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Attitude, perceived behavioral control, and intention to adopt risky behaviors

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Abstract

The theory of planned behavior (TPB, Ajzen, 1985) has proved its efficiency in predicting different behaviors among road users (Sheeran & Orbell, 2000). The present study examined the TPB factors explaining risk taking among vulnerable road users (e.g., cyclists). We presumed that attitude, social norms, and perceived behavioral control (PBC) would predict cyclists' intention to adopt a risky behavior in two traffic contexts considered as risk-conducive (i.e., run the red-light, turn left).

Participants ($N = 224$, $M_{\text{age}} = 23.34$) filled in an online scenario-based questionnaire describing two traffic situations conducive to risk taking and including measures for cyclists' intentions to adopt risky behaviors in these specific contexts, TPB factors, and self-perceived efficacy.

TPB factors explained 49% and 65% of the variance in the intention to cross the red light, respectively the intention to turn left, with positive attitude and high PBC as the best predictors. Implications of the results were discussed.

Keywords: theory of planned behavior, risk-taking, vulnerable road users, cyclists, and risk-conducive situations.

Introduction

The theories of reasoned action (TRA; Fishbein & Ajzen, 1975) and planned behavior (TPB; Ajzen, 1985; 1991) have been successfully used to examine the relation between intention and behavior and to explain a wide range of risky behaviors (e.g., Ajzen, 1991; Dohnke, Weiss-Gerlach, & Spies, 2011; Drossaert, Boer, & Seydel, 2003; Duncan, Forbes-Mckay, & Henderson, 2012; Hutching, Lac, & LaBrie, 2008; Sheeran & Orbell, 2000; Trafimow, Sheeran, Conner, & Finlay, 2002). Both models are based on the assumption that human behavior is the result of a rational process in which individuals systematically consider, process, and use the available information in order to make a behavioral decision (Ajzen, 2012). TRA promotes attitude and personal norms as the main predictors of a person's intention to display certain behaviors while TPB considers perceived behavioral control (PBC) also as a primary predictor. According to these models, the intention to perform specific behaviors results from a positive evaluation of the advantages and disadvantages of that behavior (*attitude*), the perceived approval of significant persons when performing the behavior (*social norms*) as well as the expected control one has over performing the behavior (*perceived behavioral control*; Ajzen, 1991).

The two models have been used in a significant number of empirical researches on traffic psychology to examine and predict risky behaviors such as *seatbelt use* (Ali, Haidar, Ali, & Maryam, 2011; Tavafian, Aghamolaei, & Madani, 2011), *general driving violations* (Castanier, Deroche, & Woodman, 2013; Chorlton, Conner, & Jamson, 2012; M. A. Elliott, 2012), *speeding* (Conner, Smith, & McMillan, 2003; M. Elliott, 2010; M. A. Elliott, Armitage, & Baughan, 2005; Newnam, Watson, & Murray, 2004; Paris & Broucke, 2008), *drinking and driving* (Marcil, Bergeron, & Audet, 2001; Moan & Rise, 2011; Ravis, Abraham,

& Snook, 2011), *texting while driving* (Gupta, Burns, & Boyd, 2016), or *crossing the yellow lights* (Palat & Delhomme, 2012).

TPB has also been applied to pedestrian violations (Moyano Díaz, 2002; Xu, Li, & Zhang, 2013) such as *crossing behavior* (Holland & Hill, 2007; Zhou, Horrey, & Yu, 2009) or *drinking and walking* (Gannon, Rosta, Reeve, Hyde, & Lewis, 2014; Haque et al., 2012). In regard to cyclists, most of the studies using TPB factors were focused solely on *helmet use* (Ahmed, Ambak, Raqib, & Sukor, 2013; Lajunen & Räsänen, 2004). To our knowledge, there are some studies examining cyclists' risky behaviors and electric bikes (e.g., Guo, Liu, Bai, Xu, & Chen, 2014; Wu, Yao, & Zhang, 2012) and none investigating the factors that might predict these behaviors.

In light of the environmental sustainability campaigns promoting eco-friendly means of transportation, the percentage of road users choosing cycling as main mode of transportation has significantly increased. For example, urban cycling has doubled between 2001 and 2010 in Paris with cycling accounted for approximately 650.000 daily journeys (ONISR, 2014).

