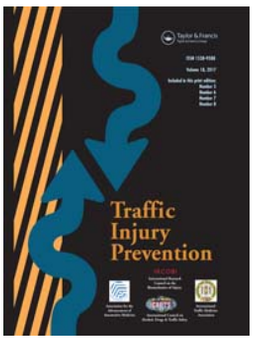

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Perceived enjoyment, concentration, intention, and speed violation behavior: Using flow theory and theory of planned behavior

Charles Atombo[a,b,c], Chaozhong Wu[a,b], Hui Zhang[a,b], and Tina D. Wemegah[d]

[a]Intelligent Transportation Systems Research Center, Wuhan University of Technology, Wuhan, China; [b]Engineering Research Center of Transportation Safety, Wuchang District, Wuhan, Hubei, China; [c]Department of Mechanical Engineering, Ho Technical University, Ho, Ghana; [d]Department of Civil Engineering, Accra Technical University, Accra, Ghana

ABSTRACT

Objective: Road accidents are an important public health concern, and speeding is a major contributor. Although flow theory (FLT) is a valid model for understanding behavior, currently the nature of the roles and interplay of FLT constructs within the theory of planned behavior (TPB) framework when attempting to explain the determinants of motivations for intention to speed and speeding behavior of car drivers is not yet known. The study aims to synthesize TPB and FLT in explaining drivers of advanced vehicles intentions to speed and speed violation behaviors and evaluate factors that are critical for explaining intention and behavior.

Method: The hypothesized model was validated using a sample collected from 354 fully licensed drivers of advanced vehicles, involving 278 males and 76 females on 2 occasions separated by a 3-month interval. During the first of the 2 occasions, participants completed questionnaire measures of TPB and FLT variables. Three months later, participants' speed violation behaviors were assessed.

Results: The study observed a significant positive relationship between the constructs. The proposed model accounted for 51 and 45% of the variance in intention to speed and speed violation behavior, respectively. The independent predictors of intention were enjoyment, attitude, and subjective norm. The independent predictors of speed violation behavior were enjoyment, concentration, intention, and perceived behavioral control.

Conclusions: The findings suggest that safety interventions for preventing speed violation behaviors should be aimed at underlying beliefs influencing the speeding behaviors of drivers of advanced vehicles. Furthermore, perceived enjoyment is of equal importance to driver's intention, influencing speed violation behavior.

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Perceived enjoyment; cognitive concentration; intention; speed violation behavior; flow theory; theory of planned behavior

Introduction

Road accidents are a global phenomenon and an important public health concern, accounting for about 18 fatalities per 100,000 population and many more injuries and loss of property each year (World Health Organization [WHO] 2013). The annual road traffic fatality rates are 20.1 and 8.7 per 100,000 people in middle- and high-income countries, respectively (WHO 2013). Eighty percent of road traffic deaths occur in middle-income countries, which account for 72.2% of the world's population (WHO 2013). In Ghana, official statistics and analyses show that from 2012 to 2015, a total of 1,952,564 vehicles were registered and, of these, 81,425 vehicles were involved in accidents, in which 7,835 people were killed and 47,350 sustained various degrees of injury. Ghanaian policy makers have made considerable efforts in the area of public education, law enforcement, penalties, and environmental changes. However, human factors have been identified as one of the major obstacles to the success of achieving sustainable road safety (Atombo et al. 2016; Damsere-Derry et al. 2010) Though there are several human factors contributing to road traffic crashes, a majority of studies have found that speeding is the most important factor and common driving offense in both Ghana (e.g., Atombo et al. 2016; Damsere-Derry et al. 2010) and other parts of the world (e.g., Aarts and Van Schagen 2006; Banik et al. 2011; Boufous et al. 2010; Mannering 2009; Penmetsa and Pulugurtha 2017; Shams and Rahimi-Movaghar 2009).

Allied studies on speeding have identified vehicle factors as influencing drivers' perceptions and behaviors toward speeding (Atombo et al. 2016; Edquist et al. 2009; Horswill and Coster 2002; Morsink et al. 2006; Naing et al. 2008). A study on the effect of vehicle characteristics on drivers' risk-taking behaviors indicates that drivers of high-powered vehicles drive faster (Horswill and Coster 2002). In another study, it was indicated that speed choice is related to the ability of vehicles to run very fast (Edquist et al. 2009).

It is apparent that with the rapid development of advanced vehicles technologies, more research efforts to gain a better understanding of speeding behaviors of drivers of advanced

