

Compliance with Traffic Rules: Reviewing Instrumental and Normative Approaches in Road Safety ¹

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Abstract

Road accidents remain a critical social, economic, and public health concern worldwide, disproportionately affecting children and young adults. Among the contributing human factors, driver behavior, particularly violations of traffic regulations, has been identified as a key risk factor. Two theoretical frameworks – the instrumental and the normative – have been widely employed to explain adherence to the norms in general. This article provides a review of the role of both approaches in the domain of (non)compliance with traffic rules and road safety. It begins by outlining the foundational concepts of deterrence and procedural justice

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and subsequently examines empirical evidence regarding these frameworks for (non)compliance with traffic rules.

Keywords: Instrumental model; Normative model; Compliance with traffic rules.

Conformidade com as Regras de Trânsito: Revisão das Abordagens Instrumentais e Normativas na Segurança Rodoviária

Resumo

Os acidentes rodoviários continuam a ser uma preocupação crítica ao nível social, económico e de saúde pública em todo o mundo, afetando de forma desproporcionada crianças e jovens adultos. Entre os fatores humanos que contribuem para tal, o comportamento do condutor, particularmente as violações das regras de trânsito, tem sido identificado como um fator de risco central. Dois quadros teóricos – o instrumental e o normativo – têm sido amplamente utilizados para explicar a aderência às normas em geral. Este artigo apresenta uma revisão do papel de ambos os modelos no domínio da (não)conformidade com as regras de trânsito e da segurança rodoviária. Numa parte inicial, abordam-se os conceitos fundamentais de dissuasão e justiça procedimental e, de seguida, analisa-se a evidência empírica relativamente a estes quadros teóricos para a (não)conformidade com as regras de trânsito.

Palavras-chave: Modelo instrumental; Modelo normativo; Conformidade com as regras de trânsito.

Conformité aux Règles de Circulation: Revue des Approches Instrumentales et Normatives en Sécurité Routière

Résumé

Les accidents de la route restent un enjeu social, économique et de santé publique dans le monde entier, affectant de manière disproportionnée les enfants et les jeunes adultes. Parmi les facteurs humains contributifs, le comportement des conducteurs, notamment les infractions aux règles de circulation, a été identifié comme un facteur de risque clé. Deux cadres théoriques – l'instrumental et le normatif – ont été largement utilisés pour expliquer la conformité aux normes en général. Cet article propose une revue du rôle des deux approches dans le domaine de la (non)conformité aux règles de circulation et de sécurité routière. Il commence par présenter les concepts fondamentaux de la dissuasion et de la justice procédurale, puis examine les preuves empiriques relatives à ces cadres pour la (non)conformité aux règles de circulation.

Mots-clés: Modèle instrumental; Modèle normatif; Conformité aux règles de circulation.

Conformidad con las Normas de Tráfico: Revisión de las Perspectivas Instrumentales y Normativas en Seguridad Vial

Resumen

Los accidentes de tráfico siguen siendo un problema crítico de carácter social, económico y de salud pública en todo el mundo, afectando de manera desproporcionada a niños y jóvenes adultos. Entre los factores humanos que contribuyen, el comportamiento del conductor, en particular las violaciones de las normas de tráfico, se ha identificado como un factor de riesgo clave. Dos marcos teóricos – el instrumental y el normativo – se han utilizado ampliamente para explicar la conformidad con las normas en general. Este artículo presenta una revisión del papel de ambas perspectivas en el ámbito de la (no)conformidad con las normas de tráfico y la seguridad vial. Comienza describiendo los conceptos fundamentales de la disuasión y la justicia procesal y, a continuación, examina la evidencia empírica relativa a estos marcos para la (no)conformidad con las normas de tráfico.

Palabras clave: Modelo instrumental; Modelo normativo; Conformidad con las normas de tráfico.

Introduction

Traffic accidents remain a persistent global concern, occurring frequently and with devastating consequences. Every year, millions of people are affected. In 2021, approximately 1.19 million individuals lost their lives in road traffic accidents worldwide. In this scope, it is worth noting that, in 2019, road traffic accidents ranked as the twelfth leading cause of death across all age groups globally, being the leading cause of death worldwide among children and young adults aged 5–29. Additionally, it cannot be overlooked that road accidents may cause different injuries that can result in disabilities. Moreover, road accidents generate substantial economic costs transnationally, accounting for an estimated 10% to 12% of global gross domestic product. Thus, the deaths, disabilities, and economic costs resulting from road traffic accidents represent a significant challenge for the health and development of contemporary societies (World Health Organization [WHO], 2023).

Regarding Portugal, data indicate that between 2001 and 2018, the country experienced higher levels of fatal road accidents compared to other European nations. Although Portugal is among the European Union (EU) member states that reduced the number of road traffic

fatalities between 2003 and 2023, it still reports figures above the EU average (European Transport Safety Council [ETSC], 2024). In 2024, Portugal recorded 58.1 road fatalities per million inhabitants, a figure 29.1% higher than the EU-27 average, placing it 22nd among EU-27 member states (Autoridade Nacional de Segurança Rodoviária [ANSR], 2024), with the same trend being observed regarding the severity of injuries between 2013 and 2023 (ETSC, 2024). Moreover, road accidents remain the leading cause of death among individuals aged 5 to 40, despite improvements in road infrastructure and vehicle safety (ANSR, 2019). Additionally, in 2019, road-related crimes accounted for approximately 27.2% of all offenses tried in first-instance courts (ANSR, 2019). Drawing on the 2022 Annual Internal Security Report (Sistema de Segurança Interna [SSI], 2022), road crimes increased compared to 2021, with driving under the influence of alcohol (≥ 1.2 g/l), driving without a valid license, and dangerous driving being the main types of offenses committed on Portuguese roads. This framework underscores the relevance of the problem in Portugal and highlights the need for further research.

The road system is generally conceptualized as comprising three key components: (i) the human element – drivers and pedestrians; (ii) vehicles; and (iii) road infrastructure. While traffic accidents are traditionally attributed to interactions among these factors, there is broad consensus in the literature that the human factor is the primary contributor to road accidents (e.g., Dingus *et al.*, 2016; Evans, 1996; Peden *et al.*, 2004; Rumar, 1982). Within the human component, driver behavior has been identified as the most critical factor in the occurrence and severity of road accidents (Aarts & Schagen, 2006; Peden *et al.*, 2004; Petridou & Moustaki, 2000; Vardaki & Yannis, 2013). Consequently, although strategies aimed at improving vehicle technology, road infrastructure, and traffic regulations remain important, they are not sufficient on their own to significantly reduce traffic accidents and fatalities (ANSR, 2019; Duarte & Mouro, 2020; Parker *et al.*, 1995). As such, research in road safety has increasingly focused on the human factor, particularly on understanding what drives compliance with traffic rules and how to promote it effectively.

Road policing remains a central strategy to influence drivers' behavior (Bates *et al.*, 2012; Hassan *et al.*, 2024), and much of the research has relied on deterrence-based theories to

explain traffic violations. However, an alternative perspective has gained prominence in recent years: the procedural justice theory, which emphasizes the importance of fair procedures by authorities (e.g., police) when interacting with citizens to enhance perceptions of legitimacy among those authorities and promote voluntary compliance with traffic rules (Bates *et al.*, 2016).

Considering this background, the primary objective of this review is to provide a comprehensive understanding of theoretical models grounded in deterrence theory and in procedural justice theory — the instrumental and normative models, respectively — in explaining adherence to traffic rules. Furthermore, by examining empirical evidence regarding these frameworks, this review seeks to highlight their respective contributions to promoting compliance with traffic rules. Thus, through this analysis, we aim to uncover the potential of these models to inform more effective road safety policies, particularly those oriented toward fostering drivers' compliance with traffic rules.