The general objective of this study was to examine cyclists' risky behaviors; more precisely, we were interested in investigating the factors that might predict cyclists' intention to adopt risky behaviors in two specific risk-conducive situations by using the extended TPB model. Studies show that attitudes, social norms, and PBC towards risky behaviors are significant predictors of behavioral intentions (Tavafian, Aghamolaei, & Madani, 2011; Zhu, Zhang, & Bao, 2011) therefore, we assumed that positive attitudes, social norms, and high-perceived behavioral control would predict cyclists' intention to adopt risky behaviors in risk-conducive traffic situations.

Additional factors (e.g., risk judgments, general self-perceived efficacy) were also taken in consideration. Previous studies showed that young drivers perceive themselves as being less vulnerable to road crashes as compared to peer drivers (Causse, Delhomme, & Kouabenan, 2005). In addition, self-efficacy has been identified as a significant predictor for texting while driving (Benson, McLaughlin, & Giles, 2015). Thus, we assumed that lower risk judgments and high self-efficacy would also predict cyclists' intention to adopt risky behaviors in risk-conducive traffic situations.

Method

Participants

Participants were selected based on their availability and cycling experience. More specifically, a cyclist was defined as a person using a personal or rented bike at least twice a week independently of the purpose of their cycling activity (e.g., commute, leisure). A link describing the study was posted on several French cycling forums and associations inviting their members to take part to a survey about the interactions between cyclists. A sample of 224 participants (56.3% men) aged between 19 and 27 years old ($M = 23.34$, $SD = 2.27$) cycling between 2 to 6 times per week) responded to our invitation.

Procedure

We selected two traffic situations (i.e., run the red-light and turn left into an intersection) conducive to risky behaviors among cyclists. These situations were selected based on previous findings showing that the main factors leading to accidents among cyclists relate to running the red-light when going straight, no entry signs, poorly negotiated turns to left and, low light and visibility conditions (Cristea & Delhomme, 2016; ONIRS, 2009, Wu et al., 2012). Furthermore, two scenarios corresponding to each of the two situations were created

and validated (Cristea & Delhomme, 2016). Each scenario was accompanied by a self-explanatory image.

Run the red light: *“You are riding to the university on a two-way road with double lanes and heading towards an intersection with traffic lights. 10m before the crossing sign, the light turns red. You are late for your class so, you decide to run the red light and go on.”*

Turn left into an intersection: *“It is Sunday afternoon and you are riding towards your favorite restaurant to have lunch. You are riding on a two-way road with double lanes, going into an intersection where you need to turn left. There is a car on the opposite lane arriving in the intersection. You are now 5m away from the intersection; you grip more to the left and express your intention to turn left with your hand. You are very hungry so you decide to turn left hoping that you will have the time to do so before the car in front of you gets into the intersection.”*

Measures and instruments

Participants were invited to carefully read each scenario and fill in an online scenario-based questionnaire. The choice of scenario-based questionnaire was carefully considered and supported by several previous studies about *driving* (e.g., Delhomme, Cristea, & Paran, 2014; Horvath, Lewis, & Watson, 2012; Lennon, Watson, Arlidge, Fraine, 2011; Parker, Manstead, Stradling, & Reason, 1992), *cycling* (e.g., Cristea & Delhomme, 2016) or *pedestrians’* behaviours (e.g., Zhou et al., 2009).

Each scenario was followed by 20 items assessing the TPB factors as well as perceived self-efficacy, risk judgments, and socio-demographical variables. Responses were provided on 7-point scales, except for the socio-demographical variables.

Intention. Three items were used to measure the intention (e.g. “How likely it is for you to run the red light/ turn left in a similar situation?”, *unlikely/ very likely*). The mean of the three items produced a composite scale for each of the two situations (Run the red light, $\alpha = .91$; Turn left, $\alpha = .94$).

Attitude. Crossing the red light and turning left were rated on three bipolar adjective scales (i.e., *good/bad*, *harmful/beneficial*, *pleasant/unpleasant*). The mean score across the three items constituted our measure of direct attitude toward the behavior (Run the red light, $\alpha = .70$; Turn left, $\alpha = .88$).

Subjective norm. Four items were used to register subjective norm (e.g., “Most of the people who are important to me think I shouldn’t run the red light/ turn left in the described situation”, *unlikely/likely*). Responses to the three items were averaged to produce a measure of subjective norm for the two situations (Run the red light, $\alpha = .63$; Turn left, $\alpha = .59$).