CONTACT Hui Zhang zhanghuiits@whut.edu.cn Intelligent Transportation Systems Research Center, Wuhan University of Technology, Wuhan, China or Charles Atombo atombocharles@gmail.com Department of Mechanical Engineering, Ho Technical University, P. O. Box HP 217, Ho, Ghana.
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vehicles are likely to be an appropriate approach for intervention. Nevertheless, previous studies that explored the theory of planned behavior (TPB; Elliott et al. 2003; Letirand and Delhomme 2005; Paris and Van den Broucke 2008; Warner and Åberg 2008) and with additional variables (Conner et al. 2007; De Pelsmacker and Janssens 2007; Elliott and Thomson 2010; Forward 2009; Newnam et al. 2004) to explain drivers' speeding intentions and behaviors focused on a general population of drivers, which may not be an appropriate approach for interventions. Moreover, researchers have shown the efficacy of flow theory (FLT) to capture the intrinsic motivations and to predict intentions (e.g., Chen and Chen 2011). Currently, the nature of the roles and interplay of FLT constructs within the TPB framework when attempting to explain the determinants of motivations for intentions to speed and speeding behavior, more specifically among car drivers, is not yet known. Thus, the study aims to synthesize TPB and FLT in explaining intention to speed and speed violation behaviors among drivers' of advanced vehicles and evaluate which factors are critical for explaining intentions and behaviors regarding speeding. The findings may provide both safety experts and academics an enhanced explanation of the intention–behavior relationship and an understanding of the extent to which motivations influence drivers' speeding intentions and behaviors for designing countermeasures for promoting road safety.

Theory of planned behavior

The TPB was developed based on the theory of reasoned action (Fishbein and Ajzen 1975). The theory states that both behavioral attitudes and subjective norms are independent determinants of behavioral intention, which in turn affects the actual behavior. To deal with the behavior that is not under the full volitional control of the individual, Ajzen (1991) extended the theory of reasoned action to the TPB by adding a third factor, perceived behavioral control (PBC), that predicts both behavioral intentions and behaviors (Figure 1). Ajzen indicated that a high degree of PBC and subjective norm and a positive evaluation of behavior lead to a strong intention to perform a behavior. Several allied studies on speeding have replicated and examined the TPB constructs and found it to be valid in explaining drivers' intentions to speed and subsequent speeding behaviors (Conner et al. 2007; Elliott et al. 2003, 2007; Elliott and Thomson 2010; Forward 2009; Letirand and Delhomme 2005; Newnam et al. 2004; Paris and Van den Broucke 2008; Warner and Åberg 2008).

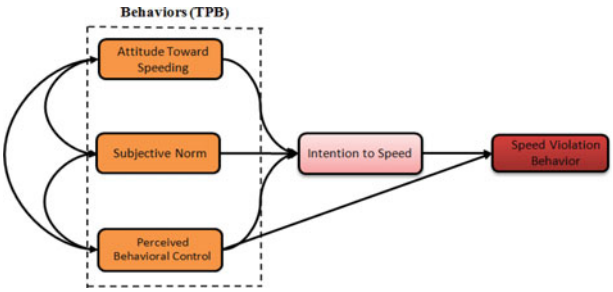

Figure 1. Planned behavior model.

In the TPB, *intentions* refers to the motivation to perform a behavior and is considered the most proximal determining factor of actual behavior (Ajzen 1991). In a study by Armitage and Conner (2001), intentions emerged as the strongest predictor of behavior. Speed-related studies have provided strong evidence that intention to speed positively predicts speeding behavior (Elliott et al. 2003, 2007; Letirand and Delhomme 2005; Paris and Van den Broucke 2008). Hence, we posit the following:

H1: Intention to speed is positively related to speed violation behavior.

Attitude refers to "the degree of a person's favorable or unfavorable evaluation or appraisal of the behavior in question" (Fishbein and Ajzen 1975, p. 6). According to Ajzen (1991), attitude influences behavioral intention, which in turn influences actual behavior. Prior studies have indicated that when drivers form positive attitudes toward speeding, they will have a stronger intention to speed and thus are more likely to violate the speed limit (Conner et al. 2007; Elliott et al. 2007; Warner and Åberg 2008). These studies have established that attitude toward speeding is a reliable predictor of intention to speed. Therefore, the following is proposed:

H2: Attitude toward speeding is positively related to the intention to speed.

Subjective norm refers to "the perceived social pressure to perform or not to perform the behavior" (Ajzen 1991, p. 188). Subjective norm is associated with the normative beliefs about the expectancy from significant others performing the behavior. Drivers may choose not to speed because they perceive that close relations or people important to them (e.g., friends, spouse, etc.) are against speeding. In other words, drivers may speed when they perceive that others support them speeding. Previous findings show that the subjective norm is positively related to intention to speed (Conner et al. 2007; Elliott et al. 2007; Newnam et al. 2004; Warner and Åberg 2008). Therefore, we hypothesize the following:

H3: Subjective norm is positively related to the intention to speed.

Perceived behavioral control refers to "people's perception of ease or difficulty in performing the behavior of interest" (Ajzen 1991, p. 183). It is associated with beliefs about the existence of control factors that may facilitate or impede the performance of the behavior in question (Warner and Åberg 2008). In this logic, becausee advanced safety systems assist drivers' skills, reduce drivers' workload, and increase comfort and safety (Malik and Rakotonirainy 2008), drivers may perceive that they have these skills and find it easy to speed. Previous speed-related studies have found PBC to be positively related to both intentions to speed and speeding behavior (Elliott et al. 2003; Letirand and Delhomme 2005; Paris and Van den Broucke 2008). Hence, we postulate the following:

H4: Perceived behavioral control is positively related to the intention to speed.

H5: Perceived behavioral control is positively related to speed violation behaviors.

