conventionalism, compliance with different rules (including traffic rules), perceived likelihood of being arrested or sanctioned, social disapprobation and legitimacy associated with rule violations.	The perceived legitimacy of rule violations is negatively associated with rules compliance and is its only significant predictor. This association is stronger among individuals with a high (vs. low) level of conventionalism.
Pechansky, F., Chandran, A., & Sousa, T. (2016). Bridging a historical gap: Can changes in perceptions of law enforcement and social deterrence accelerate the prevention of drunk driving in low and middle-income countries? <i>Revista Brasileira de Psiquiatria</i> , 38(2), 161-166. https://doi.org/10.1590/1516-4446-2015-1878	Brazil, Mexico, Argentina, USA, Australia, Norway	empirical	qualitative	n/a	n/a	n/a	Semi-structured interviews with road safety professionals from six country with different levels of driving while under the influence of alcohol/drugs (DWI) rates, based on a case vignette.	The most successful countries in reducing DWI rate seem to be those where DWI is most socially perceived as deviant. Generating a social stigma against DWI allows legislation to be enforced.
Pérez, J. A., Lucas, A., Dasi, F., & Quiamzade, A. (2002). La desobediencia masiva al código de circulación. Normas heterónomas frente a normas inter-individuales. <i>Psicothema</i> , 14(4), 788-794.	Spain	empirical	experimental	39(38%)	21.03	university students	Self-administered Spanish survey proposed to drivers and non-drivers, where Spanish drivers were presented as those who commit the most (violation condition) or the least (compliance condition) frequently traffic violations. Measures of effectiveness of fines to prevent traffic accidents and violations, preference for the type of sanction and tolerance for traffic violations.	Drivers perceive fine as being more effective in the violation condition than in the compliance condition. This pattern is reversed for non-drivers. Drivers express more tolerance for traffic violations than non-drivers in the violation condition, while this pattern is reversed in the compliance condition.

Prat, F., Gras, M. E., Planes, M., Font-Mayolas, S., & Sullman, M. J. M. (2017). Driving distractions: An insight gained from roadside interviews on their prevalence and factors associated with driver distraction. <i>Transportation Research Part F: Traffic Psychology and Behaviour</i> , 45, 194-207. https://doi.org/10.1016/j.trf.2016.12.001	Spain	empirical	qualitative	426(48%)	42.77	general population	Semi-structured interviews with drivers exploring their perceptions of distracting activities while driving, their frequency, their risky and legislative aspects.	Drivers are well aware of the distractive and risky aspects of secondary activities while driving. They have accurate knowledge of the law for distractive activities other than phone use.
Shaaban, K. (2017). Assessment of Drivers' Perceptions of Various Police Enforcement Strategies and Associated Penalties and Rewards. <i>Journal of Advanced Transportation</i> , 2017, 1-14. https://doi.org/10.1155/2017/5169176	Qatar	empirical	cross-sectional	446(77%)	n/a	general population	Face-to-face survey proposed to drivers, measuring perceptions and opinions about acceptability and effectiveness of different existing or proposed police traffic enforcement strategies and associated penalties and rewards.	Among the existing strategies, red-light running cameras are perceived as being the most effective existing strategy, particularly because of the high fine associated, while the system demerit point is perceived as being the less effective. Among the proposed strategies, rewarding safe drivers is perceived as the more effective.
Verkuyten, M., Rood-Pijpers, E., Elffers, H., & Hessing, D. J. (1994). Rules for Breaking Formal Rules : Social Representations and Everyday Rule-Governed Behavior. <i>The Journal of Psychology</i> , 128(5), 485-497. https://doi.org/10.1080/00223980.1994.9914908	Netherlands	empirical	cross-sectional	1040(50%)	n/a	university students	Self-administered survey including measures of representations about rules and situations where it is justifiable to transgress them and acceptability of violations in different situation.	Participants provide consensual and convergent responses on the reasons for not complying with certain rules such as stopping at red lights, suggesting the existence of shared representations about rule transgressions.
Watling, C. N. (2018). Drivers' perceived legitimacy of enforcement practices for sleep-related crashes: What are the associated factors? <i>Journal of Forensic and Legal Medicine</i> , 54, 34-38. https://doi.org/10.1016/j.jflm.2017.12.005	Australia	empirical	cross-sectional	293(41%)	39.20	general population	Self-administered survey proposed to drivers, including measures of perceived legitimacy of enforcement and attitude toward sleepy driving, personality and risk-taking factors.	Perceived legitimacy of enforcement of sleepy driving is negatively associated with attitude toward sleepy driving, extraversion, and positively associated with age.
Watling, C. N., & Leal, N. (2012). Exploring perceived legitimacy of traffic law enforcement. <i>Proceedings of the 2012 Australasian College of Road Safety National Conference</i> , 1-13.	Australia	empirical	cross-sectional	293(41%)	39.06	general population	Self-administered survey proposed to drivers, including measures of attitudes toward different traffic violations, perceived legitimacy of traffic law enforcement strategies and future traffic violations.	Perceived legitimacy of traffic law enforcement is negatively linked with attitudes towards traffic violation and is positively linked with future traffic violations. Attitude towards traffic violations is positively linked with future traffic violations.

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247 **3.2. Results associated with research questions**

248 **3.2.1. What are the main theoretical definitions of legitimacy in the field of road safety?**

249 The thematic analysis of selected publications shows that legitimacy can refer to
250 different objects at different levels of analysis from traffic rules to institutions that make these
251 laws. Moreover, several definitions of legitimacy refer to existing psychological concepts.
252 These elements are presented and summarized in Table 2. Thus, legitimacy can refer to
253 specific traffic rules such as speed limits and alcohol limits (e.g., Bautista et al., 2015; Oceja
254 et al., 2001). Some studies have also investigated the legitimacy that individuals associate
255 with traffic rules in general (e.g., Alonso et al., 2017). It appears from the selected
256 publications that legitimacy could also apply to traffic violations. For example, McKenna
257 (2007) addressed the legitimacy of speeding referring to how people perceived speeding as
258 acceptable. Bautista et al. (2015) addressed the legitimacy of speeding and drunk driving,
259 measuring how bad these behaviours are perceived to be. Legitimacy was also frequently
260 considered from the point of view of law enforcement authorities (i.e., police officers and the
261 police organization more broadly) and referred in particular to the process by which they
262 decide to impose penalties or interact with the road user. From this perspective, these
263 behaviours are often associated with *trustiness*, and legitimacy thus refers to *procedural*
264 *justice* (e.g., Bradford et al., 2015; Chermak et al., 2001; MacQueen & Bradford, 2015).
265 Penalties can be another issue related to legitimacy, distinct from the way in which they are
266 imposed, which is often associated with *fairness* and refers to *distributive justice* (e.g., Demir
267 et al., 2018; Watling, 2018; Watling & Leal, 2012). Finally, legitimacy can refer more broadly
268 to legal institutions (e.g., Bradford et al., 2015) or to a system of rules (e.g., Bautista et al.,
269 2015).

