

The effects of reinforcement sensitivity theory and illusion of control on reported
engagement in risky driving behaviours in Thailand

Chulalongkorn University, Thailand

Katherena Koh (5637553938)

Nattapat Kusoltammaratana (5637570538)

Tina Hager (5637574038)

Senior Project Submitted in Partial Fulfillment of the Requirements for the Degree of

Bachelor of Science in Psychological Science

Faculty of Psychology

Chulalongkorn University

Academic Year 2016

5637553938, 5637570538, 5637574038: BACHELOR OF SCIENCE KEYWORDS : DRIVING BEHAVIOURS / PERSONALITY / ILLUSION OF CONTROL / BEHAVIOURAL INHIBITION SYSTEM/ BEHAVIOURAL ACTIVATION SYSTEM / REINFORMENT SENSITIVITY THEORY / (KATHERENA KOH SHUAN LIN) : (NATTAPAT KUSOLTAMMARATANA) : (TINA HAGER) : FACTORS INFLUENCING GENERAL EDUCATIONAL COURSE SELECTION AMONG CHULALONGKORN UNIVERSITY STUDENTS, ADVISOR: DR. HARRY MANLEY, 25 pp

Abstract

This present study examined the effects of personality on driving behaviours, with illusion of control as a mediator in Thailand. Overall, there were three hypotheses: 1) People who are more sensitive to reward are more likely to engage in risky driving behaviours. 2) People who are more sensitive to punishment are less likely to engage in risky driving behaviours. 3a) Effects of reward sensitivity on driving behaviours will be mediated by illusion of control. 3b) Effects of punishment and driving behaviours will be mediated by illusion of control. A total of 75 participants participated in the study by voluntarily completing an online questionnaire made available through social platforms. The collected data was analysed by using the IBM SPSS statistical software. In conclusion, the present findings are inconsistent with the previous literature. Thus, none of the stated hypotheses have been supported.

Field of Study: Psychological Science

Student's Signature:

Academic Year: 2016

Student's Signature:

Student's Signature:

Advisor's Signature:

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Introduction

Background

The World Health Organisation (WHO) suggests that about 1.25 million deaths each year are caused by road accidents globally ("World Health Organization", 2016). Such accidents occur more frequently in low to middle income countries, with Asia showing one of the highest increase in accidents (Tanaboriboon & Satiennam, 2005). The World Health Organisation Thailand (WHO Thailand), stated that Thailand has the second highest road fatality rate worldwide ("World Health Organization Country Office for Thailand", 2017). The department of Local administration of the Thai police found that the total number of road accidents has risen strongly from about 18,445 cases in 1984, to 102,610 cases in 1994. These findings indicate that within 10 years, the number of accidents has risen by 456% (Suriyawongpaisal & Kanchanasut, 2003). Furthermore, approximately 24,000 people are killed in Thailand per year on road accidents, thus there are about 66 deaths daily ("World Health Organization Country Office for Thailand", 2017). In order to be able to find implementations to decrease these unnecessary traffic accidents, it is first important for us to fully understand the causes of these traffic accidents.

Thai driving culture

Thailand driving culture is considered to be unique. Many drivers are often reckless and overtaking is one of the most common problems on Thai roads (Royal Thai Police Central Information Technology Center, 2011). Roads are often congested and are known to be one of the most congested worldwide (WHO Thailand). During rush hours in Bangkok, cars can barely move 10-15km per hour or even have to stand still for hours (Office of Transport and Traffic Policy and Planning, 2013). Furthermore, about 26% of all road deaths can be attributed to alcohol (WHO). According to Sophana Srichampa (2014), buddhism is the most

believed religion in Thailand. Therefore, Thai drivers may over estimate their own capabilities as Thai people are culturally more dependable on superstition over their own karma. For instance, people from Thailand may believe in Amulets that are supposed to increase their own power and prosperity. The increase in one's prosperity, may also give magic power to gain confidence helping the individual to reach their goal faster. Thai people would believe that this would not be attainable without the amulet. Therefore, Thai people may have higher levels of illusion of control compared to other cultures. This may be reflected on the Thai driving culture. Thai people may overestimate their capabilities on the road by speeding and overtaking, which can also cause congestion (Srichampa, 2014).

Personality and Driving Behaviours

One important determinant of driving behaviour that might indirectly account for traffic accidents is personality characteristics (eg., impulsivity, fun seeking) (Furnham and Saipe, 1993; Ulleberg and Rundmo, 2003). Gray's (1987) reinforcement sensitivity theory(RST) is a biopsychology personality theory that underlie individual's differences in sensitivity to reward, punishment and motivation. RST has been used as a conceptual basis for investigating individual differences in driving behaviors (Castella and Perez, 2004; Constantinou et al., 2011; Ignjatovic and Todorovski, 2010; Voigt et al., 2009).