Flow theory

Flow is one of the psychological theories evidenced to be related to intrinsic motivational factors (Carl 1994). It is defined as "the holistic sensation that people feel when they act with total involvement and the experience is so enjoyable that people will do it even at great cost, for the sake of doing it" (Csikszentmihalyi 1997, p. 117). Flow experience makes a person become fully engaged in activities and narrow the sense of recognizing changes in the environments. Researchers often measure flow through multiple dimensions. However, there is no rigid application of flow theory (Jung et al. 2009), and previous studies have applied it in many diversified ways. In a study by Ghani et al. (1991), flow enjoyment and concentration were measured. In another study (Koufaris 2002), perceived enjoyment, perceived control, and concentration were developed to measure flow (Figure 2). A number of studies have applied enjoyment and concentration to predict individual intentions and behaviors (Broughton 2006; Chen and Chen 2011; Jung et al. 2009; Lee and Chen 2010) based on the fact that individuals are more likely to be motivated to continue or repeat any activity that is enjoyable compared to another activity that is not enjoyable. Moreover, in the pursuit of a goal, a person must concentrate on the task and forget everything else (Csikszentmihalyi 2014). All of these studies have evidenced that flow constructs are capable of predicting intention and behavior (Figure 2).

Perceived enjoyment (PE) is defined as "the extent to which the activity of using a specific technology is perceived to be enjoyable, aside from any performance consequences resulting from technology use" (Venkatesh 2000, p. 351). People are intrinsically motivated to engage in an activity when they enjoy using a technology for the activity (Koufaris 2002). Similarly, advanced vehicles employ a good number of technology-related features that can bring fun and pleasure to drivers during usage. Specifically, some drivers of advanced vehicles could be intrinsically motivated to speed when they perceive driving as enjoyable. A previous study (Chen and Chen 2011) on traffic safety found PE to be directly related to attitude and intention. Another study (Li and Browne 2006) also showed that while in a flow state, people feel a sense of control over their actions. Therefore, in an enjoyment disposition, if a driver has a strong intention to perform a behavior, the driver may feel that he or she has the necessary resources and skills to perform the behavior (Ajzen 2006). In other words, PE increases a person's behavioral control and has been found to positively influence PBC (Lee and Chen 2010). A direct link between enjoyment and behavior has also been found through an empirical study (Lawton et al. 2009). These studies did not examine how enjoyment is related to intention and behavior through subjective norm. Nevertheless, behavioral intention toward speeding among drivers in a state of enjoyment could be affected by the opinions of important individuals (e.g., family, friends, spouse, police, etc.); that is, subjective norm (Fishbein and Ajzen 1975). On the basis of prior empirical studies, we hypothesize the following:

> PE is positively related to attitude, subjective norm, PBC, intention, and speed violation behavior (**H6**, **H7**, **H8**, **H9**, and **H10**, respectively).

Cognitive concentration has been described as receptive attention that may be reflected in a sustained consciousness of ongoing events and experiences that narrow the focus of awareness (Csikszentmihalyi 1997). Concentration only allows a very select range of information into awareness (Csikszentmihalyi 1997). In contrast, drivers with less concentration may be more likely to behave normally, which would prevent them from following through with their intentions to speed. Concentration has been established to be positively related to attitude and intention (Chen and Chen 2011). Because advanced vehicle safety systems increase comfort and reduce driver workload (Malik and Rakotonirainy 2008; Morsink et al. 2006), it is possible that the driver of an advanced vehicle might concentrate on speeding when he or she perceives him- or herself to be in control. That is, concentration may help drivers to fulfill their intentions to speed when ability to control is strengthened. A current study examined the causal relationship between flow constructs and PBC (Lee and Chen 2010) and found concentration to be positively related to PBC constructs (self-efficacy and controllability). A person's concentration could also affect speeding intentions and behaviors when it is perceived that important people are against or in support of speeding (Ajzen 2006). Driver behavior is influenced by many factors, including cognitive and concentration capacity (Lansdown 2002; Reimer et al. 2005). Based on the empirical studies above, we propose the following:

> Cognitive concentration is positively related to attitude, subjective norm, PBC, intention, and speed violation behavior (**H11**, **H12**, **H13**, **H14**, and **H15**, respectively).

Rationale for integrating FLT and TPB

TPB and FLT are integrated to hypothesize a model to explain intention to speed and speed violation behavior among drivers of advanced vehicles. These theoretical concepts are integrated on the basis of the following reasons: First, though previous researchers have found TPB to be a sound model for understanding the intention–behavior relationship (Elliott et al. 2003; Forward 2009; Letirand and Delhomme 2005; Paris and Van den Broucke 2008; Warner and Åberg 2008), a gap has been found in speeding-related studies. For instance, Warner and Åberg (2008) found that drivers who report intention to speed may not always speed. In addition, Elliott et al. (2003) and Forward (2009) utilized TPB to examine drivers' speeding and found a variance in the relationship between intentions and behaviors that remained unexplained in the explanatory models. Such inconsistencies imply that there may be other factors

