Modeling motivation and habit in driving behavior under lifetime driver's license revocation

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ABSTRACT

The purpose of the present study was to verify the motivational factors underlying the theory of planned behavior (TPB) predicting the driving behavior of lifetime driving license revoked offenders. Of a total of 639 drivers whose licenses had been permanently revoked, 544 offenders completed a questionnaire constructed to measure attitudes toward behaviors, subjective norms, perceived behavioral control, behavioral intentions (the key constructs of the TPB), and previous driving habit strength. The finding of the study revealed that an offenders' driving behavior after a lifetime license revocation was significantly correlated to behavioral intention ($R = 0.60$, $p < 0.01$), perceived behavioral control ($R = 0.61$, $p < 0.01$), previous driving habit ($R = 0.44$, $p < 0.01$), and attitude ($R = 0.41$, $p < 0.01$). There was no evidence that subjective norms including road regulation, society ethics, and people important to offenders had an influence on driving behavior ($R = 0.03$). Low driving habit strength offenders are motivated to drive because of behavioral intention, whereas strong driving habit strength offenders are motivated to drive because of perceived behavioral control. Previous driving habit strength is a moderator in the intention–behavior relationship. The model appeared successful when previous habits were weak, but less successful when previous habits were strong.

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1. Introduction

Many drivers given a sentence of license suspension/revocation (S/R) continue to drive, but at reduced levels (Hagen et al., 1980; Ross and Gonzales, 1988). Ingraham and Waller (1971) found at least 30% of drivers given S/R for drunk-driving continued to operate a vehicle in spite of the licensing action. Williams et al. (1984) concluded that 65% of drivers admitted to operating a vehicle after a license S/R. Ross and Gonzales (1988) reported that 66% of the drivers whose licensing were suspended were still driving. DeYoung (1999) estimated that as many as 75% of S/R licensed drivers continue to drive, although they apparently drove less often and more carefully. Malenfant et al. (2002) showed the percentage of motorists driving while suspended was 57% of the expected value, relative to their representation among all drivers. Chang et al. (2006) found that 86% of offenders continued to drive, but with significantly reduced driving activities and mileage. The general approach of S/R, a driver-based sanction, was intended to keep offenders off the road during their restriction periods. In the case of short term S/R, although many S/R drivers violate driving restriction and continue to drive, most prior research has focused on the effectiveness of S/R and supported the view that this is a positive step in reducing subsequent alcohol-involved driving by offenders (Zador et al., 1989; Henderson and Kedjidjian, 1992; Lund, 1993; Sweedler and Stewart, 1993; NHTSA, 1993). However, few studies have explored motivational factors causing offenders to drive while under license S/R. Furthermore, as S/R is usually awarded for no more than a few years, few studies have explored S/R over a longer period of time (Siskind, 1996). Thus, it seems that no study has explored the motivational factors underlying the behavior of driving under a long-term S/R. In the case of administrative lifetime license revocation (ALLR) in Taiwan, the basic goal is to maintain road safety by keeping such disqualified drivers off the road allowing them no opportunity for rehabilitation in the licensing system design. Chang et al. (2006) explored the effectiveness of ALLR; however, no study has explored the motivational factors of driving while under a lifetime license revocation. Therefore, the motivational or suppressive factors leading to drive under ALLR remain unclear.

Car use is important for many household activities in western developed societies as well as developing countries such as Taiwan. Households use cars for traveling to various activities (Eriksson et al., 2008). In the last three decades, considerable progress has

