 

Improving Drivers’ Risk Management Behaviour: An Assault on Speeding

Final Report to the NRMA – ACT Road Safety Trust

Dr Brett Molesworth

March 2012

**Preface**

**Grant Recipient:**

Dr Brett Molesworth

**Research Student:**

Mr Prasannah Prabhakharan (PhD Student)

**Acknowledgement**

This research project was made possible as the result of a funding grant of $75,587.00 by the NRMA – ACT Road Safety Trust. The work has been prepared exclusively by Dr Brett Molesworth (the grant recipient) and is not endorsed or guaranteed by the Trust.

**CONTENTS**

EXECUTIVE SUMMARY iv

Background 1

Stage One 1

Stage Two 3

Stage Three 5

CONCLUSION 7

REFERENCES 8

APPENDIX A 10

APPENDIX B 11

APPENDIX C 12

# EXECUTIVE SUMMARY

Young drivers continue to be over-represented in road fatalities within Australia (Australian Transport Safety Bureau, 2004; Road and Traffic Authority, 2010). This ‘young driver problem’ is not unique to Australia as many developed countries such as the United Kingdom, Canada and the United States experience a similar problem (World Health Organization, 2007). Young drivers’ willingness to engage in risky driving practices such as speeding is thought to be a leading contributing factor to this high fatality rate. Training methods currently employed to curb such behaviour have appeared to have limited, in any effect. One method that has shown promising outside the road industry in amending at-risk behaviour involves cognitively engaging individuals in the task. Moreover within the aviation industry, Molesworth and colleagues have demonstrated an Experiential training method effective in improving pilots’ risk management behaviour (Molesworth, Wiggins, & O’Hare, 2006). This training method is founded on the principles of cognitive engagement where individual’s self-beliefs and skills are directly challenged. Hence, the main aim of the present project was to examine the utility of such a training method within the road environment specifically in improving young drivers’ risk management behaviour. As a result, the objectives of this project were:

* Investigate the utility of three different experiential training methods in order to improve young drivers’ risk management behaviour.
* Examine how cognitive resources are utilized to implement a behavioural change derived from a successful experiential training method.
* Examine if cognitive resource allocation could be taught.

Three separate studies were conducted, one relating to each objective. In each study, young licensed (Provisional 1) drivers, all under the age of 25 participated in the research. Similarly, each study featured a training session in week one, followed by a test session in the second week. All studies were conducted in a laboratory with the aid of either a computer-based driving simulator or in the case of study three, computer-based experimental tasks.

The first study examined the utility of four different training methods (Experiential, Case-Based plus Rules, Case-Based and Control) in terms of improving young drivers’ speed management behaviour. The results of this study revealed the most superior training method in reducing young drivers’ tendency to speed was an Experiential training method. Moreover, motorist in this group consistently speed for less than motorists in any other group. These results are consistent with those from the aviation industry in terms of improving pilots’ risk management behaviour.

The second study was designed to examine the impact of an Experiential training method on individual’s cognitive resources. The results of this study revealed that implementing a speed management strategy elicited by Experiential training was successful in isolation, however when performed in conjunction with another task there was a trade-off in terms of overall performance. From a cognitive perspective, these results indicate that the implementation of a successful training program such as Experiential training consumes ‘limited’ cognitive resources. These cognitive resources are crucial for the safe and successful implementation of the skills and knowledge acquired from training and without controlling for this impact, individuals are vulnerable to performance detriments.

The third study was designed to examine if cognitive resource allocation could be taught. Specifically, study two identified that the implementation of a successful training method such as an Experiential training method was cognitively taxing, study three was designed to examine it was possible to reduce the cognitive workload by training learners to allocate more cognitive attention to stimuli in a specified manner. The results of this study revealed that cognitive resource allocation can be trained and that providing explicit feedback about performance is key in this process. In addition, the results indicated that in the absence of feedback, individuals evenly distribute cognitive resources to tasks, rather than allocate based on the demand characteristics of the task. In other words, individuals appear to evenly divide their limited cognitive resources between tasks (equalization) rather than prioritize, in an attempt to maximize performance.

