

THE INFLUENCE OF ALCOHOL CONSUMPTION ON TIME REACTION AND PERIPHERAL PERCEPTUAL STIMULI

GERNOT SCHUHFRIED*
MIHAI ANIȚEI, MIHAELA CHRAIF**

Abstract

A driver's ability to divide his or her attention between two or more visual stimuli can be impaired at BAC of 0.02 percent or lower (Starmer 1989; Howat *et al.*, 1991; Moskowitz *et al.*, 1985). The faster the body absorbs the alcohol, the higher the blood alcohol level will be, and the more alcohol in blood, the greater its effect will be. The objective: In this paper we lay the foundations for studying decision-making in complex dynamic construction management scenarios using situational simulations as experimental tasks. The vine consumption (250 ml, 13%) influence statistically significant the reaction time to visual stimuli and also the appreciation of speed and distances in central field.

Cuvinte-cheie: stimuli vizuali periferici, timp de reacție, timp de reacție motoriu, reacție de decizie.

Keywords: peripheral visual stimuli, reaction time, motor reaction time, decision reaction time.

1. INTRODUCTION

Alcohol has been long used as a benchmark for assessing performance impairments in a variety of research studies, including aviation (Billings, Demosthenes, White & O'Hara, 1991; Klein, 1972), nonprescription drug use (Burns & Moskowitz, 1980), and fatigue (Williamson, Feyer, Friswel & Finlay-Brown, 2001). The World Health Organization underlined that the behavioral effects of drugs can be compared with those of alcohol under the assumption that performance on drugs should be no worse than that at the legal blood alcohol limit (Willette & Walsh, 1983).

Alcohol reduces motor coordination and the level of alertness. According to many researchers, the drivers who drive after using alcohol can't react at optimal parameters (Starmer, 1989; Howat *et al.*, 1991; Moskowitz *et al.*, 1985). Alcohol alters depth perception, making it hard to tell whether other vehicles, pedestrians or objects are close or far away. Also, their vision is affected, and may be blurred or

* Vienna Test System, Mödling GmbH.

** University of Bucharest.

doubled. Alcohol and other drugs alter the normal function of the brain and body, and interfere with even the most skilled and experienced driver's ability to drive safely.

Alcohol consumption affects brain functions, impairs judgment and inhibits behavior. According to the National Highway Transportation Safety Administration, National Center for Statistics and Analysis (1991; 2005), a blood alcohol concentration of 0.08% is the legal limit in most states. A person can be considered "legally drunk" by blood alcohol concentration even if they do not 'feel' the effects of the alcohol that they have consumed. An intoxicated person may experience slurred speech, glassy or bloodshot eyes, poor balance, lack of coordination, slowed reactions, difficulty comprehending, clumsiness, disorientation, combativeness, impulsive behavior, lowered inhibitions and poor decision making.

According to the NHTSA (2005), drivers under the influence of alcohol often display certain characteristics when on the road:

- making wide turns;
- weaving, swerving, drifting or straddling the center line;
- almost striking an object or vehicle;
- driving on the wrong side of the road;
- driving at a very slow speed;
- driving at an excessive rate of speed;
- stopping without cause;
- braking erratically;
- responding slowly to traffic signals;
- turning abruptly or illegally;
- driving after dark with headlights off.

Young drivers generally have less driving experience than older drivers and are more likely to take risks in traffic, such as speeding, disobeying traffic signals, and not wearing safety belts (Hingson, Howland, 1993).

Johnson and Fell (1995) monitored six measures of driver alcohol involvement in the first five States from USA to adopt 0.08 laws (Utah, Oregon, Maine, California, and Vermont) and identified several statistically significant post-law decreases. The researchers concluded that the effects of the law were independent of national trends.

In a study of aggressive driving, Hauber (1980) defined aggression on the road as an intended behaviour which the offender supposes might do physical or psychological harm to the victim.

Mizell (1997) offers a more dramatic and specific definition. For the purposes of his study, aggressive driving is defined as an incident in which an angry or impatient motorist or passenger intentionally injures or kills another motorist, passenger or pedestrian or attempts to injure or kill another motorist, passenger or pedestrian, in response to a traffic dispute. This definition focuses exclusively on behaviour intended to physically harm.