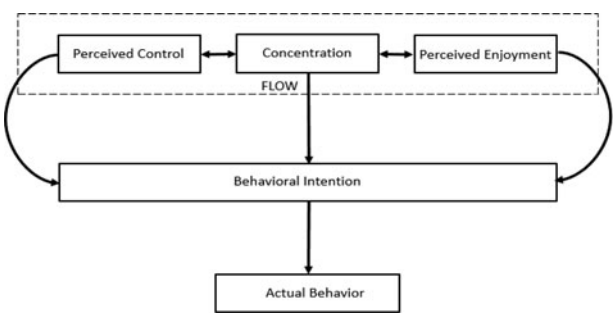

Figure 2. Representation of psychological flow theory (FLT).

that influence drivers' speeding behaviors. These findings bring to the fore the need to extend the TPB with additional relevant variables. As indicated by Ajzen (1991), other constructs may have to be considered to improve the prediction and explanation of intentions and behaviors. Flow theory provides enjoyment and concentration as 2 major factors impacting individual intentions and behaviors (Chen and Chen 2011; Koufaris 2002). On the basis of Ajzen's (1991) recommendations, because TPB and FLT have different origins and are based on a different set of variables, it is believed that these theories would separately provide some understanding of the intention–behavior relationship regarding speeding for the purposes of the current study. Therefore, integrating these 2 theories may provide an increased understanding of drivers' intention and behavior than when each theory is considered separately.

Secondly, the application of enjoyment to a real-life driving scenario could be illustrated by an example where an individual driver who may perceive driving to be enjoyable and thus experience the phenomenon of enjoyment (Csikszentmihalyi 2014). Moreover, when a person is in a flow state, other activity in the environment loses its importance and sense of time becomes inaccurate. This occurs when one's body or mind is stretched to its confines in a deliberate effort to achieve something difficult and useful (Csikszentmihalyi 1997). Because speeding has been evidenced to increase the cognitive workload (Fuller et al. 2006), there is a reason to expect that adding the flow theory could capture the components of intrinsic motivations related to fun, enjoyment, and cognitive concentration which could influence behavioral perceptions, intention, and behavior regarding speeding.

Methods

Procedure and participants

The sample for the study was taken from 8 different international automobile dealership repair centers. These centers deal with all types of vehicles, including vehicles equipped with advanced safety systems such as active cruise control, lane departure warning system, forward collision warning, collision avoidance, hill descent control, night vision, and electronic braking assist, among others. Because the study aims to assess intention to speed and speed violation behavior among drivers of advanced vehicles, it was highly possible to get drivers who service and repair vehicles equipped with such features from these centers to participate in the study. The random sampling technique was employed in selecting the participants. Based on validated self-report measures in the available literature (Ajzen 2006; Chen and Chen 2011; Moan 2013; Paris and Van den Broucke 2008; Sucha et al. 2014; Ulleberg and Rundmo 2003), a questionnaire was designed for all of the items under investigation.

Before conducting the study, the questionnaire was tested on 50 drivers of advanced vehicles. Based on feedback from the pilot sample, the survey instruments were revised by safety experts to improve clarity and readability and to address the study objectives appropriately. The main study data were collected on 2 occasions separated by a 3-month interval. This method was adapted to reduce common method variance (Elliott et al. 2007). On the first of the 2 occasions, variables of TPB and FLT were measured. On the second occasion, speed violation behavior was measured.

At both the pilot stage and first occasion, the on-site survey was adopted. Permission was sought from the management of the selected dealership repair centers to allow their customers (drivers) to participate in the study. Upon agreement, the participants were provided information about the research, including a brief explanation of the purpose of the study, how to participate, as well as anonymity and confidentiality assurances. The participants who agreed to participate were given the questionnaire to answer. There was no financial compensation for participation. The questions were mainly closed-ended in which participants were asked to tick appropriate responses that suited them. Each questionnaire had a unique identifier with a 4-digit number and a section for respondents to provide their e-mail address and telephone number. It took each respondent approximately 35 min to complete the questionnaire.

During the second stage of data collection, the participants who completed the questionnaire during the first stage were sent the questionnaire through their e-mail addresses provided at the first stage. The questionnaire was sent with a cover letter explaining that the study was about drivers' speeding behavior, that participation was voluntary, and that there were no right or wrong answers to any of the questions. Confidentiality was once again assured and participants were informed that their identity would not be linked to their responses. Follow-up calls were made 3 weeks after the initial mailing of the questionnaires. First- and second-stage data were matched using the unique number identifier. All data were analyzed in aggregate to avoid identification of individual participants.

Four hundred and fifty licensed drivers of advanced vehicles responded to the questionnaire during the first stage of data collection. Three hundred and fifty-four ($N = 354$, 79%) of the respondents returned the second-stage questionnaire. Therefore, the second-stage nonresponders were excluded from the analysis. The participants included 278 (78.5%) males and 76 (21.5%) females, with 47.5% within the age range of 25 to 35 years. The majority of the respondents (59.6%) were married and 46.9% had up to a senior high school level of education. The respondents had different years of driving experience, with 39% having driving experience ranging from 6 to 10 years. The annual mean mileage was 11,936 km (SD = 8,937) and the total mean number of accidents since obtaining a driving license was 2.26 (SD = 2.22). Moreover, 36% indicated that they had been ticketed for speeding. The participants were asked to estimate how advanced vehicle features influence their speeding, and 164 participants (46%) indicated being influenced.