1. Theoretical Models of Compliance

Understanding the motivational underpinnings of compliance with traffic regulations has been a central concern in road safety research. Within this endeavor, two theoretical frameworks have been particularly influential, namely, the instrumental and the normative. These models have been transposed from broader theories of social conformity to the specific domain of traffic regulation. The instrumental perspective emphasizes the role of legal sanctions in shaping behavior, assuming that individuals act rationally and weigh the costs and benefits of non-compliance. In contrast, the normative perspective highlights the importance of authorities using fair procedures when interacting with the public, as these shape the perceived legitimacy of those authorities. It posits that individuals are more likely to comply with norms when they perceive authorities as fair and legitimate.

In the following sections, we examine these two approaches in detail. First, we explore classical deterrence theory and its subsequent developments as the foundational framework for the instrumental model. We then turn to the procedural justice theory, which underpins

the normative model. Lastly, we analyze empirical evidence on these models in promoting compliance with traffic rules.

1.1. Instrumental Model: Deterrence Theories

1.1.1. The Classical Deterrence Theory

Philosophical and theoretical interest in deterrence can be traced back to the 18th century, during the Age of Enlightenment, with the seminal contributions of Cesare Beccaria (1764) and Jeremy Bentham (1789). Their works advanced key assumptions about human decision-making and behavior, laying the foundations of what later became known as the Classical School of Criminology and Criminal Law.

The classical deterrence theory is underpinned by a cognitive psychology rooted in Enlightenment rationalism, which presupposes that individuals act through reasoned calculation rather than impulse or passion (Beccaria, 1764; Bentham, 1789). Beccaria (1764) argued that individuals are rational actors who weigh the potential benefits of crime against the risks of punishment. He proposed that the effectiveness of punishment in preventing crime depends on its certainty, severity, and swiftness. Building upon these ideas, Bentham (1789) elaborated the principle of utility, asserting that human behavior is governed by a rational calculation of pleasure and pain — the *hedonistic calculus*. Therefore, according to the classical deterrence theorists, the effectiveness of legal sanctions depends on the potential offender's perception that there is a high likelihood of apprehension and that punishment will be applied with certainty, severity, and swiftness. Building on these principles, in Criminology, the concept of deterrence refers to the prevention of offending behavior through the threat or use of sanctions, aimed at influencing the decision-making processes and behavior of potential offenders (Meier & Johnson, 1977).

In the following sections, we present the main deterrent dimensions and the two core mechanisms by which the criminal justice system can discourage crime through apprehension and punishment, as derived from classical deterrence theory.

Deterrent Dimensions

As previously mentioned, the classical deterrence theory postulates that sanctions must incorporate three fundamental dimensions that influence the decision-making processes and behavior of potential offenders: *certainty*, *severity*, and *celerity* of punishment (Beccaria, 1764; Bentham, 1789).

Certainty of punishment refers to the perceived likelihood of being apprehended and punished following the commission of a crime. When individuals believe there is a high probability they will be caught and punished for committing a crime, they are less likely to engage in criminal behavior (Beccaria, 1764). Beccaria assigned particular importance to this dimension, asserting that “*the certainty of a punishment, even if moderate, will always make a stronger impression than the fear of a more terrible one, combined with the hope of impunity*” (1764: 58). Accordingly, he argued that a moderate punishment, but certain, exerts a more substantial deterrent effect on criminal behavior than a severe punishment, whose application is uncertain or unlikely. In fact, empirical research has consistently shown that perceptions of certainty of punishment exert a stronger inhibitory effect on criminal behavior than perceptions of severity or swiftness of punishment (e.g., Apel & Nagin, 2011; Nagin & Pogarsky, 2001; Truelove *et al.*, 2017).

Concerning the *severity* of punishment, it refers to the magnitude of the consequences associated with an offense. That is, the extent of the unpleasant outcomes resulting from a sanction for committing that offense (Beccaria, 1764). It functions as a deterrent by increasing the perceived costs of engaging in criminal behavior, for instance, through longer prison sentences (Geerken & Gove, 1975). Nevertheless, Beccaria (1764) maintained that punishment should be just and proportionate to the seriousness of the crime committed. When the punishment disproportionately exceeds the gravity of the offense, it becomes unnecessarily tyrannical and may prove counterproductive, potentially generating defiance rather than compliance with the law. Accordingly, the severity of punishment must be sufficient to outweigh the rewards of a crime, but not so excessive as to surpass the harm caused by the crime itself (Beccaria, 1764).

Lastly, *celerity* (or *swiftness*) relates to the time between the commission of a crime and the imposition of punishment (Beccaria, 1764). Beccaria (1764) emphasized that punishment should be administered swiftly to be more effective. Thus, swiftness of punishment refers to the temporal proximity between the commission of an offense and the imposition of a sanction (Davey & Freeman, 2011; Piquero *et al.*, 2011). For Beccaria (1764), punishment becomes more effective when the connection between the offense and its corresponding sanction is immediate in the human mind. The closer and clearer this association is, the more likely individuals are to perceive the crime as the cause and the punishment as its natural and inevitable consequence, thereby enhancing the deterrent effect of the sanction. In contrast, when there is a prolonged interval between the commission of the crime and the imposition of the respective punishment, regardless of its certainty or severity, the individual's ability to establish this association weakens, thereby reducing the deterrent effect of the sanction (Beccaria, 1764; Pratt & Turanovic, 2018). Despite this, the celerity dimension has received considerably less attention over the years (Nagin, 2013; Nagin & Pogarsky, 2001; Pratt & Turanovic, 2018). As noted by Abramovaite *et al.* (2023: 1667), "*while the evidence for the effect of certainty is strong and the impact of severity is ambiguous, the evidence on celerity is scant*".

General and Specific Deterrence

Building on the foundational ideas of Beccaria (1764) and Bentham (1789), classical deterrence theory posits two primary mechanisms by which the criminal justice system can discourage crime by apprehending and punishing offenders. These mechanisms are commonly referred to as *general deterrence* and *specific deterrence* (Freeman & Watson, 2006).

General deterrence operates when individuals refrain from committing criminal acts because they observe others being punished for offenses or are aware of the potential legal consequences of their actions. Its primary purpose is to discourage the general population from committing crimes by highlighting the risks and costs of those acts (Davey & Freeman, 2011; Nagin, 2013). Since general deterrence does not rely on individuals' direct experiences

with punishment, most scholars have concluded that its effectiveness largely depends on how the broader public perceives the threat of punishment. As such, for deterrence to function effectively, sanctions must be highly visible, consistently enforced, and clearly communicated to the public through educational campaigns and law enforcement practices (Davey & Freeman, 2011; Freeman & Watson, 2009; Homel, 1988). Thus, individuals must be aware of potential sanctions in advance for deterrence to be effective (Davey & Freeman, 2011; Homel, 1988).

Specific deterrence refers to the deterrent effect of first-hand experience with punishment. It concerns the process by which an individual who has been apprehended and sanctioned for a criminal act refrains from further offending due to fear of incurring additional punishment (Davey & Freeman, 2011; Piquero & Paternoster, 1998). For these individuals, the sanction no longer represents a mere threat but rather a real and concrete consequence.

In summary, both approaches recognize the importance of experience with legal punishment as a deterrent mechanism. However, for members of the *general public*, deterrence operates primarily through *indirect experience*, that is, through observing or being aware of others being punished. In contrast, for *sanctioned offenders*, it is *direct experience* that exerts the deterrent effect (Stafford & Warr, 1993). Thus, although both forms of deterrence pursue the same ultimate purpose — to discourage individuals from engaging in prohibited behavior through the threat of legal sanctions — their target audiences are distinct (Paternoster & Piquero, 1995).