Gray's RST is divided into two components:

1. Behavioural activation system(BAS)
2. Behavioural inhibition system(BIS)

BAS

BAS is referred to as the reward system as it is sensitive to reward. The BAS includes brain regions such as cerebral cortex, thalamus and striatum (Gray,1991). These brain regions are known to be involved in regulating arousal. The system is responsive to conditioned and

unconditioned reward cues. It regulates approach behaviours and motivates one to engage in harmful behaviours that could lead to negative and undesirable consequences (Larsen & Buss, 2009). It is responsible for feelings such as happiness and hope in response to environmental cues consistent with non-punishment and reward, along with goal-achievement (Smillie et al., 2006). The primary function of the BAS is to move an organism towards appetitive (i.e., rewarding) stimuli. It consists of four subsystems: reward interest, reward reactivity, impulsivity, and goal-drive persistence (Corr, 2008; Corr & Cooper, 2013). In general, individuals who score high in BAS tend to be more impulsive and thus find it harder to inhibit their behaviours when approaching a goal. Impulsivity and sensation seeking relates to BAS (Torrubia et al., 2001). Research has shown that personality characteristics (sensation seeking and impulsivity) predicted an increase in accident involvement and more aggressive driving behaviours (Arnett, 1990, 1994; Dahlen et al., 2005; Machin and Sankey, 2008; Schwebel et al., 2006; Zuckerman, 1979).

Sensation seeking is defined as the seeking of varied, novel, complex, and intense sensations and experiences and the willingness to take physical, social, legal and financial risks (Zuckerman, 1994) has been associated with risky, drunk and aggressive driving (Jonah et al., 2001; Dahlen et al., 2005). While impulsivity is defined as the propensity to engage in behaviours without proper regard for consequences (Whiteside and Lynam, 2003). It has been found to relate with risky and aggressive driving, reduced ability to perceive traffic signs and more likely to crash (Dahlen et al., 2005; Renner and Anderle, 2000). For example, many surveys have been done and BAS has been found to be connected to traffic violations (Castella and Perez, 2004; Constantinou et al., 2011; Scott-Parker et al., 2013). Furthermore, it has been found that drivers who are high in BAS are more likely to commit driving violations due to a goal pursuit (rushing to somewhere) by engaging in impulsive behaviours

such as speeding or tailgating. Drivers who score high in BAS are reward driven and are less likely to think of the consequences.

BIS

The BAS and BIS both operate independently of one another. BIS is referred to as the punishment system. BIS is sensitive to signals of punishment, frustrative non-reward and novel stimuli (Carver and White, 1994; Gray, 1987; Torrubia et al., 2001). Like BAS, BIS also includes brain regions involved in regulating arousal; right frontal lobe areas and neocortical projections to the frontal lobe (Gray, 1991). However, unlike the BAS, BIS regulates avoidance behaviours. In general, individuals who score high in BIS may react more strongly and experience negative emotions such as fear, sadness and anxiety. BIS is also related to compliance (Castella and Perez, 2004); for example, drivers who are high in BIS are more cautious and thus may be more aware of the consequences of breaking the law. Compliance with the law and road rules will inhibit the individual engaging in risky driving behaviour. High sensitivity punishment would likely predict cautious, risk averse behaviours that reduce engagement in risky-driving behaviours such as speeding or driving under the influence of alcohol and drugs (Stephens & Ohtsuka, 2014).

The theoretical arguments on why these two motivational systems, BAS and BIS, might predict different driving behaviours is due to the individual differences in sensitivity to cues of reward and punishment. On the one hand, BAS motivates people to reach their goal regardless of the consequences attached to it. On the other hand, BIS inhibits harmful behaviours that will cause bad consequences in the long run. Based on this theory, it is predicted that individuals who score high in BAS will be more likely to engage in risky driving behaviours because of their impulsivity and the sensation-seeking that comes with it. They are more likely to speed and break the laws to get to their destination. While it is

predicted that individuals, who score low in BIS are naturally more cautious and they will do anything to avoid punishment, which in this case refers to getting fined, losing license, etc. (Castella and Perez, 2004). Thus, these individuals will not break the law or speed just to get to their destination, they will follow the rules and comply with the laws.

Illusion of control and risky driving behaviours

Illusion of control is defined as the tendency to overestimate one's ability to control situations and events. It is a bias that has been empirically linked to poorer judgments and increased risk taking behaviour (Langer, 1975). Illusion of control beliefs may also contribute towards aggressive driving behaviour as in a driving context, drivers with higher levels of illusion of control are more likely to (incorrectly) attribute driving success to their driving abilities (Hammond & Horswill, 2002; Horswill & McKenna, 1999). Thus, it can be assumed that overconfidence and overestimate of control may lead to risky driving behaviours. Furthermore, an Australian study found that driver's bias towards their own illusion of control predicted aggressive behaviour. Drivers who believed that they have higher illusion of control over the situation, were more likely to engage in risky and aggressive driving behaviours (Stephens & Ohtsuka, 2014).

