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Research Article

Study of psychological aspects of the safety culture of motorcyclists' behaviors in Indonesia's urban road traffic: Construction of road users' belief systems

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ABSTRACT

The poor development of traffic safety culture by road traffic organizations in Indonesia has caused motorcyclists to behave irresponsibly while driving. Consequently, some behaviors may cause conflict with other road users, which may affect traffic safety. Therefore, studying the beliefs of road users regarding motorcyclists' behavior can describe the psychological aspects of the safety culture in urban road traffic. In this study, we used the reciprocal safety culture model as a framework, by applying a behavioral-based safety program to investigate motorcyclists' critical behaviors in urban areas in Indonesia. Adapting Ward's transformation model of belief systems to a behavior, we approach the psychological aspects of the traffic safety culture by observing the relationship between motorcyclists' critical behaviors and belief systems. We explore the belief system of Ward's model using a driving safety questionnaire (DSQ) and a cause-effect questionnaire. By applying multiple linear regression to the DSQ results, we revealed six motorcyclist behaviors critical to safety that affect car drivers and pedestrians. Furthermore, we constructed the belief systems of these behaviors by investigating behavioral beliefs, attitudes, normative beliefs, perceived norms, perceived control, and control beliefs to reveal "what road users think" about motorcyclists' behaviors related to traffic safety culture in the urban area.

1. Introduction

1.1. Background

The World Health Organization [1] reported that traffic accidents involving motorcyclists contributed to 70 % of the total road users' accidents in Southeast Asia countries (e.g., Thailand, Indonesia, and Cambodia). Furthermore, studies related to motorcyclists' traffic issues in Indonesia have argued that motorcyclists' risky driving behaviors and disregard for traffic regulations are issues of safety in urban road areas [2,3]. Therefore, this study aims to describe traffic safety culture (TSC) issues in urban areas by studying the efforts of organizations in shaping motorcyclists'' safety behaviors, identifying which motorcyclists' behaviors are critical to traffic safety, and understanding how other road users perceive motorcyclists' driving behaviors.

Since AAA Foundation [4] introduced traffic safety culture (TSC) as a new approach to solving traffic issues, many studies have strived to determine its definition, method, and application [5,6]. The application of TSC has become a challenge in approaching motorcyclists' safety issues. Previous studies have reported the application of TSC to solve motorcyclists' problems such as drunk driving and speeding behaviors [5,6]. However, both studies did not clearly explain the methods used to approach these issues. Other studies have applied the reciprocal safety culture (RSC) model, developed by Cooper [7], to approach TSC issues related to motorcyclists' safe driving behaviors in urban areas. One study that applied the RSC model revealed that safety culture weaknesses in road traffic organizations (RTO) caused motorcyclists to incorrectly implement a driving safety program in their behaviors [8]. Another study identified the critical safety-related behaviors of motorcyclists [9]. However, these two studies did not describe road users' perceptions of motorcyclists' behaviors. Hence, studying the psychological aspects of safety culture ("how people think") from the RSC model can depict the TSC situation in an urban area developed by the RTO.

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1.2. *Current study*

Previous studies on the situational and behavioral aspects of safety culture in motorcyclists' safe driving issues revealed a weak safety culture embedded within RTOs [8] which might manifest in motorcyclists' behaviors [9]. For example, a study on situational aspects applied the macroergonomic analysis and design (MEAD) [10] method to analyze the discrepancies between an organization's expectations and the current situations of motorcyclists' safe driving [8]. Andrijanto et al. [8] identified five weak elements of safety culture embedded in motorcyclists' behaviors: lack of knowledge, weak comprehension, and poor risk appraisal. Along with these weaknesses, they revealed that the licensing system has poor procedural quality and encourages candidates to ignore the lessons learned. In addition, weak law enforcement has reinforced motorcyclists' behavior to violate traffic rules and road marks during daily driving. Another study applied the behavior-based safety (BBS) program [11] to determine which motorcyclists' driving behavior might be critical to traffic safety [9]. This study examined motorcyclists' behavior related to six safe driving criteria (i.e., ethics, driving skills, compliance with traffic rules, mutual safety awareness, striving for mutual safety, and responsibility) that correlated with motorcyclists' perception of self-safe driving performance. Consequently, eight behaviors were identified that required intervention by the RTO.

Furthermore, motorcyclists' behaviors may cause conflicts with car drivers and pedestrians which could influence road traffic safety [9]. Therefore, studying the psychological effects of motorcyclists' behaviors on road users is necessary to reveal the traffic situations built by the RTO. In addition, knowing motorcyclists' critical behaviors for road users and how they perceive safety when interacting with motorcyclists would answer "what road users think" of the psychological aspects of traffic safety culture.

2. Theory

2.1. *Traffic safety culture*

According to Edwards et al. [5], the concept of organizational safety culture (OSC) can be used to explain TSC. In OSC, organizations have the authority to manage safety through procedures and regulations [12]. Hence, organizations are responsible for instilling a safety culture by shaping employees' safe behavior in their daily activities [7,13]. From the application of OSC to traffic safety, an RTO responsible for ensuring that traffic safety is well maintained through the organization's resources [4]. The highest jurisdiction on traffic organization belongs to the government [5,14], and their responsibilities include determining traffic regulations, conducting training, managing licensing systems, and ensuring proper law enforcement on the road. In this study, the term RTO is used interchangeably to describe the local government and its sub-organizations. TSC issues can be observed from how effectively an RTO maintains traffic safety with its programs and mechanisms in shaping drivers' behavior [15]. Hence, road users can share similar views and beliefs about traffic safety developed by an RTO in their activities [6]. The RSC model [7] can describe the RTO's effort and drivers' behavior [8,9]. Therefore, in this study, we reapplied the RSC model to approach road users' perceptions of traffic safety.

2.2. *Reciprocal of safety culture model*

Cooper [7,16,17] explained the RSC model as a framework for analyzing safety culture. Constructing a safety culture consists of three aspects: situational, behavioral, and psychological, as shown in Fig. 1. Situational aspects describe the organization's efforts to change situations and improve safety culture using organizational resources, such as policies, procedures, regulations, organizational structures, and management systems. The organization applies programs and mechanisms to explain the implementation of organization resources to shape employees' safety behavior which supervisors can monitor in daily action (behavioral aspects). Furthermore, as a result of changing behavior developed by organizations, psychological aspects describe how employees perceive safety in the workplace. These three aspects have a reciprocal relationship that researchers can use to investigate the construction of a safety culture within an organization [7,16].

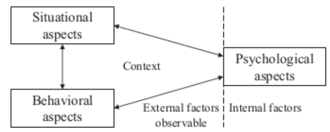

Fig. 1. Reciprocal of safety culture model developed by Cooper [7].

2.3. *Psychological aspects*

Cooper [7,16] argued that the psychological aspects of safety culture could be studied by applying a safety climate questionnaire [18,19]. However, this tool seemingly focused on the organizational management system in striving for occupational safety instead of exploring people's beliefs behind their behaviors. Therefore, we studied similar models that could approach the psychological aspects of road users, that is a shared model of beliefs, behaviors, and artifacts developed by Ward et al. [6] to describe TSC.

Ward et al. [6] argued that TSC is a shared belief among road users that affects their traffic safety behaviors. Fig. 2 describes the relationship between belief systems, behaviors, and artifacts (e.g., policies and traffic safety programs) to improve traffic safety [6]. The culture diagram of shared beliefs, behaviors, and artifacts [6] in the figure is identical to the RSC model in describing the relationship between psychological, behavioral, and situational aspects [7]. Therefore, the belief systems in Ward's model are suitable for describing the psychological aspects of motorcyclists' behaviors.

2.3.1. *Belief systems*

The theory of planned behavior (TPB) [20] has been adopted and applied in many fields to study the psychological aspects of people's behavior [3,6,21,22]. Furthermore, Fishbein and Azjen [21] developed the reasoned action (RA) model to describe the development of beliefs inside the TPB. In the context of traffic safety culture, Ward et al. [6] adapted the RA model to describe the transformation process of belief systems (Fig. 2) into driver behavior, as shown in Fig. 3. In the model, Ward et al. [6] specified belief systems as six types of beliefs from RA model [21]: behavioral beliefs, attitudes toward behaviors, normative beliefs, perceived norms, control beliefs, and perceived control. In addition, Ward et al. [6] included prototypical images, assumptions, and values in the belief system. As a pioneering study of the psychological aspects of traffic safety culture, we strived to reveal six beliefs of the RA model [21] to construct belief systems. Furthermore, we aim to include values, assumptions, and prototypical images in our subsequent study to investigate drivers' willingness and intention.

In this study, we mainly investigated motorcyclists' beliefs about performing deviant behaviors, which are driving behaviors that deviate

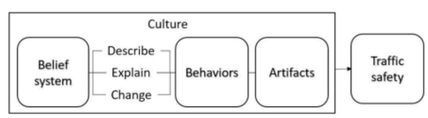

Fig. 2. Culture as shared beliefs affecting behaviors and artifacts to develop traffic safety [6].