Table 2

Main definitions of legitimacy in the field of road safety as linked with other concepts

Main concepts used to define legitimacy	References	Usual definition of the concepts
Legitimacy as perceived rationality, effectiveness or appropriateness	Bautista et al. (2015); Havârneanu & Goliță (2010); Havârneanu & Havârneanu (2012)	Perceived rationality, effectiveness or appropriateness refers to the appreciation that an object such as a rule is well adapted to a given purpose and in a given context.
Legitimacy as acceptability	McKenna (2007); Shaaban (2017); Watling & Leal (2012)	Acceptability refers to a judgment in terms of agreement or approval towards an object such as a rule, a penalty or a rule-violation.
Legitimacy as moral judgement	Bautista et al. (2015); Bradford et al. (2015); Oceja et al. (2001)	Moral judgment refers to how badly people perceive an object or a behaviour such as a rule, a penalty or a rule-violation.
Legitimacy as moral alignment	Bradford et al. (2015); MacQueen & Bradford (2015)	Moral alignment refers to the degree of congruence between the values of the individual and the values they ascribe to an object such as a rule or an authority.
Legitimacy as obligation to obey	Bautista et al. (2015); Bradford et al. (2015); MacQueen & Bradford (2015)	Obligation to obey refers to the internalized sense of duty to obey the law or the directive of the legal authority
Legitimacy as procedural justice or trustiness	Bradford et al. (2015); Chermak et al. (2001); MacQueen & Bradford (2015)	Procedural justice or trustiness refers to how people perceive the judiciary process by which an agent makes decisions and produces outcomes, in terms of fairness, equality, neutrality, rationality, dignity, respect and transparency.
Legitimacy as distributive justice or fairness	Demir et al. (2018); Watling (2018); Watling & Leal (2012)	Distributive justice or fairness refers to how people perceive the allocation of outcomes, resources, to be fairly distributed across individuals and/or social groups.

270 Throughout the selected publications, definitions of legitimacy often rely on
271 procedural and distributive justice, but also on fairness, trustiness and appropriateness. These
272 elements are presented either as concepts distinct from legitimacy, as one of its determinants
273 or outcomes, or as concepts overlapping legitimacy, therefore including procedural and
274 distributive justice dimensions as potential components of legitimacy.

275 Legitimacy also appears to be often defined through two aspects that are linked to a
276 personal sense of morality and values. Regarding *moral judgment*, legitimacy refers to what
277 extent the rules (or on the contrary their transgressions) are judged to be right or wrong
278 (Bautista et al., 2015; Bradford et al., 2015; Oceja et al., 2001). Regarding *moral alignment*,
279 legitimacy is defined as a congruence between the values of the road user and the values
280 ascribed to the rules. A strong congruence between personal values and ascribed values is
281 associated with a high perceived level of legitimacy. This mechanism leads to a process of
282 *internalization* and *legitimation* of the rules (Havârneanu & Goliță, 2010; Tyler, 1990; Yagil,
283 1998). The second aspect of legitimacy, *obligation to obey*, is defined as “a belief that the
284 legal authorities have a legitimate right to dictate behavior” (Havârneanu & Goliță, 2010, p.
285 67; see also Bautista et al., 2015; Bradford et al., 2015). In other words, there is a perceived
286 legitimacy related to the authorities enforcing the law (Tyler, 1990). Moral alignment and the
287 sense of obligation to obey can be considered as being two distinct yet related components of
288 legitimacy (Bradford et al., 2015; Hough et al., 2013; Jackson, Bradford, Hough, et al., 2012).
289 Oceja et al. (2001) argue that the obligation to obey would refer to a *conventionalist*
290 *orientation*, a tendency to comply blindly with authorities, without any evaluation of the
291 consequences of their injunctions. Less frequently, legitimacy of rules also appears to be
292 defined through the concepts of *acceptability*. However, no explicit definition of acceptability
293 is proposed in the three publications that refer to *acceptability* in relation to legitimacy
294 (McKenna, 2007; Shaaban, 2017; Watling & Leal, 2012). Finally, legitimacy also appears to

295 be defined through the perceived rationality of traffic rules, which refers to their perceived
296 effectiveness in preventing accidents, or their appropriateness for the needs of real traffic
297 safety situations (e.g., Bautista et al., 2015; Havârneanu & Goliță, 2010; Havârneanu &
298 Havârneanu, 2012).

299 *3.2.2. What are the main measures proposed to address legitimacy in the field of road safety?*

300 We identified measures associated with legitimacy in 14 empirical studies of our
301 review. In the other empirical studies of our review, legitimacy or closely related concepts are
302 mobilized theoretically but are not measured. Identified measures were grouped according to
303 the object of legitimacy to which they related and to the concept used to operationalize the
304 legitimacy (see Table 3). Thus, legitimacy measures are proposed for the following objects:
305 (a) traffic rules, (b) traffic violations, (c) **police**, (d) **sanctions and means of control**, (e)
306 general law, legal institutions, or legal system. On a general level, one should note that, in
307 most of the studies, no elements of internal consistency and construct dimensionality were
308 reported. Also, in some studies, no details were given about the content of the items used.
309 Regarding the number of items for each measure, this ranges from a single item measure to 31
310 items. This gap in the number of items used can be observed for the same concept (see for
311 instance in Table 3 the example of measures related to perceived rationality, appropriateness
312 or **efficiency of specific traffic rules**).

313 While measures focus on different objects of legitimacy, we also note that for each
314 object, several concepts can be mobilized in order to operationalize legitimacy. Thus, the
315 legitimacy of traffic rules is assessed through different characteristics such as perceived
316 rationality (i.e., the perception of the adaptation of rules to real safety needs), appropriateness,
317 or efficiency (Bautista et al., 2015; Havârneanu & Goliță, 2010; Havârneanu & Havârneanu,
318 2012), perceived general effectiveness, or perception as fair/unfair, adequate,
319 excessive/sparse, and well/poorly done (Alonso et al., 2017). Depending on the contribution,

320 these measures could be related to a general perception of traffic rules (Alonso et al., 2017) or
321 focused on specific rules such as speed and alcohol limits (Bautista et al., 2015; Havârneanu
322 & Goliță, 2010; Havârneanu & Havârneanu, 2012). In the case of Havârneanu and Goliță
323 (2010) these specific rules were distinguished on the basis of the concept of perverse norms
324 (i.e., rules that imply punishment in the case of violation but which are violated by the
325 majority of drivers). However, in the case of measures focused on specific rules, while items
326 could be treated in distinct analyses, they also could be computed in a mean score which
327 presents an acceptable reliability ($\alpha = .72$; Havârneanu & Havârneanu, 2012).

328 The legitimacy of traffic violations is mainly assessed through measures based on a
329 moral judgement associated with specific traffic violations (Bautista et al., 2015; Bradford et
330 al., 2015; Oceja et al., 2001). Participants were generally asked to evaluate how wrong some
331 traffic violations were (e.g., drunk driving, breaking the speed limit, running a red light).
332 Alonso et al. (2017), adopted a different approach and focused on the perceived
333 dangerousness and perceived seriousness of different traffic violations.

