

# Thinking styles make a unique contribution to prediction of young drivers' use of safe driving styles

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## Abstract

The relationship between driving styles and crash risk has been demonstrated in several studies (e.g. West et al. 1993; Taubman - Ben-Ari et al. 2004). The aim of this research was to determine the predictive ability of Sternberg's (1997) theory of Mental Self-Government (MSG) for young drivers' driving styles, with the goal of improving driver training. A questionnaire package consisting of the Thinking Style Inventory-Revised (TSI-R, Sternberg et al. 2003), the Multi-dimensional Driving Style Inventory (MDSI, Taubman - Ben-Ari et al. 2004) and some demographic questions was administered to a convenience sample of 314 young drivers (18-25 years; 157 female). This study found that thinking styles can make a unique contribution to the prediction of young drivers' driving styles, especially in relation to positive driving styles such as patient driving. Because thinking styles are partly socialised and can be modified (Grigorenko and Sternberg 1997; Zhang and Sternberg 2000), these findings have implications for driver training.

**Key words:** Young drivers; thinking styles; driving styles; predictive value; safe driving; driver training.

## 1. Introduction

Drivers 16-24 years of age are still over-represented in the statistics regarding crashes and fatalities on the road (Organisation for Economic Co-operation and Development (OECD) 2006). Youth make up 10.1% of the total population of the 30 countries of the OECD but account for 26.7% of the driver fatalities in these countries (OECD, 2006). The OECD states that in the member countries over 8500 young drivers die in car accidents each year, resulting in big social and economic costs for individuals, families and societies. These figures warrant extra attention for young drivers in road safety research and in the past decades many studies have been undertaken. The majority of studies on young drivers focus on dangerous driving behaviour, crash risk and crash involvement (Bina, 2006, e.g. Catchpole and Styles, 2005, Ho and Yong Gee, 2008, Williams, 2006, Prato et al., 2010, Shope, 2006, Shope and Bingham, 2008, Redshaw, 2006). The literature seems to emphasise 'the young driver problem', (e.g. Fernandes, 2007, Groeger, 2006, Sigurdardottir, 2009, Shope, 2006, Wundersitz, 2007) instead of young drivers' potential for driving safely (Kleisen, 2012).

Two well known factors that contribute to young drivers' crash risk are 'age' (see for instance Smart et al., 2005, Wundersitz, 2007) and 'sex', with young male drivers being more at risk in traffic than young female drivers (Laapotti and Keskinen, 2004, Glendon et al., 1996, Harré, 2000, Whissell and Bigelow, 2003). While these factors are obviously important, they do not offer much opportunity for a young person to actively become a safer driver as these factors cannot be influenced. The present study concentrates on an area that has gotten less attention in the past, safe driving styles, specifically patient and careful driving as defined in the Multi-dimensional Driving Style Inventory (Taubman - Ben-Ari et al., 2004), and on factors that could be influenced by young drivers, in particular thinking styles. A thinking style is defined as an individual's preferred way of thinking (Sternberg, 1997, Zhang and Sternberg, 2005).

There are four reasons why the present study concentrates on thinking styles in relation to driving. First, it has been stated in previous research that there has not been enough discussion in the field about "how young drivers think and why they think the way they do" (Harré, 2000: 208). Secondly, thinking styles are thought to influence an individual's every action (Jones, 2004) and manifest themselves in every activity (Grigorenko and Sternberg, 1997) hence it is conceivable that thinking styles are involved in the act of driving. Thirdly, thinking styles are considered to be states, which means they are modifiable (Sternberg, 1997, Balkis and Isiker, 2005) and amenable to change. In contrast, many road safety studies have investigated relationships between personality traits and crash risk (see for instance Arnett et al., 1997, Oltedal and Rundmo, 2006). Although these studies

contribute to knowledge on differential crash involvement, they do not offer much opportunity for active change to the individual since personality traits are seen as relatively stable (Westen et al., 2006). Fourthly, previous research in road safety indicated that it is important to obtain knowledge on drivers' cognitions apart from their relationships with crashes (Hatakka, 1998).

