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中文摘要

　　過去兩期研究，已分析出國內事故原型與駕駛行為特性，鑒於駕駛人行為對安全之關鍵性影響，了解駕駛人於駕駛途中的思考邏輯將有助於更進一步釐清事故之原貌，因此於本計畫當中，結合計劃行為理論 (Theory of Planned Behavior, TPB) 與風險平衡理論 (Risk Homeostasis Theory, RHT) 建構高風險駕駛行為模式，以更進一步探討駕駛行為與個人特質之關係。

　　考量國內年輕機車騎士相較於其他族群之高事故率，本研究針對年輕機車族群透過結構方程模式 (Structure Equation Model, SEM)，納入個人特質、風險認知、效用認知、安全態度與高風險駕駛行為等構面建構年輕機車駕駛高風險行為模式，以企圖了解風險行為之產生究係出自於年輕騎士對風險之低估，或對效用之高估，亦或對現代交通設施運作知識之不足；研究共蒐集 683 筆 18 歲至 28 歲間，持有合法駕駛執照，並於最近一個月內有騎乘機車經驗的駕駛人問卷。

　　研究結果顯示，個人特質會透過態度、風險感知、效用感知等構面對高風險駕駛行為產生影響，值得注意的是，機車高風險駕駛行為並非全屬於年輕經驗不足的駕駛族群，相反的，具有良好技術、自信且對於現代駕駛文化十分了解的駕駛人仍會有高頻率的高風險駕駛行為；此外，本研究發現「輕忽路況」構面對機車高風險駕駛行為產生負面影響，亦即常常忽略觀察週遭交通狀況的騎士會產生較少的高風險駕駛行為，此一駕駛族群可被視為緊張且技術生疏甚或安全知識不足的機車騎士，因為擔心發生事故而造成他們太過緊張或知識不足而忘記或怠忽觀察週遭車流。此等結果提供了安全教育以及智慧型運輸安全系統發展策略上重要之參考。

英文摘要

In the last two-year studies, a prototype of accidents and characteristics of driving behavior had been explored. Critical effects of driving behavior on safety were clearly shown. It also suggests that understanding of what drivers think while driving on the road can help to clarify the nature of accidents. Therefore, a risky driving behavior model incorporating concepts of Theory of Planned Behavior (TPB) and Risk Homeostasis Theory (RHT) was constructed for further discussion the relationship between individual personality traits and risky driving behavior.

Since young motorcyclists were frequently involved in roadway accidents in Taiwan, this paper presents a Structure Equation Model (SEM) framework to discuss the mechanism of risky riding behavior prevailing in young motorcyclists. Aiming to clarify young rider's risky behavior is due to underestimation of risk, or overestimation of utility, or lack of knowledge in modern traffic operation, a behavior model incorporating personality traits, risk perception, utility perception, attitude towards safe riding, and risky riding behavior is proposed. Questionnaires from six hundred and eighty three young motorcyclists aged between 18 and 26 years old, holding qualified licenses and having motorcycle riding experience during the past month were collected for analysis.

As expected, the results indicate that personality traits indirectly affected riding behavior via attitude, risk perception, and utility perception. Notably, risky riders are not all related to those young inexperienced riders. Instead, they tend to be skillful, confident, and understanding modern traffic rules. Furthermore, one interesting result relates to the construct of unawareness of traffic conditions, which appeared to affect strongly and negatively on risky riding behavior. Riders who frequently neglected the traffic situation exhibit fewer risky riding behaviors. Such riders can be considered nervous, unskillful or lacking safety knowledge, whose fear of involving in an accident led them to fail to observe the surrounding traffic conditions. This result suggests managerial implications for safety education and for future ITS development.

壹、研究緣起

本研究為三年連續性研究計畫之第三年計畫；在第一期的研究中，本研究以事故鏈 (accident chain) 概念出發，利用粗略集合理論 (Rough Set Theory) 分析內政部警政署道路交通事故資料庫資料 (Wong and Chung, 2007a, 2008)。研究結果發現，粗略集合理論確可有效利用事故資料庫所提供的豐富資訊，萃取出事故原型；每一事故原型描述著該類事故是由何種駕駛者、在什麼樣的時間、什麼樣的自然環境以及道路環境下發生。在七類單一小客車事故 (衝撞道路設施、衝撞建築物或橋墩、衝撞非固定物、衝撞施工區、衝出路外、翻車及其他) 中，除了衝撞道路設施外，其餘各類事故的發生型態皆非常獨特。其中較為明顯且值得注意的事故型態特徵包括，在正常的行車環境中缺乏經驗的年輕學生駕駛相對於其他族群有較高發生衝出路外事故的可能性，而路面溼滑為發生衝撞道路設施一個極重要的區別因素。

道路交通事故係為一錯綜複雜之系統，事故之發生受到人、車、路、環境等因素交互影響，於第一期研究中，事故原型分析雖能提供研究者豐富資訊以探究事故之原貌，然而囿於事故資料庫僅能提供車禍發生當下各項屬性以及事故發生後造成的結果，對於造成事故發生之關鍵因素「駕駛人行為特性」卻未能進行探討，以致無法將事故發生成因作一完整闡述；有鑑於此，於第二期研究當中本研究更深入探討駕駛行為與交通事故之間的關係，針對獨特性事故型態與重現性事故型態之特性進行區分，以及駕駛行為實證資料之收集分析。研究結果發現，符合重現性事故型態之事故，其駕駛人大都具有高風險的特徵，而獨特性事故型態則與道路環境有明顯相關。在駕駛行為實證資料收集分析方面，經由駕駛人自我報告方式，採問卷調查收集駕駛人行為特性，透過兩階段因素分析，並佐以二元羅吉斯特迴歸以及k-means 分群法。發現國內駕駛人行為可萃取出五個構面：分心性、急躁性、警覺性、解離性以及緊張性；其中愈容易分心以及愈不容易緊張的駕駛人，愈常發生超速被取締。另外，駕駛經驗愈久、結過婚、有小孩以及開車通勤的人，較不常出現分心、急躁、不警覺、解離或緊張等駕駛行為；中年人相較於年輕人或老年人，男性駕駛人相較於女性駕駛人，在駕駛行為綜合評估上表現較佳。

經過前兩階段之分析，對於事故原貌已有更深層之探討，然而考量到前述對事故情境與行為研究多針對駕駛階段，事實上事故並非僅受到近端諸如駕駛行為與駕駛情境等因素影響，從事故鏈之角度呈現事故形成經過可發現，諸多遠端因素在駕駛人坐上駕駛座前即對駕駛行為與事故風險產生顯著之影響 (Verschuur and Hurts, 2008; Wong and Chung, 2007a; 2007b)；其中，個人特質為影響駕駛行為重要因素，於第三期計畫當中，本研究將事故成因探討往更前端的事前因素做延伸以更進一步解構駕駛行為，透過駕駛者異質性分析，了解具有何種特性之駕駛人會傾向採取高風險駕駛行為。

貳、研究課題與目的

　　相較於其他年齡層之駕駛人，年輕族群駕駛曝光量較低，但是其事故率卻遠高於其他族群 (Clarke *et al.*, 2005; Machin and Sankey, 2008; Waylen and McKenna, 2008)，曾平毅等人 (民90) 透過台北市交通事故資料計算各年齡層事故率，研究結果亦發現18-26歲為事故率最高之年齡層。早期研究認為年輕駕駛族群高事故率肇因於經驗不足與技術不純熟所致，然而Clarke *et al.* (2005) 等研究者卻認為即使是經驗豐富的駕駛人仍具有較高事故風險，此外，年輕駕駛族群對於駕駛而言常出現過度自信且具有較高的風險承受度之現象，即使在單純交通環境下亦常發生事故 (Clarke *et al.*, 1998; 1999)；由上述可知，經驗不足顯然並非唯一造成年輕駕駛高事故風險的原因，亦非所有年輕駕駛人皆應認定為高風險族群，為探討此一駕駛人異質現象，必須更深入探討造成駕駛人行為特性差異的影響因素方能了解事故全貌 (Wong and Chung, 2007a; 2009)。

　　Dahlen *et al.* (2003) 與 Ulleberg and Rundmo (2003) 認為「人」是造成事故因素中最為重要的環節，為探討駕駛人特性造成之影響，過去文獻多由兩種角度切入研究年輕族群高風險駕駛行為的影響因子。其一為外在生活環境，即年輕族群於日常生活中接觸的人、事、物，影響其行使高風險駕駛行為的機率 (Bianchi and Summala, 2004; Özkan *et al.*, 2006)；另一則由個體著手，深入探討潛藏於駕駛者內在特質，及引發高風險駕駛行為的心理程序。為了及早預防與改善年輕時期高風險駕駛族群顯現之行為，多數文獻採取長期調查方式，試圖建構每一生命週期之成長狀態，瞭解高風險族群於早期各階段生活環境的表現狀況 (Begg *et al.*, 1999; Vassallo *et al.*, 2007a; Vassallo *et al.*, 2007b)，然此研究方式耗時多年，難以實施，是以本研究由個體心理認知層面著手，探討高風險駕駛行為的內在影響因素與程序。

　　參考Ajzen (1991) 提出的計畫行為理論，Ulleberg and Rundmo (2003) 以結構方程模式 (Structural Equation Modeling, SEM) 建構年輕族群高風險駕駛行為模型如圖 1，發現高風險駕駛行為受到個人特質 (personality trait) 的間接影響，其中介變數包含安全駕駛態度 (attitude towards driving safety) 以及風險感知 (risk perception)，然而其中風險感知對高風險駕駛行為並無直接影響，而是透過安全駕駛態度。

　　綜合上述，本研究擬修正 Ulleberg and Rundm (2003) 建構之年輕族群高風險駕駛行為模式，探討納入個人特質、風險感知與安全駕駛態度等構面對行為之影響，並考量駕駛效用對行為選擇之影響，將「效用感知」此一構面納入分析。
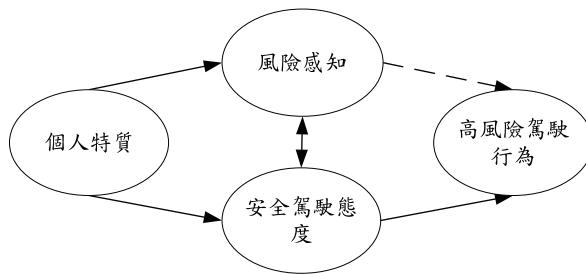
資料來源：Ulleberg and Rundmo (2003)

圖 1 高風險駕駛行為影響程序

　　納入個人特質、風險感知與安全駕駛態度，另加入「效用感知」；設定個人特質為源頭影響因素，中介變數為風險感知、效用感知與安全駕駛態度，最終外生變數為高風險駕駛行為。在年輕駕駛族群部分，訂定為 18~28 歲、持有合法駕照，並於最近一個月內有實際駕駛經驗者。在駕駛運具方面，鑒於機車事故發生機率甚高 (Elliott *et al.* 2007)，過去研究機車駕駛行為之相關文獻卻極少，本研究以機車族群作為研究對象。

　　具體而言，本研究之研究目的為：探討效用感知於年輕機車族群高風險駕駛行為影響程序中之角色，亦即希望能釐清年輕族群之高風險駕車行為究係肇致於低估風險或是高估效益，亦或是對交通系統運作常識不足之結果；並建構高風險年輕機車族群心理層面對駕駛行為之完整影響程序。

參、 高風險駕駛行為模式

　　研究架構由個人特質、風險感知、效用感知、安全駕駛態度與高風險駕駛行為五個構面組成；其中，個人特質為外生構面，風險感知、效用感知與安全駕駛態度為中介構面，高風險駕駛行為是內生構面。各構面定義如表 1 所示；

表 1 高風險駕駛行為模式構面定義

	構面	定義
個人特質	追求感官刺激	對新奇、危險且激發感官知覺的活動感到興趣並致力於參與 (Zuckerman ,1994)
	利他主義	有同理心，懂得為他人設想 (Ulleberg, 2002)
	無規範感	不遵從社會規範及法規，難以控制或不負責任 (Ulleberg, 2002)
	情緒穩定度	騎車時，駕駛者遭遇外界干擾而影響其情緒波動的程度 (Deffenbacher *et al.* ,1994)
中介變數	風險感知	駕駛者對其自身能力與環境互動後產生的駕駛情境感受的風險程度 (Machin and Sankey , 2007)
	安全駕駛態度	騎車時，為了安全行駛所抱持的態度 (Yagil ,1998)
	效用感知	駕駛者藉由高風險駕駛行為感受的效益
高風險駕駛行為		易導致車禍的駕駛行為