Combined the results from the three studies suggest that an Experiential training method that involves individuals cognitively in the task followed by feedback is an effective method to improve young drivers’ speed management behaviour. However, the results also suggest that the implementation of such a training program is cognitively taxing and processes should be put in place to limit the exposure of trainees to hazards during this time. In addition, the results suggest that training programs should compartmentalize components of driver training to facilitate in effective skill acquisition. Finally, the results suggest that with the correct training, individuals can be taught to allocate specific cognitive resources to various tasks. This type of training has the potential to essentially “fast-track” driver expertise.

While the present project is not without its limitations, the most notable being that all three studies were conducted in a simulated environment, the results nonetheless provide clear guidance as to an alternate and viable method of training to improve young drivers’ speed management behaviour. Similarly, the results provide insight into the effects of this training method from a cognitive perspective and offers practical solutions to improve the effectiveness of such a training method.

## Background

In 2008, the NRMA - ACT Road Safety Trust awarded Dr Molesworth from UNSW School (formerly a Department) of Aviation a grant to investigate the utility of three different training methods to improve young motorist risk management behaviour. The grant was conditional on including a team member from the Transport and Road Safety (TARS) group (formally NSW Injury Risk Management Centre - IRMC). After lengthy discussions with TARS, Dr Julie Hatfield was appointed. In addition, the project funded by the grant was converted from a one-year research assistant funded project to a three-year PhD stipend funded project.

In early 2009, a UNSW Psychology Honours graduate student – Mr Prasannah Prabhakharan was awarded a three-year scholarship under this grant. Since March 2009, Mr Prabhakharan under the supervision of Dr Molesworth have progressed with a modified version of the initial plan. Specifically, a revised schedule of research (research plan) was derived which involved three sequential stages.

The objective of each stage was:

* Stage one was to investigate the utility of three different experiential training methods in order to improve young drivers’ risk management behaviour.
* Stage two was to examine how cognitive resources are utilized to implement a behavioural change derived from a successful experiential training method.
* Stage three was to examine if cognitive resource allocation could be taught.

Below provides an overview of the results of each stage. Appendix A, B & C contains additional information relating to each stage, such as statistical data and detailed methodology.

## Stage One

In many European and Western countries, including Australia, road authorities are finding it difficult to contain the fatality rate of young motorists (Engstrom et al., 2003; Senserrick and Haworth, 2005). According to Australian road authorities, young drivers’ failure to comply with the road rules, namely speeding is one of the leading contributing factors to this high fatality rate (Roads and Traffic Authority (RTA), 2010; VicRoads, 2010a,b). Within Australia, present initiatives to curb young drivers’ tendency to speed can be largely divided into two categories, namely education and training. Learner drivers are required to learn the road rules and identify potential hazards that pose a threat to their safe driving (education). This includes information about speed limits, dangerous driving, the effects of alcohol on driving skills, penalties associated with infringement notices, the influence of peers on driver behaviour, obeying road signs, as well as statistical information concerning the likelihood of being involved in an accident (i.e., accident risk 10 times higher on provisional licence compared to learner licence; Gregersen, Nyberg, & Berg, 2003). In NSW, skill is developed through the required 120 supervised driving hours prior to licensing and the additional four years of provisional driver’s licence (red and green plates).

There appears to be a disconnect between the *Education* component of driver licensing and the *Skill* component. In other words, despite acquiring the knowledge required to obtain a driver’s licence and demonstrating the skills required to handle a motor vehicle, current training places little emphasis on developing insight into the influences necessary for safe driving such as risk perception and recognition of the limits to driving skills (i.e., effective decision-making). Research shows that young motorists do not believe anything negative will happen to them (i.e., motor vehicle accident) or that they are typical of the *drivers* who end up a statistic (DeJoy, 1992; Ivers et al., 2009). Therefore, the main aim of Stage One of the project was to investigate the utility of alternate training methods to improve young drivers’ risk management behaviour.