334 Measures of the legitimacy of the police or legal authorities appear to be the most
335 frequent and heterogeneous measures of legitimacy in the field of road safety and mainly
336 focus on the police. We note that in some cases, the same criteria as for the legitimacy of laws
337 or traffic violations were used. Thus, police legitimacy has been assessed through moral
338 alignment with the police, relying on the perception that the police operate in accordance with
339 the respondent's conception of what is right and wrong (Bradford et al., 2015; MacQueen &
340 Bradford, 2015). In the same way as traffic rules, police legitimacy was also assessed through
341 a criterion of effectiveness (Bradford et al., 2015; Chermak et al., 2001; MacQueen &
342 Bradford, 2015). These measures assess trust in the effectiveness of the police in a general
343 way (Bradford et al., 2015), regarding traffic issues (MacQueen & Bradford, 2015) or at
344 neighborhood level (Chermack et al., 2001). Two of these studies also used a measure of

345 obligation to obey the police (Bradford et al., 2015; MacQueen & Bradford, 2015), adapted
346 from the commonly used obligation to obey scale (Tyler, 1990). Police legitimacy was also
347 measured through various characteristics attributed to the police, mainly on the basis of past
348 experience of encounters with police officers. Depending on the contributions, participants
349 could be asked if the past experience they had with traffic police was either positive or
350 negative (Havârneanu & Goliță, 2010), if the police officer was perceived as behaving
351 properly and respectfully (Gau, 2012), or they could be asked about the perceived
352 professionalism and courteousness of the police officer encountered (Chermak et al., 2001).
353 While most of these measures consist of a few items focused on specific aspects, Demir et al.
354 (2018) proposed a multidimensional scale addressing perceived police legitimacy at different
355 levels. The authors proposed a three-factor model tested with a confirmatory principal
356 component factor analysis. The first factor “procedural justice perception” taps into different
357 perceptions of a police encounter (e.g., perceived politeness, fairness, capacity to base
358 decision on rules and listening to the respondent for the officer) and shows a good reliability
359 ($\alpha = .87$). The second and third factors referred to “traffic police legitimacy perception” and
360 “general police legitimacy perception”, tapping into feelings of respect, confidence and trust
361 from the respondent toward the police officers and show a good reliability (respectively $\alpha =$
362 $.86$ and $.89$). However, fit indices of the confirmatory analysis were not reported and the
363 authors mentioned that an exploratory principal component analysis suggested a
364 unidimensional solution.

365 As for most of the other objects of legitimacy, the legitimacy of traffic rule
366 enforcement and penalties was also assessed through a criterion of effectiveness. More
367 precisely, Pérez et al. (2002) measured the perceived effectiveness of fines in preventing road
368 accidents with one item (“Do you think that police fines are a good remedy for traffic
369 accidents?”). The other measures either focus on a broad assessment (Alonso et al., 2017) or

370 on specific traffic rules (Watling & Leal, 2012). In Alonso et al. (2017) participants were
371 asked about their degree of agreement with three purposes that may be associated with traffic
372 rules (“the purpose of the punishment is essentially tax collection”, “the purpose of the
373 punishment is primarily educational” and “the purpose of the penalty is fundamentally
374 punitive.”). In Watling and Leal (2012), the perceived legitimacy of enforcement was based
375 on several items for each violation which were drunk driving, speeding, fatigued driving and
376 driving without a seatbelt. For each traffic rule, participants were asked to evaluate the
377 legitimacy of different means of control (e.g., randomly stopping drivers to check seatbelt
378 use) or penalties (e.g., charging crash-involved drivers who were not wearing a seatbelt).

379 Finally, at a wider level, measures of legitimacy associated with the law in general,
380 legal institutions, the state and the legal system were investigated by some contributions. Here
381 again, a criterion of effectiveness has been mobilized in order to assess the functioning of the
382 justice system (both in an overall way or in the specific field of road safety; Alonso et al.,
383 2017) or within the framework of the *social conformism* measure proposed by Havârneanu
384 and Havârneanu (2012). This scale consists of two subscales that are *respect for the law* and
385 *social order acceptance* which respectively tap into perceived effectiveness and the rationality
386 of state institutions (e.g., “The law might be harsh but it must be obeyed because it is a law”)
387 and attitudes toward the effectiveness and rationality of law and governmental institutions
388 (e.g., “State institutions are rationally organized and very well-functioning”). However, both
389 of these subscales present a poor reliability (respectively $\alpha = .47$ and $\alpha = .50$). Beyond
390 effectiveness, the perceived legitimacy of the law and legal authorities was also assessed
391 through Tyler’s obligation to obey scale (Bautista et al., 2015). This version of the scale
392 included items related to obeying the law and authorities, and presented an acceptable
393 reliability ($\alpha = .67$).

Table 3.

Main measures used to address legitimacy in the field of road safety and their psychometric properties.

Object of legitimacy measured	Concept operationalizing legitimacy	Reference	Number of items	Internal consistency
Traffic rules	Perceived rationality, adequacy or efficiency of specific traffic rules	Havârneanu & Goliță (2010)	31	-
		Havârneanu & Havârneanu (2012)	6	$\alpha = .72$
		Bautista et al. (2015)	2	-
	Perceived rationality, adequacy or efficiency of traffic rules in general	Alonso et al. (2017)	1	-
	Perception of traffic rules in general as fair / adequate / excessive / well done	Alonso et al. (2017)	4	-
Traffic violations	Moral judgment of several traffic violations	Oceja et al. (2001)	3	-
		Bradford et al. (2015)	2	-
		Bautista et al. (2015)	2	-
	Perceived dangerousness and seriousness of several traffic violations	Alonso et al. (2017)	-	-
Police	Obligation to obey the police	Bradford et al. (2015)	3	-
		MacQueen & Bradford (2015)	-	-
	Moral alignment with police	Bradford et al. (2015)	3	-
		MacQueen & Bradford (2015)	-	-
	Police effectiveness	MacQueen & Bradford (2015)	-	-
		Bradford et al. (2015)	6	-
		Chermack et al. (2001)	4	$\alpha = .81$

	Procedural justice, trust in the police or fairness	Demir et al. (2018)	13	Procedural justice perception: $\alpha = .87$; Perception of traffic police legitimacy: $\alpha = .86$; Perception of police legitimacy generally: $\alpha = .89$
	Perceived professionalism and courteousness of police officer	Chermak et al. (2001)	2	$r = .67$
	Attitude toward past experience with police	Havârneanu & Goliță (2010)	1	-
	Other measure related to police legitimacy	MacQueen & Bradford (2015)	-	-
Sanctions and means of control	Agreement with several purposes associated with traffic rules	Alonso et al. (2017)	3	-
	Agreement with different control methods or penalties and resources used by the police	Watling et al. (2012)	18	Drunk-driving items: $\alpha = .72$; Speeding items: $\alpha = .91$; Fatigued driving items: $\alpha = .77$ Driving without seatbelt items: $\alpha = .81$
	Effectiveness of fines in preventing road accidents	Pérez et al. (2002)	1	-
General laws, legal institutions, legal system	Social conformism	Havârneanu & Havârneanu (2012)	8	Respect for the law: $\alpha = .47$ Social order acceptance: $\alpha = .50$
	Moral judgment of general functioning of justice	Alonso et al. (2017)	1	-
	Moral judgment of functioning of traffic justice	Alonso et al. (2017)	1	-
	Obligation to obey the law and the authorities	Bautista et al. (2015)	6	$\alpha = .67$

Note.

α = Cronbach Alpha; r = Pearson correlation coefficient.

For the number of items and the internal consistency, empty cells signify that the information was not reported in the study concerned.