Researchers have been interested to see if different types of personality affect the individual's driving behaviours. Using the RST as a personality theory basis, previous literature has shown that personality (BIS/BAS) does affect individual's driving behaviours. Castella and Perez (2004) carried out a study to find the relationship of Gray's personality theory (RST) and traffic violations. The study included 792 adults, who had driving licenses and drove frequently. Researchers found that individuals who scored high in sensitivity to punishment (BIS) and low in sensitivity to reward (BAS) were more likely to follow the rules and regulations, while individuals who scored high in sensitivity to reward (BAS) and low in

sensitivity to punishment (BIS) were more likely to go against the law. However, it was noted that sensitivity to reward (BAS) was a stronger predictor in motivating individuals to break the rules than was sensitivity to punishment in inhibiting subjects to go against the law.

Similarly, another study was carried out in 2011, to find out if personality such as sensation seeking impulsivity and sensitivity to punishment/reward can predict risky driving behaviours (accident involvement and traffic offences) among young drivers. The study involved 352 young Greek Cypriots (maximum age of 25) who were active drivers for at least a year. Results showed that personality did not directly affect driving outcomes, however personality had significant positive correlations with deviant driving behaviours. The researchers also found that young male drivers were more likely to have high risk traits such as sensation-seeking and impulsivity (Constantinou et al., 2011).

In 2013, an experiment was carried out to find how RST and perceived risk affect young drivers' reported engagement in risky driving behaviours. The experiment involved 165 Australian youth who held a valid Australian driver's license. Researchers found that individuals who scored high in BIS had higher perceived risk for risky driving behaviours. This can be attributed to the fact that individual high in BIS are sensitive to punishment and wanting to avoid the punishment (law enforcement, injury or death) of risky driving. Furthermore, Harbeck and Glendon (2013), also found that individuals who scored high in BAS-fun seeking had lower perceived risk for risky driving behaviours.

These researchers have shown that personality(BIS/BAS) does influence driving behaviours. However, most of such studies are often carried out in Western cultures. Thus, the current study aims to explore the link between BIS/BAS motivation systems, illusion of control and reported engagement in, risky driving behaviours specifically in Bangkok, Thailand. Based on previous findings, there are mixed results on the contribution of BIS/BAS in understanding risky driving behaviours. Some studies have found that BAS-drive has no

influence on driving behaviours (Voigt et al., 2009), However, other studies found that BAS fun seeking has been found to play a role in explaining risky driving behaviours (Brady, 2006; Miller et al., 2009; Voigt et al., 2009) and risky driving in males only (Scott-Parker et al., 2012).

Similarly, there are contradictions in BIS findings. Constantinou et al.'s (2011) reported findings that BIS was unrelated to risky driving behaviours while other research finds that BIS is associated to risky behaviours, however inferences are made based on small effect sizes (Miller et al., 2009; Voigt et al., 2009). It was found that drivers high in BIS (sensitivity to punishment) and low in BAS (sensitivity to reward) reported fewer violation of traffic rules (Castella and Perez, 2004). Therefore, based on these previous research findings and theories, the current study aims to look at 3 hypotheses.

Research Hypotheses

Hypothesis 1: People who are more sensitive to reward are more likely to engage in risky driving behaviours.

Hypothesis 2: People who are more sensitive to punishment are less likely to engage in risky driving behaviours.

Hypothesis 3a: The effect of reward sensitivity on driving behaviours will be mediated by illusion of control.

Hypothesis 3b: The effect of punishment and driving behaviours will be mediated by illusion of control.

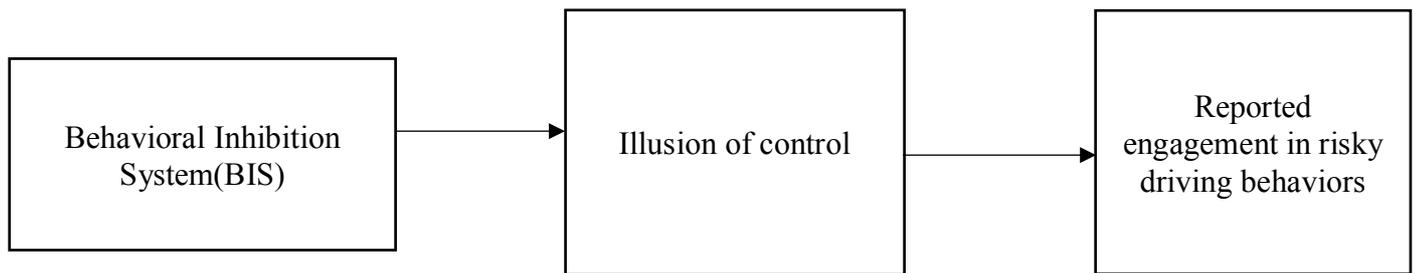


Figure 1. Path diagram showing effect of the predictor variable(BIS) on illusion of control, and reported engagement in risky driving behaviours.