Perceived behavioral control. Five items were used to provide a measure of perceived behavior control (e.g., “Running the red light/turning left in the described situation is...”, *easy/difficult*) for each of the two situations (Run the red light, $\alpha = .80$; Turn left, $\alpha = .72$).

Risk judgments. This was measured using two items about the probability of being involved in an accident due to crossing the red light or to turning left in the described situation (e.g., “How likely it is for you to be involved in an accident without being injured if you run the red light/turn left in the described situation?”, *unlikely/very likely*). The mean of the two items provided a composite scale for each of the two situations (Run the red light, $\alpha = .69$; Turn left, $\alpha = .75$).

Perceived self-efficacy. Perceived self-efficacy as a cyclist was registered using five items (e.g., “Generally, I am confident in my capacities to ride a bike”, *not at all/very much*). Mean scores over the five items served as a measure for perceived self-efficacy as a cyclist (Overall, $\alpha = .81$).

Results

Descriptive analyses

Table 1 presents descriptive information and correlations for running the red light and turning left into an intersection.

- Insert Table 1 here -

The sample reported a moderate intention and a relatively positive attitude while expressing low social pressure and a high level of PBC over running the red light in the described situation. Furthermore, they declared that the probability of being involved in an accident by running the red light is very high and they described themselves as highly efficient cyclists. Examination of the correlations indicated that positive attitude, high-PBC, high-perceived self-efficacy, and less perceived probability of being involved in an accident correlated with a high intention to run the red light. Interestingly, subjective norms had an insignificant correlation with behavioral intention suggesting that cyclists feel less social pressure to run the red light. Furthermore, participants reported a rather low intention and a relatively positive attitude while expressing a moderate level of social pressure and a high level of PBC over turning left in the described situation. They also believed that there is a high probability of being involved in an accident by turning left in the described situation. Consistent with the TPB, positive attitude, high social pressure, and high PBC over turning left indicated a high intention to turning left into an intersection in the described situation.

Structural equation models

1. General model: cyclists' intention to engage in risky behaviors

Figure 1 presents a general model examining the relations between the extended TPB factors and the intention to engage in risky behaviors independently of the two specific situations. Thus, we designed a model that we subsequently tested using AMOS.

- Insert Figure 1 here -

The goodness of fit indices for the first model was poor; thereby some adjustments were considered and new regression paths were introduced to the initial model. In addition, several covariances were added to improve the fitness of the model (see Table 2).

- Insert Table 2 here -

Table 3 shows the final model explained 56% of the variance of behavioral intention suggesting that PBC was the best predictor for cyclists' intention to perform risky behaviors.

- Insert Table 3 -

Some interesting relations between attitudes and subjective norms as well as attitudes and PBC emerged following these analyses. Positive attitudes towards risky behaviors were linked to overall perception of social approval. In addition, participants expressing positive attitudes towards risky behaviors also revealed a facility to enact those behaviors. In conclusion, behavioral intentions were explained mainly by high PBC, positive attitudes towards risky behaviors, and low risk judgments.

2. Running the red light

In order to examine the relations between the extended TPB factors and the cyclists' intention to run the red light we conducted a new model that can be seen in Figure 2.

- Insert Figure 2 here -

Table 4 includes the covariance value of this model.

- Insert Table 4 here -

The final model explained 49% of the variance of behavioral intention suggesting that PBC and attitudes towards running the red light best explained cyclists' intention to run the red light.

3. Turning left into an intersection

Similarly, in order to examine the relations between the extended TPB factors and the cyclists' intention to turn left into in the described situation we conducted a new model that can be seen in Figure 3.

- Insert Figure 3 here -

Table 5 includes the covariance values of this model.

- Insert Table 5 here –

The final model explained 65% of the variance of behavioral intention suggesting that cyclists' intention to turn to left in the described situation was best explained by high PBC and positive attitudes towards that behavior.