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been made in explaining and predicting the initiation of human behaviors as revealed by currently popular attitude-behavior models (e.g. Fishbein and Ajzen, 1975; Ajzen, 1991). Support for the efficacy of the theory of planned behavior (TPB) has been successfully found in the context of common driving behaviors relating to road safety such as seat belt use (Jonah and Dawson, 1982; Budd et al., 1984; Thuen and Rise, 1994; Şimşekoğlu and Lajunen, 2008), the use of a car child restraint device (Godin and Kok, 1996), pedestrian road crossing behavior (Evans and Norman, 1998; Moyano Díaz, 2002), speeding (Parker et al., 1992a; Forward, 1997; Elliott et al., 2003; Letirand and Delhomme, 2005; De Pelsmacker and Janssens, 2007; Warner and Åberg, 2008), drunk-driving (Parker et al., 1992a; Åberg, 1993; Parker et al., 1996; Sheehan et al., 1996; Gordon and Hunt, 1998; Marcil et al., 2001; Armitage et al., 2002), aggressive driving (Parker et al., 1995, 1998; Miles and Johnson, 2003), and driving violations (Parker et al., 1992b,c, 1995; Forward, 2006). TPB has been found to be a useful model for organizing and understanding potential factors that influence intention to engage in safe driving behavior and law compliance (Yagil, 1998; Gordon and Hunt, 1998; Poulter et al., 2008). An extended TPB seems a valuable framework for understanding and changing people's safety related actions in traffic (Victoir et al., 2005).

According to TPB, travel mode choice is determined by attitude, subjective norm, perceived behavioral control, and behavioral intention (Ajzen, 1991; Bamberg and Schmidt, 2001, 2003). Although these research efforts have explained more of the reason-based and deliberate nature of behavior, one important aspect has been overlooked in research, namely, the fact that many of the aforementioned behaviors are executed on a daily, repetitive basis, and therefore may become routine or habitual. Life consists largely of daily routines (Huff and Hanson, 1986; Pas, 1988; Eagly and Chaiken, 1993), and travel mode choice may also be determined by habits (Bamberg and Schmidt, 2003; Verplanken and Orbel, 2003). Therefore, it is proposed that when behavior is performed repeatedly and becomes habitual, that behavior is guided by an automated cognitive process, rather than being preceded by an elaborate decision making process (i.e. a decision based on attitudes and intentions) (Aarts et al., 1998). Habit has been perceived as an automatic link between a goal and a specific behavior (Verplanken and Aarts, 1999; Aarts and Dijksterhuis, 2000), or as a behavioral script stored in memory (Schank and Abelson, 1977; Abelson, 1981; Schank, 1982; Gärling et al., 2001; Fujii and Gärling, 2003). Habitual behavior, in contrast to more deliberately controlled behavior, demands only a small amount of attention, and the individual's control over behavioral intention as well as the behavior itself is minor (Bargh, 1994). Habitual car use has been demonstrated in several studies (Verplanken et al., 1994, 1998; Eriksson et al., 2008; Heath and Gifford, 2002; Klöckner et al., 2003). A strong habit to use a particular travel mode is, in comparison with a weak habit, characterized by seeking less information and a less elaborate choice of travel mode (Aarts et al., 1997). Verplanken et al. (1998) found that both habit and intention were significant predictors of car use among drivers who were encouraged to deliberately think about travel mode choice. In accordance with TPB, researchers expected that attitudes towards choosing to use one's car, together with subjective norm and perceived behavioral control, would predict behavioral intentions, which in turn were expected to predict future behavior.

The present study is concerned with the motivational factors of driving behavior using components of TPB as well as the previous habitual nature of drivers driving activity under ALLR as an example of a repetitive behavior. ALLR may be an example of a repetitive behavior that is motivated by behavioral intention and previous driving habit. This study has two goals. The first is to investigate the motivational factors that correlate to actual driving incidence while under ALLR. The second is to ponder the role of habit in

attitude-behavior models. For these goals, the researchers focused on the relationships between behavior and reason-based antecedents (i.e. as defined by TPB) on one hand and behavior and habit strength on the other hand. The present study aimed to examine the psychological factors predicting the actual driving behavior of offenders who had been punished by ALLR. For the first goal, we adopt the TPB model, which include attitude, subjective norm, perceived behavior control, behavioral intention, previous driving habit and behavior. For the second goal, the researchers explored the TPB model's ability to predict behavior under different driving habit strength (i.e. strong habit, moderate habit, and weak habit). It is expected that offenders with strong habit will report higher driving behavior while under ALLR. It is also expected that the TPB model perform more predict ability for weak habit than strong habit participants.