394 *3.2.3. Does legitimacy predict compliance in the field of road safety?*

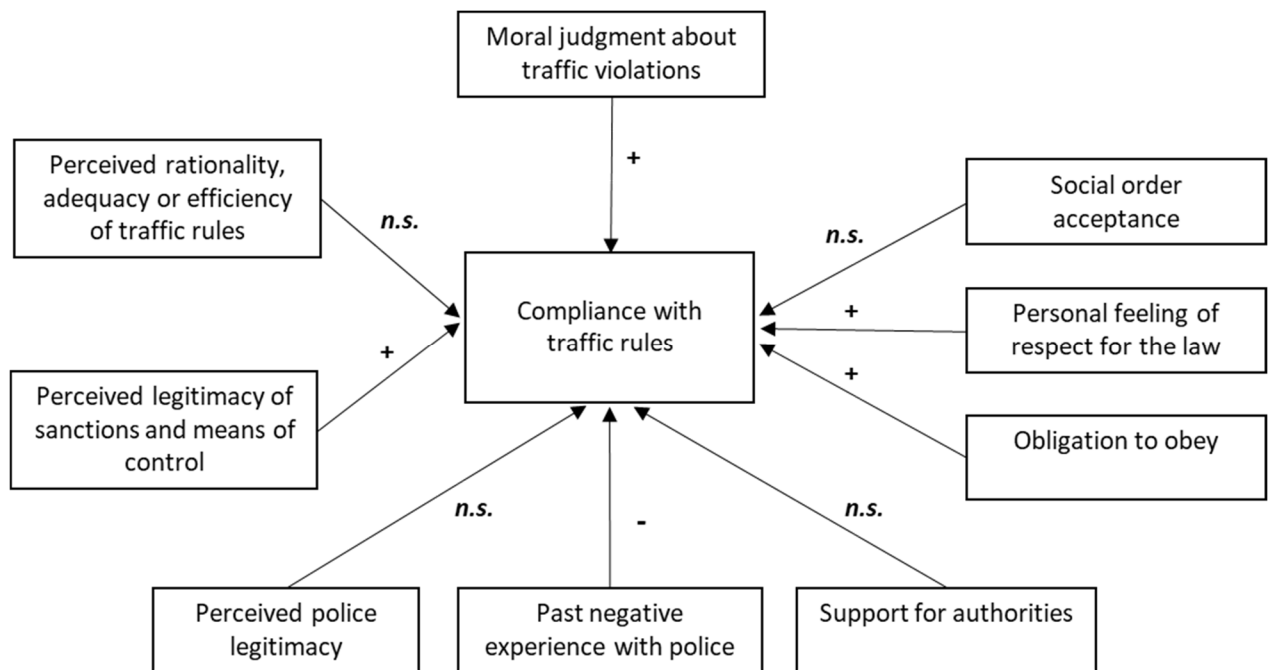
395 Of the twenty-six selected publications, six have empirically examined statistical
396 relationships between variables related to legitimacy or rule perception and compliance with
397 traffic rules. One of these studies is based on a longitudinal design while others are based on a
398 cross-sectional design. However, all studies rely on self-declared behaviours. Yet, given the
399 heterogeneity of the measures of legitimacy and compliance, it does not seem relevant to
400 report the sizes of the effects observed in the studies nor to propose a meta-analysis.
401 Statistical significance threshold considered for examining relationships between variables
402 was set at $\alpha = .05$. Main results are summarized in Figure 3.

403 Moral judgment, which, as we mentioned, has been used as a way to operationalize
404 legitimacy, was tested by three studies (Bautista et al., 2015; Havârneanu & Havârneanu,
405 2012), including the longitudinal study (Lanza-Kaduce, 1988), regarding its effect on
406 compliance. In these studies, moral judgment referred to how badly respondents perceived
407 traffic violations. A positive association between moral judgement about speeding and
408 compliance with speed limits was consistently found in the three studies. As for moral
409 judgment about drunk driving, it was positively associated with past compliance with drink
410 and driving limits in one of the cross-sectional studies (Bautista et al., 2005). However, this
411 relationship was not significant in Lanza-Kaduce's study (1988) which calls into question the
412 possible predictive link between legitimacy—through moral judgement—and compliance
413 regarding this specific law. In addition, moral judgment about running a red light appears to
414 predict compliance with stopping at a red light (Bradford et al., 2015). As for other concepts
415 used in order to operationalize legitimacy, such as rationality, adequacy or efficiency of traffic
416 rules, no significant relationship with compliance was found (Bautista et al., 2015;
417 Havârneanu & Havârneanu, 2012).

418 The perceived legitimacy of **traffic rules enforcement** was positively associated with
419 compliance with rules associated with drunk driving, speeding, and driving while fatigued,
420 but not with driving without a seatbelt (Watling & Leal, 2012). The general appreciation of
421 past experience with the police was positively associated with a measure of compliance in
422 relation to several traffic rules in Havârneanu and Goliță (2010). The measure of perceived
423 police legitimacy in Bradford et al. (2015), which combines the obligation to obey the police
424 and perceived moral alignment between oneself and the police, was not associated with
425 anticipated compliance with speed and blood alcohol limits. The authors also found a positive
426 indirect relationship between perceived procedural justice and compliance with speed limits
427 and stopping at a red light, which was mediated by perceived police legitimacy. No
428 association between support for authorities and compliance was found in Bautista et al.
429 (2015). A personal feeling of respect for the law (a measure similar to the obligation to obey)
430 was associated with compliance with several traffic rules in Havârneanu and Havârneanu
431 (2012). Congruently, the obligation to obey was found to be positively associated with past
432 compliance with speed limits in Bautista et al. (2015). Finally, in Havârneanu and
433 Havârneanu (2012), attitude toward social order (i.e., social order acceptance) was not
434 associated with compliance with traffic rules.

435 In summary, the selected publications show that the more drivers judge traffic
436 violations as bad, the more they tend to comply with the associated laws. The perceived
437 legitimacy of traffic rule enforcement appears to have a positive effect globally on compliance
438 with the traffic rules. The obligation to obey and similar measures related to a feeling of
439 respect toward laws or authorities present an inconsistent relationship with compliance. Other
440 measures related to police legitimacy such as procedural justice and positive past experience
441 with the police are significantly associated with compliance. Finally, no association between
442 perceived social order legitimacy and compliance was found.

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453 Figure 3. Main empirical relationships identified between measures of legitimacy and
454 compliance in the field of road safety.