一、外生構面—個人特質

個人特質又稱為「人格特質」，它是個體反映環境刺激時的內在心理傾向，其將決定後續的外顯行為模式 (Gordon Allport, 1937)。過去研究認為諸如憤怒 (anger)、追求感官刺激 (sensation-seeking)、利他主義 (altruism) 及無規範感 (normlessness) 等人格特質子構面會對年輕族群引發高風險駕駛行為產生顯著影響 (Ulleberg, 2002; Dahlen *et al.*, 2005; Sullman, 2006; Oltedal and Rundmo, 2006; Schwebel *et al.*, 2006)，Ulleberg (2002) 認為事故風險較高的駕駛族群通常具有較高的追求感官刺激、無規範感與憤怒，以及較低的利他性，該類型駕駛人發生高風險駕駛行為的頻率也較高，故本研究將個人特質分為上述四個構面。

二、中介構面

本研究之中介構面包含風險感知、安全駕駛態度、效用感知。風險感知除了以駕駛者自行評估未來發生車禍可能性 (likelihood of accident)、駕駛信心 (self-efficacy) 及高風險駕駛行為趨避程度 (aversion to risk taking) 等作為衡量準則 (Ulleberg and Rumdo, 2003; Taubman-Ben-Ari *et al.*, 2004)；近來亦提出情意感知 (affective perception) 的觀念，以憂慮與擔心 (worry and concern) 做為衡量基準 (Machin and Sankey, 2007)，探討其對駕駛情境的風險感知之影響。Yagil (1998) 發現多數年輕駕駛高估自身駕駛能力並低估駕駛情境風險，因而增加高風險駕駛行為的頻率。

駕駛者對於高風險駕駛行為帶來節省時間或宣洩情緒的效用感知，將顯著影響高風險駕駛行為的行使與否；倘若駕駛者極度追求效用感知，將增加高風險駕駛行為的頻率，但若駕駛者認為駕駛情境的風險性較高，這將可能降低高風險駕駛行為的頻率。

一般認為人類對某項行為的偏好程度將影響此行為的執行與否，偏好程度愈多則執行行為的機會愈大，而此偏好程度稱為人類對此項行為抱持的「態度」；將之應用於駕駛行為，高風險駕駛行為的執行與否在於其對「安全駕駛」抱持的態度，「安全駕駛」即是行駛時為了不受傷害產生的駕駛行為，假使駕駛者重視駕駛安全性，則傾向於小心翼翼駕駛，反之將增加高風險駕駛行為的機率；年輕族群的安全駕駛態度不若其他年齡族群強烈，為年輕駕駛好發高風險駕駛行為之原因 (Ulleberg, 2002; Ulleberg and Rundmo, 2003)。由於安全駕駛態度植基於過去駕駛經驗，是以每次實際駕駛的風險感知與效用感知最終將形塑而成安全駕駛態度。

三、內生構面—高風險駕駛行為

　　駕駛人行為問卷 (Driver Behaviour Questionnaire, DBQ) 最初由Reason *et al.* (1990) 開始發展，該問卷共列出50 個不同的駕駛人異常行為，經由因子分析將受測者行為分為違規 (violations)、無害疏失 (harmless lapses)、危險失誤 (dangerous errors) 三大類型；透過年齡、性別與駕駛曝光量之分析可發現，男性駕駛人較女性駕駛人容易發生違規行為，然而女性駕駛人發生無害疏失之情形較為頻繁，違規行為會隨著年齡增加而降低；此外，駕駛人道路使用曝光量愈高，其違規頻率也會增加，隨著使用道路的經驗累積，駕駛人危險失誤的發生情形有降低的現象。後續研究多數皆依循此一架構進行，其中Parker *et al.* (1995) 發現男性與年輕駕駛更容易發生事故，作者認為可針對上述駕駛族群進行教育，提升其安全駕駛之態度；Lajunen *et al.* (1998) 另發現年齡越輕的駕駛人越容易被其他駕駛人的魯莽行為激怒。

四、研究假設

　　綜合上述，本研究架構如圖 2 所示，共由八個構面組成三大階層，第一階層為個人特質，包含追求感官刺激、利他主義、無規範感及情緒穩定度；第二階層為中介變數，有風險感知、效用感知與安全駕駛態度；最後則是高風險駕駛行為。在因果關係部分，個人特質將透過中介變數間接影響高風險駕駛行為。
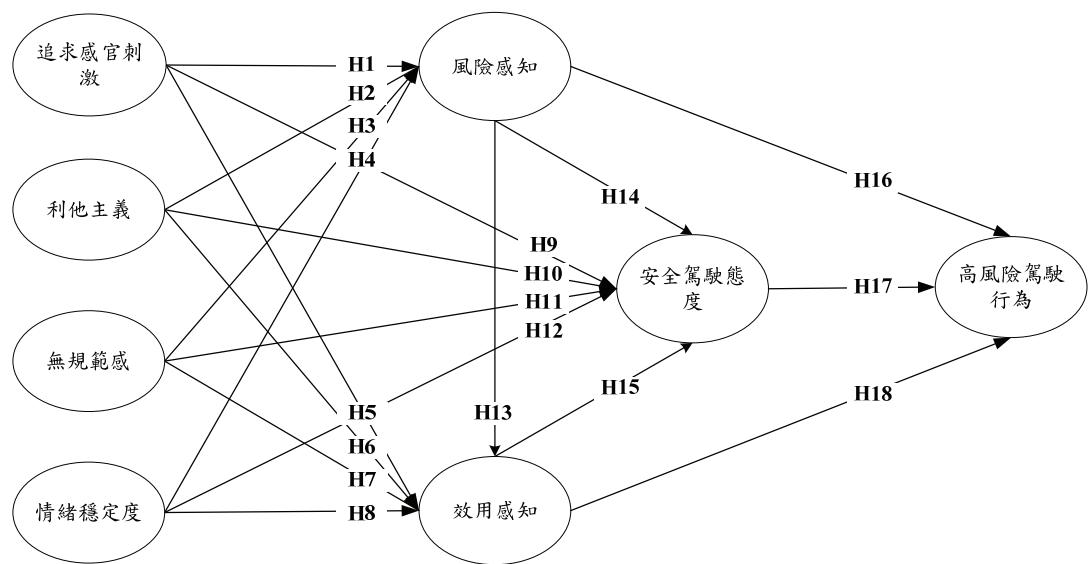

圖 2 研究架構

相關研究假說如下。

1. 個人特質與中間媒介

   a. 風險感知
   H_1：追求感官刺激對風險感知有顯著負向影響
   H_2：利他主義對風險感知有顯著正向影響
   H_3：無規範感對風險感知有顯著負向影響
   H_4：情緒穩定度對風險感知有顯著負向影響

   b. 效用感知
   H_5：追求感官刺激對效用感知有顯著正向影響
   H_6：無規範感對效用感知有顯著正向影響
   H_7：利他主義對效用感知有顯著負向影響
   H_8：情緒穩定度對效用感知有顯著正向影響

   c. 安全駕駛態度
   H_9：追求感官刺激對安全駕駛態度有顯著負向影響
   H_{10}：無規範感對安全駕駛態度有顯著負向影響
   H_{11}：利他主義對安全駕駛態度有顯著正向影響
   H_{12}：情緒穩定度對安全駕駛態度有顯著負向影響

2. 中介變數相互關係
   H_{13}：風險感知對效用感知有顯著負向影響
   H_{14}：風險感知對安全駕駛態度有顯著正向影響
   H_{15}：效用感知對安全駕駛態度有顯著負向影響

3. 中介變數與高風險駕駛行為
   H_{16}：風險感知對高風險駕駛行為有顯著負向影響
   H_{17}：安全駕駛態度對高風險駕駛行為有顯著負向影響
   H_{17}：效用感知對高風險駕駛行為有顯著正向影響

五、量表與實驗設計

除了受測者基奔資料 (如表 2) 之收集外，針對圖 2 架構中各構面相關之衡量變數進行問卷之設計與資料收集。

表 2 駕駛經驗與社會經濟變數

請寫下你/妳的年齡？
請寫下你/妳的性別？ □ 男 □ 女
請問你/妳的婚姻狀態？ □ 未婚 □ 已婚
請問你/妳的教育程度？ □ 國中或以下 □ 高中 □ 大學 □ 研究所
請問你/妳的職業為何？□ 學生 □ 上班族 □ 其他
請問你/妳開車的經驗多久？ 年
請問你/妳每個禮拜平均開車約幾天？ 天
請問你/妳每天平均開車時間約多久？ 小時
請問你/妳一個禮拜平均約開車幾公里？ 公里
請問你/妳是最近兩年內否曾經發生過車禍？ □ 是 □ 否
若有，發生幾次？□1 次 □2 次 □3 次或以上
有多嚴重？ □ 未受傷 □ 輕微受傷 (可自行處理)   □ 一般受傷 (需去醫院處理，但未住院)□ 嚴重受傷 (需住院)
請問你/妳曾經因為超速被取締嗎？ □ 是 □ 否
請問你/妳曾經因為酒醉駕車被取締嗎？ □ 是 □ 否
請問你/妳曾經因為其他違規行為被取締嗎？ □ 是 (何種行為？) □ 否

　　情緒穩定度問像部分係參考 Deffenbacher *et al.* (1994) 發展之駕駛者憤怒量表 (DAS)，並依據機車駕駛情形加以修改而成，最後共得 12 題問項，並以李克特 5 尺度衡量憤怒情緒，由 0、1、2、3、4 代表，0 表示毫不生氣，4 表示生氣程度最大。 追求感官刺激及利他主義參考 NEO-PIR 人格特質量表，追求感官刺激共有 6 個問項，利他主義有 7 個問項。以李克特 5 尺度衡量，分別代表非常不同意、不同意、普通、同意及非常同意。無規範感則是參考 Ulleberg (2002) 設計之量表，包含設計之包含 4 個問項，也是由非常不同意、不同意、普通、同意及非常同意之李克特 5 尺度衡量。表 3 列示本研究修正完成有關個人特質之問項。

　　中介變數部份包含安全駕駛態度、風險感知、效用感知。風險感知問項由駕駛者自行評估其未來發生車禍可能性及駕駛信心、憂慮及對高風險駕駛行為危險程度的認知 (Ulleberg, 2002; Machin and Sankey, 2007)。其中對高風險駕駛行為危險程度的認知一項，相關問項係由本研究針對國內機車使用之環境所設計，詢問填答者直觀上對那些所謂的高風險駕駛行為之危險感受程度。

表 3 個人特質量表

個人特質	問項
情緒穩定度	前方車輛未注意到我的機車就向後倒退
	欲超車時，發現對方車輛亦隨即加快車速
	鄰近車道車輛強行進入本人行駛中的車道，阻擋我的行進
	行走於巷道中之行人阻擋我的行進
	行駛於壅塞之車流中
	騎在一大型的卡車後頭使我無法清楚看到前方車況
	騎在排放大量廢氣的車輛後頭
	某人對我的駕駛作為比了一個不雅的手勢或大聲咆哮

表 3 個人特質量表 (續)

個人特質	問項
情緒穩定度	某人對我的駕駛作為猛按喇叭
	前方車輛速度太慢阻擋我順利前進
	看到有車輛於車流中亂竄
	看到闖紅燈的車輛
追求感官刺激	我常常渴望尋求刺激
	有時候我做某些事情只是為了尋求冒險和刺激
	我避免看那些令人震慄或恐怖的電影
	我喜歡雲霄飛車帶給我的刺激感
	我喜歡作為球賽現場觀眾一份子的感覺
	我不喜歡賭博帶給我的刺激感
利他主義	很少人覺得我自私又自我中心
	很少人覺得我冷漠又愛算計
	我盡量對遇到的每個人都表現得有禮貌
	我通常能適時給予旁人協助而不需他人提醒
	大部分認識我的人都喜歡我
	如果可能，我會盡最大的能力去幫助別人
	我不是以慷慨著稱的
無規範感	只要不會惹上麻煩，我會勇於去做任何我想做的事
	只要不是直接違法，遊走法律邊緣是可接受的
	為了順利進行某些事情，過程中有些行為的對錯不是那麼重要
	有些事情即使可以合法從事，我卻會認為是不應該的行為