2. Method

2.1. Outline of the planned behavior model and previous habit

The TPB, or adaptations of it, is the most often used theoretical framework of models explaining traffic safety behavior. In present study, the conceptual model is represented in Fig. 1. The TPB contends that behavioral intentions to engage in a behavior is the main predictor of actual driving behavior, and that behavioral intentions are influenced by attitudes towards that behavior, subjective norms (i.e., whether important others would approve or disapprove of the behavior) and perceived behavioral control (Ajzen, 1991). Attitudes are generally defined as consisting of cognitive and affective components or antecedents. In present study, offenders may rationally understand that driving under ALLR is not good or unsafe, but at the same time they may like to drive, because it gives them a good feeling or they feel deserved to drive. Subjective norm is part of the TPB, and reflects the offenders' perceived social pressure (what individuals believe other people think they should do). According to the TPB, the perceived opinion of significant others (subjective norm) can influence intentions and behavior. Perceived behavioral control represents an effect on intention to perform a behavior that is not mediated by attitude or subjective norm (Ajzen, 1988; Ajzen and Madden, 1986). While some researchers have suggested that car use may be habitual (e.g. Verplanken et al., 1994; Bamberg and Schmidt, 2003), the present study hypothesis that habit formation leads to 'automatic' that may deliberately lead to actual driving behavior. Therefore, habit may act as a moderator of the intention–behavior relationship. And intentions and behavior are also determined by perceived behavioral control and by habit formation.

2.2. Data and participants

Data were collected from a previous ALLR study (Chang et al., 2006) conducted in July 2003, and a follow-up questionnaires survey conducted three months after the first responses. The previous ALLR study investigated a sample of 768 volunteer ALLR offenders who had been involved in either a hit-and-run offence causing death/or injury, or a drunk driving offence causing death/or serious injury from 1993 to 2002 in Taiwan. Only 16.8% of ALLR offenders gave up driving entirely after the ALLR was imposed. The sample population of the present study focused on the 83.2% of ALLR offenders continuing to drive. Since these ALLR offenders were expelled from the Department of Motor Vehicles, objective records of driving behaviors are not available. The follow-up questionnaires were directly mailed to these 639 still driving ALLR offenders and their self-report data were collected. After a two-wave trialed telephone to these volunteered offenders, 563 offenders returned their
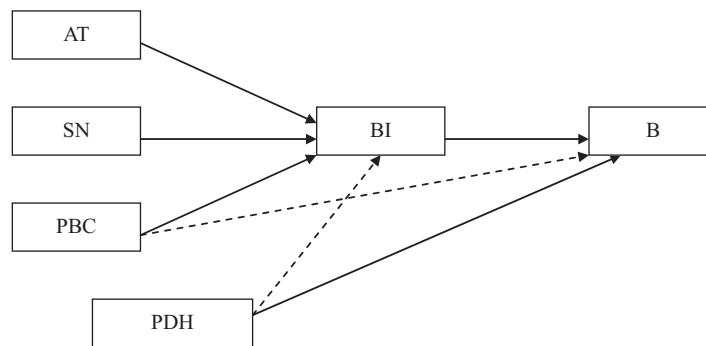
Fig. 1. The framework of the planned behavior model and previous driving habit. AT: attitude; SN: subjective norm; PBC: perceived behavioral control; BI: behavioral intention; PDH: previous driving habit; B: behavior.

questionnaires with a return rate of 88%. Finally, a total of 544 ALLR offenders effectively completed this follow-up investigation and used in this study. The participants consisted of 98.5% males and 1.5% females. Over 80% were not college educated, and 70% were under age 40. Of this group of participants, 23.9% held professional driver's licenses (professional license is defined as a license which qualifies a driver to dedicate driving as a job, including driving a car, a truck or a bus according to these different driving vehicles' requirements distinctively) and 76.1% held ordinary driver's licenses.

The self-report data on attitudes, subjective norms, perceived behavioral control, behavioral intention, and previous driving habits were collected from the previous study (Chang et al., 2006). The actual driving behavior including offenders' driving frequency and annual mileage driven under ALLR was investigated in the current follow-up survey. All items were coded using a 7-point scale. Measures of attitudes, subjective norms, and behavioral intention toward driving under ALLR were constructed according to the procedures employed by Ajzen and Fishbein (1980), whereas the measure of perceived behavioral control was designed according to Ajzen's collaborative work (Ajzen and Madden, 1986; Ajzen, 1991; Beck and Ajzen, 1991). The measure of actual driving behavior was self-reported by the participants concerning driving frequency. Self-report driving frequency was defined from very-high frequency to very-low frequency.