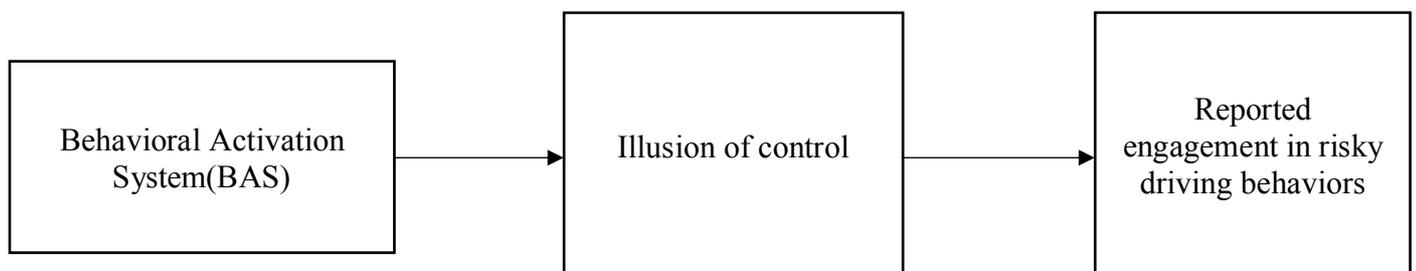


Figure 2. Path diagram showing effect of the predictor variable(BAS) on illusion of control, and reported engagement in risky driving behaviours.

Method

Participants and Recruitment

A sample of 75 Thai drivers completed the online questionnaire that was made available through social platforms. The inclusion criteria of our study include being Thai and having the ability to drive. The nature of the participation in this study was entirely voluntary and self-selected.

Following data collection, we excluded participants who did not complete the questionnaire. A total of 70 participants were used for analyses in this report. From this sample, the age ranged from 18 to 50 years old.

Materials

A total of three different questionnaires were adapted to suit the agenda required. These questionnaires included the Carver and White's (1994) BIS/BAS Inventory scale, the Dorn and Machin (2004) cognition-based scales from the learner driving experience questionnaire, and Davey, Wishart, Freeman, & Watson (2007) modified Manchester Driver Behaviour Questionnaire. All three questionnaires were translated from English to Thai using Brislin's classic back-translation method (Cha, Kim, & Erlen, 2007). Two bilingual translators independently translated the English versions to Thai, and then two other bilingual translators independently translated the Thai versions back into English. These translated English versions were then compared with the original English versions for concept equivalence. From a single iteration, translators selected the most equivalent translations and reached a consensus on the wording of all items.

Reported Risky driving behaviour questionnaire. This questionnaire is used to measure risky driving behaviour and to evaluate the connection between rewards sensitivity, punishment sensitivity and risky driving behaviours. The questionnaire is divided into three categories; errors, violation and aggression. A modified version of the driving behaviour questionnaire consisting of 20 items was used. Respondents were required to indicate on a six-point scale (0 = *never* to 5 = *nearly all the time*) how often they commit in the violations and errors in each category. There are 20 items in risky driving behaviour questionnaire, Errors (8 items) Highway Code Violations (8 items) and Aggressive Violations (4 items). Firstly, errors refer to unintentionally deviating from what is correct which can lead to accidents. For example, failure to check rear view mirror when changing lane, fail to notice

pedestrians are crossing in your path of traffic and when overtaking underestimate speed of oncoming vehicle.

Secondly, highway violation refers to the illegal driving; for example, exceeding the speed limit on a residential road or highway and driving even though you suspect you are over the legal speeding limit. Lastly, aggression violation refers to when the driver drives aggressively which increases the likelihood of others getting into an accident. For example, become impatient by slow driver and overtake on, become angered by another driver and show and sound your horn to indicate your annoyance at another driver. These three categories have a different impact on road safety and how the drivers think.

Illusion of control beliefs (IoC). We will use Stephens, & Ohtsuka (2014) 10 scenarios of driving accident risk. IoC is the tendency for people to overestimate their ability to control event therefore participants will be asked to rate the amount of control they have in each scenario. Ratings were on a 5-point Likert-type scale (1 = *no control, it's up to chance*, 5 = *completely controllable*). Higher scores on the scale show stronger IoC. For example, “losing control of your vehicle at a high rate of speed and crashing into another vehicle”, “backing into another vehicle while pulling out of a parking space” and “having your vehicle struck by a speeding hit and-run driver”.

Reinforcement sensitivity scale. The BIS/BAS Inventory scale by Carver and White (1994) will be used to measure reinforcement sensitivities. This scale consists of a total number of 20 items, which are divided into four categories; BIS (7 items), BAS Reward Responsiveness (5 Items), BAS Drive (4 items) and BAS Fun Seeking (4 items). Responses are measured using a 4-point Likert-scale (1= *strong agreement* to 4 = *strong disagreement*). No neutral response has been included in this scale. The BIS sensitivity scale consists of statements such as “I feel worried when I think I have done poorly at something” and “Criticism or scolding hurts me quite a bit.”. The BAS scales will give statements of potential

rewarding events. Participant's responses will then be recorded and further examined to measure reinforcement sensitivities.