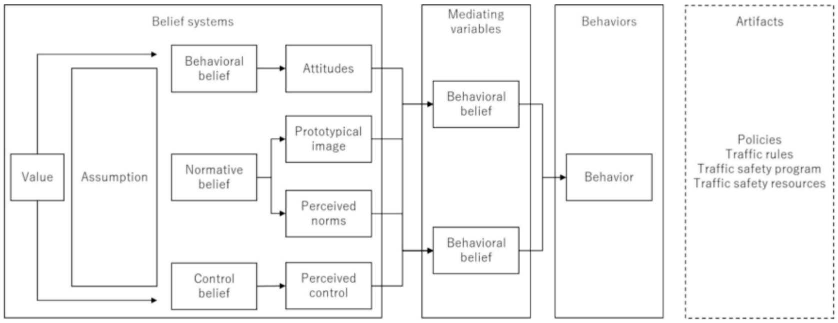

Fig. 3. Model of transformation process of belief system to behaviors developed by Ward et al. [6].

from the traffic regulations and are the opposite of the safe behaviors identified in the behavioral-based safety (BBS) program.

Based on our purpose to reveal the psychological aspects of TSC toward motorcyclists' behaviors ("what people think"), this study focused on identifying several types of beliefs for constructing belief systems.

2.3.1.1. Behavioral beliefs. A person's beliefs behind their attitudes [6,21] are known as behavioral beliefs, which we studied by investigating motorcyclists' opinions on their attitudes.

2.3.1.2. Attitude toward behaviors. A person's evaluation of the goodness or badness of a specific behavior is referred to in this study as attitude toward behaviors. One's beliefs influence attitude regarding the consequences of behavioral choices by violating norms (behavioral beliefs) [6,21]. We investigated these attitudes by asking motorcyclists about their perceptions of safe or unsafe engagement in deviant behaviors.

2.3.1.3. Normative beliefs. One's beliefs about others who perform a behavior are related to prevailing social norms [6]. Therefore, to describe this belief, we measured car drivers' and pedestrians' perceptions of motorcyclists' behaviors by asking the following question: "*How often do you find motorcyclists engage in a specific behavior?*" This question was formulated by modifying the driving safety questionnaire (DSQ) from the research of behavioral aspects [9]. We studied their beliefs on motorcyclists' critical behaviors identified in the BBS program.

2.3.1.4. Perceived norms\. A person's belief about typical behavior in a social environment that are influenced by normative beliefs [6,21] are known as perceived norms. An example question for investigating this belief is, "*In the past 12 months, how often do you think most people like you drove within two hours of consuming marijuana?*" [6]. The perceived norms in this study were motorcyclists' opinions of their behaviors affecting traffic safety. Related to this study, Andrijanto et al. [9] measured motorcyclists' perceptions in an urban area by asking them the following question: "*How often do you engage in a specific behavior daily?*" for 63 traffic safety-related behaviors. Therefore, to describe these beliefs, we studied Andrijanto's research on behavioral aspects of safety culture on motorcyclists' behaviors [9]. We aim to reveal motorcyclists' normative beliefs about the significant behaviors identified in this study based on previous data [9].

2.3.1.5. Control beliefs. Beliefs about one's self-control in an environment that influence their ability to perform or refrain from a behavior [6,21] are known as control beliefs. These beliefs were observed by questioning motorcyclists' motives for engaging in a specific behavior. We aim to reveal the factors (i.e., internal and external) that influence motorcyclists to perform deviant behaviors.

2.3.1.6. Perceived control. Perceived controls refers to how people perceive their ability to perform or prevent the behavior in their social environment [6,21]. We studied data related motorcyclist behaviors from a previous study [9] to examine perceived control.

2.4. Behavioral-based safety program

The behavioral-based safety (BBS) approach introduced by Skinner [22] has been followed by many researchers to improve workers' safety behavior in organizations [23–26]. BBS application has been applied by researchers to improve driving safety [25,27–29]. Reason, Manstead, Stradling, Baxter, and Campbell [30] demonstrated a similar approach to BBS for identifying driver error behavior. Andrijanto et al. [9] demonstrated the application of a BBS program to identify motorcyclists' critical behaviors in urban areas. Therefore, a BBS program was applied by modifying the DSQ-motorcyclists [9] to investigate motorcyclists' critical behaviors toward car drivers and pedestrians.

Geller [25] argued that the BBS approach analyzes what people do to improve organizational safety by reducing unsafe behaviors and promoting safe behaviors among front-line employees. Road users can be viewed as front-line employees supervised by RTO with law enforcement in daily driving [14]. Geller [31] also claimed that observing coworkers could reveal unrealized risk behavior. Thus, investigating road users' perceptions of traffic safety could reveal risk behaviors among them. In this study, we investigated car drivers and pedestrians perceptions to reveal critical behaviors of motorcyclist for them.

3. Method

3.1. A conceptual model for Investigating belief systems

In this study, we focused on the relationship between behavior and psychological aspects of the RSC model to investigate the psychological aspects. Furthermore, we explored the transformation model of behaviors to belief systems [6] to explain the psychological aspects of safety culture. We aim to construct belief systems for road users regarding motorcyclists' critical behaviors by revealing their behavioral beliefs, attitudes, normative beliefs, perceived norms, control beliefs, and perceived control. Therefore, this study was divided into two parts, as shown in the conceptual model (Fig. 4).

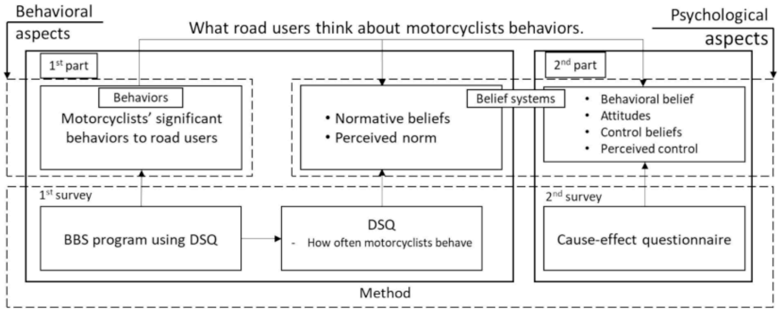

Fig. 4. Conceptual model for investigating psychological aspects of safety culture in traffic safety.

First, we determined which motorcyclists' behaviors significantly influence road users' (i.e., car drivers and pedestrians) perceptions of safety. For this purpose, we applied the BBS program by modifying the DSQ from the previous study [9]. The modification of the DSQ is described in Section 3.3, and the modified DSQ is presented in Appendices A and B for car drivers and pedestrians, respectively. Furthermore, we correlated the driving safety score (Section 2 of the DSQ) with motorcyclists' behaviors (Section 3 of the DSQ) using multiple linear regression (MLR) to obtain significant behaviors. The MLR results are presented in Sections 4.2 and 4.3.

Because normative beliefs are about specific group opinions toward behavior, whereas perceived norms refer to a person's beliefs about their behaviors toward norms in society [6], as defined in Section 2.3.2., the result of the DSQ could describe these beliefs This study investigated whether car drivers and pedestrians' beliefs about motorcyclists' behaviors are safe or unsafe. Using multiple linear regression, we determined significant motorcyclists' behaviors to identify normative beliefs. Therefore, the questions would measure how often car drivers and pedestrians observe motorcyclists' behaviors as perceived by car drivers and pedestrians. They are categorized as follows: very often, often, rare, and never, as assessed in the DSQ Section 3. By contrast, perceived norms indicate how often motorcyclists behave safely while driving, which is also categorized as very often, often, rare, and never. We used the DSQ result from a previous study to reveal this belief [9]. The results

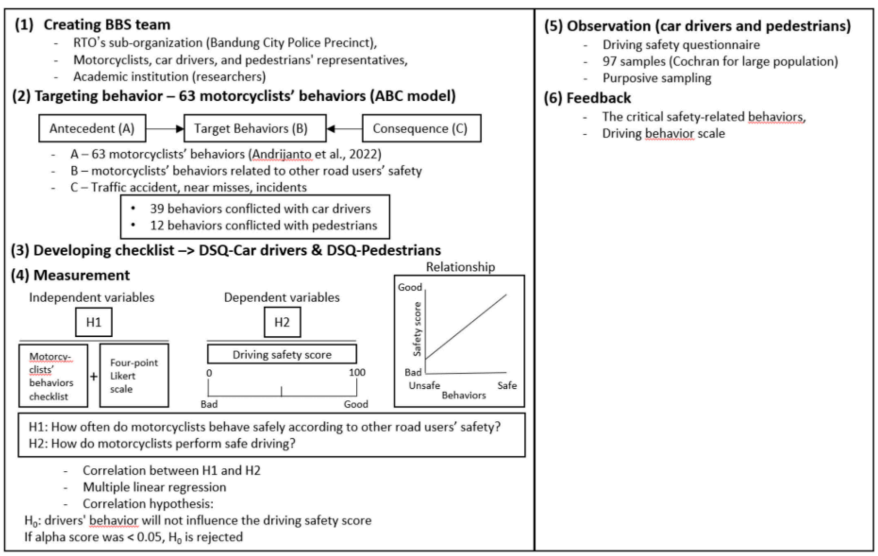

Fig. 5. Conceptual model for identifying critical behaviors, as adapted from Andrijanto et al. [9].

of DSQ in Section 3 are presented in Section 4.4.