　　至於駕駛效用問項，主要考量有二，一為宣洩情緒的效用，另一為節省時間的效用，其中省時效用於過去文獻中混於「安全駕駛態度」中，本研究將之獨立為駕駛效用。它由 8 個問項組成，量測受測者對於為節省時間或宣洩情慾而危險駕駛的同意程度。安全駕駛態度則是參考 Iversen (2004) 與 Ulleberg and Rundmo (2003) 之量表，並依據機車駕駛行為予以修改，共有 14 個問項。中介變數相關問像綜整如表 4。

表 4 中介變數問項

中介變數		問項
風險感知	未來發生車禍可能性與擔憂	我覺得騎車環境不夠安全，自己可能會遭遇車禍而受傷
		行駛於不熟悉的道路環境中，我能夠處理一切突發狀況
		當遭遇危險時，我的駕駛技巧能幫助我安全脫離險境
		我覺得假如要發生車禍，無論如何均無法避免
		我會主動關心自己可能也會成為受害者之一的交通事故風險資訊
	高風險駕駛行為危險程度的認知	未用後照鏡觀察其他車輛動向即變換車道
		轉彎時未打方向燈
		夜晚或進入隧道未開啟大燈
		交通號誌一轉為綠燈即快速駛出路口
		於車輛間隙中穿梭以
		未與前車保持安全距離
		行駛於次要道路，看到主要道路有來車，仍然勉強匯入車流
		轉彎時未放慢車速
		高於周遭車流的速度行駛於道路上

表 4 中介變數問項 (續)

中介變數			問項
風險感知	高險程度的認知	高風險駕駛行為危	路上無其他用路者時，就急速行駛
			酒後騎車
			因前方車輛阻擋前進，轉入逆向車道超車
			於兩段式左轉路口直接左轉
			闖紅燈
			騎車時手持手機通話
			未戴安全帽
駕駛效用	節省時間		為了順利前進，我會於車輛間隙穿梭前進
			當我行駛於次要道路時，為了順利轉彎，就算主要道路有來車，強行插入是必須的
			為了順利前進，於雙車道路段駛入對向車道是可接受的
			有些兩段式左轉路口紅燈秒數過長，我會選擇直接左轉
			有時候為了節省繞道時間，逆向行車是可接受的
	宣洩情緒		騎快車讓我感覺刺激
			除了運輸功能，騎車也讓我享受速度與樂趣
			騎車可抒發我的情緒與壓力
安全駕駛態度			有時候為了趕時間，不遵守交通規則是必須的
			保持順暢車流遠比遵守規則重要
			有時候冒險駕駛是必須的
			冒險駕駛與違規駕駛並非較不安全
			無論道路或氣候環境如何惡劣，交通規則是一定要遵守的
			可在交通號誌由黃燈轉為紅燈的瞬間超越路口
			當路上沒有其他用路者時，冒險駕駛是可以接受的
			交通規則都太複雜了以至於難以實際遵行
			如果駕駛者有良好的駕駛技術，超速駕駛是可以接受的
			如果駕駛環境許可，我認為超速駕駛是可以接受的
			對於超速駕駛的懲處應該更加嚴厲
			因速限訂定過於保守，超速駕駛總是會發生
			我絕對不會搭乘有喝酒者駕駛的機車
			我可以接受搭載我的機車超速行駛

另外，高風險駕駛行為之部分則參考 Chang and Yeh (2007) 之問項，以李克特 5 尺度衡量填答者行駛高風險駕駛行為的頻率，分別是從未如此、很少如此、有時如此、經常如此及總是如此。問項內容如表 5。

表 5 高風險駕駛行為問項

	問項
高風險駕駛行為	未使用後照鏡觀察其他車輛動向就變換車道
	轉彎時未打方向燈
	夜晚或進入隧道未開啟頭燈
	交通號誌一轉為綠燈即快速駛出路口，未仔細注意仍在穿越橫向車道的車輛或行人
	為了騎得更快，於車輛間隙穿梭前進
	與前車距離過近，以致於緊急剎車時幾乎撞上前車
	未注意前方動向，而差點撞上其他行人或車輛
	行駛於次要道路時，看到主要道路有來車，仍然勉強匯入車流
	車速過快，自覺即將失去對機車的控制
	相較於周遭車流，自己的行駛速度快上許多

表 5 高風險駕駛行為問項 (續)

	問項
高風險駕駛行為	夜晚或清晨騎車時忽略速限
	酒後駕車
	於兩段式左轉路口直接左轉
	闖紅燈
	違規進入逆向車道行駛
	邊騎車邊手持手機通話
	未戴安全帽

肆、 問卷分析

一、受訪者基本資料分析

本研究共回收 720 份問卷,有效問卷 683 份,樣本社經特性統計如表 6 所示。受訪者的年齡多分布於 22 歲至 25 歲,每個年齡層約占總數 10%~17%不等,21 歲以下以及 26 歲以上的受訪者所占比例較少,皆不到 10%。在性別部分,男性樣本數目較多,但男女比例差異不大。在婚姻狀態方面,因本研究鎖定 18 歲至 28 歲駕駛者為研究對象,是以受訪者未婚者約占 97%。在教育程度方面,擁有大學學歷者占 61.1%,擁有研究所學歷者佔 32.8%,其他則是擁有高中以下學歷者,可知高達 94%的受訪者擁有大學以上學歷。在職業類別方面,學生占 67.6%,上班族占 26.6%。

在騎車經驗相關問項方面,平均騎車經驗是 5.24 年,標準差為 1.70 年,超過一半的受訪者至少騎車 5 年,值得注意的是,騎車經驗最多為 15 年,交叉比對年齡後,顯示部分受訪者未達考照年齡即騎車上路;另外,受訪者每天平均約騎車 44.92 分鐘,標準差為 33.51 分鐘,顯示每位受訪者每天騎車時間的變異極大,此現象可能是因住處至公司或學校的距離存在遠近的差異所致。

在車禍經驗方面,有將近三成的受訪者於過去兩年內曾經發生過車禍,而這些車禍中約有七成未受傷或輕微受傷,另外三成傷勢較重須由醫院處理。在違規方面,有 12%的受訪者曾經因超速被取締,有因其它駕駛行為而被取締者,以闖紅燈高居第一,未兩段式左轉次之,之後依續為紅燈右轉、違規停車與未戴安全帽等,至於因酒駕被取締者則非常少,僅有一個樣本。

表 6 樣本社經特性、騎車經驗及車禍歷史

屬性	類別	樣本數/值	百分比 (%)
年齡	18	33	4.8
	19	27	4.0
	20	43	6.3
	21	55	8.1
	22	73	10.7
	23	91	13.3
	24	114	16.7
	25	88	12.9

表 6 樣本社經特性、騎車經驗及車禍歷史 (續)

屬性	類別	樣本數/值	百分比 (%)
年齡	26	57	8.3
	27	54	7.9
	28	48	7.0
性別	男性	366	53.6
	女性	317	46.4
婚姻狀態	未婚	663	97.1
	已婚	20	2.9
教育程度	高中或以下	42	6.2
	大學	417	61.1
	研究所以上	224	32.8
職業	學生	462	67.6
	上班族	182	26.6
	其他	39	5.7
騎車經驗 (年)	平均值 (標準差)	5.24(1.698)	-
	最小值	1	-
	中位數	5.00	-
	最大值	15	-
每個禮拜騎車天數	平均值 (標準差)	5.01(2.040)	-
	最小值	0	-
	中位數	5.50	-
	最大值	7	-
每天騎車時間(分鐘)	平均值 (標準差)	44.92(33.514)	-
	最小值	0	-
	中位數	130	-
	最大值	180	-
最近兩年內是否發生車禍	是	200	29.3
	否	483	70.7
車禍嚴重度	未受傷	38	19.0
	可自行處理	106	53.0
	去醫院處理但未住院	50	25.0
	住院	6	3.0
曾被取締超速駕駛	是	82	12.0
	否	601	88.0
曾被取締酒醉駕駛	是	1	0.1
	否	682	99.9
曾被取締其他違規駕駛	否	379	55.9
	是	304	44.1
被取締行為 (最多填寫三種)	闖紅燈	79	26.0
	未兩段式左轉	64	21.1
	紅燈右轉	59	19.4
	違規停車	47	15.5
	未戴安全帽	24	7.9
	禁行機車處騎車	19	6.3
	無照駕駛	11	3.6
	逆向行駛	9	3.0

二、各構面問項分析

本階段問卷分析包含各問項之平均得點、標準差、偏態系數及峰態系數,當問項之標準差過小及偏態系數和峰態系數過大時,表示該問項填答狀況相當集中且呈現不對稱分配,顯示具有較低的鑑別力,於後續分析將考慮將該問項刪除。

由表 7 可以發現,在追求刺激問項中 (Q01~Q06),Q03 與 Q06 為反向問法,即得分愈高代表愈不易追求刺激。除 Q05 之外,其他問項的平均值皆介於 1.9~2.2 間,同時各題目的標準差夠大、偏態系數及峰態系數夠低,顯示題目具有一定的鑑別能力。

表 7 追求刺激問項敘述性統計量

衡量方式	題號	問項	平均值	標準差	偏態	峰態
同意程度	Q01	我常常渴望尋求刺激	1.91	0.95	0.00	-0.46
	Q02	有時候我做某些事情只是為了尋求冒險和刺激	2.04	1.00	-0.18	-0.72
	Q03	我避免看那些令人震慄或恐怖的電影	2.03	1.12	-0.01	-0.90
	Q04	我喜歡雲霄飛車帶給我的刺激感	2.13	1.11	-0.15	-0.75
	Q05	我喜歡作為球賽現場觀眾一份子的感覺	2.62	1.01	-0.48	-0.29
	Q06	我不喜歡賭博帶給我的刺激感	2.24	1.07	-0.12	-0.75

如表 8 所示,在利他主義問項中 (Q07~Q13),平均值約位於 2.3~3.0 之間,此區間明顯高於追求刺激之平均值區間,顯示多數受訪者認為自己會由利於他人的角度對待外人,尤其 Q09 與 Q12 平均值高,標準差小且峰態系數大,表示受訪者填答狀況相當集中,此二題可能不具鑑別能力;此外,Q13 為反向問法,即分數愈高表示愈缺乏利他主義。

表 8 利他主義問項敘述性統計量

衡量方式	題號	問項	平均值	標準差	偏態	峰態
同意程度	Q07	很少人覺得我自私又自我中心	2.48	0.86	-0.39	0.13
	Q08	很少人覺得我冷漠又愛算計	2.58	0.86	-0.51	0.14
	Q09	我盡量對遇到的每個人都表現得有禮貌	3.00	0.65	-0.76	2.09
	Q10	我通常能適時給予旁人協助而不需他人提醒	2.72	0.69	-0.45	0.43
	Q11	大部分認識我的人都喜歡我	2.66	0.69	-0.18	0.07
	Q12	如果可能,我會盡最大的能力去幫助別人	2.96	0.70	-0.67	1.28
	Q13	我不是以慷慨著稱的	2.27	0.82	-0.26	0.08

由表 9 可知,在無規範感問項中 (Q14~Q17),各問題的填答狀況未趨於一致性。Q14 的平均值為 2.91 偏高,標準差小且峰態係數大,填答狀況多集中於「同意」以上,表示年輕人多勇於嘗試自己想做的事情;然 Q15 與 Q16 的平均值約為 2,標準差與峰態係數均在合理範圍內,顯示年輕人涉世未深,仍保有理想性與正義感,故填答狀況傾向於遵守法規。另外,Q17 為反向問法,即分數愈

高愈具有規範感，Q17 之平均值較高、標準差偏低且峰態係數亦偏高，所得結果與 Q15 和 Q16 之情形相互呼應。

表 9 無規範感問項敘述統計量

衡量方式	題號	問項	平均值	標準差	偏態	峰態
同意程度	Q14	只要不會惹上麻煩，我會勇於去做任何我想做的事	2.91	0.73	-0.73	1.30
	Q15	只要不是直接違法，遊走法律邊緣是可接受的	2.14	0.95	-0.22	-0.49
	Q16	為順利進行某些事情，過程中有些行為的對錯不是那麼重要	1.98	0.95	-0.05	-0.85
	Q17	有些事情即使可以合法從事，我卻會認為是不應該的行為	2.63	0.73	-0.77	1.09