4. Running the red light vs. turning left into an intersection

Finally, we were interested to investigate if the models explaining the two behaviors were significantly different by testing the differences between the goodness of fit Chi-square of the unconstrained model ($\chi^2(12) = 12.35, p = .00$) and the goodness of fit Chi-square of the model with all regression paths constrained ($\chi^2(16) = 27.44, p = .00$). The difference test suggested that the models for each situation were not significantly different ($\chi^2(4) = 15.19, p = .10$; 95% confidence). Even though the two models do not seem to be significantly different, we proceeded to test for differences between each of the paths and the covariance in the two models. The regression path between attitude and subjective norm was significantly different (path diff. = $-.55$; 90% CI [$-.89, -.32$]; $p = .007$) for running red light ($\beta = .33$) and turning left ($\beta = .57$). The squared multiple correlations for subjective norms were also significantly different (path diff. = 3.84 ; 90% CI [$1.59, 6.41$]; $p = .005$) for running the red light ($R^2 = .11$) and turning left ($R^2 = .33$). Finally, a marginally significant difference was found for the

regression path between attitude and behavioral intention (path difference = .26; 90% CI [-.26, -.61]; $p = .06$) for running the red light ($\beta = .19$) and turning left ($\beta = .44$).

Discussion

The TPB has been extensively used as a framework in understanding and predicting a large range/various risk taking behaviors with encouraging results (Armitage & Conner, 2001). The general objective of the study was to gain a better understanding of the factors that might explain and predict cyclists' intentions to adopt risky behaviors (i.e., run the red light, turn left into an intersection) in two specific risk-conducive situations by using the TBP framework.

Participants reported a moderate intention to run the red light and turn left into an intersection in the described situations in the following 12 months and expressed a mildly positive attitude towards both behaviors. These results may be explained by the fact that risky behaviors such as running the red light and turning left in an intersection have often been associated with positive outcomes such as preserving physical energy and gaining time (e.g., Cristea & Delhomme, 2016) and, therefore, are frequently encouraged by peers and significant others (e.g., (Curry, Mirman, Kallan, Winston, & Durbin, 2012; Vollrath, Meilinger, & Krager, 2002).

TPB factors explained 49%, respectively, 65% of the variance in behavioral intentions the described situations, confirming previous findings (e.g., Armitage & Conner, 2001; Castanier et al., 2013; Conner & Armitage, 1999; Cristea, Delhomme, & Paran, 2013; Trafimow et al., 2002) and providing support for the application of the TPB in understanding and explaining risky behaviors among vulnerable road users such as cyclists. Both models indicated that

perceived behavioral control and attitude were the best predictors of the behavioral intention for both situations. This suggests that, in the case of these risky behaviors, cyclists' positive evaluation of the situations and the appraisal of the ease with which they could adopt the behaviors were the most important sources of influence on behavioral intentions.

In agreement with previous research on risky behaviors among drivers (Tavafian et al., 2011; Zhu et al., 2011) and vulnerable road users (M. Elliott, 2010; Zhou et al., 2009), PBC appeared as a significant predictor of the behavioral intention in both situations. Furthermore, results underlined the importance of attitudes as predictors of the behavioral intention for both situations (e.g., Armitage & Conner, 2001; Iversen, 2004; Parker et al., 1992; Rutter, Quine, & Chesham, 1995(Armitage & Conner, 2001; Taylor, McEachan, Conner, & Lawton, 2011). In both situations, the models indicated that, as the PBC increased and attitude became more positive, the behavioral intention to adopt both behaviors also increased. These results have important implications for behavioral change and future interventions. When designing a prevention safety campaign addressing cyclists, it might be a good strategy to appeal to their attitudes towards risky behaviors and their control over these behaviors. Reducing their PBC over the two behaviors might deter them from engaging into running the red lights and turning left (Ajzen, 1991; Zhou et al., 2009).

Interestingly, subjective norms played a less significant role in explaining behavioral intentions. Subjective norms have been repeatedly identified as the least effective predictor of TPB (Armitage & Conner, 2001); however, these findings are not necessarily surprising. It could be possible that, in the described situations, subjective norms are less salient than descriptive norms (i.e., what others do). Descriptive norms might prove more useful in this type of situation, as they were identified as good predictors of risky behaviors in traffic (Cestac, Paran, & Delhomme, 2014; Ravis & Sheeran, 2003).

Nonetheless, an interesting difference in the relation between subjective norms and attitudes was observed when comparing the two risk-conducive situations. The two concepts were more strongly linked in the turning left situation as compared to the red light one suggesting that subjective norms might enhance attitudes toward a risky behavior. Although subjective norms had a less direct impact on the intention to adopt risky behaviors in both situations, participants' perception about significant others' approval of the behavior in question may have lead to a more positive attitude towards that same behavior. Furthermore, subjective norms' influence on attitudes varied according to the situation. It is well known that risk taking is a complex phenomenon, influenced not only by individual characteristics but also by situational ones and our results support these findings (Figner & Weber, 2011). However, further analysis should be conducted before drawing any conclusions concerning the implications for safety measures.