In the second part, we observed behavioral beliefs, attitudes, control beliefs, and perceived control. This investigation focused on motorcyclists' behaviors that deviated from the expected behaviors of the RTO. Following the definition of these beliefs [6], we defined behavioral beliefs as how motorcyclists understand their attitudes, which refer to how safe or unsafe motorcyclists feel about their behavior. Control beliefs are factors (i.e., internal and external) that influence the ability to perform or refrain from a behavior. Finally, perceived control refers to how strongly internal and external factors influence motorcyclists' engagement in critical behaviors. We designed a cause-effect questionnaire to assess these beliefs. The development of the questionnaire is explained in Section 3.4. Appendix C presents the results of the cause-effect questionnaire.

3.2. Investigation of motorcyclists' critical behaviors using a BBS program

We adopted a conceptual model for identifying critical behaviors using the BBS program developed by Andrijanto et al. [9]. We modified the DSQ-motorcyclist to investigate car drivers' and pedestrians' perceptions, as shown in Fig. 5.

Step 1: Creating a team.

The BBS team's members for this research is listed in Fig. 5. Motorcyclists and car driver representatives have 5-years of driving experience and drive daily in Bandung City. Adult pedestrians perform daily activities in Bandung City using sidewalks and public transportation to commute in the urban area. All road users read the driving safety program.

Step 2: Choosing target behaviors.

We, the RTO and researchers, reviewed the 63 behaviors in the driving safety questionnaire (DSQ-motorcyclist) from previous research [9]. The target behaviors (B) were determined by considering motorcyclists' behaviors that might trigger a conflict with the car drivers or pedestrians listed in the DSQ (A). For instance, "zigzagging on a busy road" may affect car drivers maintaining a safe distance and pedestrians during crosswalks. Hence, this behavior was selected for review by car drivers and pedestrians. As a result, we obtained 39 motorcyclists' behaviors related to conflicts with car drivers (Appendix A) and 12 motorcyclists' behaviors related to conflicts with pedestrians (Appendix B).

Step 3: Developing a checklist.

We constructed two lists for car drivers (Appendix A) and pedestrians (Appendix B) to assess motorcyclists' behavior when implementing the driving safety program developed by the RTO.

Step 4: Constructing measurement systems.

According to the DSQ-motorcyclists [9], the questionnaire asked motorcyclists two questions: (1) "How good am I at performing a driving safety program?'," and (2) "How often do you perform this action in your daily driving?" The first question assessed motorcyclists' performance in implementing driving safety programs, which was answered by rating the value of the driving safety score from 0 to 100 to represent bad to good performance. The second question investigated motorcyclists' daily driving behaviors and was answered by rating driver behavior on a four-point Likert scale. Safe behaviors were assessed as never(1), rarely(2), often(4), and very often(5), whereas unsafe behaviors were assessed as never(5), rarely(4), often(2), and very often(1).

We applied the same measurement in this study. By using the relationship between behavioral and psychological aspects, we identified the critical safety-related behaviors of motorcyclists, as shown in Fig. 5. Thus, the question for this research is: (H1) "How good are motorcyclists at performing a driving safety program?" and (H2) "How often do motorcyclists perform this action in daily driving?" The assessment of each question followed the original measurement [9], as presented in Appendix A and B. We analyzed the influence of drivers' behaviors (independent variables) on the drivers' performances (dependent variables) by applying multiple linear regression with a null hypothesis similar to the previous study [9]; that is, H_0: drivers' behavior will not influence the driving safety score. If alpha score is <0.05, H_0 is rejected. The independent variables are motorcyclists' behaviors from car drivers' (c_i) and pedestrians' (p_j) perspectives, where $i = 1, 2, 3, \ldots, 39$ and $j = 1, 2, 3, \ldots, 12$. Furthermore, the dependent variables are motorcyclists' safe performance scored by car drivers (y_c) and pedestrians (y_p).

Step 5: Observing behavior.

According to the original DSQ [9], the questionnaire consisted of three sections: (1) respondent information, (2) driving safety score, and (3) drivers' behaviors. Thus, in this study, we constructed two questionnaires based on the original DSQ: DSQ-motorcyclist for car drivers (Appendix A) and pedestrians (Appendix B).

We applied purposive sampling and distributed questionnaires to car drivers and pedestrians who commute on urban roads daily.

Step 6: Acquiring feedback.

We determined critical behaviors by identifying variables with a significant value of <0.05 from the regression output.

We reviewed the driving-safety score of motorcyclists from previous research [9] by comparing it with the score obtained from the MLR equation for car drivers and pedestrians on the driving behavior scale.

3.3. Cause-effect questionnaire

We will study the psychological aspects behind critical motorcyclist behaviors using a questionnaire. This research identified six critical behaviors intersecting with car drivers (c_1, c_3, c_9) and pedestrians (p_2, p_8, p_9), as discussed in Section 5.1.1. Thus, the questionnaire will be designed to investigate the following behaviors:

c_1: Using a noisy exhaust

c_3: Clearing the lane for special vehicles (ambulances and fire trucks)

c_9: Using the correct indicator to turn in the desired direction

p_2: Following police instruction

p_8: Zigzagging on the busy road

p_9: Slowing down near zebra crossing and railroads

The "caused-effect" question and answer structure for exploring control beliefs, behavioral beliefs, attitudes, and perceived norms was arranged by asking motorcyclists the cause of engaging in those deviant behaviors (control beliefs), their perception of safe or unsafe attitudes together with ideas behind the attitude (behavioral beliefs), and asking other road users' reaction toward these behaviors (perceived norms). The first part of the questionnaire concerns questions related to the cause, followed by those related to the effect, as described in Section 3.3.1. We provided each question with possible answers as suggested by the road user representatives, as explained in Section 3.3.2. Therefore, volunteers could select multiple answers to express their opinions.

3.3.1. Development of questions

We illustrate the development of cause-effect questions by describing the behavior of using a noisy exhaust (c_1). First, we identified this critical behavior (c_1) that significantly affect car drivers in the 1st part of the conceptual model shown in Fig. 4. Furthermore, we discussed this behavior with road user representatives to develop questions and obtain possible answers. Subsequently, we drafted questions and clarified them with road user representatives and the RTO. Concerning this behavior (c_1), the questions are about motorcyclists' perceptions of the reason behind making a noisy sound (Q1) to investigate their control beliefs. Furthermore, we explored how motorcyclists perceive safe or unsafe to understand their attitudes and the behavioral beliefs behind them (Q2). Finally, car drivers were asked about the effects of using a noisy exhaust (Q13). Their reaction to this behavior explains their acceptance (perceived norms). The unsafe answer for selecting attitudes is provided only once because a driving safety program developed by the RTO states that all drivers' deviant behaviors are considered dangerous for traffic safety. Therefore, the cause-effect question and answer for making a noisy sound using exhaust (c_1) are described below.

Cause (motorcyclists).

Q1: Why do you make a noisy sound from an exhaust?

Q2: Is it safe to make a noisy sound from an exhaust?

Effect (car drivers and pedestrians).

Q13: How do you react when you meet a motorcyclist who makes a noisy exhaust?

Applying the above method to other variables (c_3, c_9, p_2, p_8, and p_9), we developed a questionnaire for car drivers, pedestrians, and motorcyclists with 18 questions described in Table 1.

3.3.2. Development of answers selection

Motorcyclists would answer questions Q1 to Q12 to express their perceptions of their behaviors. The interview with motorcyclist's representatives generates the answers. These answers are about the background of the motorcyclist's behavior frequently argued by them, e.g., feelings, attitudes, situations, and safety perceptions. We assumed these answers represented motorcyclists' beliefs related to their behaviors. For instance, questions of behavior using a noisy exhaust (Q1 and Q2) would have the following answers as follows:

Q1: Why do you make a noisy sound from an exhaust?

a. Feel bored (feelings).

b. Impatient (attitude).

c. Feel distracted by someone blocking (situations).

d. Impressive - looks good to others (attitude).

e. Ignorant - to distract others (attitude).

The question related to safety perceptions of using a noisy exhaust would have the following answers:

Q2: Is it safe to make a noisy sound from an exhaust?

a. Safe, no complaints from society.

b. Safe, undangerous.

c. Save, no violations.

d. Unsafe, it disturbs the environment.