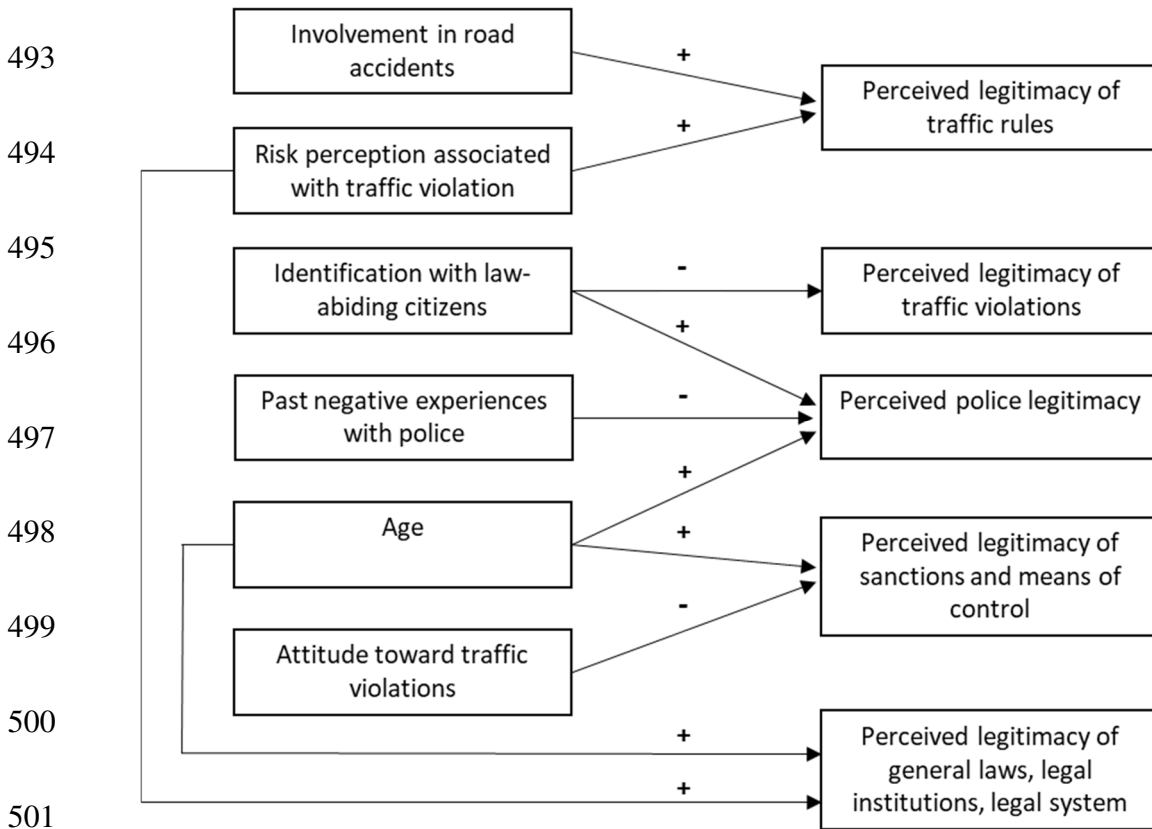
455 *Note.* *n.s.*: non-significant statistical relationship. Both objects and concepts operationalizing
456 legitimacy were considered in this summarizing figure (see Table 3 for a distinction between
457 objects and concepts operationalizing legitimacy).

458 3.2.4. What are the main determinants and outcomes of legitimacy in the field of traffic rules?

459 We identified seven publications that empirically addressed correlates of legitimacy,
460 and thought to be determinants of it. These results are summarized in Figure 4. No studies
461 addressing outcomes of legitimacy beyond compliance (which was treated in the previous
462 section) were identified. All studies rely on self-reported measures and cross-sectional design
463 and do not make it possible to establish causality directions for the investigated relationships,
464 although they were assumed.

465 The perceived legitimacy of traffic rules was found to be positively predicted by
466 accident involvement and by risk perception associated with traffic violation. Indeed,
467 Havârneanu and Havârneanu (2012) found a positive correlation between the perceived
468 rationality of traffic rules and the perceived risk associated with violating these rules. Alonso
469 et al. (2017) found a positive correlation between the perceived effectiveness of traffic rules
470 and involvement in an accident. The perceived legitimacy of traffic violations appears to be
471 negatively predicted by identification with a group sharing social norms of law compliance.
472 Bradford et al. (2015) found that social identification with law-abiding citizens of the country
473 positively predicted moral judgment about traffic violations (i.e., how violations are perceived
474 as wrong) and also with perceived police legitimacy (i.e., the moral obligation to obey the
475 police and perceived moral alignment between oneself and the police). Therefore, perceived
476 police legitimacy appears to be also positively predicted by identification with a group sharing
477 social norms of law compliance. Moreover, perceived police legitimacy was found to be
478 positively predicted by age and negatively by having previous negative experience with the
479 police, particularly being ticketed (Demir et al., 2018; Gau, 2012). For example, Gau (2012)
480 found that procedural justice associated with the police was negatively predicted by having
481 experienced a vehicle search, being previously ticketed by police, arrested by police, and
482 being confronted with the use of force from the police. The perceived legitimacy of **sanctions**
483 **and means of control** appears to be positively predicted by age and negatively by attitudes
484 toward traffic violations (Watling, 2019; Watling & Leal, 2012). For example, Watling and
485 Leal (2012) found that the perceived legitimacy of different enforcement practices was
486 negatively correlated with attitudes toward the corresponding traffic violations. Finally,
487 Havârneanu and Havârneanu (2012) found that respect for the law (i.e., a personal feeling of
488 having to respect laws in general), and social order acceptance (i.e., attitudes towards social
489 order) were positively predicted by risk perception associated with traffic violations. Also,

490 respect for the law was positively predicted by age. This suggests that the legitimacy of
 491 general laws, institutions and the legal system are negatively predicted by risk perception for
 492 traffic violations and positively predicted by age.



502 Figure 4. Main empirical relationships identified for hypothesized determinants of the
 503 different objects of legitimacy in the field of road safety.

504 *Note.* For clarity purpose, only objects and not concepts operationalizing legitimacy were
 505 considered in this summarizing figure (see Table 3 for a distinction between objects and
 506 concepts operationalizing legitimacy).

507 4. Discussion

508 The aim of this study was to produce a summary of the knowledge of perceived
 509 legitimacy in the road safety field. The analysis of the 26 identified publications showed that
 510 the definitions and measures of perceived legitimacy are heterogeneous, and focus on

511 different objects in connection with traffic rules and different dimensions of legitimacy. As
 512 definitions and measures of perceived legitimacy are highly interrelated, we propose as a first
 513 step to discuss these two aspects jointly. More precisely, we emphasize that definitions and
 514 measures of perceived legitimacy can apply to different objects or levels and that it is
 515 important to distinguish between them more clearly. We also discuss the heterogeneity in
 516 definitions of perceived legitimacy and thus propose a basis for developing a
 517 multidimensional theoretical model of perceived traffic rule legitimacy. In a second step, we
 518 discuss the results of studies that have investigated the link between legitimacy and traffic
 519 rule compliance and their implications. In a third step, we discuss the results of studies that
 520 have investigated the determinants of legitimacy and the resulting research perspectives.
 521 Finally, limitations of our scoping review will be stated before a general conclusion.

522 *4.1. Issues related to the definition and measurement of legitimacy in the field of road*
 523 *safety*

524 *4.1.1. Legitimacy can relate to different objects or levels of a given object*

525 It is important to emphasize that legitimacy can be attributed to different objects such
 526 as traffic rules, traffic violations, police and authorities, enforcement means, penalties, justice
 527 institutions, laws in general and social order (for a similar observation about police legitimacy
 528 see Jackson & Gau, 2015, see also Jackson 2018). In the field of traffic rules, these objects
 529 can be summarized and grouped into three main levels of perceived legitimacy (see Table 4).