Limitations of the study

First of all, the use of scenario-based questionnaire could have represented a source of bias in participants' way of positioning themselves in the described situations. Although the scenarios were previously validated and based on real-life situations (Cristea & Delhomme, 2016), follow-up studies should examine cyclists' behavioral intention to adopt risky behaviors in real life settings.

Second of all, although self-reported measures could be considered as problematic in terms of biased responses (e.g., social desirability), self-report scales have been frequently used in the assessment of attitudes and behaviors among different categories of road users. In addition, there is little evidence of social desirability having a moderating effect on the relationship between TPB factors (e.g., Armitage & Conner, 1999). Moreover, some authors have argued

that subjective/self-reported measures can be more effective than objective/direct measures (McKenna, 2002).

Third of all, additional factors should be considered in explaining cyclists' risky behaviors. Previous studies underlined the predictive value of additional factors (Conner, Lawton, Parker, Chorlton, Manstead, & Stradling, 2007; Elliot & Thompson, 2010; Forward, 2009; Sommer, 2011; Sparks & Guthrie, 1998). Further studies should take in consideration factors such as past behavior, descriptive norms, risk perception and/or personality traits (e.g., sensation seeking). Finally, future studies should also take in consideration other traffic contexts before being able to make general assumptions about the factors predicting cyclists' risky behaviors.

Conclusion

The present study provides theoretical support for using the TPB in understanding and explaining specific risky behaviors among cyclists. In addition, it offers valuable details regarding the TPB factors (i.e., perceived behavioral control and attitude) that need to be taken in consideration when designing campaigns to prevent risky behaviors among cyclists.

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Table 1

Means, Standard Deviations, and Correlations with Behavioral intention: running the red light and turning left into in intersection (N = 224).

	Running the red light			Turning left		
	<i>M</i>	<i>SD</i>	<i>R</i>	<i>M</i>	<i>SD</i>	<i>R</i>
Intention	4.18	2.10		3.18	2.03	
Attitude	2.61	1.29	.72	2.61	1.55	.58
Subjective norm	3.17	1.24	.49	2.83	1.43	.09
PBC	3.72	1.41	.71	3.47	1.32	.65
Risk of accident	3.65	1.70	.01	4.42	1.76	.23
Perceived self-efficacy	6.28	.90	-.50			.51

Note: Min =1.00; Max = 7.00

Table 2

Correlations - Final model for cyclists' intentions to engage in risky behavior (N = 448)

<i>Variables</i>	<i>Correlation Value</i>
Attitudes – Risk judgment	-.47 ^{***}
Attitudes – Perceived behavioral control	-.55 ^{***}

*** p<.000

Table 3

Goodness fit indices of the initial and final model for cyclists' intentions to engage in risky behaviors (N = 448)

	χ^2	df.	p	NFI	TLI	CFI	RMSEA(CI)
<i>Theory of Planned Behavior</i>							
Initial Model	556.952	10	.000	.393	.091	.394	.355 [.331 - .381]
Final Model	9.693	5	.084	.989	.984	.995	.040 [.000 - .090]

Table 4

Correlations for the model concerning the run the red light situation (N = 224)

<i>Variables</i>	<i>Correlation</i>
Attitudes – Risk judgment	-.50 ^{***}
Attitudes – Perceived behavioral control	-.53 ^{***}