The answers to questions Q13 - Q18 about reactions to motorcyclists' behaviors are developed based on interviews and discussions with car drivers' and pedestrians' representatives. For example, car drivers identify the behavior of using a noisy exhaust (c_1). Therefore, car driver representatives would discuss and give their opinions on this behavior. In this case, they all dislike hearing noisy exhaust and argue that hearing noisy exhaust while driving could raise tempers and cause sudden stress. Furthermore, we discussed the reactions that might occur toward motorcyclists. Their responses vary depending on the traffic situation and closeness to the motorcyclists. Car drivers might yell at them or give an excessive horn when the motorcyclist is nearby. However, if the noise source is a bit far from car drivers or drivers feel insecure about yelling at motorcyclists, they will ignore this behavior without any actions. The answers to car drivers' reactions to this behavior would be written as follows:

Q13: How do you react when you meet a motorcyclist who makes a noisy exhaust?

a. Just telling them, "It is noisy."

b. Yelling to them "noisy."

c. Ignore (dislike but reluctant to express it).

d. Give excessive horn.

We provide the answers to questions Q1 – Q18, by following this method. All answers are presented in Appendix C.

The term "react" is used in questions Q13 - Q18 to investigate any possible feelings or actions respondents may have or do regarding motorcyclists` behaviors. However, we did not identify any direct physical actions toward motorcyclists from the interview with road user representatives. Most representatives argued that road users expressed their feelings in words (e.g., telling, yelling) or silence (e.g., ignoring, avoiding). Therefore, the term "react" in this study represents how road users express their feelings in implicit or explicit ways toward motorcyclists' behaviors. For example, in question Q13, the respondents implicitly express their feelings represented by the choice (c) ignore (dislike but reluctant to express it). Alternatively, respondents can express their feelings explicitly to motorcyclists by (a) telling them, "It's noisy." (b) yelling at them, "Noisy!" or (d) blowing their horn excessively.

Table 1
Psychological aspects questions.

Identified Var.	Code	Questions for
		Motorcyclists (cause)
		For behaviors related to car drivers
c_1	Q1	Why do you make a noisy sound from an exhaust?
	Q2	Is it safe to make a noisy sound from an exhaust?
c_3	Q3	Why do not you give way to special vehicles (i.e., ambulances and firetrucks)?
	Q4	Is it safe not to give way to special vehicles?
c_9	Q5	Why don't motorcyclists apply their turn signal according to the vehicle's direction?
	Q6	Is it safe if you don't use turn signals correctly while driving?
		For behaviors related to pedestrians
p_2	Q7	Why do not you follow the police's guide by stopping a vehicle at a pedestrian crosswalk?
	Q8	Is it safe not to follow the police's guide?
p_8	Q9	Why are you driving zigzag?
	Q10	Is it safe to drive zigzag?
p_9	Q11	Why do you not reduce the speed at the pedestrian crosswalk?
	Q12	Is it safe not to slow down the speed in a place with many pedestrian?
		Car drivers (effect)
c_1	Q13	How do you react when you meet a motorcyclist with a noisy exhaust?
c_3	Q14	How do you react to motorcyclists' behavior who do not give way to special vehicles?
c_9	Q15	How do you react when you meet a motorcyclist who does not use turn signals correctly?
		Pedestrians (effect)
p_2	Q16	How do you react if you find a motorcyclist not following the police's instructions, e.g., by stopping at a pedestrian crosswalk?
p_8	Q17	How do you react when you find motorcyclists driving zigzag and don't give you a chance to cross?
p_9	Q18	How do you react when you find a motorcyclist not slowing down in a place with many pedestrians?

4. Results

4.1. Participant's demographics

4.1.1. First survey

Using the BBS approach, we strived to study the psychological aspects of safety culture. Therefore, we assessed 97 car drivers and 97 pedestrians who completed a questionnaire on motorcyclists' behaviors in an urban city. Car drivers are road users who drive a car daily, and pedestrians are people who walk daily on urban roads. The number of 97 participants is calculated using the Cochran formula for a large population with a 50 % proportion, alpha of 5 %, and confidence level of 95 %. We distributed the questionnaire using purposive sampling and strict with respondents from urban areas who drive a car and walk daily only. The car driver comprised of 46 % male and 54 % female. Their ages ranged from 16 to 50 years; however, only 14 % of the elderly drivers who actively drove daily participated in this survey. Nearly 50 % of the participants had more than 14 years of driving experience. We surveyed 46 % male and 56 % female pedestrians aged 17 to 77. Forty-five percent were of productive age (25 to 55 years old), 37 % were elderly (above 55 years old), and 18 % were younger ones. Car drivers could be private vehicle or taxi drivers with a vehicle plate corresponding to an urban area. Pedestrians could be workers, students, or anyone living in an urban area who walk daily on urban sidewalks.

4.1.2. Second survey

The second survey was conducted online. A total of 360 motorcyclists, aged 17 to 60, participated in the study, and 78 % of them had driving experience of more than three years. In addition, 243 car drivers aged 17 to 65, with 70 % having driving experience over three years, and 227 pedestrians aged 16 to 60 responded to the survey. All participants, of whom most were office employees and students, were Bandung City residents who commuted on the urban road daily.

4.2. Multiple linear regression – car driver

The classical assumption test resulted in 17 variables: valid, normal, linear, with no autocorrelation, and no heteroscedasticity. Table 2 shows the multicollinearity test of the 17 variables resulting in a VIF value <2, except c_{16} (2.187).

Multiple linear regression analysis revealed that the regression was significant (F (17, 79) = 4.144, $p < 0.00$, $R^2 = 0.471$). The regression equation is as follows:

$$y_c = 4.719 + 2.314c_1 + 2.239c_3 + 1.272c_7 – 0.179c_8 + 2.411c_9 + 0.689c_{11} + 2.100c_{12} + 0.240c_{13} – 0.647c_{14} + 0.662c_{15} + 0.397c_{16} + 1.470c_{17} – 0.326c_{21} + 2.653c_{32} + 0.505c_{33} + 0.036c_{38} + 1.364c_{39} \quad (1)$$

The multiple linear regression model for car drivers yielded significant variables with p-value <0.05 on c_1, c_3, and c_9, as shown in Table 2.

4.3. Multiple linear regression – pedestrian

Using the classical assumption test, we found that 11 variables were valid, normal, linear, had no autocorrelation, and no heteroscedasticity.

The multicollinearity test resulted in all variables having a VIF value of <2, as shown in Table 3.

A multiple linear regression was significant (F (11, 85) = 7.116, $p < 0.00$, $R^2 = 0.479$). Thus, the equation can be expressed as follows:

$$y_p = 9.488 + 1.684\,p_1 + 2.712\,p_2 + 0.799\,p_3 + 0.582\,p_4 + 1.011\,p_5 – 0.632\,p_6 + 0.798\,p_7 + 2.743\,p_8 + 5.302\,p_9 + 0.624\,p_{10} + 0.585\,p_{11} \quad (2)$$

Likewise, the results of multiple linear regression for pedestrians calculated significant variables with p-value < 0.05 at p_2, p_8, and p_9, as seen in Table 3.

Table 2
Multiple linear regression output – car driver.

Variable	Unstandardized Coef.		t	Sig.	Collinearity Stat.	
	B	Std. Error			Tolerance	VIF
Constant	4.719	6.242	0.756	0.452		
c_1*	**2.314**	**1.119**	**2.068**	**0.042**	**0.709**	**1.410**
c_3*	**2.239**	**1.043**	**2.146**	**0.035**	**0.699**	**1.431**
c_7	1.272	1.092	1.165	0.248	0.710	1.409
c_8	−0.179	1.105	−0.162	0.872	0.693	1.443
c_9*	**2.411**	**1.107**	**2.178**	**0.032**	**0.832**	**1.202**
c_{11}	0.689	1.088	0.633	0.529	0.788	1.268
c_{12}	2.100	1.121	1.873	0.065	0.734	1.362
c_{13}	0.240	1.079	0.222	0.825	0.829	1.207
c_{14}	−0.647	1.645	−0.394	0.695	0.622	1.607
c_{15}	0.662	1.362	0.486	0.628	0.572	1.749
c_{16}	0.397	1.355	0.293	0.771	0.457	2.187
c_{17}	1.470	1.150	1.278	0.205	0.617	1.621
c_{21}	−0.326	1.157	−0.282	0.779	0.775	1.290
c_{32}	2.653	1.427	1.858	0.067	0.588	1.702
c_{33}	0.505	1.207	0.418	0.677	0.690	1.449
c_{38}	0.036	0.996	0.036	0.972	0.820	1.220
c_{39}	1.364	1.061	1.285	0.202	0.751	1.331

* **Significant variables with p < 0.05 (Sig.)**

Table 3
Multiple linear regression output - pedestrian.