Table 1 outlines the observed variables and question items of the present study. The measure of attitudes were based on four semantic differentials (e.g., good or bad; safe or unsafe), and assessed the respondent's positive or negative evaluation of driving under ALLR. The four items were averaged to obtain the scale score. The internal consistency of the scale was 0.88. The subjective norms were measured by six questions assessing the respondent's evaluation of his referent opinions regarding actual driving behavior in the described situation. The average of the six items corresponds to the score of this scale. Cronbach's alpha was 0.82. The perceived behavioral control construct included four items that were averaged to obtain the scale score. This measure assessed the respondent's perception of control over driving after ALLR. The internal consistency of this scale according to Cronbach's alpha was 0.93. The measure of behavioral intention included two items measuring the strength of the respondent's intention to drive after ALLR. Responses to the two items were averaged to obtain the score on the scale. Internal consistency as measured by Cronbach's alpha was 0.92. The researchers operationalized the measurement for habit strength so that the measurement would match the concept of a generalized type of habit. Thus, the response-frequency (RF) measure of general habit strength which was used and validated in a number of earlier studies (Aarts, 1996; Aarts et al., 1997; Verplanken et al., 1998) was adopted. While Verplanken and Aarts

(1999) suggested that an important feature of habitual behavior is automaticity of responding, present participants responded to 10 items that varied widely in travel purposes (e.g. going to the market, visiting friends/relatives). The researchers assumed that the more invariant participants' responses were the stronger the habit strength was thus indexed by the mean of the 10 items. The measure of habit strength had high internal consistency (Cronbach's alpha = 0.94) which revealed the reliability is good. In order to justify the variation is a good representation of the habitual behavior. The researchers further to confirm weather the validity is acceptable or not. After conducting the "Principal components analyses", a two-dimensional structure appeared. There were two eigenvalues greater than 1 (6.601 and 1.070). The first component including habit measure items from 1 to 8 accounted for 55.803% of the variance and the second component including habit measure items from 9 to 10 accounted for 20.907% of the variance, totally accounted for 76.710% of the variance. Finally, it is concluded that this variation in present study is a good representation of the habitual behavior.

3. Results

3.1. Correlations of motivational driving factors under ALLR – combine the planned behavior theory and habit

Correlations were calculated between driving attitudes, subjective norms, perceived behavioral control, behavioral intention, previous driving habit, and actual driving behavior measures. These correlations are shown in Table 2. The results indicate that actual driving behavior was correlated with attitude ($R = 0.41$, $p < 0.01$), perceived behavioral control ($R = 0.61$, $p < 0.01$), previous driving habit ($R = 0.44$, $p < 0.01$), and behavioral intention ($R = 0.60$, $p < 0.01$). Among these significant correlative variables, perceived behavioral control and behavioral intention were the two most important factors correlated with actual driving behavior. The results indicate that the respondents think driving a car is a need, and whenever needing to drive, respondents will drive even if a license had been revoked. Also, most respondents think driving under ALLR is easy and possible. Attitude and previous driving habit were also significantly correlated with actual driving behavior. The results indicated that behavioral intention was significantly correlated with attitude ($R = 0.36$, $p < 0.01$), perceived behavioral control ($R = 0.65$, $p < 0.01$), and previous driving habit ($R = 0.47$, $p < 0.01$) such that the respondents who reported experiencing a more positive affect, more need to drive, and higher prior driving habit strength over driving under ALLR, also reported stronger intentions. However, the results indicate that subjective norms are not related to behavioral intention ($R = 0.07$) as well as actual driving behavior ($R = 0.03$). No matter the respondent's perceptions of approval or restriction to drive,

Table 1
Observed variables and question items ($N = 544$).