*** p<.000

Table 5

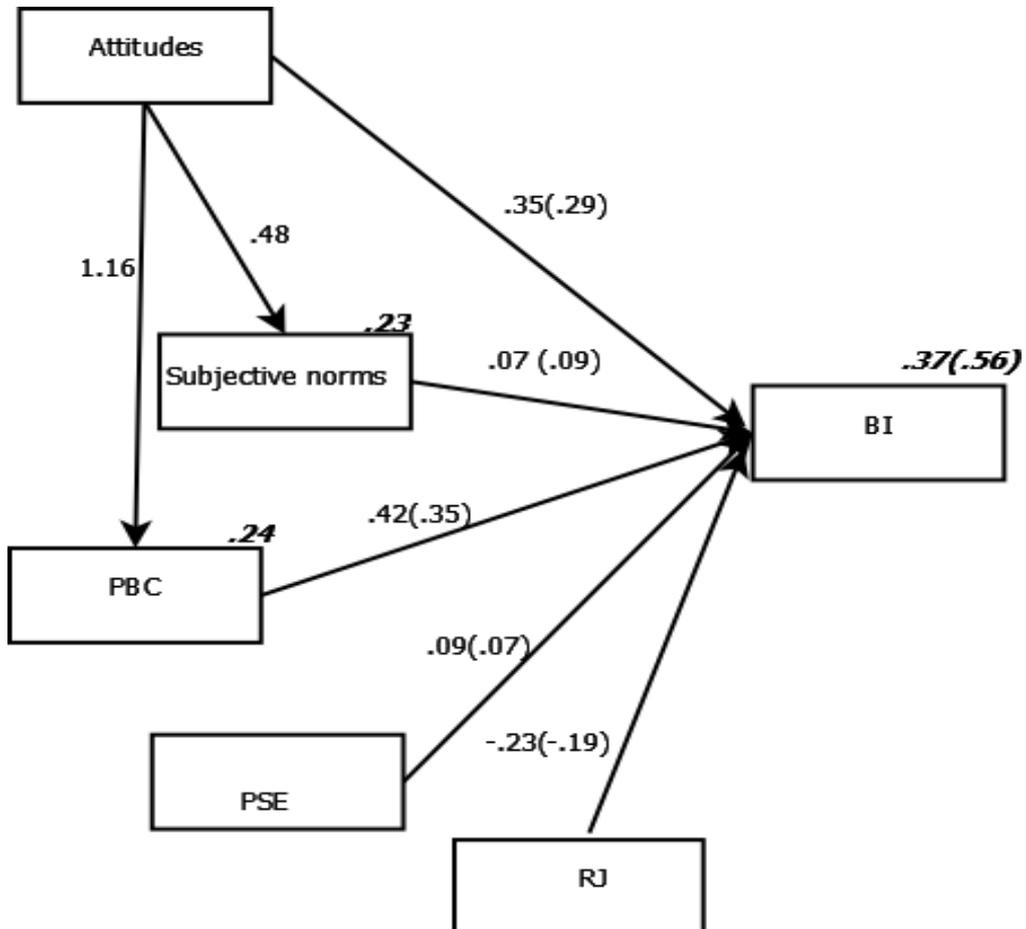
Correlations for the model for the turn to left situation (N = 224)

<i>Variables</i>	<i>Correlation</i>
Attitudes – Risk judgment	-.46 ^{***}
Attitudes – Perceived behavioral control	-.48 ^{***}

*** p<.000

Figure 1

The initial and final model for cyclists' intentions to engage in risky behaviors