1.1.2. The Reconceptualized Model of Deterrence

An important theoretical advancement in deterrence was provided by Stafford and Warr (1993), who reconceptualized the classical approach to address its limitations and offer a more comprehensive understanding of how deterrence influences offenders' decision-making processes and behavior.

According to Stafford and Warr's (1993) reconceptualized model of deterrence, there are four central deterrence mechanisms: (i) *direct punishment experience* (e.g., committing an offense

and being punished); (ii) *direct punishment avoidance* (e.g., committing an offense and not being caught or to go unpunished); (iii) *indirect punishment experience* (e.g., knowing others who have been apprehended and punished for committing offenses); and (iv) *indirect punishment avoidance* (e.g., knowing others who have committed offenses but were not caught or escaped punishment).

As it could be noted, Stafford and Warr's (1993) reformulation of classical deterrence theory expanded the traditional framework by incorporating the concept of *punishment avoidance* into both general and specific deterrence, arguing that deterrent experiences are not limited to instances of being punished, but also include situations in which individuals successfully avoid punishment. Accordingly, *specific deterrence* pertains to direct experiences of punishment or its avoidance, and *general deterrence* encompasses indirect or vicarious experiences, such as observing or being aware of others who have been punished or have escaped punishment. This conceptual refinement highlights the importance of both direct and indirect experiences, including punishment and its avoidance, in shaping individuals' decision-making processes regarding rule compliance (Watling *et al.*, 2010).

This development stems from the recognition that within the general public, there are two distinct groups of individuals who have never been subjected to legal punishment: (i) those who have never engaged in criminal behavior, and (ii) those who have committed crimes but successfully avoided punishment. Stafford and Warr (1993) argue that although the latter group has never experienced formal sanctions, they have gained experience in avoiding punishment. This experience, in turn, likely influences their future offending behavior by undermining the deterrent impact of perceived certainty and severity of punishment. Of these two core deterrence dimensions, perceptions of certainty are particularly influenced by experiences of avoiding punishment. Successfully escaping detection and sanction provides individuals with first-hand information about the likelihood of being caught, thereby shaping their assessment of the risks associated with offending (Paternoster, 1987). Thus, direct punishment avoidance may serve as an incentive for continued offending, challenging the assumption that punishment prevents future crime (Paternoster & Piquero, 1995; Stafford & Warr, 1993). The same principles apply to indirect punishment avoidance. However, it has

been suggested that indirect punishment avoidance is unlikely to exert significant deterrent effects unless it involves close associates, such as friends or family members, rather than distant or anonymous others in the broader community (Sitren & Applegate, 2006, 2007).

Overall, this expanded theoretical framework posits that unlawful behavior is deterred by both direct and indirect experiences of punishment threats and actual punishment, whereas it is encouraged by direct and indirect experiences of punishment avoidance (Paternoster & Piquero, 1995; Piquero & Pogarsky, 2002). This reconceptualization offers advantages over the traditional framework, as it emphasizes the influence of not only direct and indirect punishment experiences, but also the role of punishment avoidance, both direct and indirect, in shaping offending and rule compliance (Freeman & Watson, 2006; Sitren & Applegate, 2012). As such, this framework offers a more comprehensive understanding of how various factors shape individuals' decision-making processes and behavior (Watling *et al.*, 2010).

1.1.3. The Informal Model of Deterrence

Additional efforts have sought to broaden the deterrence paradigm by examining further factors that influence individuals' decisions to offend (Freeman & Watson, 2009). This line of theorization was primarily grounded in the widely accepted recognition that individuals do not respond uniformly to legal stimuli, as their behavior is shaped by various social factors, such as the perceptions of significant others (e.g., family, peers), as well as by internal emotions arising from the anticipation or experience of punishment (e.g., shame, guilt) (Piquero *et al.*, 2011). In fact, research highlights that punishment does not operate in a social vacuum (Anderson *et al.*, 1977; Grasmick *et al.*, 1993; Williams & Hawkins, 1986), with some studies suggesting that the threat of informal sanctions exerts a greater deterrent effect on offending than formal legal sanctions (e.g., Hassan *et al.*, 2024; Homel, 1988). Thus, extralegal factors have been defined as sanctions that exist outside the formal legal system (e.g., stigma, attachment costs, and commitment costs), but that occur because of legal punishments (Williams & Hawkins, 1986).

The most prominent deterrence model incorporating non-legal factors — the informal model of deterrence — was proposed by Homel (1988), who originally developed this model to

examine the impact of random breath testing on drunk-driving behavior. Thus, Homel (1988) further extends the deterrence framework by incorporating perceived social, internal, material, and physical risks. He argues that the higher the perceived likelihood of encountering social disapproval, experiencing internal loss, or causing physical or material harm, the lower the probability that individuals will engage in transgressive behavior. Accordingly, the model incorporates the following elements: (i) *social sanctions* (e.g., social disapproval from friends and family if they discover that the individual violates traffic rules); (ii) *internal loss* (e.g., feelings of guilt or self-shame associated with violating traffic rules); (iii) *material loss* (e.g., fear of losing material resources due to traffic rules violations, including fines or demerit points); and (iv) *physical loss* (e.g., fear of causing physical harm to other drivers as a consequence of accidents resulting from traffic rules violations) (Hassan *et al.*, 2024; Homel, 1988; Truelove *et al.*, 2021a).

Since then, the model has been widely applied to assess the deterrent effects in various road traffic violations, including drunk driving (Freeman *et al.*, 2020), mobile phone use while driving (Kaviani *et al.*, 2020), and speeding (Truelove *et al.*, 2017).

1.2. Normative Model: The Procedural Justice Theory

For many decades, the instrumental model has represented the dominant approach employed by legal authorities to secure citizens' compliance (Bradford *et al.*, 2015; Tankebe, 2009). Indeed, a common strategy to promote law-abiding behavior is to maintain a credible threat of sanctions, or their actual enforcement, against those who violate the legal norms (Hinds & Murphy, 2007; Tyler, 2004). Within the road context, this approach has been particularly prominent, perhaps applied with even greater intensity than in other regulatory domains (Bradford *et al.*, 2015). However, the instrumental approach has shown several disadvantages and limitations that challenge its suitability as a general framework for policing (Hinds & Murphy, 2007). In fact, ensuring compliance solely through coercive means has proven costly and difficult for various reasons: (i) law enforcement agencies lack the human and material resources required to continuously monitor all citizens' behavior (Hinds & Murphy, 2007; Sunshine & Tyler, 2003; Tyler, 2004); and (ii) research suggests that this

approach is neither the most appropriate for building positive police–citizen relationships (Hinds & Murphy, 2007; Sunshine & Tyler, 2003) nor effective in promoting long-term compliance with the law (Tyler, 2004).

Considering these factors, it had become increasingly evident that ensuring citizens' compliance with the law on a voluntary rather than a coercive basis was of critical importance (Hinds & Murphy, 2007; Tyler, 2004). It was in this context that Tyler's (1990) influential work *"Why People Obey the Law"* introduced a different approach to compliance — the procedural justice theory — which subsequently became a focal point of research and discussion within the scientific community (Tankebe, 2009). Briefly, in his process-based theory of self-regulation, Tyler (1990) argues that authorities can foster public self-regulation by establishing and maintaining their legitimacy. In other words, the theory posits that when the police — the primary authority in the road context — are perceived as legitimate by the public, citizens' everyday behavior is more likely to align with the law. Furthermore, it contends that the principal mechanism for strengthening the police's perceived legitimacy lies in the fairness of the procedures they employ when interacting with the public (Tyler, 1990, 2004).