Measurements

We utilized measures of Chen and Chen (2011) with 4 items to measure PE (e.g., "With the provision of advanced technology features, I find driving enjoyable") and 4 items for cognitive concentration (e.g., "With the provision of advanced technology features, I am often not absorbed entirely in the driving activities when I speed"). Furthermore, 5 items were adapted from Moan (2013) to measure participants' attitudes toward speeding (e.g., "With the provision of advanced technology features, speeding is unsafe–safe"). Subjective norm was estimated with 5 items

adapted from Ajzen (2006) to indicate whether people who were important (family, relatives, and friends) to the drivers would disapprove of speeding (e.g., "Most people who are important to me do not support me speeding when driving"). Regarding perceived behavioral control, 5 items were used, with 3 of the items adopted from Paris and Van den Broucke (2008) and 2 items introduced by the researchers (e.g., "With the provision of advanced technology features, I have often tried to reduce my speed, but I cannot"). To measure behavioral intention, 4 items (e.g., "With the provision of advanced technology features, I am likely to speed") were adapted from Ajzen (2006). Finally, speed violation behavior was measured with 6 items (e.g., "With the provision of advanced technology features, I drive faster on freeway") from Sucha et al. (2014) and Ulleberg and Rundmo (2003). Details of the items in each scale are shown in Table A1 (see online supplement).

Based on 7-point bipolar adjective scales typically employed by Ajzen (2006), the attitude items ranged from 1 = *unsafe* to 7 = *safe*. The subjective norm and PBC items ranged from 1 = *strongly disagree* to 7 = *strongly agree* and the intention items were rated 1 = *very unlikely* to 7 = *very likely*. For the sake of uniformity, PE and concentration were also rated as 1 = *strongly disagree* to 7 = *strongly agree*. Speed violation behavior items were rated as 1 = *not at all* to 7 = *very often*. A reliability test based on a Cronbach's alpha cutoff criterion of .7 (Hair et al. 2006) was used to indicate the degree of internal consistency among the items for each construct. The items in each scale show satisfactory internal consistency with the Cronbach's alpha coefficient, indicating an acceptable degree of scale reliability (Table A3, see online supplement).

Data analysis

Data were cleaned and checked for the distribution of each item for normality. There was no violation of the assumptions of normality. The data were then analyzed, using descriptive statistics to investigate the demographic characteristics of the participants. Principal axis factoring (PAF) analysis followed by promax rotation was used to examine the factor structure of the study construct. The eigenvalue cutoff point for each item was set at 1.0. Confirmatory factor analysis was then carried out to examine the fit of the factor models performed by the PAF to ensure that the measurement variables reliably reflect the hypothesis variables. To test the research hypotheses, structural equation modeling was performed. Fit indices such as the comparative fit index, goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI), normed fit index, root mean square error of approximation, and chi-square (χ^2) were used to examine the structural model to determine how well the data fit the model.

Results

Factor structure

A PAF analysis was performed on the items to analyze the factor loadings and structure. The Kaiser-Meyer-Olkin measure of sampling adequacy was 0.92 and Bartlett's test of sphericity was significant ($P = .000$), indicating that these data were appropriate for factor analysis and correlations existed among the items (Kaiser 1974). To optimize the psychometric properties of the scale, the Kaiser criterion of eigenvalues greater than 1.0, the Cattell scree plot test, and parallel analyses were used to determine the number of factors to be retained. The initial results revealed the presence of a 9-factor structure with eigenvalues greater than 1.0. An inspection of the scree plot revealed a clear break after the seventh component. After using Cattell's scree test, a 7-factor structure was retained, because these factors contributed most to the explanation of the variance in the data set. The parallel analysis results were used to further substantiate the 7 factors by comparing their eigenvalues exceeding the corresponding criterion values for a randomly generated data matrix of the same size (33 variables × 354 respondents).

In order to interpret these 7 components, promax rotation was performed and produced results as follows. Speed violation behavior items loaded on factor 1, perceived behavioral control items loaded on factor 2, attitude items loaded on factor 3, cognitive concentration items loaded on factor 4, subjective norm items loaded on factor 5, behavioral intention items loaded on factor 6, and perceived enjoyment items loaded on factor 7. The rotated factors accounted for 41, 16, 7.3, 6.8, 4.5, 3.9, and 3.1% of the variance, respectively. Cumulatively the 7 factors explained 82.6% of the variance. The items that cross-loaded on 2 factors or without substantial loadings on any factor were excluded (e.g., one item each from perceived enjoyment and subjective norm were dropped). These items were ambiguous; therefore, they were not used for further analysis. The factor loadings and percentage of the explained variance of each scale were satisfactory. In summary, the results indicated that the factor structure has satisfactory item loadings and is sufficiently reliable (Table A1). The means and standard deviations for all valid items are also displayed in Table A1.