Variable	Unstandardized Coef.		t	Sig.	Collinearity Stat.	
	B	Std. Error			Tolerance	VIF
Constant	9.488	5.425	1.749	0.084		
p_1	1.684	1.020	1.651	0.102	0.755	1.325
p_2*	**2.712**	**1.161**	**2.335**	**0.022**	**0.691**	**1.447**
p_3	0.799	0.951	0.840	0.403	0.762	1.312
p_4	0.582	1.020	0.571	0.570	0.761	1.315
p_5	1.011	1.062	0.952	0.344	0.799	1.251
p_6	−0.632	1.156	−0.547	0.586	0.798	1.253
p_7	0.798	1.045	0.763	0.448	0.701	1.427
p_8*	**2.743**	**1.109**	**2.474**	**0.015**	**0.668**	**1.497**
p_9*	**5.302**	**1.541**	**3.441**	**0.001**	**0.759**	**1.318**
p_{10}	0.624	1.131	0.551	0.583	0.716	1.397
p_{11}	0.585	1.023	0.572	0.569	0.733	1.365

* **Significant variables with p < 0.05 (Sig.)**

4.4. How other road users perceive motorcyclists' behaviors

From Tables 2 and 3, we identified four significant safe behaviors (sig. Value <0.05) for variables c_3, c_9, p_2, and p_9, and two important unsafe behaviors for variables c_1 and p_8. Fig. 6 shows the survey results related to these findings. These results described car drivers and pedestrians' perceptions of how often they witnessed motorcyclists' behaviors, as follows:

c_1: Using a noisy exhaust
c_3: Clearing the lane for special vehicles (ambulances and fire trucks)
c_9: Using the correct indicator to turn in the desired direction
p_2: Following police instruction
p_8: Zigzagging on the busy road
p_9: Slowing down near zebra crossing and railroads

4.5. How motorcyclists perceive their behaviors

Furthermore, we explored motorcyclists' perceptions to understand their beliefs related to the findings in section 4.4. Therefore, we analyzed survey data associated with these behaviors from a previous study on motorcyclists' safety-critical behaviors [9], as shown in Fig. 7. Sequentially, variables related to safe behaviors are x_9, x_{26}, x_7, and x_{31}. In contrast, those about unsafe behaviors are x_4 and x_6. These are motorcyclists' behaviors identified from previous study [9] related to this research findings:

x_4: Using noisy exhaust
x_6: Zigzagging on busy road
x_7: Following police instructions during an incident
x_9: Clearing the lane for special vehicles (ambulances and fire trucks)
x_{26}: Using the correct indicator to turn according to direction
x_{31}: Slowing down near zebra crossing and railroads.

The previous study did not identify all these behaviors as critical for motorcyclists [9]. Only behavior following police instructions during an incident (x_7) was critical for motorcyclists—however, car drivers and pedestrians perceived all these behaviors as crucial to them. Table 4 shows the association of identified behaviors in this research with the previous study [9].

4.6. Second survey result

The results of the 18 questions from the second survey are presented in Appendix C. The results answer the questions listed in Table 1. Motorcyclists, car drivers, and pedestrians answered group questions Q1-Q12, Q13-Q15, and Q16-Q18, respectively. In each group, we investigated the road users' beliefs (i.e., behavioral beliefs, attitudes, control beliefs, and perceived control), as described in the second part of the

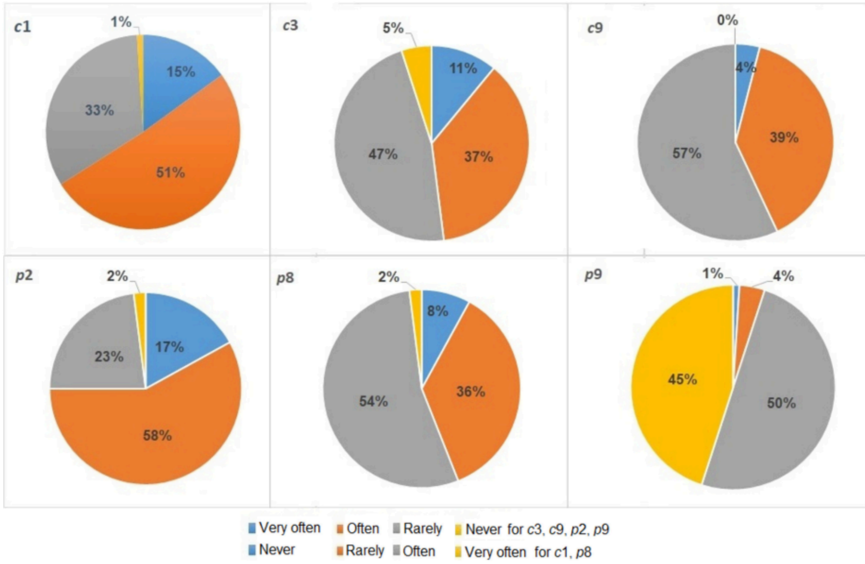

Fig. 6. Survey result for car drivers (*c*) and pedestrians (*p*) perceptions.

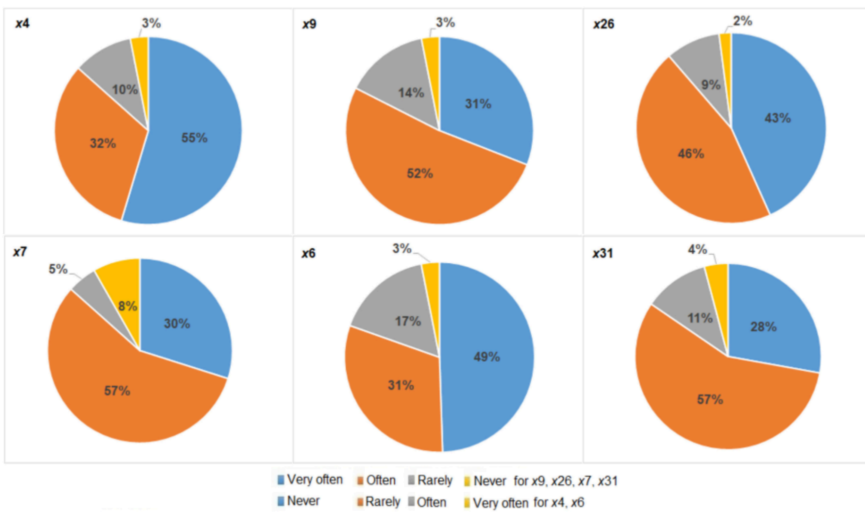

Fig. 7. Survey result for motorcyclists (*x*) perception obtained from Andrijanto et al. [9].

Table 4
The relation of variables.

Current study		Previous study [9]		Categorized
Variables		Variables		
c_1	Using a noisy exhaust	x_4	Using noisy exhaust	Unsafe
c_3	Clearing the lane for special vehicles (ambulances and fire trucks)	x_9	Clearing the lane for special vehicles (ambulances and fire trucks)	Safe
c_9	Using the correct indicator to turn in the desired direction	x_{26}	Using the correct indicator to turn according to direction	Safe
p_2	Following police instruction	x_7	Following police instructions during an incident	Safe
p_8	Zigzagging on the busy road	x_6	Zigzagging on busy road	Unsafe
p_9	Slowing down near zebra crossing and railroads	x_{31}	Slowing down near zebra crossing and railroads.	Safe

conceptual model (Fig. 4). The interpretation of each belief from the questionnaire results is discussed in Sections 5.2.2 and 5.2.3.

5. Discussion

5.1. Behavioral aspects

In this study, we adapted the previous method [9] to determine motorcyclists' behaviors that significantly influence car drivers' and pedestrians' traffic safety perceptions, which can be found in the following critical behaviors. In addition, we calculated the driving safety score to understand how car drivers and pedestrians perceive traffic safety given a motorcyclist's behavior.

5.1.1. Motorcyclists' critical behaviors

Table 2 shows significant variables with a sig. Value of $p < 0.05$ on variables c_1, c_3, and c_9. Similarly, Table 3 has a significance value of $p <$ 0.05 on three variables p_2, p_8, and p_9. These variables represent motorcyclists' critical behaviors when interacting with car drivers and pedestrians. Variables c_1 and p_8 are unsafe behaviors with positive coefficients, which means these behaviors will positively contribute to safe riding performance if motorcyclists rarely or never engage in them.

Related to these behaviors, the Bandung Road Safety Annual Report 2017 [32] (Released in 2018) claimed that 28 % of traffic accidents involving motorcyclists and pedestrians caused injury (13 %) and deaths (15 %) to pedestrians. Furthermore, 37 % of traffic accidents involving cars and motorcyclists caused injury (19 %) and fatalities (18 %) to motorcyclists. In 2017, Motorcyclists contributed to 68 % of total traffic accidents in Bandung City.

5.1.1.1. Car driver perspective. Seventeen behaviors influenced driving-safety scores as shown in Table 4. We identified five variables with significant values <0.05: c_1 (β = 2.314, $p < 0.05$), c_3 (β = 2.239, $p <$ 0.05), and c_9 (β = 2.411, $p < 0.05$). Thus, the critical behaviors are as follows:

c_1: Using a noisy exhaust
c_3: Clearing the lane for special vehicles (ambulances and fire trucks)
c_9: Using the correct indicator to turn in the desired direction

In line with the study on the behavioral aspects of motorcyclists in urban areas [9], the behaviors of clearing lanes for special vehicles (c_3) and using correct indicators (c_9) became critical for traffic safety. In addition, another study on the reasons behind motorcyclists' behaviors also claimed that using correct indicators becomes an issue for traffic safety [3]. Previous studies did not identify using a noisy exhaust (c_1) as a critical behavior [3,9]. Andrijanto et al. [9] argued that this behavior did not significantly influence motorcyclists' safety performance. The regression model in Andrijanto's study rejected a related variable of using a noisy exhaust [9]. However, in this study, car drivers perceived this behavior as critical. Therefore, to reveal the psychological aspects behind this behavior, it is also necessary to investigate motorcyclist's perceptions of using a noisy exhaust.