Elliot (1996) contends that road rage is not a road safety concern. In this way he argues that any damage, apprehension or injury resulting from behaviours associated with road rage would fall under the purview of the criminal law.

Shinar (1998) has sought to develop a comprehensive definition of aggressive driving that is grounded in the psychological theory of aggression. According to the frustration-aggression model (the dominant theory of aggression in psychology), aggression is behaviour directed at a person with the intention of inflicting psychological or physical harm to that person. Shinar (1998) also makes an important distinction between aggressive drivers and aggressive driving.

In this way, aggressive drivers constitute a small sub-set of the driving population who display aggressive driving behaviours most of the time. Aggressive driving refers to the behaviours which tend to be displayed by most drivers less frequently. The National survey of 1,008 Canadian residents aged 18 and over (Steel Alliance – Canada Safety Council, 2000) indicated the behaviours from table 1 as aggressive. The following behaviours were identified by respondents as aggressive:

Table 1
Behaviours indicated as aggressive (Steel Alliance - Canada Safety Council, 2000)

Behaviour	Per cent answering yes
Tailgating or driving too closely behind another car	93%
Passing on the shoulder of the road	87%
Making rude gesture	87%
Pulling into a parking space someone else is waiting for	82%
Changing lanes without signalling	73%
Flashing high beams at the car in front of you	72%
Driving through yellow lights that are turning red	69%
Waiting until last second to merge with traffic on highway	66%
Driving 20 km per hour or more over the speed limit	65%

According to many studies, the personality traits rarely explain more than 25 per cent of the variance in individual social behaviour (Argyle, 1983). The relationship between personality traits and driving behaviour has been studied by many researcher as: Jonah (1997), Arnett *et al.* (1997), Shinar (1998) and many others. In this way Jonah (1997) offers a systematic review of thirty-eight studies which focussed on “sensation seeking”, a trait of particular interest in traffic safety research. Much of the research has focussed on drinking and driving, but thirteen of the studies reviewed also assessed the effects of sensation seeking on other risky driving behaviours. Shinar (1998) suggests that drivers possessing traits associated with extroverted or Type A personalities may be more likely to drive aggressively. Beirness (1996) reviewed the fairly substantial research on the relationship between lifestyle, driving performance and collision risk. These studies, which focussed primarily on young drivers, found a higher incidence of risky driving behaviour and collision involvement in individuals with lifestyles characterized by a

favourable disposition towards taking chances, impulsiveness and displaying aggression. These characteristics seemed to permeate all aspects of their lives, not just driving. Furthermore, a longitudinal research conducted by the Traffic Injury Research Foundation on a sample of 2,400 Ontario high school students further demonstrates the importance of lifestyle factors (Beirness, 1996). The participants to the survey completed the Student Life-Style Questionnaire and a cluster analysis subsequently identified three distinct subgroups with similar psychosocial characteristics. The findings of the study classified 40% of the sample as “Thrill Seekers”, tolerant of deviant behaviour and more likely to be influenced by peers; 39% of participants were classified as “Conventional” and displayed a strong attachment to traditional values, high levels of self-confidence and less responsiveness to peer influence and 21% were classified as “Inadequate” and displayed low levels of self-confidence, difficulty controlling anger and frustration, low attachment to traditional values and poor academic performance.

General surveys of aggressive behaviour have been given by numerous authors (Burg, 1975; Levitt, 1975; Prévention Routière Internationale, 1974; Hills & Burg, 1977; Davison 1985, 1986; Hedin, 1980; Humphries, 1987; North, 1993). In this way Davison (1986) gives a particularly useful summary of the measurable parameters that had been used up to that time to quantify the “safety” of drivers and of the problems involved in sampling sufficiently large representative groups of drivers. It will, however, be helpful to take as a starting point here the highly-influential work of Burg and the reanalysis of his data by Hills & Burg (1977).

Tasca (2000) stated that only 21 studies in the traffic safety and psychological literatures were directly related to aggressive driving. Thus, the methods by which the problem can be effectively studied are few and fraught with difficulties, one of which is the lack of consensus on a definition for aggressive driving. While there is a noted paucity of research in the field of driver aggression (Tasca, 2000), researchers concur that there is no agreement on a definition for aggressive driving (Ellison-Potter Bell & Deffenbacher, 2001; Lonero, 2000; Sarkar *et al.*, 2000; Tasca, 2000).