在情緒穩定度問項方面 (Q18~Q29)，平均值約介於 1.7~3.2。由表 10 可以發現，此處填答狀況可粗略分為兩群，第一群 (Q18、Q20、Q24、Q25、Q26、) 的平均值約接近 3，而另一群 (Q19、Q21、Q22、Q23、Q27、Q28、Q29) 的平均值在 2 附近；儘管兩類問項皆是描述騎車時遭遇干擾導致旅程不順的情境，第一類旨在敘述他人的作為，致使受訪者面臨車禍危機或侵犯其心理情緒，尤其 Q25 與 Q26 的平均值幾乎高達 3.2，顯示受訪者對於他人蓄意的挑釁作為特別容易情緒波動而感到生氣。

表 10 情緒穩定度問項敘述性統計量

衡量方式	題號	問項	平均值	標準差	偏態	峰態
同意程度	Q18	前方車輛未注意到我的機車就向後倒退	2.81	0.96	-0.54	-0.28
	Q19	欲超車時，發現對方車輛亦隨即加快車速	1.99	1.17	0.03	-0.82
	Q20	鄰近車道車輛強行進入本人行駛中的車道，阻擋我的行進	2.80	0.98	-0.55	-0.23
	Q21	行走於巷道中之行人阻擋我的行進	1.75	1.07	0.11	-0.56
	Q22	行駛於壅塞之車流中	2.00	1.09	0.02	-0.62
	Q23	騎在一大型的卡車後頭使我無法清楚看到前方車況	2.15	1.14	-0.15	-0.74
	Q24	騎在排放大量廢氣的車輛後頭	3.07	1.00	-0.84	-0.13
	Q25	某人對我的駕駛作為比了一個不雅的手勢或大聲咆哮	3.20	0.99	-1.09	0.34
	Q26	某人對我的駕駛作為猛按喇叭	3.15	0.92	-0.96	0.40
	Q27	前方車輛速度太慢阻擋我順利前進	2.10	0.99	0.07	-0.46
	Q28	看到有車輛於車流中亂竄	2.33	1.13	-0.20	-0.68
	Q29	看到闖紅燈的車輛	2.19	1.19	-0.18	-0.80

表 11 為風險感知問項，Q30-Q36 旨在探討受訪者憂心自身遭遇車禍受傷狀況與駕駛信心度，Q37-Q52 則是探討受訪者所認知高風險駕駛行為的危險程度。首先，在憂應與擔心問項中，Q30、Q34 和 Q35 平均值偏高，尤其 Q30 的峰態係數大於 1，顯示多數受訪者認為騎車環境不夠安全，因而相當關心並且擔心自身的交通安全；Q31 與 Q32 平均值皆為 2.37，且標準差偏小，說明受訪者對其駕駛技巧具有一定的信心度；至於 Q33 平均值為 2.06，顯示仍有半數受訪者認為車禍的發生是無可避免的；Q36 平均值小於 2，表示受訪者認為其發生車禍的

可能性偏低。

在認知的風險問項方面，各問項的平均值介於 2.3 與 3.7 之間，此區間明顯高於其他部分問項的平均值區間，顯示仍有相當數量的受訪者認為問項所描述的騎車行為是危險的。值得注意的是，Q40、Q45 與 Q46 平均值約為 2.5，而三問項皆是描述「快速行駛」的駕駛情境，說明受訪者認為快速騎車的危險度不如預期的高；另外，Q49 的平均值僅為 2.49，顯示受訪者認為於兩段式左轉路口直接左轉的危險度亦較低，可能因此導致多達 64 位受訪者曾因未待轉而遭取締。

綜合上述，推論多數受訪者覺得騎車環境不夠安全，也未低估高風險騎車行為的危險度，但卻認為自己遭遇車禍的可能性不高，推論可能是他們對自身駕駛技巧具有相當信心，或者對交通系統運作安全認知不足與僥倖心理。

表 11　憂慮與擔心問項敘述性統計量

衡量方式	題號	問項	平均值	標準差	偏態	峰態
同意程度	Q30	我覺得騎車環境不夠安全，自己可能會遭遇車禍而受傷	2.96	0.82	-0.81	1.07
	Q31	行駛於不熟悉的道路環境中，我能夠處理一切突發狀況	2.37	0.80	-0.23	-0.14
	Q32	當遭遇危險時，我的駕駛技巧能幫助我安全脫離險境	2.37	0.78	-0.22	0.16
	Q33	我覺得假如要發生車禍，無論如何均無法避免	2.06	1.06	-0.01	-0.92
	Q34	我會主動關心自己可能也會成為受害者之一的交通事故風險資訊	2.71	0.71	-0.43	0.43
擔心/可能程度	Q35	我對自己可能遭遇車禍受傷擔心的程度	2.68	1.03	-0.41	-0.56
	Q36	就一般而言，我認為自己發生車禍受傷的可能性	1.89	0.96	0.34	-0.22
危險程度	Q37	未用後照鏡觀察其他車輛動向即變換車道	3.19	0.83	-0.86	0.31
	Q38	轉彎時未打方向燈	3.05	0.88	-0.70	-0.08
	Q39	夜晚或進入隧道未開啟大燈	3.11	0.88	-0.72	-0.14
	Q40	交通號誌一轉為綠燈即快速駛出路口	2.59	0.97	-0.17	-0.56
	Q41	於車輛間隙中穿梭	2.72	0.94	-0.31	-0.48
	Q42	未與前車保持安全距離	2.84	0.85	-0.31	-0.48
	Q43	行駛於次要道路，看到主要道路有來車，仍然勉強匯入車流	2.85	0.95	-0.45	-0.58
	Q44	轉彎時未放慢車速	2.91	0.92	-0.51	-0.36
	Q45	以高於周遭車流的速度行駛於道路上	2.66	1.00	-0.34	-0.60
	Q46	路上無其他用路者時，就急速行駛	2.27	1.04	0.07	-0.82
	Q47	酒後騎車	3.73	0.67	-2.97	9.64
	Q48	因前方車輛阻擋前進，轉入逆向車道超車	3.27	0.85	-1.05	0.63
	Q49	於兩段式左轉路口直接左轉	2.49	0.97	-0.15	-0.60
	Q50	闖紅燈	3.19	0.91	-0.86	-0.14
	Q51	騎車時手持手機通話	2.84	0.97	-0.54	-0.20
	Q52	未戴安全帽	2.80	1.09	-0.51	-0.67

在效用感知問項方面 (Q53~Q61)，平均值約介於 1.5~2.3，且標準差、偏態係數與峰態係數均落於合理範圍，此處問項應具一定之鑑別能力。由表 12 可發

現填答狀況粗略分為兩群，第一群 (Q53、Q54、Q55、Q56) 的平均值約大於 2，而另一群 (Q57、Q58、Q59、Q60、Q61) 的平均值小於 2；顯示受訪者認為騎車確實提供相當程度的樂趣與紓解情緒的管道，但若涉及違規行駛，受訪者仍傾向於遵守法規。

表 12　效用感知問項敘述性統計量

衡量方式	題號	問項	平均值	標準差	偏態	峰態
同意程度	Q53	騎快車讓我感覺刺激	1.99	1.03	-1.00	-0.56
	Q54	除了運輸功能，騎車也讓我享受速度與樂趣	2.32	0.90	-0.35	-0.33
	Q55	騎車可抒發我的情緒與壓力	2.21	0.97	-0.24	-0.40
	Q56	為了順利前進，我會於車輛間隙穿梭前進	2.21	0.98	-0.28	-0.64
	Q57	當我行駛於次要道路時，為了順利轉彎，就算主要道路有來車，強行插入是必須的	1.75	0.95	0.19	-0.56
	Q58	為了順利前進，於雙車道路段駛入對向車道是可接受的	1.52	1.00	0.42	-0.42
	Q59	有些兩段式左轉路口紅燈秒數過長，我會選擇直接左轉	1.76	1.09	0.17	-0.84
	Q60	有時候為了節省繞道時間，逆向行車是可接受的	1.51	1.03	0.37	-0.50
	Q61	有時候為了趕時間，不遵守交通規則是必須的	1.65	1.03	0.16	-0.72

在表 13 安全駕駛態度問項中 (Q62~Q74)，Q65、Q71 與 Q73 為反向問法，即分數愈高愈重視安全駕駛，其中 Q73 平均值為 3.28，偏態係數為-1.12，顯示多數受訪者極度反對搭乘喝酒者行駛的機車；除此之外，此處問項平均值約介於 1.4~2.5 間，顯現低平均值趨勢，說明當駕駛行為可能危害駕駛者時，受訪者明顯地反對此類行為；值得注意的是，Q72 平均值為 2.52，顯示超過一半的受訪者認為速限訂定過於保守，導致他們超速行駛。

表 13　安全駕駛態度問項敘述性統計量

衡量方式	題號	問項	平均值	標準差	偏態	峰態
同意程度	Q62	保持順暢車流遠比遵守規則重要	1.82	0.96	0.34	-0.45
	Q63	有時候冒險駕駛是必須的	1.77	1.02	0.09	-0.81
	Q64	冒險駕駛與違規駕駛並非較不安全	1.68	1.01	0.34	-0.64
	Q65	無論道路或氣候環境如何惡劣，交通規則是一定要遵守的	2.56	0.90	-0.40	-0.13
	Q66	可在交通號誌由黃燈轉為紅燈的瞬間超越路口	1.8	0.91	0.14	-0.30
	Q67	當路上沒有其他用路者時，冒險駕駛是可以接受的	1.87	0.98	-0.02	-0.73
	Q68	交通規則都太複雜了以至於難以實際遵行	1.59	0.94	0.36	-0.22
	Q69	如果駕駛者有良好的駕駛技術，超速駕駛是可以接受的	1.42	0.96	0.48	-0.25
	Q70	如果駕駛環境許可，我認為超速駕駛是可以接受的	2.07	1.02	-0.24	-0.75
	Q71	對於超速駕駛的懲處應該更加嚴屬	2.23	0.92	-0.11	0.07
	Q72	因速限訂定過於保守，超速駕駛總是會發生	2.52	0.91	-0.46	-0.03
	Q73	我絕對不會搭乘有喝酒者駕駛的機車	3.28	0.93	-1.12	0.39
	Q74	我可以接受搭載我的機車超速行駛	1.87	0.96	-0.03	-0.44

最後，由表 14 高風險駕駛行為各問項 (Q75~Q91) 之填答狀況可知，其平均值介於 0.35~1.73，此區間明顯低於其他部分問項的平均值區間，表示大部分的受訪者極少行使高風險駕駛行為，尤其 Q77、Q86 與 Q91 的峰態係數偏高，分別為「夜晚或進入隧道應開啟頭燈」、「喝酒不上路」及「騎車應戴安全帽」，顯示一般民眾不會嘗試高風險駕駛行為，以及政府的強力執法具有相當程度的作用。

表 14　高風險駕駛行為問項敘述性統計量

衡量方式	題號	問項	平均值	標準差	偏態	峰態
頻率	Q75	未使用後照鏡觀察其他車輛動向就變換車道	1.22	0.92	0.93	0.99
	Q76	轉彎時未打方向燈	1.23	0.86	0.81	0.92
	Q77	夜晚或進入隧道未開啟頭燈	0.74	0.85	1.18	1.17
	Q78	交通號誌一轉為綠燈即快速駛出路口，未仔細注意仍在穿越橫向車道的車輛或行人	1.12	0.91	0.72	0.37
	Q79	為了騎得更快，於車輛間隙穿梭前進	1.73	1.06	0.13	-0.68
	Q80	與前車距離過近，以致於緊急剎車時幾乎撞上前車	1.24	0.88	0.61	0.25
	Q81	未注意前方動向，而差點撞上其他行人或車輛	1.12	0.83	0.59	0.38
	Q82	行駛於次要道路時，看到主要道路有來車，仍然勉強匯入車流	1.21	0.91	0.56	-0.04
	Q83	車速過快，自覺即將失去對機車的控制	0.83	0.87	1.05	0.81
	Q84	相較於周遭車流，自己的行駛速度快上許多	1.55	1.05	0.36	-0.49
	Q85	夜晚或清晨騎車時忽略速限	1.65	1.10	0.19	-0.69
	Q86	酒後駕車	0.35	0.74	2.21	4.32
	Q87	於兩段式左轉路口直接左轉	1.47	0.97	0.29	-0.38
	Q88	闖紅燈	1.23	0.88	0.51	0.08
	Q89	違規進入逆向車道行駛	0.99	0.89	0.71	0.23
	Q90	邊騎車邊手持手機通話	0.76	0.94	1.14	0.70
	Q91	未戴安全帽	0.64	0.84	1.38	1.65