5.1.1.2. Pedestrian perspective. We obtained 11 behaviors that influenced the driving safety scores from Table 5. Three variables have a significant value <0.05: p_2 (β = 2.712, $p < 0.05$), p_8 (β = 2.743, $p <$ 0.05), and p_9 (β = 5.302, $p < 0.05$). The critical behaviors would be as follows:

p_2: Following police instruction
p_8: Zigzagging on the busy road
p_9: Slowing down near zebra crossing and railroads

Behaviors such as following police instructions (p_2) and slowing down near crosswalks (p_9), were also observed in the previous studies [3,9] and influenced traffic safety. In addition, driving in zigzags on a busy road (p_8) would block other vehicles from moving and pedestrians walking on crosswalks. A previous study also claimed that this behavior affects traffic safety [3].

5.1.2. Driving safety score

The driving safety score was calculated using Eqs. (1) and (2). The maximum and minimum values were yielded by inputting values five (5) and one (1) into the variables. The range and average (min-max; average) of the driving safety score would be 21.9–90.7; 56.3 (car drivers – c) and 25.7–90.5; 58.1 (pedestrians – p). We obtained a driving safety score for motorcyclists (m) from a study of behavioral aspects of safety culture [9,33]. A regression model yielded a score of 67.4, and the survey had an average total score of 76.9. We plotted these scores into a driving behavior scale (Fig. 8) developed by Andrijanto et al. [9] to get a big picture of safety on the road strived by motorcyclists in urban areas.

According to Andrijanto et al. [9], the driving safety score reflects the perception of motorcyclists' performance in striving for traffic safety by following the RTO's driving safety program. Therefore, we could compare the driving safety scores obtained in this research to understand other road users' perceptions of motorcyclists' behaviors. Fig. 8 indicates that car drivers (c) and pedestrians (p) assessed motorcyclists' performance as being lower than that of motorcyclists' assessment (m).

5.2. Psychological aspects

The following beliefs describe how car drivers and pedestrians perceive traffic safety when interacting with motorcyclists daily. Furthermore, we investigated motorcyclists' beliefs about their behaviors. However, this study only explored road users' beliefs instead of measuring motorcyclists' intentions to engage in specific behaviors.

5.2.1. Normative beliefs and perceived norms

We compare the normative beliefs (car drivers and pedestrians) and

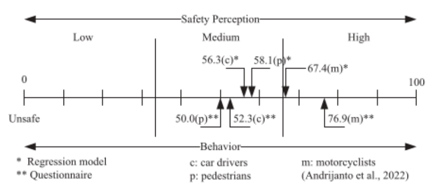

Fig. 8. Updated Andrijanto's driving safety score [9].

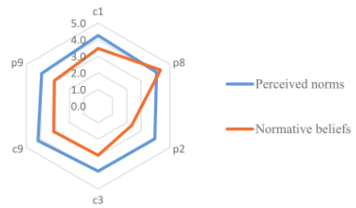

Fig. 9. Perceived norms and normative beliefs of motorcyclists behaviors.

perceived norms (motorcyclists), as shown in Fig. 9. Fig. 9 shows that motorcyclists believe that they a likely to behave safely (c_3, c_9, p_2, p_9), with an average score of 4.0 (very often 5 - never 1) and rarely in unsafe behaviors with an average score of 4.1 (never 5 - very often 1) such as using a noisy exhaust (c_1) and driving in zigzag (p_8). However, car drivers and pedestrians felt that motorcyclists were more likely to perform safe (avg. score 3.2) and unsafe (avg. score 3.3) behaviors equally. Fig. 9 shows that there was a gap between motorcyclists' and other road users' beliefs, except for the behavior driving in zigzag (p_8).

Fig. 9 uses data from the first survey. Car drivers and pedestrians have the same number of respondents, 97.

Normative beliefs also reflect how people accept performing a behavior [21]. We represent the acceptance by investigating car drivers' and pedestrians' reactions to motorcyclists engaged in deviant behaviors. The reactions were classified as aggressive or non-aggressive. However, non-aggressive reactions do not mean that road users accept deviant behaviors performed by motorcyclists. They may not accept these behaviors but are reluctant to engage in such aggressive responses. Therefore, the term "tolerable" behaviors would be appropriate to represent non-aggressive reactions instead of "acceptable." In contrast, other responses imply that they consider them "intolerable" behaviors. Fig. 10 shows the composition of aggressive and non-aggressive reactions for each behavior. We observed that road users might react more aggressively if motorcyclists do not give way to special vehicles (c_3) or give the correct signal (c_9).

Fig. 10 describes data from the second survey. We calculated the number of responses in percentage to compare the aggressiveness toward each motorcyclist's behavior from car drivers (c1, c3, c9) and pedestrians (p2, p8, p9).

5.2.2. Behavioral beliefs and attitudes

Motorcyclists are supposed to feel unsafe while breaking traffic rules. However, Fig. 11 shows that they are likely to feel safe engaging in risky behaviors for all critical behaviors.

Furthermore, we explored why motorcyclists felt safe when performing deviant behaviors. We categorized motorcyclists' opinions into three situations: they trust that other road users agree with them, misinterpret situations, and are overconfident.

Trust other road users (a): No complaints; other road users always give way; other road users also do the same.

- Misinterpret situations (b): Do not understand traffic rules; fail to predict the traffic situation; fail to understand police directions.
- Overconfident (c): I drive faster; I am used to it; I am always careful.

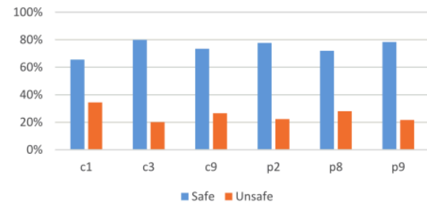

Fig. 11. Motorcyclists' attitudes in performing deviant behaviors.

We described the motorcyclists' beliefs regarding these categories for each critical behavior in Fig. 12. We can observe from Fig. 12 that each behavior has a different dominant view of safe attitudes. Thus, we argue that every behavior has beliefs that differ from a safe attitude toward committing behavioral deviations. Therefore, an RTO's intervention is necessary to ensure uniform motorcyclists' beliefs in striving for a good traffic safety culture.

5.2.3. Control beliefs and perceived control

We classified motorcyclists' opinions as external and internal factors. External factors are traffic situations that provoke motorcyclists to engage in deviant behaviors. Internal factors emerge from within the motorcyclist. We then calculated the number of motorcyclists' responses to this belief for each factor, as shown in Fig. 13.

The classification of motorcyclists' opinions into influential factors is as follows:

External factors: I felt distracted by someone blocking my way; I thought that the street was deserted; I did not see police officers on duty; I felt supported by other road users.

- Internal factors: I always feel impatient; I feel bored; I always feel like in a hurry;

  I feel lazy to follow the rule; I forget to use signals

As shown in Fig. 13, different factors influence motorcyclists' intentions to engage in deviant behaviors. For example, most motorcyclists using incorrect signals (c_9) were influenced more by internal factors (84 %). As indicated by the answers to Q5 in Appendix C, almost

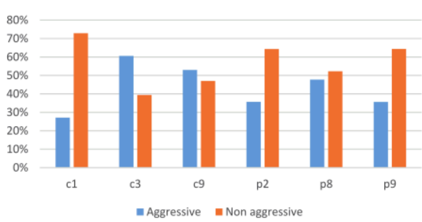

Fig. 10. Aggressive and non-aggressive reactions of car drivers (*c*) and pedestrians (*p*).

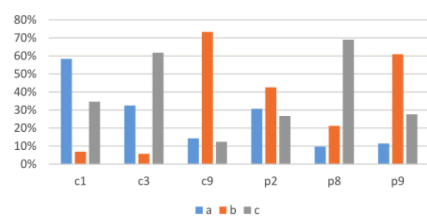

Fig. 12. Behavioral beliefs behind motorcyclists' attitudes.

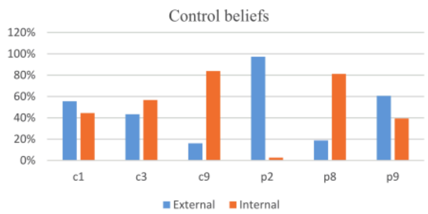

Fig. 13. External and internal factors of motorcyclists' control beliefs.

all motorcyclists admitted that they had forgotten to turn off the signal (71 %). Consistent with this result, previous studies have argued that motorcyclists are not accustomed to using signals [3,9]. Thus, motorcyclists may engage in this deviant behavior because of their lack of skills. In addition, a previous study argued that a licensing system in an urban area does not correctly assess motorcyclists' ability to use signals [9].