Thus, the normative model differs from the instrumental model by proposing that people's adherence to legal norms is not primarily driven by external factors, such as the likelihood of sanctions or rewards, but rather by internalized values and a sense of obligation to obey the police and the legal norms they enforce (Sunshine & Tyler, 2003; Tyler, 1990).

Before moving forward, it is important to look more closely at the two core elements of the normative model: (i) legitimacy, which underpins the public's sense of moral duty to follow the law; and (ii) procedural justice theory, which explains the process through which such legitimacy is built. The next sections examine these components in more detail.

1.2.1. Legitimacy: Theoretical and empirical considerations

The conceptual roots of legitimacy can be traced back to the writings of Max Weber (1968), who argued that the capacity to issue commands that are obeyed does not rely solely on the

possession or exercise of power. Instead, the author emphasized the existence of norms and authorities that individuals obey voluntarily. Such compliance, according to Weber (1968), is grounded in legitimacy, that is, in the belief that these authorities and their commands are rightful and therefore ought to be obeyed.

Over the past three decades, interest in the study of legitimacy has grown substantially, particularly over the past decade (Bradford *et al.*, 2021). This growing attention reflects a broader recognition that legitimacy plays a pivotal role in shaping public attitudes and behaviors toward the law and legal authorities, offering key insights into patterns of compliance and noncompliance (Bradford *et al.*, 2021; Tankebe, 2009; Tyler & Fagan, 2008).

Perceived legitimacy is defined as “*the property of an authority or institution that leads people to feel that that authority or institution is entitled to be deferred to and obeyed*” (Sunshine & Tyler, 2003: 514), suggesting that legitimacy is intrinsically linked to societal perceptions of authorities and institutions (Bradford *et al.*, 2015). Jackson and Gau (2016) argue that, in a democratic society, government agencies derive their legitimacy from the public's perceptions that they adhere to constitutional and legislative norms and that they act in ways perceived as fair and appropriate. In literature, legitimacy has been, more recently, typically conceptualized and operationalized based on two main dimensions: (i) *moral alignment*; and (ii) *felt obligation to obey* (Bradford *et al.*, 2015, 2021; Hough *et al.*, 2017; Van Damme, 2017).

Regarding *moral alignment*, this concept refers to the extent to which norms and values are shared between authorities and the general public (i.e., citizens). This dimension rests on individuals' judgments about whether authorities act in accordance with the values and norms widely accepted within a society (Bradford *et al.*, 2015; Bradford *et al.*, 2021). Empirical evidence (e.g., Bradford *et al.*, 2021; Van Damme, 2017) suggests that perceptions of an authority's moral legitimacy are strongly shaped by the fairness of the procedures it employs in its interactions with the public. More specifically, moral alignment tends to increase when authorities are perceived as adopting fair procedures. For instance, in the case of the police, members of the public expect officers to make decisions impartially, to treat people with dignity and respect, and to provide opportunities for individuals to voice their views before decisions are made.

Felt obligation to obey, in turn, consists of an internalized sense of duty to comply with authorities (Hough *et al.*, 2017). For instance, when individuals perceive the police as legitimate, they feel a moral obligation to follow police instructions and the laws they enforce (Tyler & Jackson, 2013). In essence, legitimacy entails granting the police the right to define and regulate appropriate behavior (Bradford *et al.*, 2021). According to Bradford *et al.* (2021), this sense of obligation must rest on the voluntary acceptance of the authority's directives and norms. Thus, the felt obligation to obey, as a component of legitimacy, represents a form of free and moral consent. Conversely, when the sense of obligation arises from coercion, fear, or a perception of powerlessness, it does not represent a normative commitment to authority and, therefore, cannot be regarded as actual legitimacy (Tankebe, 2009).

Consequences of Police Perceived Legitimacy

A substantial body of research consistently demonstrates that perceptions of police legitimacy have far-reaching consequences for public compliance with the law and the police. More specifically, individuals who view the police as legitimate are more likely to comply voluntarily with the law and police directives (e.g., Fagan & Tyler, 2004; Sunshine & Tyler, 2003). When citizens perceive the police as legitimate, they are also more inclined to accept the outcomes of their encounters with police officers, even when these outcomes may not be personally favorable (e.g., Jackson *et al.*, 2012; Sunshine & Tyler, 2003; Tyler, 1990; White *et al.*, 2016). Moreover, the perceived legitimacy of the police extends beyond specific encounters, fostering law-abiding behavior in everyday life (Sunshine & Tyler, 2003; Tyler & Huo, 2002).

Additionally, this recognition of police legitimacy enhances citizens' willingness to voluntarily cooperate with that authority (e.g., Bolger & Walters, 2019; Murphy *et al.*, 2008; Sunshine & Tyler, 2003; White *et al.*, 2016). Such voluntary cooperation is essential, as the police largely depend on community engagement to combat and prevent crime. This cooperation often involves reporting victimization (Bolger & Walters, 2019) and providing information about offenses, suspects, and offenders (e.g., Murphy & Gaylor, 2010; Reisig & Lloyd, 2009; Tyler & Fagan, 2008).

1.2.2. The Procedural Justice Theory

Given the significant role that perceived police legitimacy plays in promoting public voluntary compliance and cooperation with the police, scholars have sought to elucidate the mechanisms that shape this perception. Among these mechanisms, procedural justice has been identified in most studies as the most influential determinant of perceived police legitimacy² (e.g., Fagan & Tyler, 2004; Hinds & Murphy, 2007; Sunshine & Tyler, 2003; Tyler, 2004).

Historically, the concept of procedural justice was introduced by Thibaut and Walker (1975), who emphasized the importance of citizen participation in judicial decision-making processes. They argued that the way disputes and issues are resolved — rather than merely the outcomes themselves — plays a crucial role in shaping individuals' perceptions of fairness and justice. Their research demonstrated that perceived fairness in decision-making procedures is a key determinant of how individuals react to those outcomes. In other words, people are more willing to accept unfavorable outcomes when they believe the process leading to those outcomes is fair.

Procedural justice theory posits that the principal catalyst for an authority's perceived legitimacy lies in the fairness of its procedures when dealing with the public (Sunshine & Tyler, 2003), identifying two key dimensions underlying those people's evaluations: (i) the *quality of decision-making*; and (ii) the *quality of interpersonal treatment* (Blader & Tyler, 2003; Sunshine & Tyler, 2003).

The first dimension, *quality of decision-making*, comprises two subdimensions: *neutrality* and *trustworthy motives*. *Neutrality* refers to the perception that authorities make decisions based on objective and impartial indicators rather than personal views, biases, prejudices, or

² Although several studies have underscored the relevance of instrumental judgments — such as evaluations of police effectiveness in controlling crime — in predicting legitimacy (e.g., Hinds & Murphy, 2007; Murphy & Gaylor, 2010; Tyler & Fagan, 2008), empirical evidence consistently indicates that perceptions of police legitimacy are shaped primarily by citizens' perceptions of the quality of their treatment and the fairness of police decision-making. In other words, procedural justice exerts a stronger and more consistent influence on the formation of legitimacy perceptions than do assessments of police performance (e.g., Fagan & Tyler, 2004; Murphy & Gaylor, 2010; Sunshine & Tyler, 2003; Tyler *et al.*, 2010).

arbitrary judgments (Tankebe, 2009; Tyler, 2004). *Trustworthy motives* mean that decisions are perceived as being guided by genuine concern for citizens' well-being and made with consideration for their needs and concerns (Tyler, 2004).