由以上分析可知，本問卷之受訪者擁有高度利他主義特質；騎車時遭遇他人危險作為或蓄意挑釁動作時，易產生憤怒情緒；覺得騎車環境不安全，也認知到高風險騎車行為之風險性，但對自身駕駛技巧具有相當信心，然而對安全認識不足或存僥倖心態，故覺得自己遭遇車禍的可能性不高；騎車的確提供受訪者樂趣與紓解情緒的管道，但當駕駛行為可能引發危害時，他們明顯地反對此類行為，亦極少行使此類行為。此外，相較於其他高風險駕駛行為，受訪者對於快速行駛的接受度較高。

伍、 高風險駕駛行為模式構建

由於本研究問卷所使用之 91 題問項係以文獻回顧為基礎，然而各篇文獻最初研究目的、架構不盡相同，題項翻譯過程亦可能造成國人對問項解讀與原文不同，考量國內外人文環境條件差異、國人騎乘機車習性，為避免造成問項題意可能有所重疊以及填答者對問項認知與原文產生之偏誤，問卷問項使用必須審慎進行，以減少誤用之情形發生。是故，為將上述文獻引入作為台灣機車族群駕駛行為模式構建之用，本研究將所收集 683 筆樣本當中，使用其中 200 比樣本作為第一階段探索性因素分析之用，重新審視問卷各問項之特性，並將構面予以重新組合命名；第二階段應用結構方程模式進行驗證性因素分析與路徑分析，以探討各構面間之互動；研究流程如圖 3。
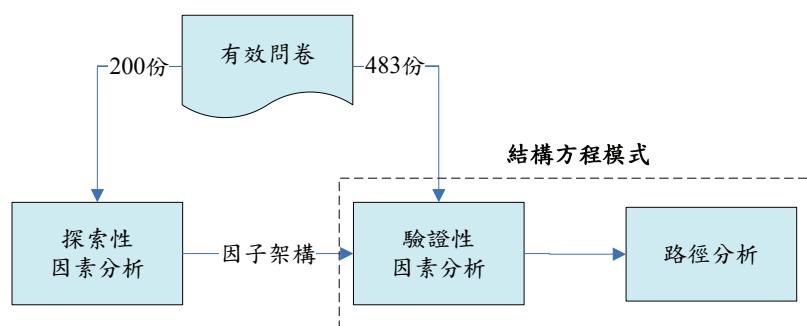
圖 3 模式建構流程

一、探索性因素分析

風險感知可切割為駕駛信心與冒進駕駛行為風險感知兩構面,高風險駕駛行為則可由輕忽路況、高速行車、違規駕駛;表 16 則列示模式組成構面與信度分析。

經探索性因素分析,個人特質可分為冒險性、隨和性、利他性、挑釁容忍性、情緒性等五大構面,然而透過不同個人特質組合的嘗試,發現僅納入冒險性、隨和性、情緒性等三大構面最能詮釋高風險駕駛行為,且不致使模式過於複雜,故於後續研究當中僅使用上述三構面作為個人特質指標。中介變數則可歸納出駕駛信心、冒進駕駛行為風險感知、駕駛效用與不安全駕駛態度等構面,高風險駕駛行為可分為高速行車、違規駕駛與輕忽路況三大構面。然而考量到輕忽路況係屬駕駛人情境察覺能力,相關問項皆屬行為問卷當中無害疏失 (lapse),例如是否有打方向燈、看後照鏡等,此類型疏失多為駕駛人無意識狀態下或習慣性的風險行為,不符計畫行為理論所稱受到意願、態度、規範等因素影響之決策過程所產生的動作,故於本模式應將其視為影響高風險駕駛行為的中介變數,而高風險駕駛行為則包含高速行車、違規駕駛兩構面。

各構面與其對應問項如表 15,模式組成構面之信度則列示如表 16。

表 15 探索性因素分析萃取構面與問項

類別	構面	觀察變項
個人特質	冒險性	我常常渴望尋求刺激
		有時候我做某些事情只是為了尋求冒險和刺激
		只要不是直接違法，遊走法律邊緣是可接受的
		為了順利進行某些事情，過程中有些行為的對錯不是那麼重要
	隨和性	很少人覺得我自私又自我中心
		很少人覺得我冷漠又愛算計
	利他性	我通常能適時給予旁人協助而不需他人提醒
		大部分認識我的人都喜歡我
		如果可能，我會盡最大的能力去幫助別人
	情緒性	行走於巷道中之行人阻擋我的行進
		行駛於壅塞之車流中
		騎在一大型的卡車後頭使我無法清楚看到前方車況
		看到有車輛於車流中亂竄
	挑釁容忍性	某人對我的駕駛作為比了一個不雅的手勢或大聲咆哮
		某人對我的駕駛作為猛按喇叭
駕駛信心		行駛於不熟悉的道路環境中，我能夠處理一切突發狀況
		當遭遇危險時，我的駕駛技巧能幫助我安全脫離險境
冒進駕駛行為風險感知		交通號誌一轉為綠燈即快速駛出路口
		於車輛間隙中穿梭
		未與前車保持安全距離
		行駛於次要道路，看到主要道路有來車，仍然勉強匯入車流
		轉彎時未放慢車速
駕駛效用		除了運輸功能，騎車也讓我享受速度與樂趣
		騎車可抒發我的情緒與壓力
不安全駕駛態度		為了順利前進，於雙車道路段駛入對向車道是可接受的
		有時候為了節省繞道時間，逆向行車是可接受的
		如果駕駛者有良好的駕駛技術，超速駕駛是可以接受的
		如果駕駛環境許可，我認為超速駕駛是可以接受的
輕忽路況		未使用後照鏡觀察其他車輛動向就變換車道
		轉彎時未打方向燈
高風險駕駛行為	高速行車	為了騎得更快，於車輛間隙穿梭前進
		相較於周遭車流，自己的行駛速度快上許多
		夜晚或清晨騎車時忽略速限
	違規駕駛	酒後駕車
		闖紅燈
		違規進入逆向車道行駛
		未戴安全帽

表 16 模式組成構面與信度分析

構面	問項數	混合信度 (Composite reliability)
個人特質		
冒險性	3	0.713
隨和性	2	0.801
利他性	3	0.704
挑釁容忍性	2	0.816
情緒性	3	0.718
風險感知		
駕駛信心	2	0.714
冒進駕駛行為風險感知	4	0.814
不安全駕駛態度與駕駛效用		
駕駛效用	2	0.793
不安全駕駛態度	3	0.729
高風險駕駛行為		
高速行車	3	0.810
違規駕駛	3	0.736
輕忽路況	2	0.684

配適度指標
χ^2/df ： 1.860　　　　NNFI ： 0.906
GFI ： 0.904　　　　RMSEA ： 0.038

二、結構方程模式

透過驗證型因素分析與路徑分析，結構方程模式 (Structural Equation Modeling, SEM) 得以呈現構面與構面間互動關係，本研究以圖 2 研究概念性架構為基礎，納入探索性因素分析之結果，建構出年輕機車駕駛族群高風險駕駛行為模式如圖 4，其中虛線代表不顯著之路徑，表 17 則為各構面間的總效果。

表 17 總影響效果

構面	駕駛信心	冒進駕駛行為風險感知	駕駛效用	不安全駕駛態度	輕忽路況	高風險駕駛行為
冒險性	0.24	-0.13	0.53	0.40	-0.05	0.24
隨和性	0.23	0.14	-0.06	-0.06	-0.01	-0.02
情緒性	-	0.38	0.14	0.21	0.05	0.06
駕駛信心	-	-	0.24	0.14	-0.12	0.17
冒進駕駛行為風險感知	-	-	-	-0.45	0.13	-0.33
駕駛效用	-	-	-	0.15	-	0.08
不安全駕駛態度	-	-	-	-	-	0.50
輕忽路況	-	-	-	-	-	-0.85
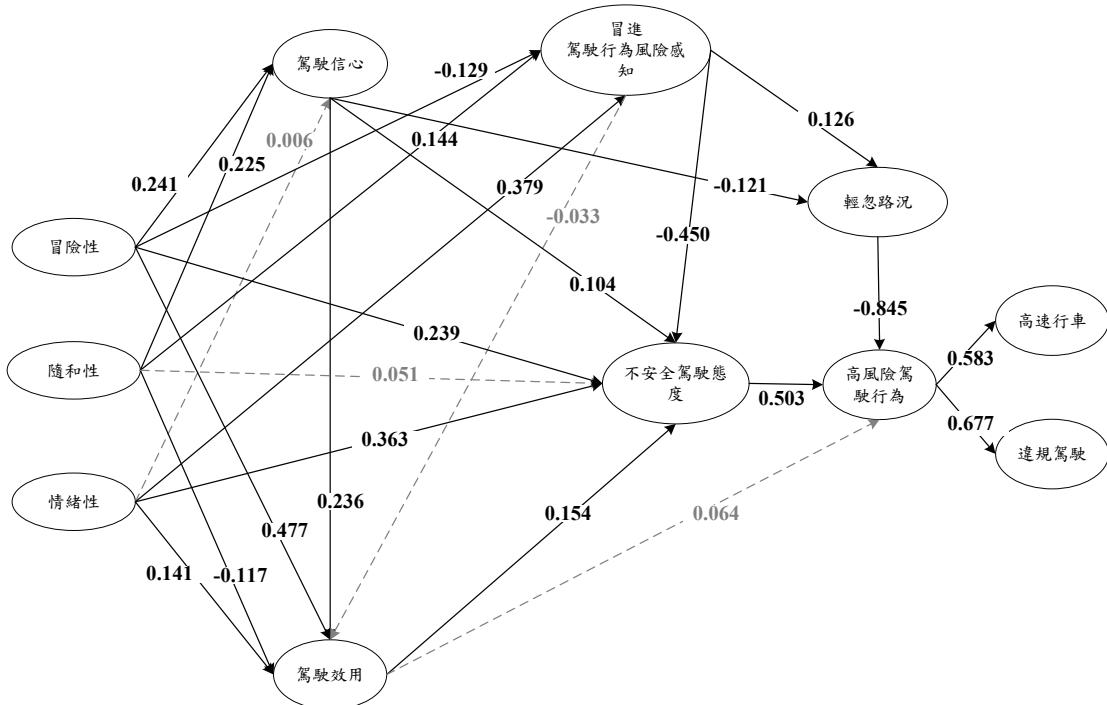
圖 4 年輕機車族群高風險駕駛行為模式

　　三項主要個人特質構面當中，分析結果顯示情緒性會對冒進駕駛風險感知造成負向影響，對駕駛效用則有高度正向影響，對高風險駕駛行為總效果為正向關係，顯示較具冒險性格的機車騎士所認知的風險程度較低，並且會從駕駛行為當中獲得較多的效用，換言之，該類型駕駛人傾向在高風險駕駛行為當中獲得刺激感，同時亦可能認為其駕駛能力足以應付該類型之行為而不致產生危險。隨和性分析結果與冒險性剛好相反，此一構面會對冒進駕駛風險感知造成正向影響，對駕駛效用則有負向影響；另外對於情緒性而言，情緒較易起伏的駕駛人會從高風險駕駛行為當中獲得較高的駕駛效用，同時此等駕駛人也會有較高的風險感知，顯示駕駛人雖然知道風險行為的潛在後果，但是不夠穩定的個性卻可能促使選擇高風險駕駛行為以求盡速到達目的地，情緒性對高風險駕駛行為總效果亦呈現正向關係。此外，冒險性與情緒性兩構面亦會對不安全駕駛態度造成正向的直接影響，此一結果亦驗證 Hoyes (1996) 認為傾向接受感官刺激的冒險型與衝動型駕駛人對不安全的駕駛行為具有較高接受程度之假設；隨和性較高的騎士基本上是有信心且不追求感官刺激的，其對不安全駕駛態度之總影響為負向，也就是以較謹慎的態度去面對行車安全，唯其透過駕駛信心、冒進駕駛行為風險感知與駕駛效用間接影響。

　　選擇效益最大化之決策為人類本性，以高風險駕駛為例，唯有在預期效益大於成本時，駕駛人才會選擇採取高風險駕駛行為。由本模式分析結果顯示，較具信心的駕駛人傾向在駕駛過程當中獲得較多的效用，顯然對於駕駛沒有信心的駕駛人很難享受駕駛行為並獲得效用。另外值得注意的是冒進駕駛行為風險感知構面對不安全駕駛態度產生顯著負向影響，同時其會進一步透過不安全駕駛態度對