The aim of this research was to determine the predictive ability of Sternberg's (1997) theory of Mental Self-Government (MSG) for young drivers' driving styles, with the subsequent goal of improving driver training. The study therefore focused on safe driving styles and factors that could be influenced in relation to these safe driving styles, specifically thinking styles, but for reason of comparison some data on negative driving styles are given.

## 2. Methods

This study focused on young drivers aged between 18-25 years old, in the Australian Capital Territory (ACT), holding a current drivers licence. The NRMA-ACT Road Safety Trust scholarship that funded this research required that the research was conducted within the boundaries of the ACT. However, while the study was conducted within the ACT many participants have come from other parts of Australia to study in the country's capital. Therefore, it could be said that the study was conducted with Australian young drivers in the ACT.

### 2.1 Participants and sampling

Participants were recruited from both the University of Canberra (UC) and the Canberra Institute of Technology (CIT). As different fields of study have been linked to the use of different thinking styles (Sternberg and Zhang, 2005), this study aimed to recruit participants from a variety of courses. The UC students were from a range of academic disciplines and the CIT students were recruited from trades' courses (such as electricians, car mechanics, beauticians, and chefs).

Students were randomly approached on the UC campus by the researcher during class and lunch breaks and asked to complete the questionnaire package. Only students unknown to the researcher were approached in order to avoid placing undue pressure on potential participants to participate. A payment of AU\$5 was offered to compensate participants for the fifteen to twenty minutes it took to complete the questionnaire. Some students accepted the AU\$5, others participated without receiving any compensation. At CIT participants could only be recruited during their lunch break since the TAFE system requires students to work as if they were in a job. The researcher approached CIT students at random during lunch breaks at the Fyshwick and Reid campuses that provided access to students from different courses. All participants received the AU\$5 compensation in return for completing the questionnaire, which took most of them over half an hour to complete.

In total, 314 participants completed the questionnaire package: 155 males, 157 females (two did not indicate their sex). Their ages ranged from 18-25 years, with 84.9% between 18-22 years. The mean age was 20.46 years (median 20 years). 312 participants held a current Australian drivers licence, 2 participants had their licences temporarily suspended. 17 participants were on a learner's permit (L-plates) but had at least a year driving experience, 161 on a provisional licence (P-plates), and 134 had a full licence. A higher percentage of females held a full drivers licence (40.6% of the males and 45.2% of the females). The mean number of years of licensed driving was 3.2 years (median three years). In Australia pre-licensed driving is quite common, especially in rural areas where teenagers often learn driving on their own property (so off road). This explains why the mean for total years of driving (pre-licensed and licensed) was 4.4 years (with a median of four years). 79.3% of participants spent between 0 and 10 hours driving per week and 84.7% between 0 and 10 hours on the weekends. 92.1% of participants drove 0-500 kilometres per week and 93.5% drove 0-200 kilometres on the weekend. There was a slight sex difference in weekly driving: 75.2% of the males drove 0-10 hours a week against 83.1% of the females. 44.3% of participants were students in social sciences, 25.5% in applied science, 18.2% were pursuing vocational courses, 3.5% were science students, 2.9% were in arts/humanities, 4.1% were in other fields of study and 1.6% did not indicate their field of study.

### 2.2 Questionnaires

With the Multidimensional Driving Style Inventory (MDSI), Taubman – Ben-Ari et al. (2004) have developed a conceptual and empirical integration of the various definitions and scales into a single conceptualisation of driving style. The MDSI is a validated and reliable 44-item self-report scale. Participants rate on a 6-point scale how each item fits their feelings, thoughts and behaviour during driving, from 'not at all' (1) to 'very much' (6). This study

uses the MDSI to determine young drivers' driving styles, because it is the first questionnaire to include positive driving styles (patient and careful), which suits the aim of focusing on the development of safe driving styles. The original study, in which the MDSI was constructed and validated (Taubman - Ben-Ari et al., 2004), revealed eight main factors (the driving styles) clustered in four broad domains of driving style: reckless and careless (risky and high-velocity driving styles), angry and hostile (angry driving style), patient and careful (patient and careful driving styles), and anxious (anxious, dissociative and distress reduction driving styles).