Within the field of aviation, Molesworth et al. (2003, 2006, 2011) had experienced repeated success employing an experiential training method to improve pilots’ risk management skills. Specifically, they found employing a training method which involved pilots cognitively in the task and provided them feedback about their performance, they could improve their risk management skills in terms of the minimum altitude they descended during a low level exercise. The success of this technique was said to be attributed to the level of cognitive involvement in the task as well as the direct demonstration of pilots’ skill. Therefore, stage one of the current project was to test an experiential training (Group 3) method similar to that employed by Molesworth and colleagues in the aviation environment. In addition, the present study sought to test the utility of three other training groups: Case-Based (Group 1), Case-Based plus Rule (Group 2), and Control (Group 4). The Case-Based training groups involved providing individuals information about other motorist accident involvement in the form of a case example to read, while the rule component of the training involved providing individuals information about the road rules that related to the accident.

In order to test the utility of these training methods, 58 participants, with a mean age of 21.17 (SD =1.73) were randomly divided into the four groups and asked to complete two simulated drives on a computer-based training simulator. The two simulated drives occurred one week apart and during the first week participants were provided training according to the training group randomly assigned. In the second week all participants underwent a test drive which involved completing a paper delivery exercise over a 10km track. The 10km track had a number of different speed zones that were clearly marked, they included, 40km, 60km and 80km zones. The dependent variables in week 2 (test drive) included, percentage of drivers’ speed exceedance as a function of distance, and the frequency of speed zone violations (40km, 60km and 80km).

The data from the test drive was analysed using a series of planned comparisons through a statistical package called ‘PSY’ (Bird et al., 2000). With all analyses, alpha was adjusted using Bonferroni’s adjustment. As can be seen in Figure 1, the Experiential group exceeded the speed limit significantly less throughout the test drive compared to their counterparts in the other three groups (Control, Case, Case plus Rule). This reduced speeding tendency was reflected across all three speed zones examined (40km, 60km and 80km; see Figure 2). These results are overwhelmingly positive for a training program that actively demonstrated the limitations of individuals’ skill in improving their speed management behavior (i.e., experiential training). They demonstrate that providing individuals direct experience along with feedback regarding their performance has clear benefits for young, novice driver training.

Figure 2: Percentage of speeding per zone

Figure 1: Overall percentage of speeding

In summary, the aim of stage one was to examine the utility of various training methods to improve young drivers’ speed management behaviour. The results suggest that the most effective method to achieve this aim was to employ a training method involving a driving episode plus feedback. These results are consistent with those from the Aviation industry where similar methods have been employed (Molesworth et al., 2003, 2006, 2011). Specifically, the results of the present study found when a driving episode is accompanied by feedback regarding participants’ speeding behaviour, there was a significant reduction in overall percentage of speeding and the frequency of zone violations, when tested one week later. Conversely, the results also found that providing individuals with cases examples of speeding behaviour and their negative consequences was not an effective method (in this domain) in reducing speeding behaviour. There was also no reduction in speeding when the cases included information about the road rules violated and their legal ramifications.

## Stage Two

Stage two directly extended the results of stage one and was designed to examine how cognitive resources are utilized to implement a behavioural change derived from a successful experiential training method. Specifically, the results from stage one revealed employing an experiential training method positively influenced young drivers’ risk management skills, however what remained unknown is how this new or modified behaviour impacts upon performance on other related tasks. Specifically, how the implementation of this behavioural change impacts upon other tasks from a cognitive resource perspective.