高風險駕駛行為產生間接負向影響。

　　態度為影響行為之關鍵因素，一如預期，研究結果顯示願意接受危險駕駛行為的機車駕駛人發生高風險駕駛行為頻率較高；然而當中輕忽路況對高風險駕駛行為卻呈現高度負向關係，亦即較常忽略應該要有的駕駛操作之駕駛人反而是具有較少高風險駕駛行為，此類型駕駛人具有較高的冒進駕駛行為風險感知與較低的駕駛信心，此一特性與經驗不足且容易緊張的駕駛人特性相符，此類型駕駛人容易忽略正確的駕駛操作，例如看後照鏡、打方向燈等，但是由於擔心發生事故，該類型駕駛人並不會主動採取高風險駕駛行為；反之，具有高度駕駛自信與較低冒進駕駛行為風險感知的駕駛人通常較具經驗且技術純熟，反而因為過度相信自己而傾向採取較多的風險行為。

陸、 結論與討論

　　於國內，近年來駕駛行為分析受到眾多研究者之注目，並自事故情境中萃取出對事故的重要影響因素 (Hoyes, 1996; Machin and Sankey, 2008; Ulleberg and Rundmo, 2003)。年輕機車騎士被視為具有高事故率與高死亡率的駕駛族群，因此，基於 Ulleberg and Rundmo (2003) 與 Hoyes (1996) 兩研究所提出駕駛行為模式與風險平衡理論，本研究特別針對年輕機車駕駛族群提出高風險行為模式，以探討個人特質在風險與效用的影響下對高風險駕駛行為造成之影響。

　　結果顯示，本研究所提出之架構可將高風險駕駛行為發生過程，有效的透過風險 (以冒進駕駛行為風險感知表達) 與效益 (以駕駛效用表達) 之交互影響加以詮釋；除了過去的研究與道路交通安全改善方案經常探討的駕駛人風險認知外，對於特定駕駛族群而言，效用感知對高風險駕駛行為確實存在顯著之影響，兩者需並重考量方能了解駕駛人決策邏輯並得以對症下藥，有效降低高風險駕駛行為。本研究亦發現即使不具有冒險性的駕駛人，仍可能受到其經驗與安全認知不足、緊張或對道路駕駛文化不熟悉等因素影響，導致怠忽路況而造成事故發生。

　　每一種類型的駕駛人都會有其獨特的決策過程，透過高風險駕駛行為模式的發展分析，相關更深入的資訊得以提供做為教育、執法、工程等策略制定參考，以及作為未來智慧型安全運輸系統發展之用。由結構方程模式之路徑圖可清楚的說明個人特質傾向、態度與風險駕駛行為之關聯，但是其如何能夠與事故模型加以聯結，以及能夠完整說明事故發生的緣由則尚待進一步的挖掘。

　　由於本研究所採用之量表並無針對特定情境，無法針對真實世界的事故進行分析，後續研究可考慮繼續結合事故原型分析，針對高事故風險的駕駛情境設計相關問項，更深入探討駕駛行為對事故、環境之互動。此外，考量年輕駕駛人具異質性 (Chliaoutakis, 1999; Gregersen and Berg, 1994)，後續可針對不同族群駕駛人進行分群再進行駕駛行為分析，以加強對事故全貌之了解。

經過三年期的研究，從事故鏈的探索，事故情境的解構，以至駕駛者特性與駕駛行為之結構分析，除了充分體會交通安全的複雜性與困難外，亦逐漸拼湊出一完整的事故分析藍圖，圖 5 之藍圖綜整過去研究的軌跡，也指出未來值得努力的議題
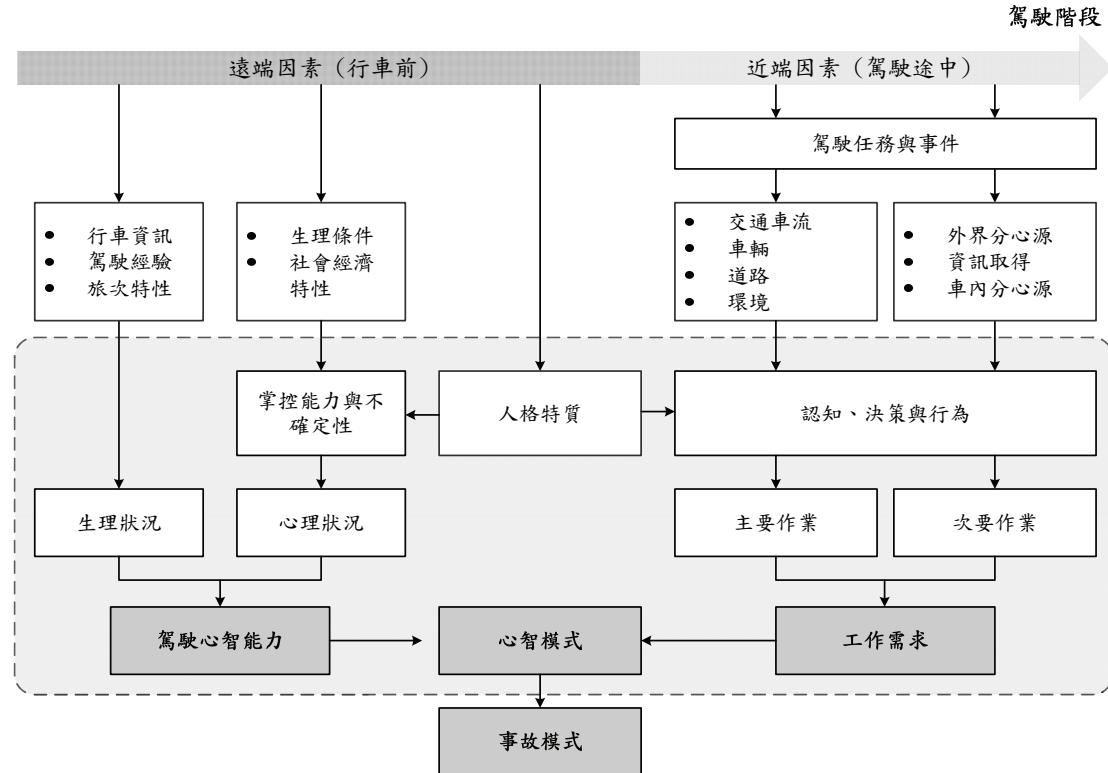
圖 5 交通事故分析藍圖

過去三年針對事故原型與駕駛行為分析，對於事故「如何」發生提供了相當豐富的資訊，然而，事故情境與行為分析僅能呈現外在環境與事故之關係以及駕駛人的決策邏輯，相關研究尚無法真正了解駕駛人「為什麼」發生事故。事實上，每天有數以萬計車輛通過所定義之高風險的道路環境，為什麼有些駕駛人會發生事故，而其他駕駛人卻能安全通過？顯然的，目前對於總體性的事故分析，以及對於個人特質與行為的分析仍無法回答上述問題，未來應針對個體駕駛人的層面更深入探討。

以圖 5 為例，過去關於事故原型、情境之分析多著重於人、車、路、環境以及其他相關社會經濟變數對事故之影響，然而對於其中駕駛人接受外界資訊與環境刺激後，透過心智模式互動產生決策之過程 (如圖 5 虛線框內所包含之心智模式因素互動) 仍未能被完整解釋；於本研究第二、三期計劃當中，已分別針對駕駛行為本身以及人格特質對風險駕駛行為之影響進行探討，然而為更完整建構事故鏈並深入了解事故成因的全貌，「人」這一環節值得更進一步的探討，後續心智模式研究將可幫助釐清駕駛人於駕駛過程當中心智負荷之變化，進而可透過智慧型運輸安全系統等科技提供駕駛人適切之幫助。

駕駛人為事故鏈當中最重要的環節，無論外界環境給予何種刺激或工作都必須透過駕駛人的思考、決策與執行；其中駕駛人心智模式 (Mental model) 於駕駛過程中扮演蒐集、處理、回應外界資訊並做出決策的重要角色，當駕駛人心智負荷 (Mental Workload) 過高時，可能導致駕駛人無法做出正確判斷進而造成事故風險的提升。心智負荷可被定義為駕駛者在給定能力 (Capability) 之下，為滿足特定的工作需求 (Task demand) 所必須消耗的心智資源，而心智負荷的強度受到能力與工作需求差距的影響，當工作需求越接近能力水準時，心智負荷越高，而當心智負荷越高造成事故的風險亦隨之增加 (Hart and Staveland, 1988; Jex, 1988)。

　　由心智負荷與圖 5 之定義，工作需求與駕駛心智能力為影響心智負荷最重要之兩大關鍵因素。工作需求主要來自於駕駛過程當中，駕駛人在車、路、環境等條件下欲完成一駕駛任務或事件所產生的作業，在完成駕駛任務的過程當中，外界環境、車流組成等因素會影響工作本身的複雜度；心智能力則主要受到駕駛人行前階段的特性影響，其中對於駕駛人而言，對於駕駛過程當中的掌控能力越高、不確定性越低，則心智能力越高，此外，諸如疲勞、飲酒、服藥、年齡等生心理條件亦會影響能力水準。

　　工作需求與駕駛心智能力並非定值，而是會受到各因素之影響並隨時間改變 (Höger *et al.*, 2005)，如圖 6 所示，在不同的狀況下，不同駕駛任務與交通環境組成會產生不同程度的工作需求，即使在同樣的工作需求下，駕駛人亦有可能產生不同的心智能力水準，以 A 點為例，在高心智能力情境下，工作需求與能力差距甚大，心智負荷仍處於可接受範圍，然而相較在低心智能力的情境下，同樣的工作需求卻可能造成極大的心智負荷。
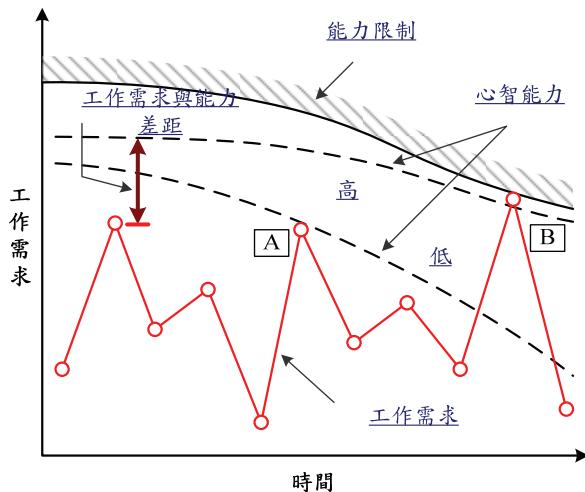
資料來源：Jex (1988)

圖 6 心智模式概念架構圖

近年來由於科技進步，利用智慧型運輸系統 (Intelligent Transportation System, ITS) 來預防事故為一個可行且有效的方向。然而在接受資訊的同時駕駛人亦必須付出相當程度之心智負荷方能理解資訊意函並做出決策，過度複雜且大量的資訊未必能夠幫助駕駛人，反而可能因資訊過載而分心，進而導致心智能力餘裕的退化而造成更嚴重之意外 (Horberry *et al.*, 2006a)，不同駕駛族群對安全資訊的要求亦有所差異。是故，能夠充分的了解駕駛人於各情境下的心智負荷水準，以及各種資訊內容、來源、強度等對心智負荷與安全之淨效果，才能針對不同駕駛人的特性與不同客觀條件，在合適的時間、合適的地點以及適當的情況下，提供適切有效之安全資訊，也唯有如此，足以解釋故事發生邏輯與機制之完整的事故模式始得以實現。因此，未來將繼續積極針對最佳化安全資訊與心智模式議題，更進一步探討個體心智特性於事故鏈當中所扮演的角色。

柒、計畫成果自評

本研究為三年研究畫中的之第三期研究。綜觀過去三年之研究成果，第一期計畫中，本研究以事故鏈 (accident chain) 概念出發，利用粗略集合理論 (Rough Set Theory) 分析內政部警政署道路交通事故資料庫資料，並自單一車輛事故當中歸納出重要事故原型；第二期計畫將事故原型做更深入切割，透過羅吉斯迴歸應用找出重現性與獨特性之事故。

本期計畫將事故鏈之概念延伸至駕駛人個人特質對高風險駕駛行為之影響，同時考量高風險駕駛行為的發生不只為駕駛人帶來風險，同時亦會使駕駛人於其中獲得正面的效益 (例如時間節省或刺激感)。考量認知風險與效用以及相關之中介變數如安全態度等，應用結構方程模式探討個人特質對高風險駕駛行為之影響，結果顯示所發展之架構對高風險行為具有相當良好的解釋能力。前兩期計畫研究成果已陸續發表於事故研究重要期刊 Accident Analysis and Prevention (SSCI)、Transportation Research Record (SCI) 與美國運輸學會年會，本期計畫成果目前業已被美國運輸學會第 88 屆年會接受，將於明年一月發表，後續並將持續進行修改與期刊投稿。

唯一的遺憾是本研究設計了完整之重現性事故情境，但國內並無可配合之安全模擬設備可供作更深入的研究，對國內安全研究者而言，實為一最大的限制。

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ABSTRACT

Young motorcyclists are traditionally considered a high risk population in Taiwan. Given the critical influence of rider's behavior on the traffic safety, identifying what riders think can help clarify the nature of accidents. This paper presents a framework incorporating personality traits, risk perception, utility perception, attitude towards safe riding, and risky riding behavior into a Structure Equation Model (SEM) in a discussion of the mechanism of risky riding behavior in young motorcyclists. 683 young motorcyclists aged between 18 and 26 years old, holding qualified licenses and having motorcycle riding experience during the past month were collected.