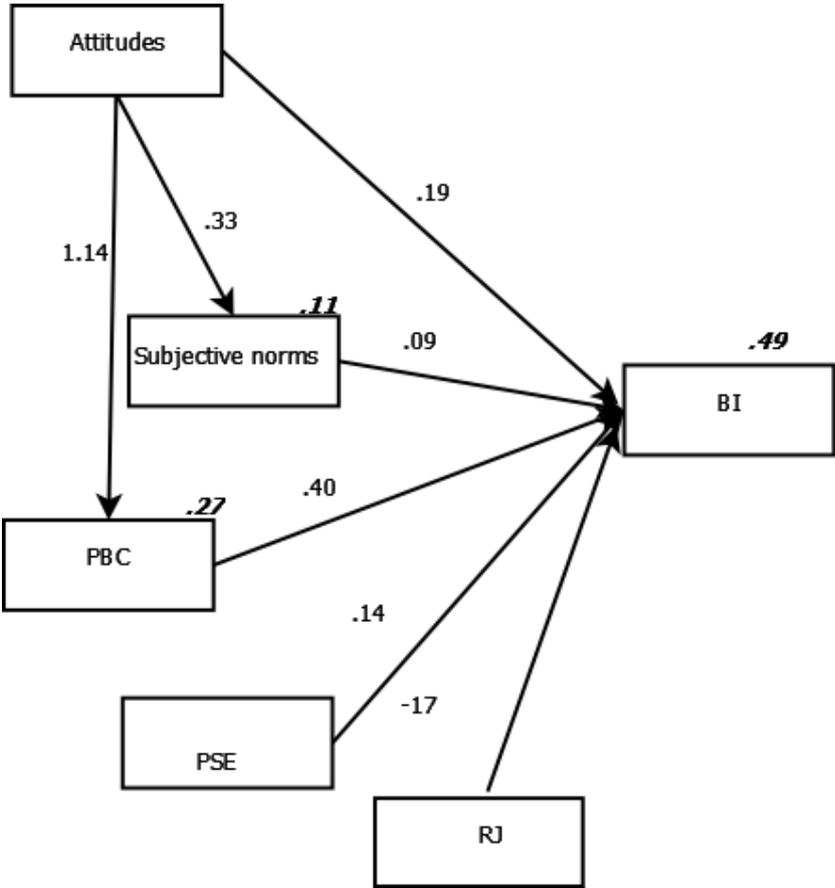


*Note: PBC – perceived behavioral control; PSE – perceived self-efficacy; RJ = risk judgment; BI – behavioral intention. *Bold values represent square multiple correlations;*

***Values between parentheses represent the values of the first and last model.*

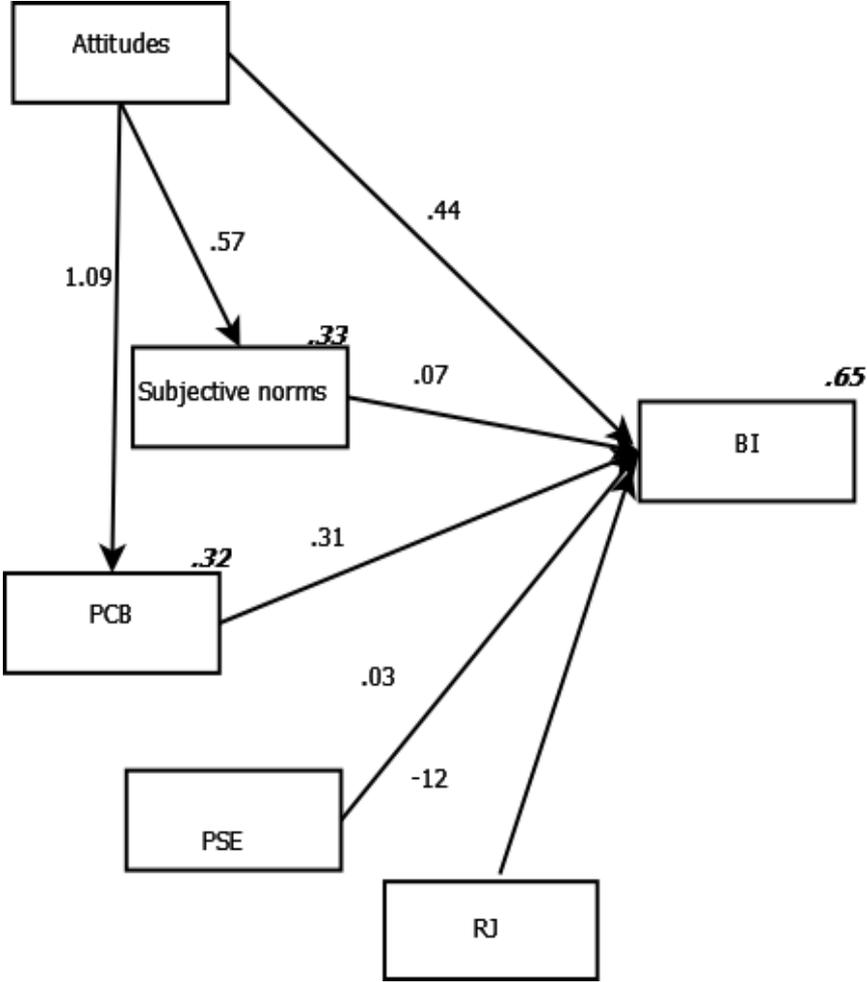
Figure 2

The Model for Run the Red Light Situation



Note: PBC – perceived behavioral control; PSE – perceived self-efficacy; RJ = risk judgment; BI – behavioral intention. *Bold values represent square multiple correlations

Figure 3 – The Model for Turn to Left Situation



Note: PBC – perceived behavioral control; PSE – perceived self-efficacy; RJ = risk judgment; BI – behavioral intention. *Bold values represent square multiple correlations.