The BAS Reward Responsiveness scale consists of items reflecting on participant's positive responses towards rewards that are either occurring ("When I see an opportunity for something I like, I get excited right away") or foreseen ("It would excite me to win a contest"). BAS Drive scale includes statements reflecting a continual ambition of reaching goals ("I go out of my way to get things I want"). The BAS Fun Seeking scale consists of statements reflecting one's ambition for new ("I'm always willing to try something new if I think it will be fun"), and potential rewarding events on the "spur of the moment" ("I often act on the spur of the moment") combined (Carver and White, 1994).

Demographics. Participants were asked to report demographics relating to their age, gender, nationality, years of driving experience, car ownership (e.g., Who does the car you most often drive belong to?), frequency of driving (e.g., How often do you drive?), level of license (eg., How long they have been holding on their license), accident history (eg., Have you been involved in a car accident before?), location of driving learning centre (eg., where did you learn driving from?).

Data Collection

For data collection, an online questionnaire created in Google Form will be used. Google form provided a unique web address that directed participants to the online questionnaire. The hyperlink to this unique web address was shared on several social media platforms including Facebook, Twitter, and Line chat. Using such online questionnaire is beneficial as it can be easily distributed towards other people. Also, Google Form gives easier access to participants who can not be met in person at that moment in time.

Data Analysis

The collected data were analysed using IBM SPSS statistical software on the following statistical methods: Descriptive analysis, Linear regression and PROCESS mediation analysis.

Linear regression will be used to test if the predictors (BIS, BAS, Illusion of control) will accurately predict driving behaviours. Furthermore, a mediator analysis will be ran using PROCESS in SPSS, to examine whether illusion of control mediates the effects of BIS/BAS to predict driving behaviours. *PROCESS* can also be used to test if the interaction between BIS and BAS will predict driving behaviours.

Results

Descriptive analysis

Descriptive statistics and zero-order correlations for the study are presented in Table 1 below. Subscales fun seeking ($r = .65, p < .01$), drive ($r = .79, p < .01$), reward responsiveness ($r = .76, p < .01$) was correlated to BAS. Furthermore, aggressive driving was not significantly correlated with BAS ($r = .13, n.s.$). Illusion of control was negatively correlated to aggressive driving ($r = -.24, p < .05$).

Table 1

Means, Standard Deviations, Reliability and Bivariate Correlations for personality variables, aggressive driving behaviour and illusion of control.

Variables	1	2	3	4	5	6	7
1.BIS	-						
2.BAS	.361**	-					
3.BAS Drive	.196	.791**	-				
4.BAS Fun	.133	.649**	.405**	-			

5.BAS RR	.415**	.764**	.452**	.100	-		
6. Aggressive driving	.150	.133	.153	-.141	.255*	-	
7. Illusion of control	-.016	.112	.171	.416**	-.242*	-.206	-
Mean	14.76	28.6	9.01	10.4	9.24	29.8	25.6
SD	3.17	6.80	2.42	3.05	3.80	11.4	15.4
Range	[7, 24]	[16,42]	[5,19]	[4,25]	[4,16]		
Reliability	.93	.86					.92

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

BIS = Behavioural Inhibition System, BAS = Behavioural Activation System, BAS RR = BAS reward responsiveness, BAS Fun= BAS fun-seeking

Table 2

Linear Regression for the effects of personality on driving behaviours

Variable	<i>B</i>	SEB	<i>t</i>	<i>p</i>	<i>R</i> ²
Step 1					
BIS	.74	.59	1.25	.22	.021
Step 2					
BIS	.60	.62	.96	.34	.009
BAS	.24	.30	.79	.43	
Total $R^2=.03$					

Note. *B*= Unstandardized beta, SEB= Standard error of beta

Simple Linear regression

A simple linear regression analysis was conducted to examine the effect of personality (BIS and BAS) on aggressive driving behaviours. The linear regression analysis established that personality (BIS and BAS) did not significantly predict aggressive driving behaviours, $F(2,70) = 1.08$, $p = .344$, with an R^2 of .030.

Mediation analysis using PROCESS

The relationship between personality and driving behaviour was not mediated by illusion of control. The predictors were mean-centered prior to the analysis. As Figure 3 illustrates, the unstandardized regression coefficient between personality and illusion of control was not statistically significant, as was the regression coefficient between driving behaviours and illusion of control. The indirect effect was -.02. We tested the significance of this indirect effect using bootstrapping procedures. Unstandardized indirect effects were computed for each of 10,000 bootstrapped samples, and the 95% confidence interval was computed by determining the indirect effects at the 2.5th and 97.5th percentiles. The bootstrapped unstandardized indirect effect was .84, and the 95% confidence interval ranged from -2.15, .106. This includes 0, therefore indicating that the indirect effect was not statistically significant.