Perceived controls refer to how people perceive their ability to perform or prevent behaviors in their environment [21]. However, we found a previous study [9] did not measure motorcyclists' perceived controls. Therefore, further studies are necessary to determine motorcyclists' ability to refrain from engaging in deviant behaviors. Measuring the extent to which internal and external factors influence motorcyclists may further reveal their perceived control.

5.2.4. Limitation of study

This research continues the previous study conducted two years earlier by Andrijanto et al. [9]. Therefore, we assumed that the traffic conditions were same as those at the time of the initial study. We confirmed this condition with the RTO, and they understood it. The RTO claimed that the changes were still in the discourse stage and had not yet been implemented. Therefore, traffic conditions should remain the same as those the previous study.

Although we asked respondents to answer questions based on reality, there is still a possibility that they did not answer correctly still. However, similar studies on the behavior and psychology of drivers have frequently used self-evaluation questionnaires and interviews to investigate their opinions [6,21,25,31,34]. Thus, we expect the results obtained in this study to reflect the actual situation.

The classification and categorization of road users' opinions were performed subjectively by the researchers. Therefore, for validation, we clarified the results with the road users' representatives and subsequently asked for RTO approval.

Regarding perceived control, this study revealed the internal and external factors (control beliefs) of motorcyclists engaging in deviant behaviors. However, owing to the time limit, we could not measure how strongly motorcyclists could prevent internal and external factors from influencing them to engage in deviant behaviors.

As per the previous research conducted by Andrijanto et al. [9], the multiple regression model in the current study is used to identify significant safety behaviors of motorcyclists from car drivers' and pedestrians' perspective over a period. However, the regression model resulting from this study cannot be used to determine motorcyclists' future behaviors. Further study is needed to review whether safety behaviors will change after some periods.

6. Conclusion

In this study, we demonstrated the application of the RSC model as a framework for studying the psychological aspects of traffic safety culture. Focusing on the relationship between behavioral and psychological aspects, we adapted the BBS program's conceptual model to identify critical behaviors and investigating critical motorcyclists' behaviors toward car drivers and pedestrians. Furthermore, we adapted the transformation process model of belief systems to behaviors in approaching the psychological aspects. Finally, we developed a survey to investigate belief systems, that is, behavioral beliefs, attitudes, normative beliefs, perceived norms, control beliefs, and perceived control, to describe "what road users think about motorcyclists' safe driving."

Six critical behaviors of motorcyclists that significantly affect other road users were identified. We then clarified these behaviors in line with those reported in other studies. Furthermore, we constructed road users' beliefs by exploring their perception of motorcyclists engaging in deviant behaviors related to the identified critical behaviors. Thus, the survey results could explain the construction of belief systems. The surveys revealed that most motorcyclists felt safe when performing deviant behaviors (attitudes). We found that motorcyclists made a noisy sound with exhaust (c_1) because they believed that other road users were not disturbed (behavioral beliefs). Normative beliefs and perceived norms described motorcyclists as feeling that they often performed safe behaviors. However, other road users rarely encountered motorcyclists driving safely. In addition, most car drivers and pedestrians perceive motorcyclists' risky behaviors by having non-aggressive reactions. Finally, we revealed internal and external factors that might influence motorcyclists' engagement in deviant behaviors (control beliefs). We reviewed these beliefs using existing licensing system procedures and assessment of motorcyclists' driving abilities. In addition, internal factors (e.g., impatient, in a hurry) also influence motorcyclists' behavior.

Generally, studying psychologically related behavior involves investigating people's intentions to engage in a particular behavior. Therefore, further studies measuring belief systems are expected to describe motorcyclists' intention to perform or refrain from engaging in certain behaviors. This study was limited to observing general road users in urban areas, such as, car drivers and pedestrians. Studying groups of professional drivers (e.g., taxi and Uber drivers) may provide a broader perspective on the psychological aspects of safety culture.

CRediT authorship contribution statement

Andrijanto: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Makoto Itoh:** Writing – review & editing, Writing – original draft, Validation, Supervision, Project administration, Methodology, Funding acquisition. **Sunardy:** Software, Resources, Data curation. **Michael Jonathan:** Software, Resources, Data curation.

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Declaration of competing interest

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

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Appendix A. Driving Safety Questionnaire

A.1. *(Motorcyclist – Car Driver Perspective)*

A.1.1. *Introduction*

Introduce the observer affiliation and the purpose of research.

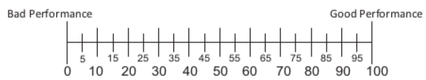
Section 1 – General information.

The content of section 1 is following the original DSQ [9].

Section 2 – 1st questionnaire.

From 0 to 100.

How good are motorcyclists at performing a driving safety program? (Encircle the score).



Section 3 – 2nd questionnaire.

From the following table, please indicate.

How often do motorcyclists perform this action in daily driving? (Mark the selected option with a "V").

Questionnaire		Never	Rarely	Often	Very Often
c_1	Using noisy exhaust				
c_2	Following police instructions				
c_3	Clearing the lane for special vehicles (ambulances and fire trucks)				
c_4	Yelling at other road users				
c_5	Spitting on the road				
c_6	Following the lane demarcation when turning				
c_7	Estimating a safe space and speed before overtaking other vehicles				
c_8	Parking in the right place with the correct position (not blocking other vehicles)				
c_9	Using the correct indicator to turn in the desired direction				
c_{10}	Avoiding chain reaction collisions				
c_{11}	Checking wing mirrors intensively when changing lane				
c_{12}	Recognizing traffic signs and rules that apply on the road.				
c_{13}	Slowing down near zebra crossing and railroads				
c_{14}	Zigzagging on a busy road				
c_{15}	Using the opposite lane for taking over another vehicle				
c_{16}	Ignoring traffic lights when a road is deserted				
c_{17}	Changing the direction of a vehicle that is turning				
c_{18}	Holding the steering wheel with one hand				
c_{19}	Assessing road and weather conditions when driving				
c_{20}	Considering the speed (accelerate/decelerate) to keep a safe distance				
c_{21}	Considering the speed in relation to visibility at night or when raining				
c_{22}	Driving slowly while chatting with other motorcyclists on a busy road				
c_{23}	Using the horn excessively				
c_{24}	Suddenly merging into the other lane without signalling				
c_{25}	Assessing situations before changing lanes due to an obstacle up ahead				
c_{26}	Not driving against the flow of traffic				
c_{27}	Using a slow lane for normal driving				
c_{28}	Turning off the indicator after turning				
c_{29}	Turning on the indicator before turning				
c_{30}	Not driving while exceeding the vehicle's capacity (more than one passenger)				
c_{31}	Not carrying oversized goods				
c_{32}	Waiting at the stop area when a train passes				
c_{33}	Using vehicles with standard equipment according to the regulations				
c_{34}	Carrying driving license and vehicle documentation when driving				
c_{35}	Understood sanctions of violated traffic rules				
c_{36}	Realizing the mutual interests on the road that must come first				
c_{37}	Wearing a standard helmet (following regulations)				
c_{38}	Being careful when crossing damaged roads				
c_{39}	Paying attention to signals from other vehicles (brake lights, turning indicators, etc.)				

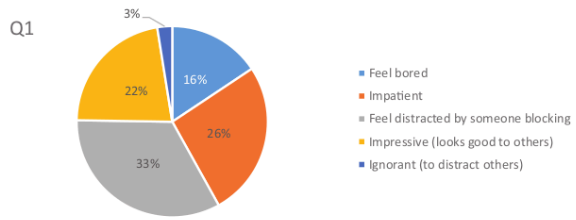
Appendix B. Driving Safety Questionnaire (Motorcyclist – Pedestrian Perspective)

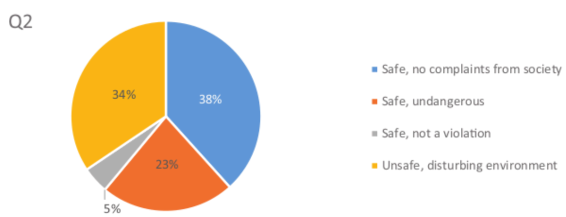
B.1. Introduction

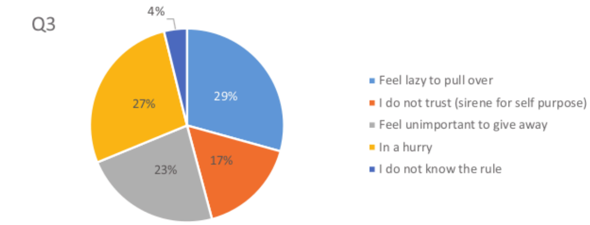
Introduce the observer affiliation and the purpose of research.
Section 1 – General information.
The content of section 1 is following the original DSQ [9].
Section 2 – 1st questionnaire.
This section asks the same question as the DSQ (Motorcyclists – Car Driver Perspective).
Section 3 – 2nd questionnaire.
From the following table, please indicate.
How often do motorcyclists perform this action in daily driving? (Mark selected option with a "V").

