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A Preliminary perception study among youths on road traffic accidents and domino theory

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ABSTRACT

The issue of road traffic accidents has become a major concern to Malaysia and it is now also being regarded as one of the most serious social problems. Thus, this study has been undertaken as a preliminary investigation to examine whether the perceptions of youths on the causation and risk management of road traffic accidents conform to domino theory. A self-administered survey questionnaire was used to gather data from youths who were Universiti Utara Malaysia students. Frequency counts and rank order analysis were used to analyse the data collected. The major findings of this study show that the perceptions of the youths participated in this study conform to domino theory. However, the "imbalanced" perceptions of the youths suggest that domino theory alone is not adequate to explain road traffic accidents. Speeding, inattention and queue jumping are the three main risky driving behaviours that the youths participated in this study perceived to be potentially highly likely in leading to road traffic accidents. Among a list of four risk management measures for road traffic accidents intended to change the road users' behaviours in order to attain road safety, the youths perceived that imposing severe punishment is the most effective measure, then it is followed by enforcement activities – for which overt enforcement activities are perceived to be more effective than covert enforcement activities, and road safety campaign or education is perceived to be the least effective measure. The potential use of the findings of this study has also been discussed. As this study is a preliminary investigation, further and more in-depth studies about road traffic accidents and other accident theories (or models) are warranted.

Keywords:
Road traffic accidents, Domino theory, youths

1. Introduction

The statistics in the annual report 2013 of the Department of Road Transport Malaysia [1] show that the number of road traffic accidents in Malaysia has been increasing over time. For a period of three years, reported cases of road traffic accidents have increased from 414,421 in 2010 to 477,204

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in 2013, an average growth rate of about 5% per year. Of the cases reported, fatal accidents have claimed 6,872 lives in 2010 and 6,915 lives in 2013. Further, during the same period, the number of vehicles which has been taken action against by the Department of Road Transport Malaysia due to committing various offences also has increased alarmingly. The number has increased more than double in the 3-year period from 754,471 in 2010 to 1,627,140 in 2013. The worsening situations of road traffic accidents have prompted both the government and the private sectors to spend huge resources on road safety programs, with two-pronged targets, first and foremost in preventing the occurrence of road traffic accidents, and second in reducing property damages and human injuries with the ultimate aim of achieving zero fatalities.

In view of the issue of road traffic accidents has become a major concern to Malaysia and it is now also being regarded as one of the most serious social problems, this study is undertaken as a preliminary investigation to examine whether the perceptions of youths on the causation and risk management of road traffic accidents conform to domino theory. Specifically, this study considers the perceptions of youths aged 19-28 years old and undertakes domino theory as the underlying accident theory. Why youths aged 19-28 years old? It is because youths in this age group, which comprised 20% of three million Malaysian populations in 2013 [2], are the novice or young drivers in Malaysia. Why domino theory? It is because domino theory is a widely acceptable accident theory associated with human factors and this theory is closely related to road traffic accidents. According to Raouf [3], domino theory is a deterministic causal accident theory developed by Heinrich (1931). It assumes that an accident is an element in five linear events with a cause – (i) 'social environments' influence (ii) 'human behaviours' that originate from (iii) 'unsafe acts or conditions' which cause (iv) 'accidents' leading to (v) 'property damages, human injuries or fatalities'. Each of the elements is dependent on the preceding element. Knocking over one element will cause subsequent elements to topple in turn. The theory suggests that safety can be attained when the cause of accident is established, so the removal of the third element, i.e. unsafe acts or conditions, would prevent accidents and the resultant property damages, human injuries or fatalities.

To put into the context of this study, youths aged 19-28 years old are the most important pillar of a nation towards its development and in this study they are the novice or young drivers, if their perceptions on the causation and risk management of road traffic accidents conform to domino theory, this would suggest that it deems appropriate and effective for the relevant authorities to manage road traffic accidents by changing the road users' behaviours (i.e. human behavioural approach) in order to attain road safety to minimize the loss of precious human assets (especially youths) and also physical assets.

The remaining parts of this paper are organized as follows: Section 2 reviews past studies that have examined road traffic accidents, Section 3 states the objectives of this study, Section 4 describes the research methodology, Section 5 presents and discusses the results, and Section 6 concludes the findings of this study.

2. Literature Review

Based on the research context of this study, a review of past studies on accident theories (or models) and road traffic accidents is briefly provided below.

Huang *et al*. [4] and Jamroz [5] have conducted a review to evaluate traditional accident models on modern road traffic. Both have concluded that traditional accident models are inadequate to fully describe the causation and risk management of road traffic accidents.