As expected, the results indicated that personality traits indirectly affected riding behavior via attitude, risk perception, and utility perception. Notably, risky riders are not all related to those young inexperienced riders, and unlike inexperienced riders they tend to be skillful, confident, and knowledgeable of modern traffic rules. Furthermore, one interesting result relates to the construct of unawareness of traffic conditions, which appeared to strongly and negatively influence risky riding behavior. Riders who frequently neglected the traffic situation exhibit fewer risky riding behaviors. Such riders can be considered nervous or skill lacking riders whose fear of experiencing an accident led them to fail to observe the surrounding traffic conditions. This analytical result suggests managerial implications for safety education and for future ITS development.

INTRODUCTION

Young drivers are considered a high risk traffic group. Despite their comparatively low exposure to driving, young people were more likely to be involved in vehicle accidents *(1)(2)(3)*. In Britain, for example, the average accident rate among the young population was 2.5 times that for other age groups *(1)*. Tseng *et al. (4)* also indicated that drivers aged between 18 and 26 had the highest accident rate.

Early research has indicated that the high accident rate among young drivers can be blamed on immature skills or insufficient experience. However, several investigations have suggested that experienced young drivers still have a high accident risk *(1)*. Furthermore, young drivers have been shown to be excessively confident or to have higher risk acceptance and tended to suffer accidents in less complex intersections *(5)(6)*. Obviously, inexperience was not the only explanation for the accidents. Other factors differentiating young riders from others must also be clarified *(7)(8)*.

Human factors, which represent the main cause of vehicle accidents, were seen as the main contributor to crashes *(9)(10)*. Analysis and identification of risky psychological traits significantly affects accident prevention. Based on the theory of planned behavior (TPB), Ulleberg and Rundmo (10) incorporated personality traits, attitudes towards safety and risk perception into a Structure Equation Model (SEM) in a discussion of the mechanism of risky driving behavior in young drivers. The results demonstrated that personality may indirectly influence risky driving behavior via attitude. However, risk perception, which is positively correlated with attitude, was not found to be directly and significantly related to driving behavior. Furthermore, risk homeostasis theory (RHT) indicated that risky driving behavior induced not only costs, which can be expressed as perceived risk, but also benefits such as excitement or time saving *(11)*. Ignoring potential driver benefits from such driving is likely to result in an incomplete understanding of such risky behavior. Thus, it is worthwhile to extend the previously developed model to include utility of risky driving.

Motorcycles are the main transportation mode among the young population in Taiwan. As a consequence, accident and mortality rate for single motorcycle accidents were markedly higher than for non-motorcycle accidents *(12)(13)(14)*. To better understand the unique characteristics of risk-taking behavior among young motorcyclists, this study focused on young motorcyclists and the interactions of their associated latent constructs consisting of personality, attitude, risk perception, and perceived riding utility during their riding decision making process.

Based on the research by Ulleberg and Rundmo *(10)* and Hoyes et al. *(11)*, section two proposes a conceptual behavior model. Data collection and measurements are then presented in section three. Sections four and five then illustrate the process of model construction and the results of exploratory factor analysis and SEM. The final section comprises discussion.

CONCEPTUAL FRAMEWORK AND MEASUREMENTS

Previous research mostly divided psychological factors into personality trait and social cognitive variables *(10)*. Personality reflects internal characteristics of individual differences and demonstrates consistent patterns and tendencies in individual reactions to the external environment *(10)(15)*. Since personality represents a stable condition which might be formed while a person growing up, it can be assumed that personality would influence social cognitive variables. Personality thus can be treated as a latent explanatory construct, while risky riding behavior can be considered a latent dependent construct. Meanwhile, some social cognitive latent intermediate variables should also appear.

Conceptual Framework

Based on the literature review and framework proposed by Hoyes *et al. (11)* and Ulleberg and Rundmo *(10)*, a preliminary conceptual framework is proposed, as shown in Fig. 1. Four personality traits, including sensation seeking, altruism, normlessness, and driving anger, provided the explanatory construct. Risk perception, attitude towards safe driving, and utility perception were treated as latent intermediate constructs. The dependent construct was risky driving behavior. Each construct is discussed as follows.
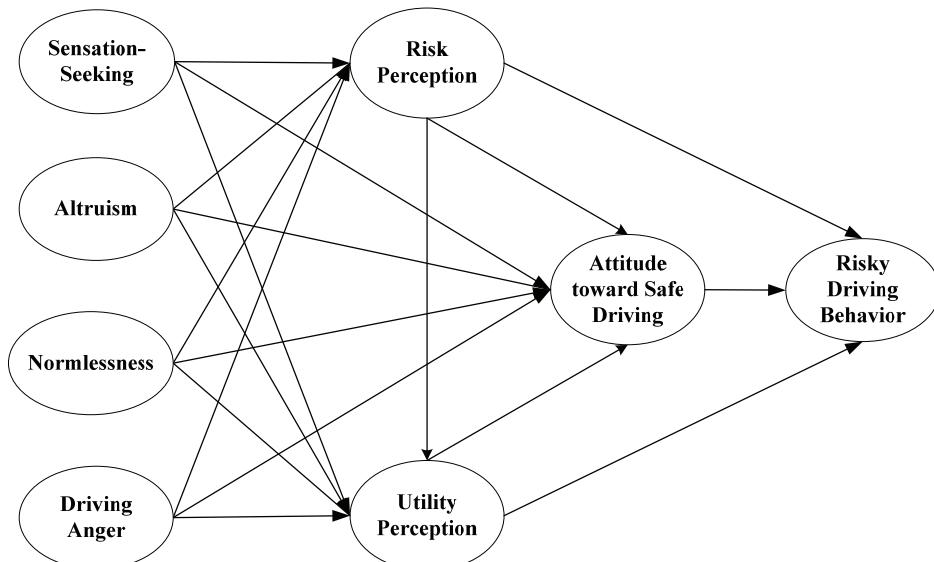

FIGURE 1 Conceptual framework of risky driving behavior model

Explanatory Construct

Personality traits, considered the explanatory construct in this research, comprise driving anger, sensation seeking, normlessness, and altruism. Numerous studies have investigated the direct *(2)(9)(16)(17)(18)* and indirect *(2)(10)* effects of personality traits on risky driving behavior. By clustering the personality and driving behavior of young drivers, Ulleberg (18) claimed that high risk populations share general characteristics of low altruism and high

driving anger, normlessness and sensation seeking. Several works have also suggested that high driving anger, sensation seeking, and normlessness increase the frequency of risky driving behavior *(2)(9)(10)(16)(17)(18)*. Furthermore, the possession of the characteristics of both driving anger and sensation seeking may increase the possibility of traffic violations.

Driving anger can be considered a negative or angry emotion when encountering interference when driving *(19)(20)*. Angry drivers were more frequently considered to be engaged in risky driving behavior. Deffenbacher et al. (19) developed a Driving Anger Scale (DAS) for measuring the frequency of angry emotions among drivers. Sullman (20) adopted the scale to analyze the effect of age on driving anger and found younger drivers were more likely to display angry behavior while driving.

Sensation seeking is defined as a personality trait involving the desire of an individual for excitement and stimuli *(9)(10)*. Altruism is defined as displaying concern for others. Both constructs can be derived from the measurement of NEO-Personality Inventory which measured the degree of agreement of personality trait statements *(10)*. Additionally, measurements proposed by Ulleberg *(18)* were frequently adopted to measure normlessness, which can be characterized as the belief that socially unapproved behaviors are acceptable means of achieving certain goals.

Latent Intermediate Construct

Three latent intermediate constructs are considered, including attitude towards safe driving, and perceptions of risk and utility.

Attitude, formed by learning or experience, indicates the continuous tendency of people to like or dislike some behavior *(21)*. The construct of attitude towards safe driving specifically represents the attitude of that individual towards safe driving behavior. Ulleberg and Rundmo *(10)* indicated that, among the personality traits, only altruism both directly and indirectly affects risky driving behavior. However, all other personality traits influence risky driving behavior only indirectly via attitude towards safe driving. Regarding the relationship between personality traits and attitude towards safe driving, normlessness and sensation seeking negatively affect attitude towards safe driving while altruism has a positive effect. Likewise, Ulleberg and Rundmo *(10)* also indicated that young drivers, who tended to disobey traffic laws, speeded and saw driving as recreation, exhibited more frequent risky driving behavior. Scales used to measure the agreement of specific statements or behavior to identify driver attitudes are contained in Iversen *(22)* and Ulleberg and Rundmo *(10)*.

Risk perception comprises subjective cognitive perception and affective perception. Subjective cognitive perception includes self-evaluation of the likelihood of involvement in an accident, self efficacy, and risk aversion. Affective perception includes concern regarding risky driving behavior *(2)*. Machin and Sankey *(2)* found that sensation seeking and self-evaluation of the likelihood of involvement in an accident positively affected tendency to

speed. At the mean time, altruism and risk aversion negatively affected speeding. In this work, a risk perception scale was proposed to measure motorcyclist's perceived danger of certain risky riding behaviors. Notably, the perceived danger may not necessarily reflect the actual risks faced by riders in undertaking risky behaviors, but rather reflects the risk they assigned such behaviors based on their experience.

According to the risk homeostasis theory proposed by Hoyes *et al. (11)*, risky driving behavior simultaneously induced both costs and benefits. Costs, presented here as risk perception, reflect undesired outcomes of risky behavior, including fines, injuries or fatalities. Meanwhile, benefits indicate positive outcomes of risky behaviors, including time savings or feelings of excitement. Provided that the benefits exceed the costs, drivers may choose to engage in high risk driving behavior. Furthermore, after drivers have failed to perceive adequate costs for an extended period, they are likely to select risky behaviors more frequently *(23)*. This study used utility perception to represent the benefits of risky behavior, which were measured by the acceptance of certain risky riding behaviors to save time or simply for fun.

Dependent Construct

The model treated risky riding behavior as a dependent construct. Although risky riding behaviors did not necessarily result in an accident, such behaviors increased their likelihood. This study adopted the scale devised by Chang and Yeh *(13)* to measure the frequency of risky riding behavior.

DATA COLLECTION

Based on the review of related research *(2)(10)(13)(18)(19)(22)* and the characteristics of motorcycles, a scale comprising 91 items was used in this research. Each measurement was scaled using a five point Likert Scale. The questionnaire was distributed through Internet and 683 valid questionnaires were gathered. To be legitimate, participants had to be:

- 18 to 28 years old,
- Hold a qualified driving license,
- Have motorcycle riding experience during the past one month.

Besides answering the 91 questions, participants were asked to provide background information including demographic data, riding related information, as well as information on accidents and violations. According to the data, the average length of riding experience was 5.24 years and most participants rode motorcycles five days weekly. The above statistics showed that most participants were experienced and rode motorcycles to commute.

Table 1 shows that most participants were aged between 21 and 26 years old. This result was consistent with the education and occupation information showing that the majority of participants had a university or graduate level education.

TABLE 1 Background information of participants

Category	Count	Percentage
Age		
18~20	103	15.1
21~23	219	32.1
24~26	259	37.9
27~28	102	14.9
Gender		
Male	366	53.6
Female	317	46.4
Education		
Senior high school and under	42	6.2
College or university	417	61.1
Master's and above	224	32.8
Occupation		
Student	462	67.6
Others	182	32.3

Table 2 lists participant experiences of traffic accidents and violations. Approximately 29.3 percent of participants had experienced an accident. Among these, 28 percent had suffered serious injury, 53 percent had suffered minor injury and 19 percent had only suffered property damage. Approximately half of all participants had experienced traffic violations. Red light running and turning violations were the most frequent.