Table 4.
 Main levels of perceived legitimacy in the field of road safety

Level of legitimacy	Definition	Examples of objects of legitimacy
Institutional legitimacy	Perceived legitimacy of institutions that create or modify traffic rules and determine the procedures (control/penalty) to enforce them.	- Social order and system - Governmental and legislative institutions

Enforcement legitimacy	Perceived legitimacy concerning the enforcement procedures and their actual implementation.	<ul style="list-style-type: none"> - Enforcement means - Penalties - Legal procedures - Police
Traffic rule legitimacy	Perceived legitimacy regarding obligations or prohibitions imposed by traffic rules.	<ul style="list-style-type: none"> - Traffic rules as a whole - Specific traffic rules

530

531 **Thus, legitimacy should be considered as a** relative concept in that it describes an
532 *attribute* or a *property* that an individual associates with a defined object. Beyond road safety
533 research, measures of legitimacy do not always distinguish these objects of legitimacy. For
534 example, in Tyler et al. (2015), legitimacy was measured with a single-index that included
535 moral alignment with the law, moral alignment with the police, and obligation to obey the
536 police. In Penner et al. (2014), legitimacy combines measures of obligation to obey the law
537 and support for the police and the courts. However, we argue that a clear distinction between
538 objects of legitimacy could be used in order to improve its definition and measurements. For
539 example, legal legitimacy (i.e., legitimacy of laws in general) and police legitimacy are
540 identified as related but distinct objects of legitimacy by Jackson (2018). Moreover, feeling
541 the obligation to obey *traffic rules* may be distinct from feeling the obligation to obey *traffic*
542 *police*, as drivers could agree with the content of traffic rules but not with the way a traffic
543 police officer enforces these rules. In this case, the obligation to obey refers to a particular
544 *dimension* of legitimacy while traffic rules and police officers refer to a particular *object* of
545 legitimacy.

546 The results of the selected articles show that compliance with traffic rules can be
547 explained by the perceived legitimacy of different objects. Therefore, it would be important
548 for future research to determine whether some objects of legitimacy explain compliance with
549 traffic rules more than others. Investigating possible mediational or interactive relationships
550 between different objects of legitimacy on explaining compliance with traffic rules would also

551 be important. Indeed, it may be possible that the effects on compliance of the perceived
552 legitimacy of some objects are mediated or moderated by the effect of the perceived
553 legitimacy of other objects. For instance, the perceived legitimacy of a given institution or
554 authority may favor the perceived legitimacy of the laws it enacts. Empirical evidence
555 supports the idea that legitimacy associated with legal authorities and institutions can
556 outweigh legitimacy associated with other objects of legitimacy on shaping compliance.
557 Oceja et al. (2001) found that the legitimacy of traffic rules predicts more compliance for
558 drivers with low levels of conventionalism (i.e., a tendency to respect the law, beyond all
559 ethical considerations) than for drivers with a high level of conventionalism. This suggests
560 that a high perceived legitimacy of the legal system (i.e., the laws of a country in general)
561 could motivate drivers to voluntarily comply with traffic rules independently of the legitimacy
562 they associated with these traffic rules. Beyond road safety, Tyler (2006) reports several
563 findings showing that when legal authorities are perceived as legitimate, people are more
564 willing to perceive procedures dispensed by these authorities and their outcomes as being fair.
565 In other words, the legitimacy of authorities can influence perceived procedural and
566 distributive justice, in turn influencing compliance. Several research findings also suggest that
567 when an authority is perceived as legitimate, people may voluntarily comply with injunctions
568 even when they conflict with their personal values (Milgram, 1974; Tyler, 2006). Thus, better
569 identifying relationships between the different objects of legitimacy and their joint effect on
570 compliance would allow us to identify the main levers of legitimacy on which to act in order
571 to increase compliance with traffic rules.

572 *4.1.2. Heterogeneity and variability in definitions and measures of legitimacy*

573 The thematic analysis of selected publications shows that legitimacy in the field of
574 road safety can endorse different definitions, which can be more or less heterogeneous and
575 extensive. The same observation seems to emerge more broadly from the literature on

576 legitimacy in social sciences and outside of the field of road safety research (for a similar
577 critique about police legitimacy see Jackson & Gau, 2015; see also Hough et al., 2013). We
578 note that examining the measurement of legitimacy in the selected publications also added to
579 the concepts mobilized in order to define it. Differences, heterogeneity, and expansivity in the
580 way in which legitimacy is defined in the field of road safety could reflect the diversity of
581 disciplinary fields - and therefore the diversity of theoretical frameworks - that have
582 investigated this object and that we have identified. However, this diversity also appears in
583 studies in the same fields (Jackson, 2018). Thus, legitimacy does not seem to be the subject of
584 a consensual and well-delineated definition, even in a given disciplinary field such as
585 psychology and criminology (for similar critiques see Oceja et al., 2001; see also Jackson &
586 Gau, 2015). This point presents a serious limitation in considering legitimacy as a
587 psychological construct in itself, and thus the way legitimacy can be investigated, measured
588 and manipulated.

589 In order to propose a more delineated and consensual definition of legitimacy, it
590 would be important to know to what extent different elements identified in selected
591 publications and overlapping the definition of legitimacy would be its components or rather
592 distinct constructs (i.e., determinants or outcomes of legitimacy). This question could
593 particularly concern elements such as perceived procedural justice, fairness, trustiness,
594 appropriateness, effectiveness, obligation to obey and moral alignment (see Jackson & Gau,
595 2015). Legitimacy sometimes appears to be more or less clearly defined through these
596 elements, and sometimes even reduced to them (for an example of the definition of legitimacy
597 including procedural, distributive justice, and perceived effectiveness, beyond road safety, see
598 Tankebe, 2013). However, these elements are also defined in other selected publications as
599 concepts distinct from legitimacy, and their expected causal relationships are sometimes
600 specified (e.g., Bradford et al., 2015; MacQueen & Bradford, 2015). Moreover, none of the

601 selected studies were based on an empirically corroborated - or have proposed to test an
602 empirical - multidimensional model of legitimacy that accounts for a large part of the
603 different aspects of the construct that could be identified. Only one study in the selection has
604 investigated the dimensional structure of measures related to legitimacy through exploratory
605 factor analysis, but was focused only on aspects of police legitimacy (Demir et al., 2018). A
606 lack of theoretical consensus and empirical support in the definition of several elements as
607 being part of legitimacy or as being a rather distinct construct is problematic because it limits
608 the construct and nomological validity of legitimacy and closely related concepts.

609 The heterogeneity and limitations we underline in defining legitimacy also appear in
610 the measurement of legitimacy and closely related concepts, as shown by our scoping review
611 (see Jackson & Gau, for a similar critique about police legitimacy; see also Jackson, 2018). Of
612 the twenty-six selected publications, only fourteen include empirical studies using such
613 measurements. Only a few of these were used more than once across these studies, and when
614 this was the case, these measures were often not rigorously validated beforehand. A large part
615 of the measures of legitimacy and closely related concepts more often appear to be proposed
616 and created by authors for the purpose of their study, without having been subject to a
617 validation procedure, and they are not often reused by other authors. When the validity of the
618 measure is assessed, it is most often limited in checking its internal reliability through a
619 Cronbach alpha. We did not identify any studies other than Demir et al. (2018) providing an
620 exploratory factor analysis of the dimensionality of tools, nor having examined the convergent
621 and discriminant validity of tools, as well as test-retest reliability. A lack of consensus in the
622 operationalization of legitimacy and lack of empirical validation of measurement also serves
623 to limit its construct and nomological validity.

624 4.1.3. *Toward a multidimensional model of perceived traffic rule legitimacy*

625 Based on the definitions and measures identified in the selected publications, we
626 propose to (re)define the perceived legitimacy of traffic rules as *a propriety that individuals*
627 *associate with a given traffic rule which promotes acceptance of its implementation,*
628 *enforcement, and motivates individuals to respect the prescriptions that result from it.* As
629 highlighted, this definition could be improved by considering that legitimacy includes
630 different dimensions, and thus could be based on a multidimensional model. In this way,
631 Hough et al. (2013) have proposed a tripartite model where perceived legitimacy results from
632 three components which are the obligation to obey, moral alignment and perceived legality.
633 This model was also used by Van Damme and Pauwels (2016) to investigate the perceived
634 legitimacy of traffic police.