The review of Huang *et al*. [4] shows that almost all traffic accident analysis based on traditional accident models have attributed "driver error" as the main cause of road accidents. According to

them, these accident models are outdated, having not accommodated the changes that have been taken place in modern road traffic. Hence, the traditional accident models are inadequate to describe why accidents happen in modern road traffic and this has resulted in inadequate counter-measures taken to address the problems. In light of the inadequacy of traditional accident models, they have proposed that accident models developed for modern road traffic should focus on socio-technical system and are capable of identifying factors that can lead to incompatibilities among drivers, vehicles and roadway systems (environments) that can cause road accidents.

On the other hand, Jamroz's [5] review concludes that road safety is a complex phenomenon and so far the many proposed accident theories have not been able to produce a general theory that could be used as a basis to identify all causes of accidents (including road accidents). In view of each theory is only able to explain road accidents partially, he has suggested that other theories be used together to describe road accidents to enable the introduction of appropriate safety measures to manage road accidents effectively.

According to an empirical study outside of Malaysia, Thomas *et al*. [6] have applied a new approach developed by Ljung (based on Hollnagel's accident model), which considers a collision to be a consequence of a breakdown in the interaction between road users, vehicles and traffic environments, to analyse 997 crashes in six member states of European Union (EU) involving 1,512 different types of road users (comprising car drivers, motorcyclists, pedestrians and bicyclists). Their major findings on general accident causation factors show that (from a list of eight factors being examined) timing errors (e.g. no response or responding too quickly) (50%) and speed (15%) are found to be the most and second most common factors across all types of road users. Meanwhile, for specific accident causation factors, their major findings show that five groups of the factors, accounted for 81% of a total of 14 groups being examined, have been identified to be common across all types of road users: (i) temporary personal factors (24%) especially distraction, (ii) interpretation errors (16%) especially faulty diagnosis in mental model, (iii) planning errors (15%) especially overlooking side effects due to inadequate planning, (iv) communication errors (14%) and (v) the design of traffic environment (12%). They have proposed (mechanical engineering approach using) technology-based counter-measures (such as autonomous braking system with pedestrian detection to enhance road users' abilities) to improve road safety when greater details about the factors surrounding a crash could be established.

According to empirical studies conducted in Malaysia, Liana *et al*. [7] have adopted analytic hierarchy process (AHP) to weigh and rank the judgements of road accident analysis experts (i.e. traffic police inspectors, road transport department officers and fire brigade department officers) on five selected causes of road accidents by different types of motorised vehicles (i.e. cars, motorcycles, buses and lorries). Their study has found that (i) driving beyond speed limit, (ii) driving carelessly (i.e. failed to look, misjudged distance and decision), (iii) adverse road and traffic conditions, (iv) obstructions (i.e. animals and weather) and (v) tyre and brake defects are being ranked as the most to the least important causes of road accidents respectively. Their findings show that human behaviours are the major contributing factors to road accident as speeding and driving carelessly are ranked the first and the second respectively (among the five selected causes of road accidents). Next, it is environmental factors (i.e. adverse road and traffic conditions and obstructions) followed by vehicle conditions (i.e. tyre and brake defects).

Mohd Khairul Alhapiz *et al*. [8] believe that risk-taking behaviours have contributed to road traffic accidents, especially motorcycle crashes. They have conducted a case study to examine the risk-taking behaviours of motorcyclists at accident prone areas in the vicinity of Klang Valley. Their major findings show that (i) riding without license, (ii) riding without crash helmet, (iii) riding over speed limit, and (iv) riding without headlights on and not stopping at junctions are among the risk-taking

behaviours most likely committed by motorcyclists. Their major findings also show that risk-taking behaviours of motorcyclists are related to (i) age, (ii) gender and (iii) income level. They have found that (i) teenagers aged 16-20 years old tend to ride without license and crash helmet, (ii) male riders tend to ride over speed limit and without crash helmet, and (iii) lower income groups earning less than RM1,000 tend to ride without crash helmet, and without having headlights on and not stopping at junctions.

In addition to the above, another major findings of Mohd Khairul Alhapiz *et al*. [8] show that (i) peer influence, (ii) enforcement of traffic law and (iii) parental guidance play a significant influence on the likelihood of motorcyclists committing risk-taking behaviours. They have suggested that these findings could be exploited to plan more effective road safety measures and campaigns for motorcyclists in the future.