What is known is that driving is a complex task that involves the integration of multiple tasks, the most prominent being: physical tasks (e.g., steering, accelerating, braking, changing gears), and cognitive tasks (e.g., hazard perception, traffic management, route planning). According to Sweller, (1988; 1994) for a novice, the initial phase of learning any new task including driving is highly cognitively taxing. Learning a new task/s draws heavily on individual’s information processing ability namely in Working Memory (WM). Working memory is said to be the main area where stimuli is detected, encoded and information is stored to successfully execute tasks (Paas et al., 2010; Sweller, 1994). However, as an individual gains experience, the demands on WM resources decrease as task execution becomes more automated largely as a result of the more fluent manner in which information is processed (Sweller, 1994). Once the stimuli/information or task is well known to the individual, WM is often bypassed as information is directly applied from long-term memory (LTM; Paas et al., 2010). For tasks performed routinely, automation plays a vital role for the resource-limited WM, increasing the residual cognitive resources available to perform and manage other tasks.

In the context of driver training, the implementation of a new or modified task, such as a speed management strategy elicited through Experiential training should initially be highly cognitively taxing (Paas et al., 2010; Sweller, 1988, 1994). In situations where this new or modified task is performed in isolation, the impact of these demands should be minimal, as cognitive resources can be wholly directed towards performing, monitoring and correcting the new task. However, if this task is performed in conjunction with others, there may be a negative impact, specifically decrements in performance on one or both tasks. Therefore, the aim of the present study (stage two) was to examine how cognitive resources are utilized to implement a behavioural change derived from a successful experiential training method.

In order to test this, 59 participants with a mean age of 20.78 (SD =1.99) were randomly divided into the four groups (Group 1: No Training, Control; Group 2: Training, No Secondary Task; Group 3: No Training, Secondary Task; Group 4: Training, Secondary Task). The experimental designed comprised a 2 x 2 factorial design incorporating two levels of training (Control – no experiential training or Experiential Training) and two levels of secondary task (no mental arithmetic task or mental arithmetic task). Consistent with stage one, all participants were asked to complete a training drive in week one (10km paper delivery drive) followed by a test drive in week two. Whilst this concluded the first week for Group 1 and 3, Group 2 and 4 received Experiential training (see Table 1). In week 2, all participants completed the same test drive, but Group 3 and 4 completed a secondary task which required them participate in a mental arithmetic task. The dependent variables included percentage of drivers’ speed exceedance as a function of distance for the driving task and error rates for the mental arithmetic task.

Table 1.

Participant’s task/s from Session 1 to Session 2 by group allocation.

|  |  |  |
| --- | --- | --- |
|  | Session1 | Session2 |
| Group 1 | Drive | Test Drive |
| Group 2 | Drive + Experiential Training | Test Drive |
| Group 3 | Drive | Test Drive with Mental Arithmetic Task |
| Group 4 | Drive + Experiential Training | Test Drive with Mental Arithmetic Task |

In contrast to stage one, a factorial ANOVA was employed followed by four simple effects analyses. The results of the factorial ANOVA on driving performance in the second week revealed that the secondary task only impacted drivers’ speed management when individuals did not receive experiential training. Speed management was unaffected by the secondary task when drivers received Experiential training. The simple effects analysis revealed that Experiential training was effective in reducing speeding, with or without a secondary task (see Figure 3). In terms of performance on the mental arithmetic task, the results of two paired-sample t-tests revealed that Group 3 improved significantly in performance from Session 1 to Session 2, while Group 4 did not.

Figure 3: Percentage of Speeding (by distance) in week 2 (session 2).

In summary, the aim of stage two was to examine how cognitive resources are utilized to implement a behavioural change derived from a successful Experiential training method. The results of this study revealed that implementing a speed management strategy elicited by Experiential training was successful in isolation, however when performed in conjunction with another task there was a trade-off in terms of overall performance. From a cognitive perspective, these results indicate that the implementation of a successful training program such as Experiential training consumes limited cognitive resources. These cognitive resources are crucial for the safe and successful implementation of the skills and knowledge acquired from training and without controlling for this impact, individuals are vulnerable to performance detriments. Applying these findings to driving training, these results indicate training programs should be compartmentalized in order to reduce the cognitive load experienced by trainee drivers, and hence facilitate in safe acquisition of driving skills.