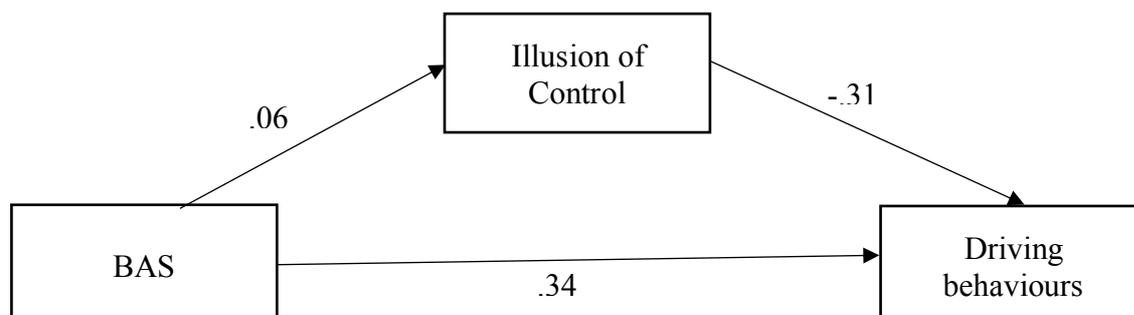


Figure 3. Unstandardized regression coefficients for the relationship between BAS and driving behaviours as mediated by illusion of control.

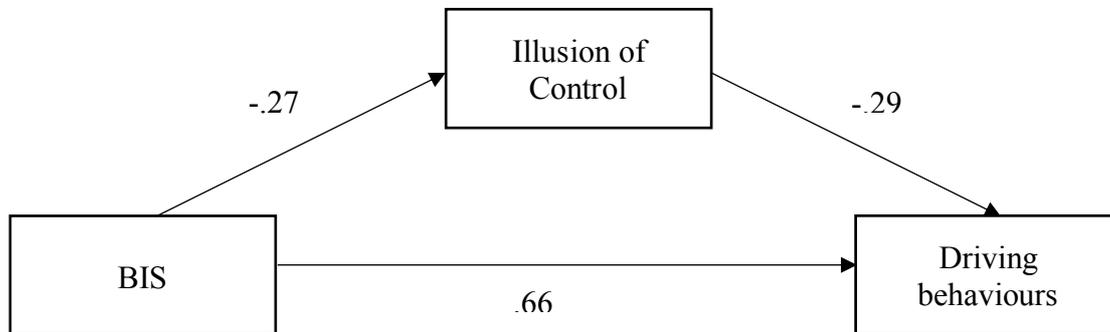


Figure 4. Unstandardized regression coefficients for the relationship between BIS and driving behaviours as mediated by illusion of control.

Discussion

The aim of the study is to examine relationship between personality, illusion of control, and driving behaviours in Thailand. According to Gray's theory (1987), people who score high in BAS are more likely to engage in risky driving behaviours. Hence, an impulsive behaviour might be acted out to be able to attain a goal pursuit such as reaching a destination on time by speeding, regardless of the consequences that may arise. (Castella and Perez, 2004; Constantinou et al., 2011; Scott-Parker et al., 2013). These present results are inconsistent with the previous research. Our first hypothesis was that people who are more sensitive to reward, are more likely to engage in risky behaviours; however, this hypothesis was not supported. Our findings suggest that people, who are more sensitive to reward, are not more likely to engage in risky driving behaviours. A possible explanation for this incongruent finding may be that, though personality may cause one to engage in more risky behaviour to gain reward sensitivity, it does not directly predict the likelihood of being involved in driving and traffic accidents (Furnham and Saipe, 1993; Ulleberg and Rundmo, 2003). Furthermore, it was noticed that our mean results of the BIS Reward responsiveness

was significantly lower from that of Harbeck et al (2013)'s. Our participants had relatively low reward responsiveness (mean = 1.85) as compared to Harbeck et al (2013), (mean = 3.37), thus it may have affected our results in finding an effect of high BAS on aggressive driving behaviours due to the nature of the participants. As participants may not respond well towards reward, therefore it makes it trickier to find an effect of BAS on aggressive driving. Also, BAS findings on previous research seem to have some inconsistencies. There are studies suggesting that BAS has no impact on ones decision to engage in risky driving behaviours (Brady, 2006; Miller et al., 2009; Voigt et al., 2009). Instead of engaging in risky driving behaviours, some may engage in other behaviours to obtain reward sensitivity.

The second hypothesis was that people, who are more sensitive towards punishment, are less likely to engage in risky driving behaviours. Nonetheless, our second hypothesis was not supported. Our findings indicate that people who are more sensitive to punishment, are not less likely to engage in risky behaviours. Previous research suggested that BIS is not always linked to risky driving behaviours (Constantinou et al., ,2011). This is contradicting to other research, which found that BIS is associated with risky driving behaviours (Miller et al., 2009; Voigt et al., 2009). Regardless of the level of BIS, individuals may still engage in risky driving behaviours as individual's perception of risky driving may differ. In addition, risky driving behaviour can still be carried out without having to disobey the law. This may cause the individual to feel as if they are not engaging in risky driving behaviours even though they do.