Confirmatory factor analysis

Following the 2-step procedure suggested by Anderson and Gerbing (1988), prior to the testing of the structural model to examine the strength and direction of the relationships among the constructs, confirmatory factor analysis was performed to evaluate the structural validity of the measurement model. According to Anderson and Gerbing (1988), GFI, AGFI, and comparative fit index values of 0.9 or above and root mean square error of approximation of 0.05 or less indicate a good fit between the model and the data. The goodness of fit indices are within the threshold of the recommended values (Table A2, see online supplement). All composite reliabilities were over 0.7, indicating that the scales had good reliability.

The standardized estimates of factor loadings for the measurement models are displayed in Table A2. As indicated, all of the measurement items were significant at the .001 level, indicating that all constructs measured fairly well and were retained for further analysis. The average variance extracted for each construct ranged from 0.53 to 0.78 (see Table A3). These values were over the recommended value of 0.5 (Anderson and Gerbing 1988), indicating that the scales have good convergent validity. The square roots of average variances extracted of each construct on diagonal cells were greater than the correlation coefficients with other constructs, indicating good discriminant

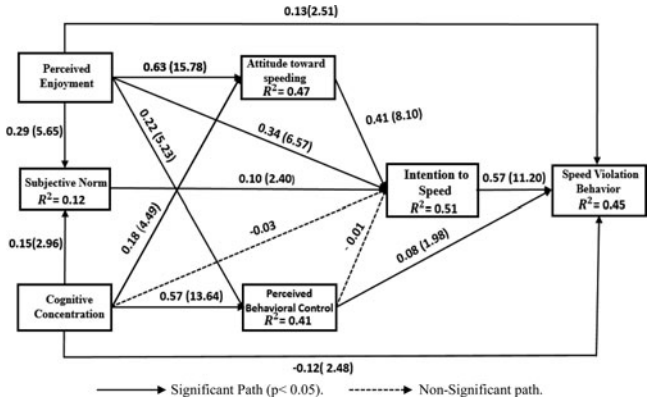

Figure 3. The structural model for the sample. Values in parentheses are *t* values.

validity. The internal consistency with Cronbach's alphas for each construct was satisfactory and above the recommended threshold of 0.7 (Hair et al. 2006).

Hypotheses testing

The significance path of each hypothesized link in the research model and the variance explained (R^2 value) were examined using a structural equation model with age, sex, and mileage included as control variables. Figure 3 presents the results of the structural model with nonsignificant paths as dotted lines and the standardized path coefficients between constructs. All hypothesized links were supported, except for the 3 links between concentration, intention, and speed violation behavior and between PBC and intention.

The speed violation behavior was positively and significantly predicted by PE ($\beta = 0.13, P < .05$) and PBC ($\beta = 0.08, P < 0.05$) and strongly related to intention to speed ($\beta = 0.57, P < .001$). Concentration was negatively related to speed violation behavior ($\beta = -0.12, P < .05$). These constructs jointly explained 45% of the variance in speed violation ($R^2 = 0.45$). Notably, however, attitude was significantly indirectly related to speed violation ($\beta = 0.24, P < .001$) via intention to speed (see Table 1). In addition, enjoyment had a strong positive and significant indirect relation to speed violation behavior ($\beta = 0.38, P < .001$), contributing 5% of the total variance in the speed violation behavior.

As expected, intention to speed was jointly and positively predicted by PE ($\beta = 0.34, P < .001$), attitude toward speeding ($\beta = 0.41, P < .001$), and subjective norm ($\beta = 0.10, P < .05$). These variables together explained 51% of the variance in intention to speed ($R^2 = 0.51$). In addition to its direct relationship, enjoyment had a significant indirect relationship with the intention to speed ($\beta = 0.29, P < .001$) through attitude and subjective norm constructs, contributing 10% of the variance in intention to speed. Contrary to our expectation, concentration and PBC had no significant associations with intention to speed.

The hypothesized paths from PE and concentration to attitude toward speeding, subjective norm, and PBC were significant. PE was significant and positively related to attitude ($\beta = 0.63, P < .001$), subjective norm ($\beta = 0.29, P < .001$), and PBC ($\beta = 0.22, P < .001$). Similarly, concentration was significant and positively related to attitude ($\beta = 0.18, P < .001$), subjective norm ($\beta = 0.15, P < .01$), and PBC ($\beta = 0.57, P < .001$). PE and concentration together explained 47, 12, and 41% of the variance in attitude, subjective norm, and PBC, respectively.

Table 1. Effects of TPB and FLT variables on the speed violation behaviors.

Constructs	Direct effects	Indirect effects	Total effects
Cognitive concentration	− 0.12*	0.08	− 0.04
Perceived enjoyment	0.13*	0.38**	0.51**
Attitude	—	0.24**	0.24**
Subjective norm	—	0.05	0.05
Perceived behavioral control	0.08*	0.002	0.08*
Behavioral intention	0.57**	—	0.57**

* $P < .05$. ** $P < .001$.

Discussion

The study aims to extend the TPB by adding the variables of FLT to explain intention to speed and speed violation behavior of drivers of advanced vehicles and evaluate factors that are critical for explaining intention and behavior. The FLT explored in this study consisted of perceived enjoyment and cognitive concentration and the TPB consisted of direct measures. The study result shows that, except for 3 hypotheses (i.e., H9, H10, and H13) that were not supported, the remaining hypotheses were found to be supported.