635 Legality refers to the perception that the object of legitimacy is based on a sound legal
636 framework. For authorities, legality refers to the perception that they are acting in accordance
637 with legal standards and that their decisions are impartial and objective. Transposed to traffic
638 rules this model could address the obligation to obey traffic rules, moral alignment with
639 values associated with traffic rules, and their perceived legality. However, we argue that
640 considering the obligation to obey as a dimension defining the legitimacy of traffic rules or
641 other objects more broadly could present some theoretical limitations. Indeed, to the extent
642 that legitimacy should *imply* voluntary compliance with rules as a consequence, the obligation
643 to voluntarily comply with rules would be considered as an *outcome* of perceiving legitimacy
644 and not as a *dimension* defining it. Consequently, defining legitimacy by mobilizing the
645 obligation to obey would be tautological. Transposing the legality of traffic police to traffic
646 rules may also appear to be somewhat problematic, as in the first case it refers to measuring to
647 what extent the respondent perceives the actions and decisions of police officers as being
648 firmly based on and in compliance with the law. Following this approach, the legality of

649 traffic rules would refer to the extent to which they are perceived as being compliant with
650 other traffic rules and other non-traffic-related laws. However, this should be often the case
651 for road users, so this should not be a particular dimension of perceived traffic rule
652 legitimacy. Finally, we argue that only the dimension of moral alignment of the tripartite
653 model of police legitimacy (Hough et al., 2013) could be a relevant dimension for inclusion in
654 a model of traffic rule legitimacy.

655 Identified definitions and measures of the selected publications, as well as the
656 theoretical reflections that they give to rise to suggest we may consider *effectiveness*,
657 *efficiency* and *fairness* as possible dimensions of traffic rule legitimacy. *Acceptability* was not
658 explicitly defined in the selected publications. Beyond these publications, Wolfe et al. (2002)
659 propose that an object is judged as acceptable when it is perceived, by the individual, as a
660 relevant means of achieving values that are important for the individual. Therefore, the
661 definition of acceptability seems to overlap with the definition of moral alignment (i.e., a
662 congruent relationship between the values of the individual and the values s/he associated
663 with the object) which already appears as a possible dimension of traffic rule legitimacy. The
664 *effectiveness* of traffic rules refers to their perceived ability to fulfil their road safety objective
665 properly. In this way, effectiveness also includes the identified definitions and measures of
666 legitimacy related to perceived rationality and appropriateness as they also tap into the
667 perceived ability of traffic rules to fulfil safety objectives that drivers consider to be relevant.
668 In addition, to the extent that the notion of effectiveness might seem too broad, we suggest
669 that it could be differentiated from that of *efficiency*. While effectiveness would refer to the
670 appreciation that a rule is well adapted to fulfill its purpose, efficiency would refer to the
671 appreciation that the injunctions emanating from the rules are sufficiently proportionate,
672 neither too low nor too high, to achieve the associated objective. We argue that the perceived
673 *fairness* of the actions and decisions of police officers, which often refers to procedural and

674 distributive justice in selected publications, could be transposed to traffic rule legitimacy.
675 Indeed, people could perceive some traffic rules as applying more or less to all road users, or
676 as being intended to favor or further constrain certain road users or groups of road users.
677 Finally, these theoretical propositions seem to be consistent with Tyler's definition of
678 legitimacy as "a psychological property of an authority, institution, or social arrangement that
679 leads those connected to it to believe that it is appropriate, proper, and just" (2006, p. 375),
680 insofar that appropriateness, properness and justness would respectively refer to effectiveness,
681 efficiency and fairness.

682 In summary, we suggest that traffic rule legitimacy could be based at least on four
683 main dimensions which are *moral alignment*, *effectiveness*, *efficiency* and *fairness* associated
684 with traffic rules. Because of legitimacy, people feel that they ought to defer to decisions and
685 rules, following them voluntarily out of obligation rather than out of fear of punishment or
686 anticipation of reward. This proposal could serve as a basis for further developing a
687 multidimensional model and measure of perceived traffic rule legitimacy.

688 *4.2. Does legitimacy predict compliance in the field of road safety?*

689 Identified results in selected studies suggest that moral judgment about traffic
690 violations generally predict compliance with the associated rule. The more drivers perceive a
691 traffic violation as being wrong, the more they declare that they comply with the
692 corresponding traffic rule. However, this relationship could be moderated by the type of
693 traffic rules concerned, as it was not significant for all traffic rules. It is possible that
694 perceived legitimacy explains violations resulting from deliberate behaviours and not
695 violations resulting from unintentional driver errors. This should be explored in more detail in
696 future studies. A favorable perception of enforcement means is also positively associated with
697 compliance. However, this observation needs to be further corroborated as it was investigated
698 by only one study (Watling & Leal, 2012). Variables related to perceived rationality,

699 efficiency and adequacy (that are measured similarly) were not found to be significantly
700 associated with compliance in two studies. However, outside of our selected publications,
701 another study on perverse norms found a positive association between the perceived
702 rationality of traffic rules and compliance (Havârneanu & Havârneanu, 2012). Thus, the role
703 of perceived rationality in shaping compliance needs to be further investigated.

704 Measures related to perceived police legitimacy such as procedural justice and positive
705 past experience with the police are positively associated with compliance, while associations
706 between compliance and obligation to obey or similar measures related to sense of respect for
707 the law and authorities are mitigated. These inconsistencies could be explained by the
708 variability of scale content used to measure these two aspects of police legitimacy or traffic
709 rule compliance, as this relationship is strongly corroborated in fields other than traffic
710 (Walters & Bolger, 2019). The only variable identified regarding general attitude toward laws
711 was found to be positively related to compliance with various road rules (Havârneanu &
712 Havârneanu, 2012). This suggests that the general representation of laws, beyond solely
713 traffic rules, could influence the representation of specific traffic rules. Finally, attitude
714 toward social order was not found to be associated with traffic rule compliance. This
715 challenges the question of whether general attitudes toward the political and social systems
716 could influence more specific attitudes toward traffic rules. Further research would be needed
717 to confirm or reject this.

718 More broadly, our scoping review shows that few empirical studies have directly
719 tested the relationship between variables related to legitimacy and compliance with traffic
720 rules (six out of the twenty-six selected publications). Currently, the heterogeneity of the
721 measures used for these variables makes it difficult to compare the results of studies and to
722 perform a meta-analysis to estimate an average effect size. Moreover, all of these studies rely
723 on cross-sectional design, except one, and all rely on self-declared behaviours. Thus, this does

724 not allow us to precisely estimate how legitimacy truly influences effective compliance with
725 traffic rules (which refers to the external validity of legitimacy). This is a crucial point that
726 needs to be investigated in order to develop applied perspectives for road safety. Otherwise,
727 cross-sectional designs do not allow us to establish the direction of causality between
728 legitimacy and compliance. Causality needs to be investigated as perceived legitimacy could
729 be the outcome of a process of rationalization, determined by compliance or violation of
730 traffic rules. In other words, drivers who often violate traffic rules could increase their
731 perception of traffic rules as illegitimate in order to maintain a congruent relationship between
732 their attitudes and behaviours and avoid or reduce cognitive dissonance. Conversely, drivers
733 that often comply with traffic rules could increase their perception of traffic rules as
734 legitimate, following the same motivation (Proudfoot & Kay, 2014; Watling & Leal, 2012).