The second dimension, *quality of interpersonal treatment*, also encompasses two subdimensions: *participation* and *dignity and respect*. *Participation* refers to the opportunity for citizens to express their views and explain their situation during the decision-making process. That is, the extent to which individuals are given a "voice" in their interactions with authorities before a decision is made (Paternoster *et al.*, 1997; Tyler, 2004). *Dignity and respect* reflect the perception that authorities treat individuals with courtesy and politeness, while also recognizing their rights as citizens (Tankebe, 2009; Tyler, 2004).

Research conducted within the procedural justice framework, particularly in the context of police–citizen encounters, has demonstrated that the way police officers make decisions and treat members of the public has significant implications for their perceived legitimacy. When police procedures are perceived as fair, citizens experience a sense of procedural justice and are consequently more likely to regard the police as legitimate (Walters & Bolger, 2019; Reisig & Lloyd, 2009; Sunshine & Tyler, 2003) and less likely to engage in offending behavior (Bradford *et al.*, 2015; Murphy & Gaylor, 2010). Furthermore, empirical evidence indicates that such deference often fosters a normative commitment that tends to persist over time, shaping individuals' subsequent attitudes and behaviors toward the law and legal authorities (Paternoster *et al.*, 1997; Tyler, 2004). Conversely, research has shown that when police practices are perceived as unfair (e.g., cases involving racially biased stops), perceived police legitimacy tends to erode (Tyler & Wakslak, 2004). In turn, such experiences are associated with a reduced willingness to comply with legal norms (McCluskey *et al.*, 1999) and can give rise to feelings and behaviors of alienation, dissatisfaction, and resistance among members of the public (Fischer *et al.*, 2008; Sunshine & Tyler, 2003).

Having outlined the principal elements of the instrumental and normative models from a predominantly theoretical perspective, the following section reviews the empirical evidence concerning both models within the specific context of traffic rule (non)compliance.

2. Empirical Evidence on (Non)Compliance with Traffic Rules: The Instrumental and Normative Models

Understanding why individuals comply with, or violate, traffic rules remains a central concern in efforts to enhance road safety. In this regard, theoretical approaches that explain rule (non)compliance are essential for informing effective interventions and policies. Two prominent frameworks have guided much of the research in this area: the instrumental model, grounded in deterrence theories, and the normative model, derived from the procedural justice theory. Therefore, this section examines empirical research addressing both models in the specific context of (non)compliance with traffic rules. It first reviews studies grounded in the instrumental model, then those grounded in the normative model, and concludes with empirical studies that have jointly tested both models, offering a more comprehensive understanding of (non)compliance behavior.

2.1. Empirical Evidence on the Instrumental Model

In the context of road policing, deterrence theories have long underpinned enforcement strategies aimed at reducing traffic accidents, particularly those involving a higher risk of serious injury (Bates *et al.*, 2012; Hassan *et al.*, 2024). These approaches are grounded in an instrumental view of human behavior, which posits that individuals are less likely to commit traffic offenses, such as speeding or driving without a license, when they perceive a high likelihood of detection and sanction (Bradford *et al.*, 2015). Accordingly, numerous studies have applied the deterrence framework to examine the effectiveness of both legal and nonlegal factors in shaping compliance with traffic rules. In this scope, it has been used to study a wide range of unsafe driving behaviors, including drug-and alcohol-impaired driving (e.g., Hassan *et al.*, 2024; Szogi *et al.*, 2017; Watling *et al.*, 2010), speeding (Hassan *et al.*, 2024; Truelove *et al.*, 2017), mobile phone use while driving (e.g., Hassan *et al.*, 2024; Kaviani *et al.*, 2020; Truelove *et al.*, 2019), tailgating (Ochenasek *et al.*, 2022), and unlicensed driving (Watson, 2004). Moreover, common deterrence strategies include random breath tests (Homel, 1988), drug detection tests (Armstrong *et al.*, 2014; Watling *et al.*, 2010), fixed and

mobile speed cameras (Truelove *et al.*, 2017; Watson *et al.*, 2015), and automated detection of mobile phone use (Truelove *et al.*, 2023).

As previously mentioned, within the framework of classical deterrence constructs, the *certainty of punishment* is theoretically central to inhibiting offending behavior. Several studies report that higher perceptions of punishment certainty are associated with lower engagement in traffic offenses, including driving under the influence of alcohol (e.g., Freeman & Watson, 2009; Stringer, 2021; Szogi *et al.*, 2017), driving under the influence of psychoactive substances (Davey *et al.*, 2008), and speeding (Truelove *et al.*, 2017). Taken together, these findings suggest that drivers who perceive a greater likelihood of detection and sanction are generally less prone to violating traffic rules. However, this relationship has not been consistently replicated.

Recent studies report mixed results regarding the predictive power of classical deterrence dimensions, including certainty. For instance, research conducted in Australia by Hassan *et al.* (2024) and Kaviani *et al.* (2020) found that none of these dimensions significantly predicted self-reported offending concerning driving under the influence of alcohol, speeding, or mobile phone use while driving. The authors attributed this to participants' uniformly low perceived certainty about apprehension, which limited the explanatory power of these variables. In fact, drivers often do not perceive the risk of being caught for traffic violations as high (Fleiter *et al.*, 2009; Szogi *et al.*, 2017). Accordingly, scholars have emphasized that, beyond increasing police presence and visibility, media campaigns may play a crucial role in amplifying public perceptions of sanction certainty (Davey & Freeman, 2011; Homel, 1988). Deterrence depends not only on the existence of formal sanctions but also on citizens' awareness and understanding of the likelihood of detection and its legal consequences; in the absence of such perceptions, the threat of punishment is substantially weakened (Hassan *et al.*, 2024).

Paradoxically, some studies have found that a higher perceived certainty of punishment may be associated with more frequent offending, as highlighted by Fleiter *et al.* (2009), who examined drivers in Beijing (N = 299) and Queensland (N = 833). In their Chinese sample, perceptions of punishment certainty were mixed: while most participants moderately agreed

that speeding could lead to sanctions, about one-third reported never being effectively penalized, possibly due to informal warnings or successful evasive strategies. By contrast, in the Australian sample, a higher perceived certainty of punishment was associated with more frequent speeding. This may reflect prior learning among 'seasoned speeders': drivers who regularly speed and have been repeatedly fined may perceive a strong link between apprehension and punishment (i.e., high certainty), yet continue offending if penalties are seen as lenient, predictable, or avoidable. These findings indicate that perceptions of enforcement alone are insufficient to ensure compliance, as prior experiences can lead drivers to calibrate their behavior based on both the likelihood and severity of sanctions. Overall, they suggest that perceptions of detection certainty are shaped not only by the presence of enforcement but also by its type, intensity, and consistency in practice.

Evidence from recidivist drivers reinforces this point. Davey *et al.* (2008) found that drivers convicted of drug-impaired driving (N = 49) perceived a higher likelihood of detection and shorter intervals to sanction, yet nearly half intended to reoffend within six months. Therefore, frequent substance use appeared to undermine deterrence, highlighting the importance of addressing underlying problematic behavior. Similarly, Watson (2004) found that drivers previously convicted of driving without a license (N = 309) showed higher intentions to reoffend. These results reflect the "emboldening effect" (Piquero & Pogarsky, 2002), whereby prior punishment experiences may paradoxically increase the likelihood of future offending. To explain this effect, Pogarsky and Piquero (2003) proposed several mechanisms: the *reset effect*, the *self-serving bias*, and the *gambler's fallacy*. The *reset effect* suggests that offenders perceive a reduced likelihood of detection immediately after a sanction, diminishing perceived future risk. On the other hand, the *self-serving bias* posits that offenders see themselves as particularly skilled at avoiding detection, with vicarious punishment experiences reinforcing this belief and lowering perceived certainty. Lastly, the *gambler's fallacy* implies that individuals may erroneously believe the probability of apprehension decreases after a rare punishment event, fostering a false sense of security even in the absence of personal experience.