Lastly, the first part of the third hypothesis was that reward sensitivity and driving behaviours will be mediated by illusion of control; and reward punishment and driving behaviours will be mediated by illusion of control. No support for these hypotheses has been found. Our findings suggest that neither reward sensitivity and driving behaviours nor reward punishment and driving behaviours were mediated through illusion of control. These findings

suggest that having an illusion of control does not necessarily mean that a higher risk of engaging in risky driving behaviour has to occur. Some may still not engage in risky driving behaviour regardless of their over attribution towards their own driving skills. All in all, our findings revealed that none of our hypothesis have been supported.

Limitations and Future research

This study has several limitations that have to be discussed for further research. One of the primary limitation is the small sample size obtained. Some participants had to be excluded because not all parts of the questionnaire were answered which would have also affected the findings. Since the effect and sample size was small, the experiment was underpowered, thus making it impossible to detect an effect of personality on driving behaviours. A larger sample would allow one to detect any of the smaller effects. This is because when giving out the questionnaire, there was a human error when creating it. Due to human error, participants were not required to complete all responses; consequently, there were a number for missing responses, especially for age and gender variable which prevented us from controlling for these factors.

Secondly, there may have been response bias due to the questionnaire being self-report. This may be due to individuals tendencies to respond towards some questions in a certain way in comparison to others. For instance, when asked about personal experiences some participants might be more biased towards responding more positively about themselves than others. Future research should also consider a different measure other than using only questionnaires. Measures such as a driving app that can measure participants real driving behaviours on the road may be interesting as participants may not be truthful when reporting their driving styles themselves. This has not been used in the present study because no appropriate app was found suitable for the study. Furthermore, since most past research have

been based on questionnaires and self-report, it would be interesting to see if using other measures might reveal a different effect.

Thirdly, participants could do the questionnaire at any time, day and location during their own personal free-time. Therefore, it is unknown if there may have been environmental factors that have affected their responses. Environmental influences include being distracted by indirect factors that can influence behaviour. Factors could include being distracted by a friend while doing the survey, which could affect the participants attention of reading the questions and giving answers. If environmental factors would have been different, the answers given could be different. Future research can perhaps control and minimise different environmental influence by conducting the research in the lab. Fourthly, a simple conceptual framework was used rather than a structural equation modelling which might have been a more appropriate analysis technique given the multiple predictor variables (i.e., BAS and BIS) but this was beyond the scope of the current thesis and instead we ran two mediation models to test BIS and BAS separately. Further research can consider running a structural equation which is a more powerful way of detecting effects. Fifth, since most of such research on personality and driving behaviours have been conducted in the west, questionnaires of such are mostly available in English only. Thus, translating the questionnaire to Thai language was necessary as the experiment was specific to Thai participants. However, when translating, it is not possible to have the exact translation as the original version. Furthermore, there was one specific question that many participants were confused about. One plausible reason why the question ‘scraping the side of your vehicle while driving up to the drive-in window at the bank’ was confusing to many Thai participants may be due to the fact that there are no drive-in banks in Thailand, thus the unfamiliarity. Some participants gave feedbacks that they may not have fully understood every question and therefore may gave inaccurate responses. Further research on Thai

community may look into creating a completely new questionnaire and pilot study that would be specific to Thai people. Another suggestion would be to exclude questions that are not relevant to Thai people. Though the questionnaire may have not been overly long (50 questions), some participants reported it being too lengthy. When the results were examined, it was noticeable that responses seemed to be somewhat random towards the end of the questionnaire, which may further explain the findings of this study. Participants may have felt the 'survey fatigue' and thus this would have affected the results of the data collected.

Sixthly, the recruitment of participants through social media and social platforms may have led to an exclusion of individuals who do not have access to the computer and internet access. The prerequisite of having access to the internet may have resulted in limited socioeconomic diversity in our studied samples, and thus not being able to generalise our findings to a wider Thai drivers' population. However, online data collection methods facilitate access to people who may not be living in Bangkok metropolitan area or even people living outside of Bangkok. Lastly, demographic factors such as age and gender was not moderated due to methodological problems. Past research found a strong gender effect on risky driving behaviours due to the differences in personality between men and women (Norris et al., 2000) Men are more likely to be impulsive and sensation seeking than women, especially in younger age groups (Arnett, 1994). Thus, if demographic factors were controlled, results may have been different.

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Appendix

Reinforcement sensitivity scale

BIS

1. ถ้าฉันคิดว่าจะมีสิ่งไม่ราบรื่นกำลังจะเกิดขึ้นกับฉัน ฉันรู้สึกพร้อม
2. ฉันรู้สึกกังวลเวลาฉันทำพลาด
3. เวลาฉันโดนคำวิจารณ์หรือโดนต่อว่าฉันรู้สึกไม่ดี
4. ฉันรู้สึกกังวลหรือเศร้าเมื่อฉันคิดหรือรู้สึกว่ารู้อักคนที่โกรธฉันอยู่
5. ถึงสิ่งไม่ดีกำลังจะเกิดขึ้นกับฉัน ฉันก็ไม่รู้สึกกลัวหรือกังวล
6. ฉันรู้สึกกังวลเวลาฉันทำอะไรไม่ดีเท่าที่ควร
7. ฉันรู้สึกไม่กลัวเท่าไรเมื่อต้องเปรียบเทียบกับเพื่อน