**Table 1: Key characteristics of the MDSI eight driving styles**

Domain	Driving Style	Key characteristics
Reckless and Careless	Risky	Excitement from dangerous driving
	High-velocity	Speeding, impatient
Angry	Angry	Expression of irritation and rage
Patient and Careful	Patient	Polite, calm, attentive
	Careful	Keeping traffic rules, cautious
Anxious	Anxious	Feelings of alertness and tension
	Distress reduction	Meditate, relaxation exercises
	Dissociative	Daydreaming, non attentive

(After Taubman – Ben-Ari et al. 2004)

The present study uses the thirteen thinking styles of the theory of mental self-government (Sternberg, 1997) because this has been classified as a testable theory (de St. Aubin et al., 2007). The theory of mental self-government (MSG) is based on the idea that the different ways in which societies are governed may be, at some level, external reflections of styles of thought (Sternberg, 1997). He defines a thinking style as an individual's preferred way to use their abilities. The MSG is nomothetic and continuous; individuals can possess every style to some degree, but they will differ in their preferences, and strength of those preferences, and the type of tasks or situations that will evoke specific preferences .

The MSG is operationalised through the Thinking Style Inventory-Revised (TSI-R) (Sternberg et al., 2003). All existing studies using the TSI-R have demonstrated sufficient reliability and good validity data (Zhang, 2004) and the questionnaire has been validated in both academic and non-academic settings (Zhang, 2005). Sternberg's theory (1997) isolates thirteen thinking styles, falling within five dimensions, as shown in Table 2. The TSI-R has 65 statements (Sternberg et al., 2003), with each five statements falling into one of the thinking styles. Participants rate themselves on a 7-point Likert-type scale: (1) indicates that the statement does not at all represent the way they normally carry out tasks and (7) suggests that the statement characterises extremely well the way they normally carry out tasks.

Previous research found several personal characteristics related to driving behaviour and driving style. Some of these factors have been included in the questionnaire package as additional questions to the TSI-R and the DBQ: 'age', 'sex', 'years of driving' (licensed and pre-licensed), 'type of drivers licence', and 'weekly driving' (hours and kilometres). This study concentrated on how young drivers may develop adaptive driving styles. Thus, no questions were included on negative aspects of driving such as violations of traffic rules or crash involvement.

**Table 2: Key characteristics of the MSG thinking styles**

Dimension	Thinking style	Key characteristics
Function	Legislative	Creating rules, likes to do things their own way
	Executive	Implementing, likes to follow established rules
	Judicial	Judging, likes to evaluate rules and procedures
Form	Hierarchic	Multi-tasking, multiple goals with different priorities
	Monarchic	Likes to focus on one task at the time
	Oligarchic	Has multiple goals of equal importance at the same time
	Anarchic	Random approach, does not like systems or rules
Level	Global	Likes abstract thinking, problems of a general nature
	Local	Preference for details and precision in tasks
Scope	Internal	Likes to work independently, alone
	External	Likes to work with other people, interaction
Leaning	Liberal	Allows change, goes beyond existing rules
	Conservative	Prefers familiarity, follows traditions

(After Sternberg 1997)

### 2.3 Analysis

All demographic data and data from the questionnaires have been entered into SPSS17. Missing values in the raw questionnaire data were replaced with the item mean scores which led to 314 valid sets of data. As long as the number of respondents and of missing items in Likert scale questionnaires is 20% or less, replacement with the item mean is an effective method of retaining a good representation of the original data (Downey and King, 1998). The largest missing rate was 1.6% for any of the variables.