Factors	Item	Cronbach's alpha	Questions	Scoring
Behavior	1	–	Although your license was revoked, you drove with _ frequency after ALLR.	7 = very high, 1 = very low
Behavioral intention	2	0.92	Although your license was revoked, you _have to drive in the future. Although you license was revoked, you _will drive in the future.	7 = extremely likely, 1 = extremely unlikely
Attitude	4	0.88	You think to drive under ALLR is _ good. You think to drive under ALLR is _ convenient. You think to drive under ALLR is _ deserved. You think to drive under ALLR is _ safe.	7 = extremely likely, 1 = extremely unlikely
Subjective norm	6	0.82	Most people important to you would _ agree you to drive. Those who important to you, their opinion have _ the influence on you. Your societies _ agree you to drive under ALLR. Your societies have _ influence on you for driving under ALLR. Regulations _ agree you to drive. Regulations _ influence you to drive.	7 = extremely likely, 1 = extremely unlikely
Perceived behavioral control	3	0.93	Driving under ALLR is _ easy for you. Driving under ALLR is _ possible for you. Whenever you have to go somewhere, you will _ choose driving a car.	7 = extremely likely, 1 = extremely unlikely
Previous driving habit[a]	10	0.94	You _ drive a car to go around somewhere market. You _ drive a car to visit your friends/or relatives. You _ drive a car for shopping. You _ drive a car to have your dinner. You _ drive a car to transport your kids or families. You _ drive a car to go around somewhere downtown. You _ drive a car for leisure activities on weekdays. You _ drive a car for leisure activities on weekends. You _ drive a car for commuting to work. You _ drive a car for business.	7 = extremely likely, 1 = extremely unlikely

[a] Participants were requested to response as soon as possible, and not think too much or take too much time to respond.

these perceptions had no influence on both behavioral intention and actual driving behavior.

3.2. Motivational driving factors under ALLR

According to the planned behavior theory, driving behavior under ALLR should be predicted by motivational components. Given that the dependent variable "driving frequency under ALLR" has an ordinal nature, with seven possible outcomes (from 1 = very low to 7 = very high). Ordinary least squares are seldom appropriate for such data since it requires a continuous dependent variable. An ordered-response model appears the most appropriate approach. The ordered-discrete choice models (i.e., the ordered logit modes) have been employed by several researchers (see, for example, Pai and Saleh, 2008; Neyens and Boyle, 2008) for modeling injury severities. Therefore, the ordered logit model was adopted to estimate the motivational factors of driving behavior under ALLR. The theoretical framework of the ordered logit model and method of evaluation has thoroughly discussed in several studies (e.g., Long, 1997; Borooah, 2001). The actual driving behavior under ALLR was modeled as a function of the attitudes, subjective norms, perceived behavioral control, behavioral intention and previous driving habits, was created and verified the motivational driving factors under ALLR. The researchers examined whether actual

driving behavior formed as a result of the variables of TPB. The results presented in Table 3 indicate that attitudes, perceived behavior control, behavioral intention and previous driving habits account for around 49% (Pseudo $R^2 = 0.487$) of the total variance in actual driving behaviors. A closer look at these results indicated that behavioral intention ($\beta = 0.718$, $p = 0.000$) and perceived behavioral control ($\beta = 0.651$, $p = 0.000$) are the two most important factors in the determination of actual driving behavior. Previous driving habits ($\beta = 0.141$, $p = 0.049$) and attitudes ($\beta = 0.266$, $p = 0.004$) also significantly influence actual driving behavior. The results indicate that subjective norms ($\beta = -0.022$, $p = 0.841$) are not significantly associated with actual driving behavior.

3.3. Motivational driving factors under ALLR – TPB model with different driving habit strengths

In this section, the effects of the TPB model while under various driving habit strengths are explored. Previous studies classified participant's habit strength into different levels mainly by use of the participants' standard deviation (i.e. at one standard deviation below the mean: weak or no habit; at the mean: moderate habit; and at one standard deviation above the mean: strong habit; Aiken and West, 1991; Gardner, 2009). In the present study, the respondent's habit strength was divided by sequence into three groups

Table 2
Correlation among theory of planned behavior variables ($N = 544$).