Parry (1968) conducted a survey of British drivers and found reactions fitting a hostile profile that included such behaviors as: negative facial expressions, obscene gestures, tailgating, headlight flashing, chasing other vehicles, and physical fights.

2. THE OBJECTIVES

The objectives of this study are:

1. to reveal the influence of red wine consumption (250 ml) in multiple choice reaction time and situational judgment traffic test;
2. to evidence the risk perception after consuming 250 ml of red wine and to highlight any difference between the two experimental situations: with wine administration and without wine.

3. THE RESEARCH HYPOTHESIS

The research hypotheses are:

1. the consumption of red wine (250 ml) has a significant statistical influence on the peripheral perception stimuli reaction time;
2. the consumption of red wine (250 ml) has a significant statistical influence on appreciation of speed and distances.

4. THE METHOD

4.1. THE PARTICIPANTS

The participants were 78 students at the Faculty of Psychology and Educational Science, University of Bucharest, age between 19 and 29 years ($m = 24.6$, $S.D. = 1.6$), both female and male, having driver licence.

4.2. THE INSTRUMENTS

4.2.1 The Peripheral Perception Test (Schuhfried, 1992) is destined to evaluate the abilities to perceive and process the visual peripheral information, and mostly on the rapid perception of the stimuli that enter the visual field through the lateral sides.

The test represents a driving simulation task and allows the results to be presented as a report containing the following variables: the name of the program, the tested subject's identity (name, gender and age), the date and array of selected parameters as well as the following 3 depending variables:

- The number of correct, incorrect and non-reactions;
- The mean value of the reaction time at the stimuli coming from the left and right and the total means' value;
- The standard deviation of the reaction times at the stimuli coming from the left and right and the total standard deviation.

4.2.2. The DEST test (Schuhfried, 1992) studies the subject's ability to estimate the speed and distance, displaying a small rectangle on the monitor that moves with a constant speed from the left side to the right, in a horizontal manner and represents a driving simulation task regarding the central visual field stimuli processing.

The central role of the DEST test is played by the white spot (small rectangle) which disappears after a certain distance behind an invisible barrier. The subject has to push a button when he thinks the rectangle would reach the edge of the barrier, which is evidenced by a vertical line at the edge of the screen.

The test can display the test results as a report, containing the program name, the date of the experiment, the subject's name, gender and age, the number of exercises, the number of variations of speed, distance and orientation. It also includes the crude results of the following dependent variables:

- *The precise number of estimations* (the ones that are between -3.5 mm and $+3.5$ mm from every barrier);
- *Underestimations* (the delayed reaction times – underestimations of the measured distance in mm);
- *Omissions* (the number of exercises the subject didn't react at all or the reaction was much delayed);
- *The estimation tendency's balance* (the absolute difference between the number of overestimations and underestimations), the sign (+/-) signals if there were more or less overestimations and underestimations;
- *The mean estimation error* (the number of deviant results).

5. RESULTS

In order to analyse the collected data, we used the Mann-Whitney non-parametric test for statistical differences between independent groups.

Table 2

Descriptive statistics, the mean and standard deviation of control group (N = 78) for DEST test

Variable	Mean	Standard deviation	p value
The precise number of estimations			
group 1	2.8	2.15	0.04
group 2	1.5	1.2	
Underestimations			
group 1	19.5	9.06	0.067
group 2	21.4	9.3	
Omissions			
group 1	.57	1.05	0.03
group 2	3.2	1.43	
The estimation tendency's balance			
group 1	-12.82	15.69	0.078
group 2	-14.12	16.4	
The mean estimation error			
group 1	30.63	10.19	0.03
group 2	48.54	12.43	
Viziotest-stereoscopic vision			
group 1	10.38	5.85	0.068
group 2	11.2	6.21	

Applying the Man U nonparametric test for the experimental group 2 with alcohol consumption and for the control group 1 statistically significant differences had been obtained for the variables of the DEST test: the mean estimation error, omissions and the precise number of estimations. Thus, the second statistical hypothesis had been confirmed ($p < 0.05$).