Original instructions were followed for the scoring of the TSI-R thinking styles: legislative, executive, judicial, hierarchic, monarchic, oligarchic, anarchic, global, local, internal, external, liberal and conservative. For the MDSI the reverse-worded items were reverse-scored and further original instructions were followed for the scoring of the eight driving styles: risky, angry, high-velocity, patient, careful, anxious, distress reduction and dissociative. After establishing the internal coherence and validity of both instruments, the questionnaire data were analysed using the following calculations:

- Pearson's correlations between TSI-R thinking styles and MDSI driving styles
- Partial correlations (controlling for sex and age) between TSI-R thinking styles and MDSI driving styles
- Stepwise multiple regressions to examine the predictive value of the TSI-R thinking styles in relation to the MDSI driving styles

Stepwise multiple regressions were calculated for the eight driving styles as the dependent variable and the thirteen thinking styles, 'sex', 'age' (years), 'time driving' (years), and 'hours driving' (per week) as the independent variables. A stepwise multiple regression will start with the most powerful predictor of the criterion variable (driving style), and then select the next best predictors based on how well it improves upon the prediction achieved by the first variable. Second and subsequent predictors should correlate as little as possible with the first predictor variable and as highly as possible with the criterion variable (Gall et al., 2007, Coolican, 2004). For this study, new predictor variables could only be added by SPSS if the contribution to the multiple regression analysis was statistically significant. Predictors that accounted for more than 1% of the variance, which is the lower limit of a small effect size (Cohen, 1988), were regarded as meaningful. Collinearity statistics were computed for all predictive models for the patient and careful driving style domain. The independent variables were not highly correlated with each other and therefore contributed something unique to the prediction of the patient and careful driving domain.

### 3. Results

#### 3.1 Associations between thinking and driving styles

Pearson's correlation coefficients were computed to determine any Pearson's correlations between the MSG thinking styles and the MDSI driving styles. Secondly, partial correlations were calculated, controlling for the factors of sex and age. Similar associations were found as when not controlling for the factors 'sex' and 'age' with five exceptions; four significant correlations disappeared, while one significant correlation emerged. No relationships remained between hierarchic thinking and the angry and high-velocity driving styles, no significant correlations remained between monarchic thinking and angry and high-velocity driving, and a correlation between anarchic thinking and high-velocity driving emerged but was only just significant ( $r(305) = .113, p = .049$ ). The remaining correlations are similar in strength to the Pearson's correlations as shown in Table 3.

**Table 3: Pearson's correlations for 13 thinking styles and 8 driving styles**

N= 314		Risky	Angry	High Velocity	Patient	Careful	Anxious	Distress Reduction	Dissociative
Legislative	Pearson	-.055	-.022	-.054	.172	.135	-.179	-.034	-.145
	Sig.	.332	.697	.341	.002	.017	.001	.553	.010
Executive	Pearson	-.183	-.078	-.102	.272	.248	.050	-.107	-.035
	Sig.	.001	.169	.071	.000	.000	.379	.057	.537
Judicial	Pearson	-.025	-.066	-.067	.155	.127	.066	-.041	.001
	Sig.	.660	.241	.238	.006	.025	.240	.472	.992
Hierarchic	Pearson	-.233	-.116	-.112	.333	.300	-.011	-.072	-.147
	Sig.	.000	.041	.047	.000	.000	.848	.202	.009
Monarchic	Pearson	-.056	-.117	-.112	.233	.093	-.001	-.099	-.027
	Sig.	.323	.038	.047	.000	.100	.983	.079	.639
Oligarchic	Pearson	-.059	-.069	-.019	.195	.145	-.057	-.052	-.016
	Sig.	.297	.222	.741	.001	.010	.318	.355	.781
Anarchic	Pearson	.111	.125	.109	.010	.052	-.011	.086	.086
	Sig.	.049	.027	.054	.858	.362	.848	.130	.128
Global	Pearson	.016	.026	.045	.118	.055	-.037	.058	.061
	Sig.	.784	.644	.422	.037	.332	.510	.304	.281
Local	Pearson	-.015	-.075	-.077	.181	.135	.042	.031	-.010
	Sig.	.794	.187	.175	.001	.017	.457	.582	.864
Internal	Pearson	-.011	-.009	-.042	.146	.054	-.119	-.083	-.063
	Sig.	.843	.879	.454	.009	.339	.034	.142	.267
External	Pearson	-.083	-.054	-.089	.178	.218	-.084	-.036	-.144
	Sig.	.140	.343	.116	.002	.000	.138	.525	.011
Liberal	Pearson	.010	.003	.010	.072	.084	-.077	-.036	-.012
	Sig.	.861	.959	.858	.202	.136	.173	.521	.829
Conservative	Pearson	-.146	-.086	-.164	.246	.229	.058	-.093	-.038
	Sig.	.010	.129	.003	.000	.000	.309	.100	.505