Study variable	Mean	S.D.	1	2	3	4	5	6
1. Behavior	4.7	1.9	–					
2. Behavioral intention	6.1	1.2	0.60**	–				
3. Attitudes	3.8	1.0	0.41**	0.36**	–			
4. Subjective norms	3.9	0.7	0.03	0.07	−0.04	–		
5. Perceived behavioral control	5.7	1.4	0.61**	0.65**	0.43**	0.002	–	
6. Previous driving habits	4.8	1.4	0.44**	0.47**	0.49**	−0.023	0.47**	–

** $p < 0.01$.

Table 3
Ordered logit model estimation results: prediction of behavior by intension, attitudes, subjective norms, PBC and previous driving habits – all participants, $N = 544$, average annual mileage = 14,370 km.

Variables	β	S.E.	Wald	Significance (P)	95% C.I.
Intension	0.718***	0.098	53.782	0.000	0.526 to 0.910
Attitudes	0.266***	0.093	8.126	0.004	0.083 to 0.448
Subjective norms	−0.022	0.110	0.040	0.841	−0.237 to 0.193
PBC	0.651***	0.084	60.730	0.000	0.487 to 0.815
Previous driving habits	0.141*	0.072	3.851	0.049	0.000 to 0.282

Nagelkerke Pseudo $R^2 = 0.487$; Cox & Snell Pseudo $R^2 = 0.475$; Log-likelihood: 1674.296; β: regression coefficients; S.E.: standard error of β.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

Table 4
Ordered logit model estimation results: prediction of behavior by intension, attitudes, subjective norms and PBC – high habit strength, $n = 180$, average annual mileage = 16,945 km.

Variables	β	S.E.	Wald	Significance (P)	95% C.I.
Intension	0.439*	0.205	4.571	0.033	0.037 to 0.841
Attitudes	0.136	0.150	0.820	0.365	−0.158 to 0.431
Subjective norms	−0.038	0.166	0.052	0.819	−0.364 to 0.288
PBC	0.563***	0.145	15.067	0.000	0.279 to 0.847

Nagelkerke Pseudo $R^2 = 0.241$; Cox & Snell Pseudo $R^2 = 0.231$; Log-likelihood: 439.195; β: regression coefficients; S.E.: standard error of β.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

Table 5
Ordered logit model estimation results: prediction of behavior by intension, attitudes, subjective norms and PBC – moderate habit strength, $n = 184$, average annual mileage = 13,258 km.

Variables	β	S.E.	Wald	Significance (P)	95% C.I.
Intension	0.782***	0.168	21.713	0.000	0.453 to 1.112
Attitudes	0.579**	0.184	9.917	0.002	0.219 to 0.940
Subjective norms	−0.087	0.181	0.230	0.631	−0.442 to 0.268
PBC	1.046***	0.177	35.076	0.000	0.700 to 1.392

Nagelkerke Pseudo $R^2 = 0.420$; Cox & Snell Pseudo $R^2 = 0.407$; Log-likelihood: 614.850; β: regression coefficients; S.E.: standard error of β.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

with each group containing a similar number of respondents. The reason for this is that the grouping will reduce the variance of the respondents' habit strength. If these results represent habit strength influence on behavior, then the relationship of habit and behavior can be more easily conceived. Therefore, all respondents were classified into three habit strength groups including a high driving habit strength group, a moderate driving habit strength group, and a weak driving habit strength group. Tables 4–6 reveal the actual driving behaviors regressed on attitude, perceived behavioral control, and behavioral intention for the three driving habit strength groups. For the high habit strength group, perceived behavioral control ($\beta = 0.563$, $p = 0.000$) is the most important factor that influenced actual driving behavior. However, for the low habit strength group, behavioral intention ($\beta = 0.822$, $p = 0.000$) is

the most determinant factor on actual driving behavior. Attitudes are significantly associated with the participants' actual driving behavior for moderate habit strength ($\beta = 0.579$, $p = 0.002$) and low habit strength ($\beta = 0.401$, $p = 0.009$) groups. There was no evidence that subjective norms have an influence on the respondents' driving behavior no matter whether driving habits are strong or not ($\beta = -0.038$, $p = 0.819$; $\beta = -0.087$, $p = 0.631$; $\beta = 212$, $p = 0.412$ for strong, moderate and low habit strength, respectively).

The strength of the associations with actual driving behavior was correlated with perceived behavior control, behavioral intention and attitude, but not the norms in all three habit strength groups. The association between behavioral intention and actual driving behavior should become weaker while driving habit strength was high. The association between behavioral intention

Table 6
Ordered logit model estimation results: prediction of behavior by intension, attitudes, subjective norms and PBC – low habit strength, $n = 180$, average annual mileage = 4,349 km.