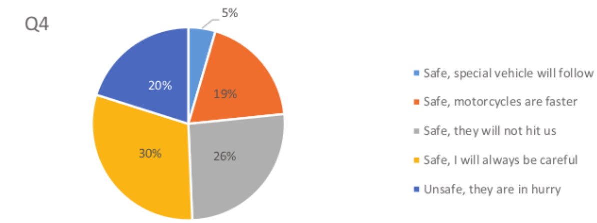
Questionnaire		Never	Rarely	Often	Very Often
p_1	Using noisy exhaust				
p_2	Following police instructions				
p_3	Clearing the lane for special vehicles (ambulances and fire trucks)				
p_4	Spiting on the road				
p_5	Following the lane demarcation when turning				
p_6	Parking in the right place with the correct position (not blocking other vehicles)				
p_7	Recognizing traffic signs and rules that apply on the road.				
p_8	Slowing down near zebra crossing and railroads				
p_9	Zigzagging on a busy road				
p_{10}	Ignoring traffic lights when a road is deserted				
p_{11}	Using the horn excessively				
p_{12}	Assessing situations before changing lanes due to an obstacle up ahead				

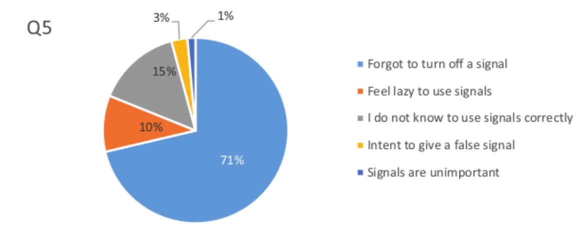
Appendix C

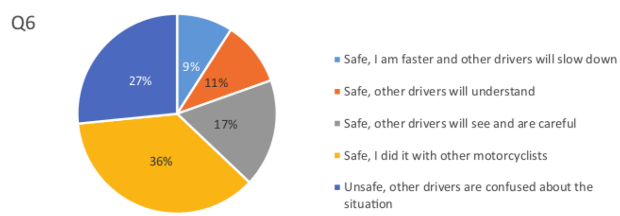


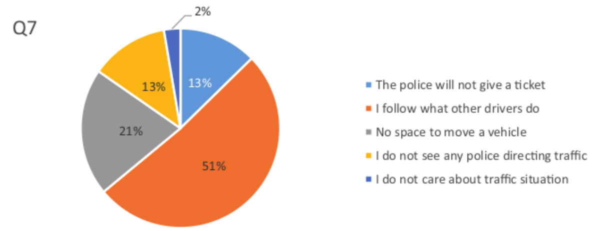


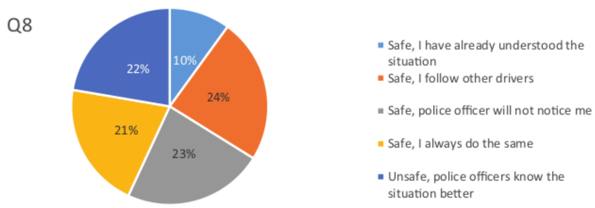

Q3
4%
29%
17%
23%
27%
Feel lazy to pull over
I do not trust (sirene for self purpose)
Feel unimportant to give away
In a hurry
I do not know the rule

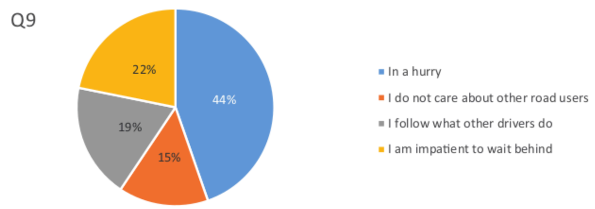

Q4
5%
19%
26%
30%
20%
Safe, special vehicle will follow
Safe, motorcycles are faster
Safe, they will not hit us
Safe, I will always be careful
Unsafe, they are in hurry

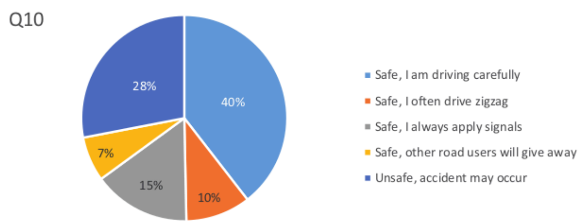

Q5
3%
1%
15%
10%
71%
Forgot to turn off a signal
Feel lazy to use signals
I do not know to use signals correctly
Intent to give a false signal
Signals are unimportant

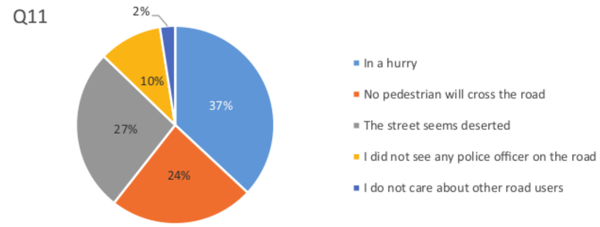

Q6
27%
9%
11%
17%
36%
Safe, I am faster and other drivers will slow down
Safe, other drivers will understand
Safe, other drivers will see and are careful
Safe, I did it with other motorcyclists
Unsafe, other drivers are confused about the situation

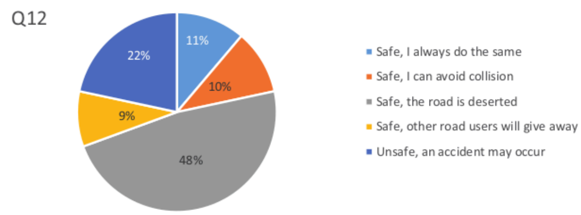

Q7
2%
13%
13%
21%
51%
The police will not give a ticket
I follow what other drivers do
No space to move a vehicle
I do not see any police directing traffic
I do not care about traffic situation

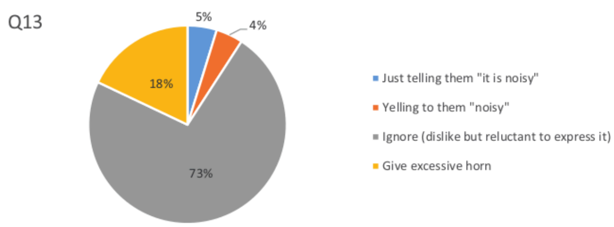

Q8
22%
10%
24%
21%
23%
Safe, I have already understood the situation
Safe, I follow other drivers
Safe, police officer will not notice me
Safe, I always do the same
Unsafe, police officers know the situation better

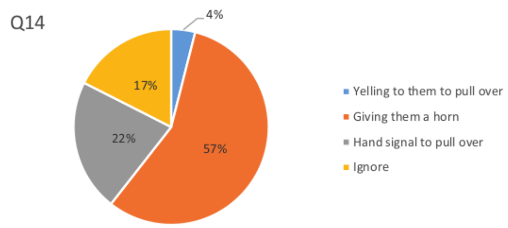

Q9
22%
44%
19%
15%
In a hurry
I do not care about other road users
I follow what other drivers do
I am impatient to wait behind

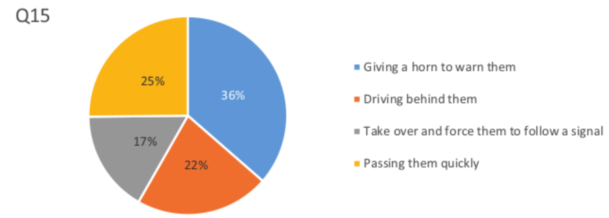

Q10
28%
40%
7%
15%
10%
Safe, I am driving carefully
Safe, I often drive zigzag
Safe, I always apply signals
Safe, other road users will give away
Unsafe, accident may occur

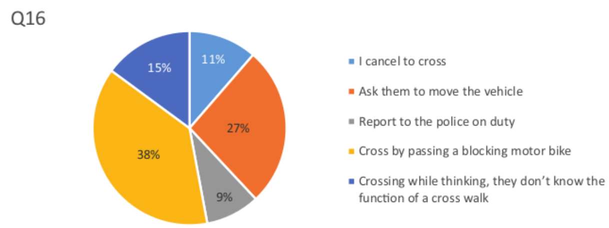

Q11
2%
10%
37%
27%
24%
In a hurry
No pedestrian will cross the road
The street seems deserted
I did not see any police officer on the road
I do not care about other road users

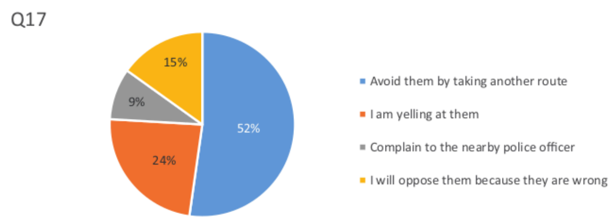

Q12
22%
11%
10%
9%
48%
Safe, I always do the same
Safe, I can avoid collision
Safe, the road is deserted
Safe, other road users will give away
Unsafe, an accident may occur


Q13
5%
4%
18%
73%
Just telling them "it is noisy"
Yelling to them "noisy"
Ignore (dislike but reluctant to express it)
Give excessive horn


Q14
4%
17%
22%
57%
Yelling to them to pull over
Giving them a horn
Hand signal to pull over
Ignore







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