#### 3.2 Thinking styles as predictors of driving styles

This study focused on patient and careful driving, but some data are given on the risky driving style and the reckless and careless driving style domain for reasons of comparison.

The variables 'sex', 'weekly driving', 'hierarchic thinking', 'anarchic thinking' and 'age' all significantly predicted the risky driving styles, with 'sex' being the strongest and 'age' being the weakest predictor. The combined variables explained 23.6% of the variance in risky driving scores. An individual is more likely to use a risky driving style when they are male, drive more hours per week, and use anarchic thinking, but less likely to employ this driving style when they utilise the hierarchic thinking style and when they are older.

When examining the predictors for the reckless and careless driving style domain, there was a slight change when compared to the risky and high-velocity driving styles separately. Contrary to expectations stemming from the literature, the weekly hours that participants drove proved to be the strongest predictor of this negative driving style. Males were still more likely to demonstrate this way of driving, older participants are less likely to use reckless and careless driving, and the use of the anarchic thinking style and less use of the conservative and hierarchic thinking styles all predicted this driving style. The combined variables explained 24.8% of the variance.

**Table 5: Model summary for reckless and careless domain multiple regression results**

Predictor	Standardised $\beta$	t-value	p-value	VIF value
Weekly driving	.326	5.853	.000	1.000
Sex	-.262	-4.845	.000	1.017
Conservative	-.152	-2.845	.005	1.017
Anarchic	.140	2.614	.009	1.037
Hierarchic	-.149	-2.589	.010	1.232
Age	-.119	-2.300	.022	1.004

The variables 'hierarchic thinking', 'executive thinking', 'weekly driving' and 'age' all predicted the patient driving style and were positive correlated to patient driving with the exception of 'weekly driving'. This indicates that young drivers using the hierarchic thinking style, the monarchic thinking style, who drive fewer hours per week, and who are older were more likely to demonstrate a patient driving style. The four variables combined predicted 19.3% of the variance in patient driving scores.

The variables 'hierarchic thinking', 'weekly driving', 'executive thinking', and 'external thinking' all predicted the careful driving style. All variables combined predicted 19.9% of the variance in careful driving scores. All predictor variables were positively correlated to careful driving, except for 'weekly driving'. This indicates that young drivers using the hierarchic, executive, and external thinking styles, and who drove fewer hours per week were more likely to use a careful driving style.

The patient and careful driving style domain was predicted by 'hierarchic thinking', 'executive thinking', 'weekly driving', 'sex', 'age', and 'external thinking'. The combined variables explained 26.4% of the variance. The hierarchic, executive, and external thinking styles were all positively related to patient and careful driving, as were the variables 'sex' and 'age'. 'Weekly driving' was inversely related to this driving style.