Another study by Noradrenalina *et al*. [9] have examined the effectiveness of traffic enforcement, as a measure taken to manage road traffic accidents, based on the risk perception of being caught among 27,658 road users with a valid driving license. Their major findings on the effectiveness of Ops (integrated traffic enforcement) show that in general the road users' risk perception of being caught is low but it is higher during Chinese New Year and Hari Raya Aidilfitri. Speeding is the traffic offence majority of the road users are worried of being summonsed (fined), while queue jumping is considered as a not serious traffic offence. Between overt and covert traffic enforcements, the former is perceived by road users to be a more effective risk management measure. However, (from a list of four) traffic punishment is regarded to be the most influential factor in raising the risk perception of road users being caught, and this is followed by media exposure and safety campaign, the experience of being caught in the past, and the visibility of enforcement activities is ranked last. Their study has concluded that in general the Malaysian road users are seemed to be not affected by traffic enforcement due to their perceptions of the lack of enforcement by the authorities.

3. Research Objectives

This study is a perception study. Its main objective is to examine whether the perceptions of youths on the causation and risk management of road traffic accidents conform to domino theory. Specifically, the objectives of this study are as follows:

(a) to examine the perceptions of youths on the main cause of road traffic accidents;
(b) to examine the perceptions of youths on the effective approach to manage road traffic accidents;
(c) to examine the perceptions of youths on the three main risky driving behaviours that are potentially highly likely in leading to road traffic accidents; and
(d) to examine the perceptions of youths on the effectiveness of four different measures intended to change the road users' behaviours in order to attain road safety in managing the risks of road traffic accidents

4. Research Methodology

4.1 Data Collection

The data of this study were collected from primary source. The units of analysis were youths who were Universiti Utara Malaysia students. The respondents were being approached randomly at their residential colleges and they were asked to participate in this perception study by answering a self-administered survey questionnaire. In view of the study has been conducted via convenient sampling

and the data were based on self-reports, it is not free of bias, hence the results of this study cannot be generalized but are only applicable to the sample of this study.

4.2 Design of Survey Questionnaire

A survey questionnaire was used to gather data from the respondents. The survey questionnaire contains four sections as follows:

(a) Section-A is meant to serve objectives (1) and (2) of this study. It requires the respondents to indicate their perceptions on the following:

- the main cause of road traffic accidents whether it is because of risky human behaviour or the lack of mechanical engineering [objective (1)]; and
- the effective approach to manage road traffic accidents whether it is via human behavioural approach or mechanical engineering approach [objective (2)].

(b) Section-B is meant to serve objective (3) of this study. It requires the respondents to state to what extent they perceive a list of 13 different types of risky driving behaviours (derived from the literatures of Mohd Khairul Alhapiz *et al*. [8] and Noradrenalina *et al*. [9]) to be the potential causes in leading to road traffic accidents based on a six-point ordinal scale, with "1" indicating the least and "6" indicating the most potential cause in leading to road traffic accidents. The 13 risky driving behaviours are then ranked accordingly from the most to the least potential causes in leading to road traffic accidents based on their mean scores. From the rank order results, the three main risky driving behaviours that are potentially highly likely in leading to road traffic accidents can be identified.

(c) Section-C is meant to serve objective (4) of this study. It requires the respondents to indicate their perceptions on the effectiveness of four different measures intended to change the road users' behaviours in order to attain road safety in managing the risks of road traffic accidents (derived from the literature of Noradrenalina *et al*. [9] that there are four important ways in changing road users' behaviour, namely legislation, enforcement, reinforcement and education), by ranking them from the most to the least effective measures, with "1" indicating the most while "4" indicating the least effective measure.

(d) The last section, Section-D gathers the background information of respondents.

5. Research Findings

The results of this study are presented in this section. A total of 479 youths who were Universiti Utara Malaysia students have participated in this perception study. They are all Malaysians in the age range from 19 to 28 years old with majority of them in ages 22 (39.7%; n=190), 21 (28.4%; n=136) and 23 (17.1%; n=82). Among them, 64% are females (n=305) while 36% are males (n=174).

5.1 Perceptions of Youths on the Main Cause of Road Traffic Accidents and the Effective Approach to Manage Road Traffic Accidents

The results on the main cause of road traffic accidents show that almost three quarters of the respondents (74%; n=353) perceived that it is because of risky human behaviour. Meanwhile, slightly more than a quarter of the respondents (26%; n=126) perceived that it is because of the lack of mechanical engineering (Refer to Table 1).

On the other hand, for the approach to manage road traffic accidents, more than half of the respondents (55%; n=265) perceived that it is more effective to manage via human behavioural

approach. Meanwhile, the remaining 45% of the respondents (n=214) perceived that it is more effective to manage via mechanical engineering approach (Refer to Table 1).