BAS Reward Responsiveness

1. เวลาฉันได้ในสิ่งที่ฉันต้องการ ฉันรู้สึกตื่นเต้นและมีพลัง
2. เวลาฉันทำดีในสิ่งใด ฉันรักที่จะทำสิ่งนั้นต่อ
3. เมื่อสิ่งดีเกิดขึ้นกับฉัน สิ่งนั้นมีผลกระทบกับฉันมาก
4. ฉันคงรู้สึกตื่นเต้นดีถ้าฉันชนะการแข่งขัน
5. เมื่อฉันเห็นโอกาสที่จะได้ทำในสิ่งที่ฉันชอบ ฉันรู้สึกตื่นเต้นทันที

BAS Drive

1. เวลาที่ฉันอยากได้อะไรสักอย่าง ฉันมักจะทุ่มสุดตัวเพื่อจะคว้ามันมา
2. ฉันยอมขจัดใจตัวเองเพื่อให้ได้สิ่งที่ต้องการ
3. ถ้าฉันมีโอกาสได้ในสิ่งที่ฉันต้องการ ฉันจะใช้โอกาสนั้นทันที
4. เมื่อฉันต้องการอะไรสักอย่าง ฉันจะไม่สนใจข้อจำกัดของฉัน

Fun seeking

1. ฉันมักจะทำสิ่งต่างๆ เพียงเพื่อความสนุกเท่านั้นโดยไม่มีเหตุผลอื่น
2. ฉันโหยหาความตื่นเต้นและสิ่งใหม่ๆ
3. ฉันจะลองทำสิ่งใหม่ๆ เสมอถ้าคิดว่ามันสนุก
4. ฉันมักจะทำอะไรโดยไม่เตรียมตัว

Illusion of control scale

1. ฉันสร้างรอยขีดข่วนให้กับพาหนะระหว่างขับรถขึ้นไปทำหน้าที่ของรถอาคาร
2. เป็นผู้โดยสารในอุบัติเหตุร้ายแรงในพาหนะเป็นผู้ที่คนอื่นขับ
3. ประสบอุบัติเหตุและเสียชีวิตเนื่องจากไปขาดพลาด
4. โดนรถชนจากข้างหลังระหว่างหยุดอยู่ที่ไฟจราจร
5. ขับพาหนะข้ามชิ้นส่วนอันตรายที่ตกมาจากรถบรรทุกที่อยู่คันหน้า
6. ประสบอุบัติเหตุและเสียชีวิตเนื่องจากโดนมอเตอร์ไซด์ที่โดนระงับใบขับขี่ชน
7. เสียการควบคุมพาหนะในขณะที่พาหนะมีความเร็วจนไปชนกับพาหนะคันอื่น
8. ถอยหลังไปโดนพาหนะอีกคันระหว่างออกจากที่จอดรถ
9. พาหนะโดนคนอื่นชนและหนี
10. เกิดอุบัติเหตุร้ายแรงเนื่องจากเมาและขับ

Reported risky driving behaviour questionnaire

1. เร่งความเร็วจากไฟสัญญาณจราจรเพื่อให้เร็วกว่ารถคันข้างๆ
2. รู้สึกหมดความอดทนเพราะคนอื่นขับช้าหรือโดนแซง
3. รู้สึกและแสดงความโกรธเพราะคนอื่นขับรถช้า
4. บีบแตรเพื่อแสดงความรู้สึกความรำคาญที่มีต่อคนขับรถอีกคัน
5. ขับรถไปจี้เพื่อบ่งบอกอีกคันให้ขับเร็วขึ้น

6. อยู่ไหนทางที่กำลังจะปิดเพื่อจะได้ไปอีกเลน
7. ขับฝ่าทางแยกทั้งๆที่รู้ว่าไฟแดงแล้ว
8. ลื่นไถลขณะหยุดรถหรือเลี้ยวในถนนลื่น
9. รู้สึกโกรธเมื่อผู้ขับรถคันอื่นขับจี้
10. ออกจากทางแยกทั้งๆที่รู้ว่าจะทำให้จราจรติดขัด
11. ลืมดูกระจกข้างในขณะที่เปลี่ยนเลนส์
12. ลืมดูคนข้ามถนนข้างหน้าทางที่กำลังไป
13. ลืมหยุดหรือให้ทางตรงป้ายจราจร
14. ในขณะที่แข่งประมาทความเร็วของรถที่กำลังจะแข่ง
15. เกือบชนคนขี่จักรยานเวลาเลี้ยว
16. เกือบชนรถอีกคันในขณะที่จะเข้าสู่ทางหลัก
17. กำลังจะแข่งอีกคันแต่ไม่รู้ว่ารถคันนั้นกำลังเลี้ยว
18. ขับรถเกินความเร็วที่กฎหมายกำหนดในย่านผู้อยู่อาศัย
19. ขับรถเกินความเร็วที่กฎหมายกำหนดในทางหลวง