TABLE 2 Accident and violation experience of participants

Category	Count	Percentage
Accident within the last two years		
Yes	200	29.3
No	483	70.7
Severity of accidents		
Property damage only	38	19.0
Minor injuries	106	53.0
Serious injuries	56	28.0
Violation experience		
Yes	304	44.1
No	379	55.9
Traffic violation		
Running a red light	79	26.0
Left turn violation	64	21.1
Right turn violation	59	19.4
Speeding	82	12.0
Not wearing a hamlet	24	7.9

EXPLORATORY FACTOR ANALYSIS

The questionnaire designed in this study was based on literature review, and comprised 91 items. Since each study has its own structure and purpose, the measurements used here may overlap. To seek appropriate influencing factors of motorcycle riding behavior in Taiwan, an exploratory factor analysis which can be employed to discover an optimal set of factors that accounts for the covariance among the items is necessary for reorganizing and reducing the dimensionality of the numerous questionnaire responses, and for restructuring the model framework. Each factor is then re-interpreted and re-named based on the subset of items with high factor loadings. This study only considers those factor loadings greater than 0.4.

The 683 samples collected were divided into two groups, 200 samples were used for exploratory factor analysis, while the remainder were used for confirmatory analysis. The principal component and promax approaches were adopted in the present factor analysis for abstracting factors from questionnaire responses. To prevent confusion and misinterpretation, four categories of measurements were processed separately, including personality trait, risk perception, attitude towards unsafe riding and utility perception, and risky behavior. The results listed in Table 3 summarized the abstracted factors and associated reliabilities. Personality trait can be represented by five factors: sensation seeking, complaisance, altruism, indignation, and impatience. The risk perception can be represented by two factors: riding confidence and sense of danger; and risky riding behavior can be represented by three factors: unawareness of traffic condition, fast riding, and traffic violation. Table 4 lists the corresponding subset items for each factor.

TABLE 3 Factors and the associated reliabilities

Construct	Composite Reliability
Personality trait	
Risk seeking	0.713
Complaisance	0.801
Altruism	0.704
Indignation	0.816
Impatience	0.718
Risk Perception	
Riding confidence	0.714
Sense of danger	0.814
Attitude & Utility	
Utility Perception	0.793
Attitude towards unsafe riding	0.729
Unawareness of traffic conditions	0.684
Risky riding behavior	
Fast riding	0.810
Traffic violation	0.736

Index

χ^2 / df :	1.860	NNFI :	0.906
GFI :	0.904	RMSEA :	0.038

Among the abstracted factors, the latent explanatory factors include sensation seeking, indignation, altruism, complaisance, and impatience. Meanwhile, the intermediate latent factors include riding confidence, sense of danger, utility perception, and attitude towards unsafe riding. The latent dependent factors include unawareness of traffic conditions, fast riding, and traffic violations. "Unawareness of traffic conditions" is associated with level of situational awareness. Since individual situational awareness in a given riding environment may reflect their prevailing manners or part of their safety culture, but not the result of a decision, therefore, "unawareness of traffic conditions" should be considered an intermediate variable and reassigned as an intermediate construct before the risky riding behavior (24). Furthermore, personality traits initially comprised five constructs. However, after a trial run, it was found that the three most closely related factors: risk seeking, complaisance, and impatience, were sufficient for the risky behavior model.

TABLE 4 Subset items for each construct

Personality Traits

Sensation seeking
    I often crave excitement.
    I have sometimes done things just for kicks or thrills.
    It's OK to get round laws and rules as long as you don't break them directly.
    If something works, it is less important whether it is right or wrong.
Complaisance
    Few people think I am selfish and egotistical.
    Few people think of me as calm and calculating.
Altruism
    I generally try to be thoughtful and considerate.
    Most people I know like me.
    I try to help others as much as I can.
Impatience
    Pedestrians block my way when riding in an ally.
    I am stuck in a traffic jam.
    I am riding behind a large truck and my views are blocked.
    Someone is weaving in and out of traffic.
Indignation
    Someone makes an obscene gesture or yells at me for my behavior.
    Someone honks at me for my behavior.

Riding confidence
    I can handle any unexpected situation even when riding on unfamiliar roads.
    If I get into a dangerous situation while riding, I have the skills to get out of it safely.

Sense of danger
    Rush running at the start instance of the green light.
    Ride between two lanes of fast moving traffic.
    Ride so close to the front vehicle that it would be difficult to stop in an emergency.
    Merge onto major roads from a minor road when there is coming traffic.
    Ride so fast into a corner that I feel like losing control.

Utility Perception
    Riding is not only for transportation, but also for fun or recreation.
    Riding motorcycle make me feel relax.

Attitude towards unsafe riding
    It is acceptable to ride on the opposite lane of a two-lane road for convenient.
    In order to save time, riding against the direction on a one-way road is acceptable.
    If I have good skills, speeding is OK.
    I think it is OK to speed if the traffic condition allows me to do so.

Unawareness of traffic conditions
    Do not use mirror to check surrounding vehicles while riding or turning.
    Do not use turning signals when turning.

Risky riding behavior

Fast riding
    In order to ride faster, I squeeze through an extremely narrow space between vehicle and vehicle.
    Compared to the surrounding traffic flow, I ride much faster.
    Disregard the speed limit at late night or in the early day.
Riding violation
    Drink and ride.
    Run through a red light.
    Ride on the wrong way.
    Do not wear a hamlet when riding.

STRUCTURE EQUATION MODEL (SEM)

The term SEM conveys that the causal process being studied was represented by a series of structural equations. Based on Fig. 1, a preliminary model framework and factors resulted from the exploratory factor analysis, the refined risky riding behavior model is shown in Fig. 2 (dashed line indicates insignificant path).
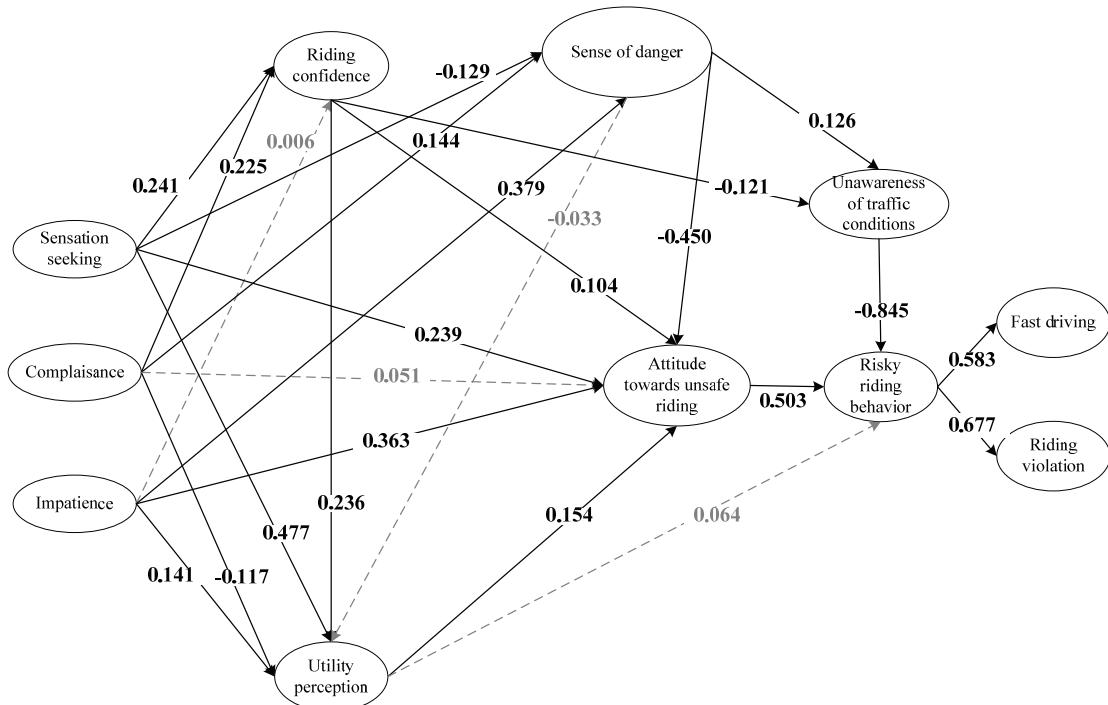
FIGURE 2 Refined risky riding behavior model

Figure 2 shows that unawareness of traffic conditions is re-identified as a latent intermediate factor. Additionally, effectively using the personality trait factors leads to their reduction, and only those factors that are significantly related to risky riding behaviors are selected for the refined model.

Regarding the three personality traits, the analytical results show that sensation seeking negatively impacted sense of danger and strongly and positively influenced utility perception. This indicated that riders who are seeking excitement would perceive less danger of certain risky riding behaviors and enjoy greater utility from such behaviors. This may also reveal some sort of safety culture among the sensation seeking rider group. Meanwhile, complaisance positively influenced sense of danger and negatively affected utility perception, which largely reflect the beliefs of the general public. As for riders with impatience characteristics, they not only perceive greater danger but also enjoy utility gained from certain risky riding behaviors. One explanation for this result may be that impatient riders are more frequently exposed to dangerous situations. All above stated results meet our expectation.

Furthermore, the characteristics of sensation seeking and impatience, besides the indirect effects via sense of danger and utility perception constructs, significantly and

positively affect attitudes towards unsafe riding, which confirms the hypothesis that riders who are impulsive or engage in seeking excitement have higher acceptance of unsafe riding *(11)*. However, the complaisance construct does not directly affect attitude towards unsafe riding instead only exerting indirect effects via latent intermediate constructs.

It is human nature for riders to make decisions based on utility maximization. Risky behaviors are undertaken only if the perceived benefits exceed the perceived costs. Despite the influence of personality traits, confident riders tend to gain more utility from riding. Clearly, it is difficult for riders with less confidence to enjoy risky riding. Additionally, it is notable that the sense of danger construct significantly and negatively impacts attitudes towards unsafe riding. Utility perception and sense of danger indirectly influence risky behavior via attitude towards unsafe riding. This analytical result suggests managerial implications for safety education.

Attitude is a key contributor to behavior. As expected, the result demonstrated that riders who tend to accept unsafe riding more frequently engage in risky riding behavior. However, one interesting result relates to the construct of unawareness of traffic conditions, which appeared to strongly and negatively influence risky riding behavior. Consequently, riders who frequently neglected the traffic situation exhibit fewer risky riding behaviors. Such riders can be considered nervous riders whose fear of experiencing an accident led them to fail to observe the surrounding traffic conditions. Consequently, such riders appear to have less risky riding behaviors. On the contrary, riders with a low sense of danger and high riding confidence tend to be those experienced and skillful riders who are both more aware of traffic conditions and engage in more risk taking. This suggests that those with risky riding habits pay more attention to the traffic in order to protect themselves.

CONCLUSIONS

Young riders were found to have high accident and mortality rate. Recently, behavioral analysis has attracted the attention of researchers leading to valuable information being uncovered *(2)(10)(11)*. In this research, the refined framework based on Ulleberg and Rundmo *(10)* and Hoyes et al *(11)* was developed for analyzing the nature of risky riding behavior in young motorcyclists. As expected, the results demonstrated that personality traits are indirectly related with risky behavior. This study also confirmed the risk homeostasis theory.

Decisions to engage in risky riding behavior result from the interaction between risk (represented by sense of danger) and gain (represented by utility perception). Most research and safety improvement plans focus on risk reduction. However, for some rider groups, accident prevention plans should also include strategies on the perceived utility of risky riding behaviors. The research results clearly indicate that riders without risky riding behaviors can also cause problems. A large portion of the riding group is not sensation

seeking ones. Although these riders are not risky riders, they can be inexperienced, nervous, or even unfamiliar with traffic culture. Instead, risky riders are not all related to those young inexperienced riders, and unlike inexperienced riders they tend to be skillful, confident, and knowledgeable of modern traffic rules. Each group of riders may have their own specific decision making characteristics. Strategies such as education, enforcement, and engineering should consider the risky behaviors of young riders. This information can yield insights not only for safety education but also for future ITS safety development.

Most of the measurements presented in this study are only applicable to general scenarios and thus do not reflect real world traffic situations and may make it difficult for participants to imagine the scenario precisely. Setting more specific scenarios may enable the extraction of more interesting and detailed features. Furthermore, considering the heterogeneous characteristics of young riders *(25)(26)*, further research on risky riding behavior in different groups of young riders may further enhance understanding of the nature of accidents.

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