Perceptions of *sanction severity* can also influence behavior, with research indicating that severe penalties may reduce both initial offending and recidivism across various traffic violations, including speeding, alcohol-impaired driving, and tailgating (e.g., Freeman & Watson, 2006; Truelove *et al.*, 2021a; Watson *et al.*, 2015). For example, Ochenasek *et al.* (2022) found that perceived severity, but not certainty, negatively predicted tailgating among Queensland drivers (N = 887). Similarly, Freeman and Watson (2006) reported that, among individuals with prior alcohol-impaired driving offenses (N = 166), only perceived severity negatively predicted intentions to reoffend. Overall, these findings suggest that severity may exert a deterrent effect even among recidivists, although its long-term impact may be limited when the certainty of detection is low.

Nevertheless, the evidence on perceived severity remains inconsistent, with several studies indicating that higher perceived severity does not always reduce offending and can even correlate with increased risk-taking (e.g., Love *et al.*, 2024; Szogi *et al.*, 2017; Truelove *et al.*, 2017). For instance, Stringer (2021) found that drivers perceiving sanctions as more severe were 56% more likely to report alcohol-impaired driving. Similarly, Szogi *et al.* (2017) and Truelove *et al.* (2017) observed that perceiving high personal impact of penalties could paradoxically increase offending. These results highlight that severity is highly subjective, varying with individual characteristics, values, and socio-cultural context.

Two factors may explain these inconsistencies. First, if sanctions are less aversive than expected or fail to produce consequences, individuals may adjust their perception of severity downward and feel emboldened to reoffend (Pogarsky & Piquero, 2003). Second, severity appears to interact with perceived certainty: penalties are only effective in deterring when the likelihood of detection is high. If apprehension is deemed unlikely, even severe sanctions may have little impact (Grasmick & Bryjak, 1980; Homel, 1988).

Overall, these findings suggest that the effectiveness of classical deterrence depends not only on the objective presence of enforcement and sanctions but also on individuals' subjective perceptions, prior experiences, and the interaction between certainty and severity. Under certain conditions, both perceived certainty and severity may fail to deter and may even

paradoxically encourage offending, highlighting the complexity of designing effective traffic enforcement strategies.

Regarding empirical research on the perceived *swiftness of punishment*, it has consistently yielded non-significant effects in predicting future traffic offending. This finding recurs across behaviors such as driving under the influence of alcohol (e.g., Hassan *et al.*, 2024; Szogi *et al.*, 2017) and psychoactive substances (e.g., Davey *et al.*, 2008), speeding (e.g., Fleiter *et al.*, 2009; Truelove *et al.*, 2017), and mobile phone use while driving (Hassan *et al.*, 2024; Truelove *et al.*, 2023). The weak deterrent impact associated with swiftness is often attributed to a prevailing perception that sanctions are not applied promptly. In practice, punishments are rarely administered without delay, particularly when judicial proceedings are involved (Davey & Freeman, 2011; Fleiter *et al.*, 2009; Nagin & Pogarsky, 2001). Even when offenses are detected through automated enforcement mechanisms, such as speed cameras or video surveillance, sanctions are typically experienced only after a substantial temporal lag, thereby weakening the contingency between behavior and consequence (Fleiter *et al.*, 2009; Hassan *et al.*, 2024; Truelove *et al.*, 2023). Moreover, installment-based fine payments, uncertainty regarding enforcement timelines, and limited legal awareness may further attenuate perceptions of immediacy (Truelove *et al.*, 2021b). Enhancing procedural immediacy, such as through the on-the-spot issuance of fines or payment at the point of interception, could strengthen the perceived link between the offense and the sanction. However, it should be noted that such approaches impose considerable logistical and financial demands on law enforcement agencies (Watling & Leal, 2012).

Nevertheless, empirical data concerning individuals' perceptions of sanction immediacy remain mixed. In the study by Davey *et al.* (2008), one-third of participants (32.7%) perceived the interval between the offense and punishment as short, while more than half were uncertain. Similarly, Hassan *et al.* (2024) found that the participants largely rejected the notion that the time between committing an offense and receiving a fine or court summons was lengthy. In contrast, Fleiter *et al.* (2009) observed that 45.9% of Australian drivers disagreed that sanctions were applied promptly, whereas 67.6% of Chinese respondents reported moderate to strong agreement, suggesting notable cross-cultural differences in perceived

enforcement efficiency. Overall, perceptions of swiftness appear to be contingent upon the socio-cultural context, enforcement modality, and the type of offense. The absence of significant deterrent effects may therefore reflect either the limited behavioral salience of current sanctioning frameworks (Truelove *et al.*, 2023) or methodological constraints, such as reliance on hypothetical scenarios and samples lacking direct exposure to punitive processes (Szogi *et al.*, 2017).

Research on road safety has increasingly applied Stafford and Warr's (1993) *reconceptualized deterrence model* to explain compliance with traffic rules. As previously referred, according to Stafford and Warr's (1993) reconceptualized deterrence framework, *direct punishment* should inhibit future offending by heightening perceptions of sanction certainty and severity. However, empirical evidence in the road context remains inconsistent. Some studies report that direct punishment experiences increase perceived certainty and reduce self-reported offending (e.g., Stringer, 2021), whereas others fail to replicate these effects (e.g., Bates *et al.*, 2017; Hassan *et al.*, 2024; Truelove *et al.*, 2023).

Findings from recidivist drivers reinforce this inconsistency. Davey *et al.* (2008) observed that drivers convicted of drug-impaired driving perceived higher detection likelihood and shorter sanction intervals, yet nearly half intended to reoffend within six months. Therefore, frequent substance use appeared to undermine deterrence, underscoring the need to address underlying behavioral factors rather than relying exclusively on punitive mechanisms. Similarly, Watson (2004) found that drivers previously convicted of unlicensed driving expressed stronger intentions to reoffend, exemplifying what Piquero and Pogarsky (2002) termed the "emboldening effect," and previously explained in this section.

A similar inconsistency characterizes evidence of *vicarious punishment*, i.e., observing others being sanctioned. While some studies indicate that socially shared punishment experiences increase perceived certainty of detection and promote compliance (e.g., Ochenasek *et al.*, 2022; Szogi *et al.*, 2017; Truelove *et al.*, 2019), others report null effects (e.g., Truelove *et al.*, 2021a). In some instances, individuals even interpret others' punishment outcomes self-

servingly, perceiving themselves as more competent or less likely to be caught (Hassan *et al.*, 2024; Piquero & Paternoster, 1998).

In contrast to the limited and inconsistent evidence for the deterrent effect of direct or vicarious punishment, Stafford and Warr's (1993) model finds its strongest empirical grounding in experiences of *punishment avoidance*, both *direct* and *indirect*. These dimensions consistently emerge as more robust and consistent predictors of risky driving and repeat offending than the experience of punishment itself.