## Stage Three

Consistent with the previous stage, stage three was designed to build on stage two’s results and examine if cognitive resource allocation could be taught. As most motorists can attest to, driving involves a complex integration of multiple tasks, the two most common being physical (e.g., steering, braking) and cognitive (e.g., hazard identification, risk perception, and decision-making). As identified in Stage Two, completing these tasks in conjunction with others is cognitively taxing and if left uncontrolled can have a negative impact on performance. However from a cognitive perspective, how an individual allocates cognitive resource in situations that are novel remains unknown. What also remains unknown is if the division of cognitive resources can be trained. In other words, whether it is possible to train individuals to allocate more attention and information processing to one task, opposed to another. From an applied perspective and specifically driver training, deriving answers to these two questions should facilitate in the design of training program, as the content in such programs can be tailored to the specific area in need. For example, if speed management has been identified as an area requiring improvement, teaching individuals to better monitor and manage their speed whilst performing other tasks concurrently (and safety) should aid in improving their overall driving performance, including their speed management skills.

Research in a similar field, namely training drivers to enhance their attentional skills whilst driving has identified that it is possible to target specific training for one task, albeit attentional systems (Regan, Deery, & Triggs, 1998). Such training methods stem from the Variable Priority training (VP) examined by (Gopher, 1992). However, what remains unknown is whether cognitive resources can be trained in the same way as attentional skills.

In order to test this, 45 participants between the ages of 18-25 years (Mean 21.47, SD = 2.44), all with a provisional 1 licence volunteered for the research. In contrast to the previous studies, the present study employed a stimuli detection exercise. Specifically, participants were provided visual stimuli in additional to audio stimuli and told to respond only when certain stimuli (target) was present. For example, with the visual stimuli a ‘letter matrix’ exercise was created where a target letter was embedded amongst 400 distractor letters. With the auditory stimuli, an ‘numerical detection’ task was created where two digits from one to nine were paired and played to participants at the same time, however each digit was played in a separate ear. The participant had to detect if the two numbers presented were either odd or even numbers.

Using these two tasks, the participants were randomly divided into three groups (Explicit, Implicit and Control) and provided training in week one followed by a test exercise in the second week. The Explicit training group completed the dual-exercise (visual task and audio task) task and at the end of each block were provided feedback about their performance. The objective of this group was to train them to achieve a theoretical cognitive resource split of 75%/25% on the visual and audio task respectively. Performance scores were inferred to reflect division of cognitive resources. In contrast to the explicit training group, the objective of the second group - Implicit Training group was examine performance in a naturalistic setting. Hence, this group received no performance feedback at the end of each block. They did however receive information about the task which informed them that each block had a significant number of targets for both the visual and auditory component and that if they felt they were not responding enough in the block that they were likely to be missing the targets. This information was designed to facilitate in internal feedback, however this remained untested. In addition the dual-exercise task they completed involved visual stimuli which had been independently rated to be more difficult than that experienced by the Explicit training Group; auditory stimuli was the same. The Control group also received no feedback about their performance and similar to the Explicit training group completed a dual-exercise task of the same level of difficulty.

During week 2, all participants were asked to complete the same dual-exercise task as both the Explicit and Control group completed in week one. All groups were expected to draw from how they had learned to allocate cognitive resources in the previous week and apply it in a similar fashion in Week 2. That is, the Explicit group should allocate more resources to the visual task because of their training. The Implicit group should allocation more resources to the visual task because it was harder to perform last week than it was this week. The control group was expected to equally split resources to try maximize performance on both tasks.

A one-way ANOVA was conducted with all three conditions (two training conditions and one control) examining performance on the visual task alone in Week 2. It was of no relevance which of the two modalities (visual or auditory) was used for the analysis; they were complementary to each other (summed to 100%).

In relation to the main aim, the results from week two test revealed that there was a significant difference between the Explicit training (65%) compared to Control (52%). There was no significant difference between the Implicit training condition (55%) compared to the Control group (52%; see Figure 3).