Variables	β	S.E.	Wald	Significance (P)	95% C.I.
Intension	0.822***	0.153	29.013	0.000	0.523 to 1.121
Attitudes	0.401**	0.154	6.786	0.009	0.099 to 0.703
Subjective norms	0.212	0.258	0.674	0.412	−0.294 to 0.718
PBC	0.469***	0.128	13.466	0.000	0.218 to 0.719

Nagelkerke Pseudo $R^2 = 0.593$; Cox & Snell Pseudo $R^2 = 0.582$; Log-likelihood: 566.727; β: regression coefficients; S.E.: standard error of β.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

and actual driving behavior become stronger while habit strength was weak. While taking a closer look at the Pseudo R^2 of the three models, 0.241, 0.420 and 0.593 for high, moderate and low habit strength group, respectively, the TPB model accounts for a higher percentage of the total variance of the actual driving behavior while previous habit strength was weak, and vice versa.

4. Discussion

While facing a serious traffic violation problem, traffic authorities commonly adopt a deterrent of increasing the penalty for such serious traffic offence. The penalties include car-based sanctions and driver-based sanctions. In driver-based sanctions, the most serious penalty for an offender is a lifetime driver's license revocation. Such a deterrent has the aim of maintaining road safety by suspending serious traffic offenders, and offering no opportunity for the offender to re-enter the licensing system even when they demonstrate an ability and willingness to follow the regulations of road and society. However, in a modern society many economic and social activities rely on driving a vehicle to fulfill living purposes. Many previous studies, based on a short-term license S/R, have found that drivers continued to drive but at reduced levels (Hagen et al., 1980; Ross and Gonzales, 1988; Smith and Maisey, 1990; Voas and DeYoung, 2002). In the case of lifetime driver's license revocation, drivers are in the same situation as a short-term license S/R, and have to seek an alternative efficient way of going to work, shopping, visiting relatives/friends, and for leisure purposes. Such an alternative system of transportation must continue for a relatively longer time, in some cases, the rest of life. To endure such a long alternative system of transportation is more difficult than that of a shorter suspension period. Therefore, the hypothesis that the ratio of lifetime license revocation offenders continuing to drive is greater than the ratio for a short-term license revocation is a logical assumption. Chang et al. (2006) found that lifetime driver's license revocation offenders who continued to drive (83.2%) were higher than that in previous findings allowing the conclusion that complying with a short-term license S/R may be relatively easy for most people while a lifetime suspension of driving privileges may be too much for drivers to endure. However, there is almost no study explored the motivational factor influence on offender's driving, no matter under a short-term S/R, a long-term license S/R or lifetime license revocation. Present study applied TPB model as well as habit strength to specific instances of aberrant behavior and successfully explored the motivational factors, which influence offenders to drive a vehicle after their licenses had been revoked for lifelong.

The present study results revealed that the significant motivational factors correlated to driving after ALLR are behavioral intention ($R = 0.61$), perceived behavioral control ($R = 0.60$), previous driving habit ($R = 0.44$), and attitude ($R = 0.41$); the former two factors having the highest and the second highest influential roles. This finding is consistent with what the TPB contends in that intentions to engage in a behavior is the main predictor of actual behavior, and behavioral intentions are influenced by attitudes towards that behavior, subjective norms (i.e., whether important others would approve or disapprove of the behavior), and perceived behavioral control (Ajzen, 1991). Empirical tests of intention–behavior correlative studies show that intention is reliably associated with behavior (i.e., Webb and Sheeran, 2006). Armitage and Conner (2001), in a meta-analysis of 185 studies that have used the TPB, also found that the sample-weighted average correlation between measures of intention and behavior was 0.47. The intention–behavior correlation of the present ALLR case is higher than the average of previous findings. Moreover, the present study is based on offenders of serious traffic offences.