**Table 6: Model summary for patient and careful domain multiple regression results**

Model	R	R <sup>2</sup>	Adjusted R <sup>2</sup>	Std. Error of the Estimate
1	.392a	.153	.150	.71062
2	.440b	.194	.188	.69471
3	.475c	.225	.217	.68213
4	.490d	.240	.230	.67663
5	.503e	.253	.240	.67202
6	.514f	.264	.249	.66825
a. Predictors: (Constant), Hierarchic				

b. Predictors: (Constant), Hierarchic, Executive
c. Predictors: (Constant), Hierarchic, Executive, Weekly driving
d. Predictors: (Constant), Hierarchic, Executive, Weekly driving, Sex
e. Predictors: (Constant), Hierarchic, Executive, Weekly driving, Sex, Age (years)
f. Predictors: (Constant), Hierarchic, Executive, Weekly driving, Sex, Age (years), External

## 4. Discussion

### 4.1 Correlations between thinking and driving styles

Significant correlations were found between twelve of the thirteen thinking styles and seven of the eight driving styles; so 34 relationships in total. No correlations were found for the liberal thinking style. When controlling for the variables 'sex' and 'age', 30 of the 34 correlations remained and they were of similar magnitude as when not controlling for these factors. These findings show that there is an actual association between thinking styles and driving styles. Due to limitations of space in this paper, only the thinking styles that are relevant as predictors for both the patient and careful driving style domain and the reckless and careless domain are discussed.

The legislative thinking style was positively correlated to the patient and careful driving styles. People who adopt the legislative thinking style like tasks that allow them to do things in their own way and they have a tendency for risk-taking (welcoming new and challenging tasks) (Zhang, 2009). It was expected that this way of thinking might be related to negative driving styles because the road rules could be experienced as too dictating for someone who wants to follow their own ideas and likes to take risks. Still, this contrasting outcome can be interpreted from results of previous research. A qualitative Australian study found that young males experience being alone in the car as a situation in which they can do anything they want, while young females see being alone in a car as time to themselves (Redshaw, 2006). Both experiences correspond with legislative thinking and doing things in your own way, which can then be related to any driving style that you choose to maintain which, in this study, was patient or careful driving.

Hierarchic thinking had a positive relationship with patient and careful driving. The hierarchic thinking style refers to people who like to distribute attention to several tasks at the same time while prioritising them according to one's valuing of these tasks. The correlation with positive driving styles was expected because careful driving incorporates an element of planning and problem solving (Taubman - Ben-Ari et al., 2004) and hierarchic thinking would be helpful for that facet of driving. Furthermore, as for judicial thinking, previous research has found a positive correlation between the hierarchic thinking style and conscientiousness (Zhang and Huang, 2001, Fjell and Walhovd, 2004) which corresponds with the patient and careful way of driving.

Monarchic thinking was positively related to patient driving. People who adopt the monarchic thinking style prefer to focus completely on one thing at the time. In relation to driving focusing on one thing may be a double edged sword, despite the results from the questionnaires. When a driver focuses completely on driving without paying attention to distracting factors such as passengers talking or turning on music, this could lead to safe driving. On the other hand, since driving is a complex task with several factors demanding attention, focusing on the 'wrong' task (e.g. changing gears) could lead to unsafe situations (e.g. not noticing a changing traffic light).

External thinking had a positive relationship with patient and careful driving. People using the external thinking styles prefer to work collaboratively on tasks so work in a team. Driving takes place in a complex environment full of other road users (motorists, cyclists, pedestrians), so it makes sense that a preference for collaborating with other people would lead to patient and careful driving styles.

As expected, the conservative thinking style was positively correlated to the patient and careful driving styles. Conservative thinkers like working on tasks that allow them to adhere to existing rules and procedures when performing them. This makes conservative thinking congruent with adhering to the traffic rules while driving and, thus, to demonstrating a patient and careful driving style.