Direct punishment avoidance (i.e., successfully committing offenses without detection) serves as a strong reinforcer. Such experiences reduce perceived certainty of punishment (Piquero & Pogarsky, 2002; Stringer, 2021) and foster adaptive evasion strategies, such as selecting less-patrolled routes, adjusting speed according to enforcement patterns, or driving in low-surveillance areas (Bates & Anderson, 2021; Hassan *et al.*, 2024). These behaviors generate a sense of immunity that erodes deterrence and sustains offending (Paternoster & Piquero, 1995; Stafford & Warr, 1993). Evidence across contexts, from drug- and drink-driving, to speeding, unlicensed driving, and mobile phone use, confirms that the absence of punishment normalizes deviance and entrenches risky conduct (e.g., Armstrong *et al.*, 2014; Watling *et al.*, 2010; Freeman & Watson, 2006; Szogi *et al.*, 2017; Truelove *et al.*, 2021a).

The evidence concerning vicarious or *indirect punishment avoidance* (i.e., knowing others who have evaded sanctions) is more mixed. In several studies, this awareness has been found to predict increased intentions to engage in risky behaviors, including driving under the influence of drugs or alcohol and using mobile phones while driving (e.g., Armstrong *et al.*, 2014; Watling *et al.*, 2010; Hassan *et al.*, 2024; Truelove *et al.*, 2019). Observing peers who repeatedly offend without consequence appears to lower perceived risk and normalize transgression. Other research, however, reports no significant associations (e.g., Watson, 2004; Freeman & Watson, 2006; Szogi *et al.*, 2017; Truelove *et al.*, 2021a), possibly due to variations in sample composition, methodological design, or the degree of social proximity to the observed offender.

Thus, the deterrence-based constructs mentioned above account for only a portion of the variance in risky and transgressive driving (Szogi *et al.*, 2017; Truelove *et al.*, 2019). Building on Homel's (1988) framework, recent studies emphasize the salience of non-legal sanctions, such as social disapproval, guilt, shame, or perceived loss of respect, as more effective deterrents in some contexts (e.g., Freeman & Watson, 2009; Hassan *et al.*, 2024; Kaviani *et al.*, 2020; Ochenasek *et al.*, 2022). Internal and social sanctions frequently predict compliance more strongly than formal legal mechanisms, though their relative impact varies across behaviors and demographic groups (Poirier *et al.*, 2018; Truelove *et al.*, 2017).

2.2. Empirical Evidence on the Normative Model

To date, most road policing strategies have been primarily informed by the assumptions of deterrence theories (Bates *et al.*, 2012; Truelove *et al.*, 2017). However, as previously discussed, the extensive body of research in this area has yielded inconsistent or insignificant findings, suggesting inherent limitations in the instrumental model to explain (non)compliance with traffic rules and the need to broaden theoretical perspectives beyond deterrence-based explanations. In this context, increasing attention has been directed toward the normative model as a complementary framework (Bates, 2014; Tudor-Owen, 2021). Although extensive evidence supports the role of perceived legitimacy in promoting compliance, research explicitly applying this model to the road context, and specifically in explaining (non)compliance with traffic rules, remains comparatively limited.

Among the existing studies, most have examined whether the incorporation of procedural justice principles (e.g., treatment with dignity and respect, neutrality in decision-making) during face-to-face encounters between police officers and drivers, including enforcement operations like random breath testing (RBT) or stop-and-search interventions, influences perceptions of police legitimacy and, consequently, drivers' willingness to comply with traffic rules. To explore this, randomized field experiments have frequently been employed.

For instance, Mazerolle *et al.* (2012) conducted the Queensland Community Engagement Trial (QCET) in Australia — a randomized field experiment undertaken by the Queensland Police

Service in collaboration with the University of Queensland. The study examined whether incorporating procedural justice principles into Random Breath Testing (RBT) operations influenced drivers' attitudes toward drunk driving, compliance, and satisfaction with the police. Sixty RBT sites were randomly assigned to either a control condition reflecting standard police practice (N = 1,649) or an experimental condition incorporating procedural justice–based communication (N = 1,097). Survey data from 2,746 drivers revealed that those exposed to the procedural justice approach were 1.24 times more likely to report a change in their attitudes toward alcohol consumption and driving, expressed slightly higher satisfaction with the police, and had greater perceived compliance during the encounter. Although compliance with traffic rules was not directly measured, the higher levels of compliance with the police during the encounter suggest a positive impact on drivers' behavior.

Another Australian study by Hasan *et al.* (2024) examined ways to improve Random Roadside Drug Testing (RDT) by assessing drivers' perceptions of procedural justice and the legitimacy attributed to both enforcement practices and the laws governing drug-impaired driving. Perceptions of RDT were compared with those of Random Breath Testing (RBT), and the influence of these perceptions on drivers' future intentions to drive under the influence of drugs or alcohol was analyzed. Based on an online survey of 1,483 drivers, results showed that participants who reported driving under the influence of drugs and who had previously experienced RDT operations perceived lower levels of procedural justice and attributed less legitimacy to both the police and the law than those subjected to RBT operations. Although procedural justice components were not directly associated with future intentions to offend, lower perceptions of police and law legitimacy significantly predicted such intentions, particularly regarding drug-impaired driving. The authors conclude that police practices grounded in procedural justice principles are essential to strengthening the legitimacy of authorities and legal norms, thereby indirectly reducing the likelihood of transgressive driving behaviors.

In contrast to the findings above, Kim *et al.* (2019) found that adopting fair procedures directly influenced compliant behavior, while perceptions of police legitimacy did not mediate this relationship. Drawing on a sample of South Korean drivers (N = 1,241), the study tested the

applicability of Tyler's (1990) procedural justice theory beyond Western contexts by examining the links between perceptions of procedural justice, police legitimacy, and intentions to speed. The results indicated that procedural justice positively predicted legitimacy and negatively predicted intentions to commit offenses (i.e., speeding). However, legitimacy did not mediate the association between procedural justice and intentions to offend, thereby contradicting a central premise of the theory. According to the authors, these findings suggest that, in certain sociocultural contexts, perceived police legitimacy may not be a decisive factor in explaining legal compliance. Rather, drivers' behavior appears to be primarily shaped by the direct perception of fairness in police procedures. As highlighted in previous research, this pattern may reflect the importance of industrialization and political regime type as preconditions for the empirical validation of Tyler's model, particularly in "imperfect" industrialized democracies (e.g., Ghana, Jamaica, South Korea), where results have often been mixed or inconsistent (e.g., Reisig & Lloyd, 2009; Tankebe, 2009).

Still within the domain of speeding behavior, Bates *et al.* (2022) examined whether young drivers' perceptions of police procedural justice during direct interactions influenced their intentions to offend. Using an online survey administered to young drivers (N = 2,124) in Queensland and Victoria, Australia, the researchers found that higher perceptions of procedural justice were associated with lower intentions to speed, even after controlling for factors known to be associated with increased speeding intentions, such as sensation-seeking. In a more recent study, Bates *et al.* (2025) investigated the effects of procedural justice on subsequent offending behavior through the Queensland Speeding Engagement Trial (QSET). The study tested whether attaching a letter incorporating procedural justice principles to a speeding infringement notice would reduce recidivism. Participants in the control group (N = 7,946) received the standard notice, whereas those in the experimental group (N = 8,209) received, in addition, a letter designed to communicate trust, neutrality, and respect — core elements of procedural justice. The letter also explained how speed limits are determined and how revenue from speed camera fines is reinvested in road safety initiatives. Results showed that, over the following 12 months, drivers aged 25 and older in experimental conditions committed significantly fewer speeding offenses than those in the control group. Thus, according to the authors, the findings suggest that procedural justice principles can be

effectively communicated in written form, resulting in measurable improvements in subsequent offending behavior, even without direct contact with the police. In turn, this underscores the potential of simple and low-cost interventions to promote legal compliance in the road safety context.