Generally, the current results provide considerable support for the prediction validity of the combined TPB and FLT variables. The model predictors jointly accounted for 45% of the unique variance in speed violation behavior, and intention, PBC, and enjoyment were each significant independent predictors. These results compare favorably with the explained variance between 27 and 51% of the speeding behavior reported in previous studies that included additional variables in the TPB to predict self-reported speeding behavior (Conner et al. 2007; Elliott and Thomson 2010; Letirand and Delhomme 2005; Newnam et al. 2004). Notably, intention was the strongest significant independent direct predictor of speed violation behavior, meaning that drivers who have the motivation to speed are more likely to violate the speed limit. In accordance with previous studies (Elliott and Thomson 2010), this result confirmed that intention to speed is the overall motivation for drivers to be involved in a speed violation. Additionally, the model explained 51% of the variance in intention to speed, and attitude and enjoyment were the strongest predictors. This variance is comparable to between 28 and 68% of the variance in intention reported in related previous studies (e.g., Conner et al. 2007; Elliott and Thomson 2010; Letirand and Delhomme 2005; Newnam et al. 2004). Previously allied studies omitted the link between PE and speeding behavior (e.g., Chen and Chen 2011; Elliott and Thomson 2010; Forward 2009). Instead, inspection of the standardized total effect on speed violation behavior showed that the direct and indirect effects of PE ($\beta = 0.51$) were comparable to the direct effect of intention ($\beta = 0.57$) and outweighed the direct effects of PBC ($\beta = 0.08$). These findings suggest that the role of feelings may be more ubiquitous in the context of driving. The direct effect of PE on speed violation behavior could also mean that when drivers' enjoyment is aroused by motivations, the power of intention might be taken in the moment and their speed violation behavior is likely to be controlled by enjoyment.

These results imply that intervention could target the enjoyable moments of engaging in speeding behaviors. Contrary to a previous study (Chen and Chen 2011) and expectation, in this study, cognitive concentration was not found to be an independent predictor of the intention to speed but, similar to previous findings (Barkley and Cox 2007), was negatively related to speed violation behavior. This finding could suggest that concentration is not an important determinant of intention to speed and is likely not related to speeding behavior, at least in the present context. In other words, a driver who is under influence of motivations, but performs better at concentration could exhibit better driving performance and refrain from speeding.

It is also important to note that, based on Cohen's (1988) qualitative indices for interpreting effects sizes, where $r = 0.10$ ($R^2 = 0.01$) is a small effect size, $r = 0.30$ ($R^2 = 0.09$) is a medium effect size, $r = 0.50$ ($R^2 = 0.25$) is a large effect size, the present findings relating to the amount of variance added to the prediction of intention and speed violation behaviour ($R^2 = 15\%$) as a result of the inclusion of FLT variables exceeded what is considered a medium effect size. Thus, the conclusion drawn from the present study is that the inclusion of FLT constructs, especially PE, help increase the explanation for intention to speed and speeding behavior.

Attitude toward speeding is another important predictor of drivers' intention to speed and speeding behavior. Attitude, in addition to being the strongest independent predictor of intention to speed in this study, which is consistent with previous empirical research on drivers (Conner et al. 2007; Elliott et al. 2007; Elliott and Thomson 2010), also had an indirect significant relationship with speed violation behavior. This result suggests that attitudes toward speeding among drivers of advanced vehicles are not related only to their intentions to speed but also to speed violation behaviors. Therefore, the higher the motivation, the higher the attitude toward speeding and intention to speed as well as subsequent speed violation behavior.

Congruent with previous studies (Fishbein and Ajzen 2011), subjective norm also predicted intention to speed. It should be noted, however, that the items used in this study were directed toward disapproval of speeding by people who are important to the drivers. Therefore, a significant relation indicates disapproval toward speeding behaviors. Thus, the results demonstrate that when drivers are under the influence of motivation, though they may have the urge to speed, the opinions of others might impede their speeding behavior. Moreover, it means that this group of drivers may control their speeding behaviors when they perceive social condemnation for speeding and that important others would not speed themselves.

According to Ajzen (2002), the magnitude of the PBC and intention relationship is dependent on the type of behavior and the nature of the situation. Contrary to expectations, PBC had an insignificant relationship with intention to speed. In addition, it was a weaker predictor of speed violation behavior. Similar to previous studies, this result suggests that PBC is a proxy for actual control (Sheeran et al. 2003) and that avoiding speeding is to some extent controllable. In addition, this result confirmed the findings that drivers' perceptions of control over dispositional resources do to some extent reflect their ability to abstain from speed violations (Elliott and Thomson 2010).

The result of the relationship between FLT variables (perceived enjoyment and concentration) and TPB variables shows that PE and concentration were significantly and directly, but independently, associated with attitude toward speeding, subjective norm, and PBC. This implies that flow constructs are likely to be important predictors of speeding behaviors in the context of the present study. Therefore, flow variables, especially enjoyment, are important factors to consider when designing measures (e.g., education) for changing aberrant driver behaviors.