735 Importantly, we identify three experimental studies which tested procedures designed
736 to increase perceived police legitimacy on the road (Bradford et al., 2015; Demir et al., 2018;
737 MacQueen & Bradford, 2015). The procedure used by Demir et al. (2018) was found to be
738 efficient. The procedure used by Bradford et al. (2015) was also found to be efficient but not
739 in MacQueen and Bradford (2015), which was an attempt to replicate the former contribution
740 cited here. Thus, further research in implementing means of action on perceived police
741 legitimacy, but also on other objects of legitimacy on the road, need to be proposed. This
742 appears an important point for further development as their study could allow causal
743 assumptions between variables to be tested and the trialing of interventions focused on road
744 safety which could be deployed on a larger scale.

745 Finally, we recommend addressing identified gaps in the investigation of the
746 relationship between perceived legitimacy and traffic rule compliance through further
747 research based on: (a) a robust and validated multidimensional model and measures of
748 legitimacy that allow studies to be compared, (b) experimental and longitudinal designs to test

749 the direction of causality between legitimacy and compliance and to test the effectiveness of
750 road safety interventions, (c) behavioral measures of compliance which test external validity
751 and the actual effects of legitimacy on compliance.

752 *4.3. What are the main determinants and outcomes of legitimacy in the field of road* 753 *safety?*

754 Involvement in accidents was found to be associated with greater perceived legitimacy
755 of traffic rules in two studies. Having experienced a traffic accident could make the driver
756 more aware of the risk associated with violations, and therefore of the importance of
757 complying with traffic rules. However, several studies found that accident involvement is
758 associated with a decreased perception of risk while these results are sometimes mitigated,
759 and some other studies found that accident involvement is not associated with effective risk-
760 taking. Moreover, the effect of accident involvement on risk perception could be nonlinear as
761 a function of the characteristics of the accident (Ngueutsa & Kouabenan, 2017). Therefore,
762 further research should investigate more closely how traffic accident history could affect
763 perceived traffic rule legitimacy. Risk perception associated with traffic violations was found
764 to be positively associated with the perceived rationality of traffic rules. This suggests that the
765 more drivers perceive traffic violations as risky, the more they perceive laws prohibiting them
766 as legitimate. Moreover, identified results also suggest that this effect could be generalized to
767 the perceived legitimacy of the social order.

768 Interestingly, the study of Bradford et al. (2015) introduces an approach of legitimacy
769 based on the social identity theory (Tajfel & Turner, 1979). Indeed, the authors found that
770 sharing norms of general law compliance with a social group would lead to greater
771 compliance with traffic rules. Further investigating perceived legitimacy from a social identity
772 and self-categorization approach (Tajfel & Turner, 1979; Turner et al., 1987) could be
773 interesting, as taking into account self-categorization and social identification with different

774 groups allows us to predict the effects of social norms on behaviours, such as compliance with
775 traffic rules (Elliott, 2010; see also Tunnicliff et al., 2012). Moreover, recent studies suggest
776 that the dispositional characteristics of road users but also contextual factors on the road can
777 influence self-categorization and social identification processes (King et al., 2012; Tekeş et
778 al., 2019). A better understanding of how these processes are related to legitimacy on the road
779 could offer interesting perspectives for road safety.

780 A negative past experience with the police such as having been arrested, ticketed, and
781 confronted with the use of force, is associated with lower perceived police legitimacy. These
782 results are in line with the broader literature on police legitimacy showing that positive past
783 experience with the police positively predicts compliance (e.g., Jackson, Bradford, Stanko, et
784 al., 2012; Sunshine & Tyler, 2003). Finally, identified results show that age is positively
785 related to perceived legitimacy for the police, punishment and traffic rule enforcement. This is
786 consistent with the literature showing that, compared to older drivers, young drivers take more
787 risks on the road, have a more positive attitude toward traffic violations and a more negative
788 attitude toward traffic rule enforcement (e.g., Akaateba & Amoh-Gyimah, 2013; Nordfjærn et
789 al., 2010; Starkey & Isler, 2016). In this context, perceived legitimacy could be characterized
790 by a mediating role which should be further investigated.

791 Finally, few empirical studies have investigated the determinants of perceived
792 legitimacy in the field of road safety and all rely on a cross-sectional design that does not
793 allow causality assumptions to be tested. Also, to our knowledge, no study has explored the
794 effects of perceived legitimacy beyond compliance. Thus, experimental or longitudinal
795 studies should be proposed in order to fill in these gaps.

796 *4.4. Limitations*

797 This scoping review has several limitations that should be acknowledged. Classical
798 selection bias in scoping review methodology (Sucharew & Macaluso, 2019) could have

799 operated at several levels. Only publications in English, French and Spanish were considered
800 and we did not take into account research published in other languages, for example in Africa
801 or Asia. Despite the diversity of the databases and keywords used, some studies well suited to
802 our scope could not have been identified. Indeed, the adoption of an exhaustive strategy was
803 not possible because of the limitations of the advanced research features of several databases.
804 In particular, grey literature was not checked. The publication selection steps based on
805 authors' evaluations could also involve subjective bias, despite decision criteria being based
806 on shared agreement. Also, scoping reviews do not formally evaluate the quality of evidence,
807 particularly for empirical associations between variables (Sucharew & Macaluso, 2019).
808 However, in the selected publications, the heterogeneity of measures and the low number of
809 studies investigating associations between the same constructs did not allow us to do so.

810 *5. Conclusion*

811 Our scoping review was structured around four main research questions that were: (a)
812 What are the main theoretical definitions of legitimacy in the field of road safety? (b) What
813 are the main measures proposed to address legitimacy in the field of road safety? (c) Does
814 legitimacy predict compliance in the field of road safety? (d) What are the main determinants
815 and outcomes (beyond compliance) of legitimacy in the field of road safety? A
816 comprehensive examination of the selected literature points out the importance of more
817 delineate objects in the field of road safety for which perceived legitimacy is investigated. The
818 identified lack of convergence in the definition and measures of perceived legitimacy calls for
819 further theoretical and empirical development of a multidimensional model and scale for the
820 perceived legitimacy of traffic rules. In this vein, we propose *effectiveness*, *efficiency*, *fairness*
821 and *moral alignment* as possible theoretical dimensions of a perceived legitimacy model for
822 traffic rules. The identified research indicates that, overall, perceived legitimacy on the road is
823 clearly associated with compliance, but studies currently available are not comparable enough

824 to assess the size of this relationship and causality should be confirmed by experimental or
825 longitudinal studies. Also, identified determinants of legitimacy should be more
826 systematically investigated by future research as they could be interesting levers for acting on
827 perceived legitimacy and increasing compliance with traffic rules and thus decreasing road
828 accidents. Finally, the further development of a federative framework for defining and
829 measuring the perceived legitimacy of traffic rules appears to be a prerequisite for producing
830 further comparable studies on the determinants and effects of legitimacy, in order to verify the
831 predictive power of legitimacy over compliance, evaluate the quality of evidence, and thus
832 guide concrete actions in the field of road safety.

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