People who use anarchic thinking prefer flexibility in their tasks so they can decide on what, when, where, and how they work. This thinking style was positively related to risky and angry driving. This result could be explained by Taubman - Ben-Ari et al.'s (2004) suggestion that a desire for control, which is obvious in the anarchic thinking style, when frustrated can lead to maladaptive driving styles, such as angry and risky driving. When controlling for sex and age another positive correlation emerged between anarchic thinking and high-velocity driving. This is in accordance with expectations because the present data suggest that the risky, angry and high-velocity driving styles are very closely related (Kleisen, 2011). In fact, they could be considered as one driving style domain, rather than two domains as previous research proposes (Taubman - Ben-Ari, 2006, Taubman - Ben-Ari et al., 2004, Taubman - Ben-Ari et al., 2005, Miller and Taubman - Ben-Ari, 2010). In contrast, previous research has linked the anarchic thinking style to conscientiousness (Nielsen, 2005) which is related to safe driving rather than to unsafe driving styles. These findings from the present study and previous research could indicate that for drivers using the anarchic thinking style the importance and usefulness of obeying the traffic rules should be very clear, because otherwise they will easily revert to negative driving styles.

## 4.2 Predicting driving styles from thinking styles

If thinking and driving styles are related, to what extent can one's thinking styles predict one's driving styles? Several factors have been examined in relation to certain ways of driving and the results have suggested that different predictors were relevant to different driving styles. Although thinking styles were significant in predicting all driving styles, they were especially relevant to the patient and careful driving styles; the negative driving styles (such as risky or angry driving) were firstly predicted by being male, but the positive driving styles (patient and careful) had thinking styles as their strongest predictor. The discussion focuses on thinking styles.

The results of the questionnaires showed that 'sex' was the strongest predictor of the risky driving style. This was followed by a higher amount of 'weekly driving', a lower preference for the hierarchic thinking style, a higher endorsement of the anarchic thinking style and a lower age. The first predictor of risky driving, being male, is in accordance with the literature; males, especially young males, are more likely to use a negative driving style than are females (e.g. Catchpole and Styles, 2005, Laapotti and Keskinen, 2004, Laapotti and Keskinen, 1998, Ho and Yong Gee, 2008, Özkan, 2006). 'Age' was found as the weakest significant predictor, in contrast to expectations from previous research (Catchpole and Styles, 2005).

'Weekly driving', either in hours or kilometres, can be considered as being similar to the factor exposure. 'Exposure' has been examined in many road safety studies (Hutchinson et al., 2009, Bianchi and Summala, 2004) but mainly in relation to crashes. The higher crash involvement of some drivers could be a result of their greater exposure to potentially risky situations. There is considerably less research examining the links between weekly driving and driving styles instead of between exposure and crashes. No evidence was found that indicated that the 'amount of driving', seen as driving experience, has a direct influence on higher hierarchical levels of driver behaviour (Laapotti and Keskinen, 2004). On the other hand, Brown (1982) suggested that exposure alone cannot account for individual differences in crash rates, but rather it is the way people drive during the hours they spend on the road. "It would thus be possible for two individuals to exhibit radically different accident rates, if one always drove at the average speed of the traffic around him and one always drove erratically; sometimes faster and sometimes slower than the average of the flow. But their "exposure to risk", in terms of driving time or distance driven per year, could be identical" (Brown, 1982: 346). Thus any relationship between 'weekly driving' and specific driving styles could be important, especially when these links are between two negative driving styles that are known to enhance crash risk. The two thinking styles could therefore be the most interesting factors in relation to risky driving. Training drivers in the use of the hierarchic thinking style during driving, at the same time as discouraging anarchic thinking, could contribute to the development of a safer driving style.

Contrary to expectations from the literature, the first predictor for the reckless and careless driving style domain was 'weekly driving hours' rather than being male. Being male was the second predictor of this driving domain, while less inclination to use the conservative thinking style was the third predictor. The fourth significant predictor was a preference for anarchic thinking. The fifth predictor was less use of the hierarchic thinking style (which was found to be a strong predictor of the positive driving styles). The last predictor was 'age'; older drivers are less likely to use the reckless and careless driving style than are younger drivers. The variables accounted for in this study predicted more of the variance when considering the driving style domain (24.8%) than the separate risky and high-velocity driving styles (23.6% and 18.1% respectively). This finding would suggest examining the domain over the original two driving styles in hierarchical regressions.