Table 1
Perceptions of Youths on the Main Cause of Road Traffic Accidents and the Effective Approach in Managing Road Traffic Accidents

	Main Cause			Effective Risk Management Approach	
	N	%		n	%
Human Behaviour	353	74		265	55
Mechanical Engineering	126	26		214	45
Total	479	100		479	100

The above findings show that majority of the youths participated in this study perceived that the main cause of road traffic accidents is because of risky human behaviour and it is more effective to manage road traffic accidents via human behavioural approach. Hence, this lends support to domino theory. However, the following phenomena must be paid attention to:

(a) The findings of only slightly more than half of the respondents (55%) perceived that it is more effective to manage road traffic accidents via human behavioural approach although there are about three quarters of the respondents (74%) perceived that the main cause of road traffic accidents is because of risky human behaviour.

(b) The findings of 45% of the respondents perceived that it is more effective to manage road traffic accidents via mechanical engineering approach when there are only 26% of the respondents perceived that the main cause of road traffic accidents is because of the lack of mechanical engineering.

The "imbalanced" perceptions of the youths participated in this study on the main cause of road traffic accidents and the effective approach to manage road traffic accidents may suggest that domino theory alone might not be sufficient to explain road traffic accidents. This finding provides support to the concluding remarks of Huang *et al*. [4] and Jamroz's [5] review of accident models on modern road traffic. For this finding, it is suggested that future studies be conducted to examine domino theory in combination with other accident models or newly developed accident models that can better explain road traffic accidents.

5.2 Perceptions of Youths on the Three Main Risky Driving Behaviours in Leading to Road Traffic Accidents

A list of 13 types of risky driving behaviours was being investigated and their mean scores were computed. Their mean scores are in the range of 4.342 to 4.894 on a six-point ordinal scale. This shows that in general the youths perceived the 13 types of driving behaviours to be roughly equally risky and they are at the higher end of the six-point scale. When they are ranked from the most to the least according to their mean scores, the rank order results show that the youths perceived: (Refer to Table 2).

(a) speeding (i.e. driving beyond speed limit) (mean score = 4.894) to be the most potential cause in leading to road traffic accidents;

(b) inattention (i.e. not paying full attention on the road such as eating, smoking or using mobile phone at the time of driving) (mean score = 4.781) to be the second most potential cause in leading to road traffic accidents; and

(c) queue jumping (i.e. dangerously cutting into traffic) (mean score = 4.681) to be the third most potential cause in leading to road traffic accidents.

Table 2
Rank Order Results for 13 Types of Risky Driving Behaviours Based on Mean Scores

Item	Driving Behaviour	Mean Score	Rank
1	Speeding	4.894	1
2	Inattention	4.781	2
3	Queue jumping	4.681	3
4	Dangerous overtaking	4.678	4
5	Fatigue	4.645	5
6	Beating traffic lights	4.624	6
7	Not using signals	4.599	7
8	Drink driving	4.543	8
9	Not using seatbelt or crash helmet	4.524	9
10	Not stopping at road junctions	4.493	10
11	Getting involved in “unofficial” races	4.424	11
12	Not carrying out maintenance on vehicles	4.388	12
13	Not switching on headlights	4.342	13

Note: A bigger value of mean score indicates a higher potential that the risky driving behaviour will lead to road traffic accidents (based on the perceptions of youths who have answered the survey questionnaire).

The finding of speeding being perceived to be the most potential cause in leading to road traffic accidents is in line with the finding of Thomas *et al*. [6] that speed is an important general causation factor for collisions across 15% of all types of road users in EU, and the finding of Liana *et al*. [7] that speeding is a major cause of road accidents by motorised vehicles in Malaysia. This finding is also consistent with the finding of Mohd Khairul Alhapiz *et al*. [8] that riding over speed limit is the risk-taking behaviour most likely committed by motorcyclists and it is a contributing factor to motorcycle crashes. Meanwhile, the finding of inattention being perceived to be the second most potential cause in leading to road traffic accidents provides support to the finding of Thomas *et al*. [6] that temporary personal factors especially distraction is found to be an important specific causation factor for collisions across 24% of all types of road users. However, the finding of queue jumping being perceived to be the third most potential cause in leading to road traffic accidents is contrary to the finding of Noradrenalina *et al*. [9] that queue jumping is being perceived to be not a serious traffic offence by the road users in their study.

The findings on speeding, inattention and queue jumping being perceived as the three main risky driving behaviours that have high potential in leading to road traffic accidents are important findings. These findings could be used by relevant authorities and agencies to devise specific road safety programs to raise the awareness of road users regarding the dangers of speeding, inattention and queue jumping in order to manage road traffic accidents more effectively.