Although not all studies have examined the influence of perceived legitimacy in shaping road-traffic compliance, they share a focus on the effects of fair procedures by police authorities. These effects have been explored through randomized field experiments and situations without direct interpersonal contact with police (e.g., fine notification letters). Among studies that assessed legitimacy alongside procedural justice, findings remain mixed: some report a direct effect of legitimacy on compliance (e.g., Hasan *et al.*, 2024), whereas others identify a direct effect of procedural justice on compliance (e.g., Kim *et al.*, 2019). Even so, the normative model, in its various operationalizations, still provides a promising framework for understanding and shaping driver behavior.

2.3. Empirical Evidence from Studies Testing Both Models Jointly

While much of the existing literature has examined each model separately, a small but important body of research has sought to evaluate both frameworks simultaneously. This line of inquiry is valuable for understanding whether legal compliance in the road context is better explained by instrumental factors (e.g., perceived certainty or severity of punishment) or by normative considerations (e.g., perceived fairness and legitimacy of police and other authorities). As such, two key studies are particularly relevant to this review, as they directly analyze both deterrence theory and procedural justice theory, providing clearer insights into how each framework contributes to drivers' behavior.

The first study, conducted in the Netherlands by Hertogh (2015), tested Tyler's process-based model in a European context, also incorporating deterrence, personal morality, and peer opinion on compliance with traffic rules. Notably, the study combined self-reported data with objective behavioral measures (i.e., offending behavior) drawn from the Dutch Central Judicial Collection Agency (CJCA). Regarding *self-reported compliance*, survey results from traffic

offenders ($N = 1,182$) largely supported Tyler's model. As for perceived legitimacy, drivers who expressed a stronger perception of obligation to obey the law, greater support for the police, and higher legitimacy attributed to legal norms also reported higher compliance with traffic rules. Moreover, positive perceptions of procedural justice — measured by evaluations of the fairness of procedures implemented by the CJCA — were associated with higher compliance with traffic rules. Thus, although the results did not fully align with the proposed pathway, in which procedural justice enhances legitimacy, which in turn promotes compliance, both variables nonetheless emerged as direct and positive predictors of adherence to traffic rules. In contrast, perceived deterrence (measured solely by the certainty of apprehension) showed no significant effect. When examining *actual compliance* (using the number of fines received by participants in the 12 months before completing the survey according to the CJCA database), only one component of legitimacy — perceived obligation to obey the law — was negatively related to offending, while deterrence also showed a negative association, with higher deterrence scores predicting fewer accumulated fines. Therefore, these mixed results highlight the importance of distinguishing between perceived and actual compliance. While legitimacy emerged as a strong predictor of self-reported adherence to traffic rules, only one of its components — the perceived obligation to obey the law — influenced actual compliant behavior, with deterrence also exerting an effect. Because the study focused exclusively on traffic offenders, as Hertogh (2015) highlights, the generalizability of the findings to the general driver population is limited. Even so, the results indicate that normative factors play a central role in shaping drivers' behavior, with legitimacy influencing both perceived and actual compliance, even among offenders, while deterrence showed an effect on actual compliance.

Similarly, Bradford *et al.* (2015) compared the instrumental and normative models to explain drivers' self-reported propensity to commit traffic violations (i.e., speeding and red-light running). Using data from the Scottish Community Engagement Trial (ScotCET) — which, like the QCET (Mazerolle *et al.*, 2012), assigned road-policing units to (i) an experimental group, applying fair procedures in interactions with citizens or to (ii) a control group, following standard practice — the authors analyzed 816 completed self-administered questionnaires. With respect to the *instrumental model*, perceived risk of sanction, operationalized as perceived certainty of punishment, significantly predicted self-reported propensity to offend.

Drivers who believed they were more likely to be detected if they offended reported lower intentions to commit future violations. Regarding the *normative model*, perceived fair and respectful treatment during encounters with police officers was associated with higher perceived legitimacy of the police. However, legitimacy did not exert a direct effect on self-reported intentions to offend. Instead, social identity — specifically, identification with the community represented by the police (i.e., Scottish citizens) — emerged as the key mediating mechanism linking procedural justice to legal compliance. This suggests that procedural justice enhances individuals' sense of shared identity with the wider community and the police, and that this identity-based pathway, rather than perceived police legitimacy alone, more directly shapes compliant behavior. However, the study presents important methodological limitations. First, unlike Hertogh's research (2015), it relied exclusively on self-reported intentions, which may diverge from actual behavior due to subjectivity and social desirability bias. Second, deterrence was assessed only through perceived certainty of punishment, neglecting severity and swiftness, as well as other deterrence models and, therefore, preventing a more complete test of deterrence assumptions, a limitation shared with Hertogh (2015).

Taken together, the findings from both studies indicate that instrumental and normative mechanisms each contribute meaningfully to understanding and promoting compliance with traffic rules. This highlights the value of integrating normative considerations into a domain traditionally dominated by instrumental strategies, particularly in efforts to prevent traffic offenses (Bradford *et al.*, 2015).

Conclusions

This article examined the contributions of instrumental and normative models to understand (non)compliance with traffic rules and to assess the extent to which each model explains drivers' behavior within the broader domain of road safety. By outlining the theoretical foundations of deterrence and procedural justice underpinning these models and examining

empirical studies that have applied them to the road context, several important conclusions can be drawn.

Within the *instrumental model*, evidence regarding *classical deterrence* is mixed. Among its three dimensions, perceived *certainty* of apprehension consistently shows the strongest association with compliance, whereas *severity* and *swiftness* demonstrate weak, inconsistent, or even paradoxical results. These limitations highlight the difficulty of relying solely on threat-based approaches to influence drivers' behavior. Empirical research grounded in the *reconceptualized model of deterrence* shows that the most consistent finding across studies is the strong effect of *punishment avoidance*, especially *direct avoidance*, which predicts offending across a range of traffic violations. Overall, the reconceptualized model highlights that avoiding punishment, rather than experiencing it, is the most reliable predictor of road offending. Research on the *informal deterrence model* indicates that social and internal sanctions, including social disapproval and emotions of guilt and shame, deter offending. In fact, several studies show that non-legal sanctions negatively predict compliance more strongly than legal sanctions, though they also reveal that their influence is uneven and varies by context and driver's characteristics. Together, these results suggest that even with expanded forms, deterrence approaches offer an incomplete explanation for traffic offending.

The *normative model*, grounded in procedural justice, reveals consistent and robust relationships between fair procedures, legitimacy, and compliance with traffic rules across studies, although the strength and direction of these effects vary across sociocultural settings. Importantly, some studies demonstrate a direct effect of procedural justice on behavior, even when legitimacy does not mediate this relationship, suggesting that perceptions of fairness alone can foster normative compliance. Moreover, simple low-cost procedural justice interventions (e.g., a letter incorporating procedural justice principles attached to a speeding infringement notice) have been shown to reduce reoffending, even without face-to-face contact. Thus, these findings reinforce the notion that adherence to traffic rules cannot be secured solely through coercion.

Studies testing *both instrumental and normative models simultaneously* reinforce this conclusion, indicating that instrumental and normative mechanisms contribute meaningfully to understanding and promoting compliance with traffic rules. These results underscore the importance of incorporating the normative model into a field that has traditionally been guided by instrumental approaches, particularly when aiming to reduce traffic offenses.

Taken together, this review highlights the importance of integrating both instrumental and normative models to develop more effective and sustainable road safety policies and strategies. While the instrumental model remains essential, enhancing police (and other relevant authorities') procedural justice and strengthening their perceived legitimacy are equally important, especially since they can promote long-term compliant behavior on the road. In fact, instrumental and normative models are not mutually exclusive; rather, they can operate in complementary ways.

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