The first two predictors for patient driving, hierarchic and executive thinking, were stronger and more significant indicators than the expected predictors 'age' and 'sex'. Fewer hours behind the wheel were the third predictor of patient driving. Although weaker, the fourth and fifth predictors, 'age' and 'sex', correspond with previous research; increasing age was linked to a decrease in the use of maladaptive driving styles (Taubman - Ben-Ari et al., 2004, Catchpole and Styles, 2005) and being female was linked to a higher use of safe driving styles (Özkan and Lajunen, 2005).

The four significant predictors for careful driving were a greater use of the hierarchic thinking style, driving fewer hours per week, and the use of the executive and external thinking styles. Hierarchic thinking was found as the strongest predictor for both positive driving styles, patient driving and careful driving, which is promising from the perspective of preventive intervention. Fewer driving hours also predicted careful driving. 'Sex' and 'age' did not enter into the regression model for careful driving because they were not significant as predictors. This supports the idea that different driving styles are predicted by different factors and that 'sex' and 'age' may be more important as predictors of maladaptive driving styles than as predictors for normal safe driving styles.

Finally, the regression model for the combined patient and careful driving domain did show sex and age as predictors but only as the fourth and fifth predictors. The strongest predictors were the use of the hierarchic and executive thinking styles, followed by less 'weekly driving'. The driving style domain predictors accounted for a greater percentage of the variance (23%) than either the patient or careful driving styles (19.3% and 19.9% respectively). This would favour researching the driving style domain over the separate driving styles when attempting to make predictions from the variables accounted for in this study.

### 4.3 Limitations

There were some limitations to this study. Firstly, participants were recruited from young drivers pursuing tertiary education. It is unclear how far the results are generalisable to young drivers not studying. However, students represent a large group of young drivers in the ACT and in that sense they are a meaningful group in themselves to assess in relation to new directions of research, such as the present study, that also could be of value in other young driver populations. In addition, a substantial part of the quantitative findings support previous research on young drivers conducted in several different countries (including Australia). This suggests that the participants of this study are at least not unrepresentative of the larger population of young drivers.

Secondly, although participants were recruited from several disciplines, participation was voluntary and the procedure was not statistically random, which may have biased the results. An important criterion during recruitment, namely willingness of people to participate, does not correlate with any of the factors under examination in the present study. In addition, much of the published research in the field of thinking styles reports on convenience samples instead of statistically random samples (e.g. Zhang, 2005, Zhang, 2004). Previous research using the MDSI has not used a statistically random sample either (Taubman - Ben-Ari et al., 2005, Taubman - Ben-Ari, 2006). This suggests that it is acceptable in both fields of research to report on findings from a non-probability sample and that the results of the present study can be compared to previous research.

Thirdly, the quantitative part of this study relied on self-report measures. Self-report is an appropriate way of examining thinking styles; thinking styles can be seen as an internal condition, which is often best reported by the participant (Deffenbacher et al., 2004). Although driving behaviour could be studied using observational measures, it would be very difficult to study one's habitual way of driving by observing one or a few trips (Lajunen and Summala, 2003). Also, self-reports of driving behaviour have been deemed appropriate as a surrogate for actual driving (Ulleberg and Rundmo, 2002, Hatakka et al., 1997).

## 5. Conclusion

Considering this study focused on normal, safe driving, these results are very promising. While negative driving styles with a higher crash risk (risky, angry, high-velocity) are predicted most strongly by sex (that is, being male), the positive driving styles with less crash risk (patient and careful driving) are influenced most strongly by young drivers' preferred ways of thinking, less so their 'sex' or 'age'. Since thinking styles are amenable to modification through socialisation and training, these findings indicate an opportunity to enhance young driver road safety. A starting point for enhancing road safety training would be to examine how thinking styles are most effectively modified in (young) adults and to build on this in the delivery of road safety training. A subsequent step would be to establish the preferred thinking styles of learner drivers during training and provide 'thinking' training

accordingly. In short, this study suggests that incorporating training in effective thinking styles would contribute to the development of safer driving styles among young drivers.

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