Figure 3: Cognitive Resources Allocation to Visual Task in Week 2 (Average of 10 blocks).

In summary, the results of Study Three indicate that cognitive resource allocation can be trained and that providing explicit feedback about performance is key in facilitating this. In addition, the results suggest that in the absence of feedback, individuals evenly distribute cognitive resources to task, rather than allocate depending on the demand characteristics of the task. Hence there appears to be a natural phenomena of an equalization of cognitive resources rather than a prioritizing of cognitive resources. This result has implications for training methods that assume individuals can naturally detected the more important information to attend to. In fact, the results suggest that given a new task individuals do not perform well unless specifically trained to identify components of that task that require more attention to others. In terms of road safety, it may be the case that the ‘young’ fail to monitor their speed because they are busy or otherwise consumed in performing the many other tasks required to safety drive a motor vehicle. Further, the driver may be attempting to evenly distribute cognitive resources and as such misallocating cognitive resources. Whether targeted training about cognitive resource allocation for this task will improve driver’s speed management behaviour is an area for future research.

# CONCLUSION

The present research project involved three separate studies where each study attempted to build on the findings of the preceding study. The results from study one revealed an Experiential training method which involves individuals cognitively in the task and provides feedback about their performance, yields performance improvements in terms of young drivers’ speed management behaviour above other training methods such as providing individuals information about other motorist involvement in motor vehicle accidents. The results of study two replicate these findings, in addition to indicating that the application of new skills derived through an Experiential training method are initially cognitively taxing. These results suggest that training programs need to compartmentalize their training in order to reduce the cognitive load experienced by trainee drivers, and hence facilitate in driver skill acquisition. The results from study three revealed that unless specifically trained, when an individual engages in a novel dual-task exercise, they attempt to equalize the allocation of cognitive resources rather than prioritize to the specific tasks. These results also suggest that cognitive resources allocation can be trained.

The objective of the present research was to improve young drivers’ speed management behaviour. The results from the present study indicate that with targeted training methods, improvement in young driver behaviour, albeit in a driving simulator can be achieved. The results also suggest that a blanket training program may not be best suited when training new skills. A more targeted training program where skill acquisition is compartmentalized and key or pertinent information desired to be acquired from this training should be targeted. While there are a number of limitations with each of the three studies presented above (see Appendix A & B), the most notable being the research was conducted in driving simulators, the results are a positive step towards better understanding the limitations of current training practices and methods to improve these practices.

In summary, the NRMA - ACT Road Safety Trust awarded Dr Molesworth from UNSW School of Aviation a grant to investigate the utility of three different training methods to improve young drivers’ risk management behaviour. As illustrated in the above summaries of the three studies, Mr Prasannah Prabhakharan under the supervision of Dr Molesworth was successful in achieving this aim, in addition to extending the project in an attempt to further knowledge about methods to improve training methods for young novice drivers. The results are positive and provide direction and understanding about training methods to improve young drivers’ speed management behaviour.

# REFERENCES

Australian Transport Safety Bureau, 2004. *Young People and Road Crashes*. Canberra, Australia: Author.

Bird, K. D., Hadzi-Pavlovic, D.., & Isaac, A. P. (2000). *PSY* (Computer software). Sydney, Australia: School of Psychology, University of New South Wales

DeJoy, D. M. (1992). An examination of gender differences in traffic accident risk perception. *Accident Analysis and Prevention 24*, 237–246.

Engstrom, I., Gregersen, N. P., Hernetkoski, K., Keskinen, E., & Nyberg, A. (2003). *Young Novice Driver Education and Training, Literature review*. In: VTI- rapport 491A. Linkoping, Sweden: Swedish National Road and Transport Research Institute.

Gopher, D. (1992). The skill of attentional control: Aquisition and execution of attention strategies. In D. Meyer & S. Kornblum (Eds.), *Attention and Performance XIV: Synergies in Experimental Psychology, Artificial Intelligence and Cognitive Neuroscience.* (pp. 299-322). Cambridge, MA: The MIT Press.