PE was proposed as a determinant of intention to speed. Sometimes drivers want to speed when they find it pleasurable to exceed the speed limit. Previous studies have sometimes referred to the affective outcome as enjoyment and have measured affective factors based on the fact that the behavior in a particular context may be either enjoyable or unenjoyable (Chen and Chen 2011; Elliott and Thomson 2010). Consistent with previous studies, PE is indicated to be an important determinant of intention to speed (Chen and Chen 2011; Elliott and Thomson 2010). Drivers with higher levels of enjoyment-seeking are more likely to report greater speeding. In accordance with a previous study (Elliott and Thomson 2010), this finding could mean that drivers may intend to speed because they feel that speeding will be enjoyable, even though they know speeding is dangerous. Drivers who wish to enjoy the experience of speeding may have more illustrative encouragement with regard to their intentions to speed. Therefore, in addressing measures to reduce road accidents, it is important to focus not only on what the driver intends to do but also on the driver's emotions as possible factors that can influence violation.

In summary, the variance explained in intention and behavior was consistent with speed-related studies that included an additional variable in the TPB, demonstrating the importance of including FLT constructs in understanding drivers' intentions and behaviors. Thus, among drivers of advanced vehicles, the efficacy of the combined TPB and FLT for explaining intentions to speed and speed violation behaviors is compatible with the results of previous studies. The findings suggest the need for appropriate safety interventions, aimed at beliefs influencing the speeding behaviors of drivers of advanced vehicles. Furthermore, perceived enjoyment is of equal importance to participants' intentions, influencing speed violation behaviors.

Practical implications for interventions

The present findings imply that there is strong justification for developing road safety interventions that deal with the variables of PE and attitudes toward speeding aimed at drivers of advanced vehicles. This is because PE and attitude were independent predictors of intention to speed and had a large total effect on speed violation behavior. It may be difficult to use only campaign messages as a tool to change the speeding behavior of a driver who has experienced the positive effects of speeding. Therefore, regarding intervention strategies for changing speed violation behaviors, a study on the motive behind speeding and dangerous overtaking (Forward 2008) found group support to be an important tool for changing and maintaining attitudes. Based on the current study findings, people who are important to the drivers and social condemnation for speeding could

be useful tools for countermeasures on speeding behaviors. In Ghana, the majority of traffic offenses are often concentrated on highways, which are hard to identify and suppress. Therefore, another possible means is to persuade drivers to change their own speed violation behaviors (Meng and Siren 2012) by targeting the underlying salient beliefs (Fishbein and Ajzen 1975) influencing the behaviors.

It is important to note that the present study findings may not necessarily be applicable to every country because empirical evidence shows that the cognitive social behavior processes and attitudes are influenced by cultural background, including values and norms (Özkan et al. 2006). Therefore, appraisal and ways of expressing behaviors can be expected to vary from culture to culture. Additionally, the study model has been validated considering drivers of advanced vehicles. Therefore, precautions need to be taken not to generalize the findings on drivers' speeding behaviors.

Strengths and limitations

Despite the existence of previous studies relating to drivers' speeding behaviors, these studies focused on a general population of drivers, which may not be appropriate targets for intervention. Therefore, the present study focused on drivers of vehicles with advanced technology features. Moreover, the nature of the roles and interplay of FLT constructs within the TPB framework in an attempt to explain the determinants of motivations for intentions to speed and speeding behaviors, more specifically among car drivers, has remained unexamined. Hence, this study is the first attempt to use FLT and TPB to investigate speeding behaviors of Ghanaian drivers. In addition, the study findings will augment information for policy makers and scientists to understand that intention–behavior relationship and the perceptions of drivers toward the use of advanced technology features for appropriate safety interventions to promote road safety, especially in Ghana.

Despite the strengths of this study, a number of methodological issues need to be considered when interpreting the results. First, the behaviors were measured using self-report, which is potentially vulnerable to social desirability bias. However, the present behavior measure has previously been validated against speeding behavior. Additionally, the predictive validity of the TPB and FLT with respect to the measures has been strongly supported by previous studies (Ajzen 2006; Chen and Chen 2011; Moan 2013; Paris and Van den Broucke 2008), which also enhances the confidence in the validity of the present findings. Secondly, the survey data were limited because only a cross section of the Ghanaian drivers of vehicles with advanced technology features was used. Therefore, the findings may not represent a larger group. However, the findings make a valuable contribution to the available literature. In addition, the results have provided useful information for designing road safety intervention strategies to reduce road accidents in Ghana. Thirdly, flow is a multifaceted concept that includes several dimensions. In this research, we employed perceived enjoyment and cognitive concentration to measure the flow experience. Future studies can give more attention to this theory.

Finally, the present study used the path analysis approach, which is suitable for identifying predictors of intentions and behaviors. In a future study, it would be valuable to employ a moderated hierarchical regression model where the moderator and independent variables can be centered (i.e., the mean subtracted from each individual score) and the interaction term calculated before the analyses (Aiken et al. 1991). In this way, the statistically significant interactions can be plotted by generating simple regression equations of a given outcome (dependent variables) variable at low (i.e., one standard deviation below the mean), moderate (mean), and high (i.e., one standard deviation above the mean) levels (Aiken et al. 1991; Özkan et al. 2010).

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