5.3 Perceptions of Youths on the Effectiveness of Risk Management Measures for Road Traffic Accidents

In this section, the effectiveness of four risk management measures meant to prevent the occurrence of road traffic accidents by changing the road users’ behaviours in order to attain road safety were being investigated. The findings show that majority of the youths perceived that severe punishment (e.g. a heavier penalty amount or a longer jail sentence imposed on violating traffic rules)

(38%; n=182), overt enforcement activities (e.g. traffic police in uniform on patrols, roadblocks, or putting up enforcement cameras) (37%; n=178), covert enforcement activities (e.g. plain-clothes traffic police on patrols or using unmarked police vehicles for enforcement) (34%; n=162) and road safety campaign or education (48%; n=230) are the most, second most, third most and the least effective risk management measures respectively for road traffic accidents. (Refer to Table 3)

Table 3
Perceptions of Youths on the Effectiveness of Risk Management Measures for Road Traffic Accidents

	Risk Management Measure Intended to Change Road Users' Behaviours							
	Severe Punishment		Overt Enforcement Activities		Covert Enforcement Activities		Road Safety Campaign / Education	
Rank	n	%	n	%	n	%	N	%
1	182	38.0 *	132	27.6	75	15.7	90	18.8
2	91	19.0	178	37.2 *	144	30.1	66	13.8
3	98	20.5	126	26.3	162	33.8 *	93	19.4
4	108	22.5	43	9.0	98	20.5	230	48.0 *
Total	479	100.0	479	100.0	479	100.0	479	100.0

Note: (1) The rankings of "1" to "4" with "1" indicating the most while "4" indicating the least effective measure in managing the risks of road traffic accidents.
(2) When the percent column does not sum up 100.0, it is because of rounding effect.

Although the sequence (order) of perceived effectiveness on risk management measures for road traffic accidents of this study (i.e. severe punishment, overt enforcement activities, covert enforcement activities, and road safety campaign or education) does not completely match those in the study of Noradrenalina *et al*. [9] (i.e. traffic punishment, media exposure and safety campaign, the experience of being caught in the past, and the visibility of enforcement activities), there are similarities in the findings of these two studies: (i) both studies have found that punishment is perceived to be the most effective risk management measure for road traffic accidents, and (ii) both studies have found that overt enforcement is perceived to be more effective than covert enforcement in managing road traffic accidents.

6. Conclusion

Road traffic accidents have become a major concern to Malaysia and effective measures should be put in place to address this issue. This study is a preliminary investigation to examine whether the perceptions of youths conform to domino theory on the causation and risk management of road traffic accidents. The major findings of this study show that the perceptions of the youths participated in this study conform to domino theory. Majority of them perceived that risky driving behaviours are potential causes of road traffic accidents, and human behavioural approach would be effective to manage the risks of road traffic accidents through the implementation of various measures intended to change the road users' behaviours in order to attain road safety.

Speeding, inattention and queue jumping have been identified to be the three main risky driving behaviours that are potentially highly likely in leading to road traffic accidents. In trying to change the road users' behaviours in order to attain road safety, imposing severe punishment is perceived to be the most effective risk management measure. Then, enforcement activities are seen to be an effective measure in improving traffic order and to enhance road safety. Between overt and covert enforcement activities, the former is preferred. Meanwhile, road safety campaign or education is perceived to be the least effective among the four risk management measures examined.

Based on these findings the relevant authorities and agencies could work out appropriate risk management plans in trying to change the road users' risky behaviours, especially on speeding,

inattention and queue jumping, in order to attain road safety. This could be done through imposing heavy penalties on traffic offences, and more heavy penalties to be imposed on road users who have committed traffic offences identified in this study as the three main risky driving behaviours in leading to road traffic accidents. The relevant authorities and agencies also could increase the visibility of enforcement activities to remind the road users that their behaviours are being monitored in order to improve traffic order and to enhance road safety. Besides that safety programs, campaigns and education to raise the awareness of road users regarding the dangers of risky driving behaviours should be put in place in order to inculcate a safe driving culture among road users.

Having said the above, the "imbalanced" perceptions of the youths on the causation and risk management of road traffic accidents between (i) the cause is due to risky human behaviors and to manage via human behavioral approach and (ii) the cause is due to the lack of mechanical engineering and to manage via mechanical engineering approach suggest that domino theory alone is not adequate to explain road traffic accidents. As such, further and more in-depth studies in this respect are warranted to search for accident models that can better explain road traffic accidents.

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