Gregerson, N., 1996. Young drivers’ overestimation of their own skill–an experiment on the relation between training strategy and skill. *Accident Analysis Prevention 28*, 243–250.

Gopher, D. (1992). The skill of attentional control: Aquisition and execution of attention strategies. In D. Meyer & S. Kornblum (Eds.), *Attention and Performance XIV: Synergies in Experimental Psychology, Artificial Intelligence and Cognitive Neuroscience.* (pp. 299-322). Cambridge, MA: The MIT Press.

Molesworth, B., Tsang, M. H, & Kehoe, J. E. (2011). Rehearsal and verbal reminders in facilitating compliance with safety rules. *Accident Analysis and Prevention, 43*, 991-997.

Molesworth, B., Wiggins, M., & O'Hare, D. (2003). Personalising risk and training to improve the risk management behaviour of pilots. In B. J. Hayward & M. Nendick (Eds.), Proceedings of the *Sixth International Australian Aviation Psychology Symposium*. Sydney, AUS: Australian Aviation Psychology Association. ISBN 0-9751731-0-3.

Molesworth, B. R. C., Wiggins, M. W., O’Hare, D. P. (2006). Improving pilots’ risk assessment skills in low-flying operations: the role of feedback and experience. *Accident Analysis and Prevention 38*, 954–960.

Paas, F., van Gog, T., Sweller, J. (2010). Cognitive load theory: new conceptualizations, specifications, and integrated research perspectives. *Educational Psychology Review 22*, 115–121.

Regan, M. A., Deery, H. A., & Triggs, T. J. (1998). Training of attentional control in novice car drivers: a simulator study. *Proceedings of the 42nd Annual Meeting of the Human Factors and Ergonomics Society, (pp.* 1452-1456) Chicago, IL: Human Factors and Ergonomics Society.

Road and Traffic Authority, (2010). *Road Traffic Crashes in New South Wales: Statistical Statement for the Year Ended 31 December 2009*. NSW Centre for Road Safety, Sydney, Australia; Author.

Senserrick, T., & Haworth, N. (2005). *Review of literature regarding national and international young driver training, licensing and regulatory systems.* Monash University Accident Research Centre, Report No. 239. Clayton, Australia: Monash University.

Sweller, J. (1988). Cognitive load during problem solving: effects on learning. *Cognitive Science 12*, 257–285.

Sweller, J. (1994). Cognitive load theory, learning difficulty and instructional design.

*Learning and Instruction 4*, 295–312.

VicRoads., n.d. Arrive Alive: Young Drivers. Retrieved on 14 December, 2010. From [http://www.arrivealive.vic.gov.au/strategy/safer road users/young drivers/young drivers.html](http://www.arrivealive.vic.gov.au/strategy/safer%20road%20users/young%20drivers/young%20drivers.html).

VicRoads. (2010). Speeding and Safety. Retrieved on 23 August, 2010. From <http://www.vicroads.vic.gov.au/Home/SafetyAndRules/SafetyIssues/Speed/SpeedingandSafety.htm>.

World Health Organization. (2007). Youth and Road Safety. T. Toroyan, & M. Peden, M. (Eds.). World Health Organization, Geneva, Switzerland. Author.

# APPENDIX A

Prabhakharan, P., & Molesworth, B. R. C. (2011). Personalising risk to reduce young driver speeding behaviour. Proceedings of the *9th International Symposium on Aviation Psychology* (pp. 221 - 224), Sydney, AUS: ISBN 978-0-9751731-5-2.

# APPENDIX B

Prabhakharan, P., Molesworth, B., & Hatfield, J. (2012). Repairing Faulty Scripts to Reduce Speeding Behaviour in Young Drivers. *Accident Analysis and Prevention,* 43, 1696-1702.

# APPENDIX C

Prabhakharan, P., Molesworth, B., & Hatfield, J. (2012). Impairment of a speed management strategy in young drivers under high cognitive load. *Accident Analysis and Prevention, 47,* 24-29.