Perceived behavioral control is the second strongest influential factor motivating actual driving behavior after ALLR. Present results indicated that respondents deem driving after ALLR is a need, and when drivers perceive a need to drive or desire to accomplish living activities via driving a vehicle, respondents will drive. Attitudes were also a significant factor influencing actual driving behavior. Many respondents think driving under ALLR is safe and convenient and continue to drive. Attitude usually plays an important role in car use and travel mode choice as the findings of this study indicate and are consistent with previous findings (Ajzen, 1991; Tertoolen et al., 1998). The present study is also consistent with the findings of previous studies in that the rate of traffic law violations is influenced by the level of law enforcement, and as long as the perceived threat of detection remains low, traffic violators are unlikely to change behavior (Harper, 1991; Yagil, 1998). Subjective norms are not strongly correlated with actual driving behavior ($R = 0.03$) and behavioral intention ($R = 0.07$). Road regulations, social ethics, and important people to offenders have almost no influence on choosing to operate a vehicle. This finding is different from other previous traffic safety studies, e.g. Lajunen and Räsänen (2004), who found that the subjective norm was the strongest predictor of the intention to use a bicycle helmet. This finding is also different from Manstead's (2000) review of 20 studies finding only three reporting no empirical support for the independent predictive utility of personal norm. The present model better predicts these results than previous studies, which predict between 23% and 47% of the variance (Parker et al., 1992a, 1995).

Specifically, for the low driving habit group, the most motivational factor influencing drivers to drive after an ALLR was behavioral intention, whereas for the strong driving habit group, the most influential factor influencing drivers to drive was perceived behavioral control. Behavioral intention influenced the low driving habit group more than the high driving habit group. In contrast, perceived behavioral control influenced the high and moderate driving habit groups more than the low driving habit group. The results of this study are consistent with the TPB emphasis of the reason-based antecedents of behavior. However, when behavior is repeatedly and satisfactorily executed and becomes habitual, it may lose its reasoned character. Behavior may then be more guided by the automaticity of stimulus–response relations and less by intentions (Verplanken et al., 1998), therefore, intentions are assumed to predict behavior to the extent that the habit component is weak, and not, or to a lesser degree, when habit is strong (Triandis, 1977).

According to Wood and colleagues (Ouellette and Wood, 1998; Wood et al., 2002; Wood and Quinn, 2005), behaviors that are performed frequently in stable contexts support the development of habits, and thus the impact of intention on behavior is attenuated. A meta-analysis by Ouellette and Wood (1998) showed that when behavior is practiced repeatedly and the context of performance is stable, past behavior is a better predictor of future behavior than is intention whereas the reverse was true when behaviors were performed infrequently in unstable contexts. Similarly, Verplanken et al. (1998) found an interaction between habit and intention such that intentions were only significantly related to behavior when habit strength was weak. When participants possessed strong habits, intentions had less influence on subsequent behavior (see also Ferguson and Bibby, 2002; Klöckner et al., 2003); see Ajzen (2002) for a different view. Thus, whether behaviors have the potential to be controlled by habit could be an important moderator of intention–behavior relations. The present study also found driving habit strength was a moderator in the intention–behavior relation, moreover, the model appeared relatively successful in modeling driving behavior under ALLR when previous habits were weak, whereas less successful in modeling when previous habit were strong.

5. Conclusions

Previous research found that the ALLR policy effectively influenced offenders to drive less frequently, fewer miles, more carefully, more defensively (Chang et al., 2006) and less crash risk (Chang et al., 2011). The present study identified the motivational factors leading offenders to drive with a revoked licensed. However, the privilege to drive is valued, and withdrawal of the privilege feared (DeYoung and Gebers, 2004). Even for a short-term S/R, one-fifth of the US states rejected the adoption of administrative S/R because it could lead to loss of employment, in turn impacting the offender's dependents and subsequent social welfare costs (Knoebel and Ross, 1997; Voas and DeYoung, 2002). ALLR may not be implemented in developed countries; however, it may be implemented in developing countries. Future study employs TPB model or other measuring methods may confirm present results. In 2001, the Taiwan Constitutional Court asked the transportation authority to reconsider whether ALLR offenders should be allowed to re-enter the licensing system if they can demonstrate an ability and willingness to follow the regulations of the road and society. In 2006, the ALLR policy was revised by a license revocation for 8, 10, or 12 years according to the same offence causing injury, serious injury, or death, respectively.

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