Table 3
Descriptive statistics for Peripheral Perception Test

Variable	Mean	Standard deviation	p value
VMS group 1	2.49	.92	0.03
group 2	3.53	0.87	
VMD group 1	2.51	.95	0.067
group 2	3.03	.95	
VMT group 1	2.50	.94	0.062
group 2	3.28	0.91	

Also applying the Man U nonparametric test for the experimental group 2 with alcohol consumption as well as for the control group 1 significant statistically differences had been obtained for the variables of the peripheral perception test: the mean estimation error, omissions and the precise number of estimations. Thus, the first statistical hypothesis had been confirmed ($p < 0.05$).

Findings revealed that after drinking a glass of wine the self-perception about aggressive driving was highly negative, the participants considering that are very calm and secured in traffic, they were not assuming risk in driving and negative emotions.

6. CONCLUSIONS

The study reveal that the alcohol consumption (250 ml red wine) influence statistically significant the reactivity to multiple visual and acoustical stimuli. The first research hypothesis has been partially for the dependent variable DT omission ($p = 0.001 < 0.01$). Testing the second hypothesis “the consumption of red wine (250 ml) has a significant statistical influence DEST test” using the nonparametric test Mann-U the results revealed statistically significance ($p < 0.05$). Thus, the wine consumption influence the risk choice in traffic simulated situations.

The participants from the experimental group admitted that are less aggressive, have only positive emotions and no tendency to risky behavior in traffic.

Primit în redacție la: 22. IV. 2010

REFERENCES

1. Aggressive Driving Issues Conference, 2000, <http://www.aggressive.drivers.com/papers/lonero/lonero-paper.html>.
2. ARGYLE, M., *The Psychology of Interpersonal Behaviour*, Harmondsworth, Penguin Books, 1983, p. 336.
3. ARNETT, J.J., OFFER, D., FINE, M.A., *Reckless Driving in Adolescence: 'State' and 'Trait' Factors*, *Accident Analysis and Prevention*, **29**, 1, 1997, p. 57–63.

4. BEIRNESS, D., *The Relationship between Lifestyle Factors and Collisions Involving Young Drivers*, in H. SIMPSON (Editor), *New to the Road: Reducing the Risks for Young Motorists*, Regents of the University of California, 1996, p. 71–77.
5. BILLINGS, C. E., DEMOSTHENES, T., WHITE, T. R., & O'HARA, D. B., *Effects of Alcohol on Pilot Performance in Simulated Flight*, *Aviation, Space and Environmental Medicine*, **62**, 1991, p. 233–235.
6. BURNS, M. & MOSKOVITZ, H., *Effects of Diphenhydramine and Alcohol on Skills Performance*, *European Journal of Clinical Pharmacology*, **17**, 1980, p. 259–266.
7. BURG, A., *The Relationship between Visual Ability and Road Accidents*, in *1st International Congress on Vision and Road Safety*, Prévention Routière Internationale, Linas-Montlhéry, France, 1975.
8. DAVISON, P.A., *Inter-Relationships between British Drivers' Visual Abilities, Age and Road Accident Histories*, *Ophthal. Physiol. Opt.* **5**, 1985, p. 195–204.
9. DAVISON, P.A., *Inter-Relationships between British Drivers' Age, Visual Attributes, and Road Accident Histories*, in *Vision in Vehicles*, A.G. GALE, M.H. FREEMAN, C.M. HASLEGRAVE, P. SMITH, S.P. TAYLOR (Eds.), Amsterdam, Elsevier, 1986, p. 25–32.
10. ELLIOT, B., *Road Rage – Media Hype or Serious Road Safety Issue?*, Paper presented at the Third International Conference on Injury Prevention and Control, Brisbane, Australia, 9–12, 1996, p. 14.
11. ELLISON-POTTER, P., BELL, P. & DEFFENBACHER, J., *The Effects of Trait Driving Anger, Anonymity, and Aggressive Stimuli on Aggressive Driving Behavior*, *Journal of Applied Social Psychology*, **31**, 2001, p. 431–443.
12. HAUBER, A.R., *The Social Psychology of Driving Behaviour and the Traffic Environment: Research on Aggressive Behaviour in Traffic*, *International Review of Applied Psychology*, **29**, 1980, p. 461–474.
13. HEDIN, A., *Retesting of Vehicle Drivers' Visual Capacity*, *J. Traffic Med.*, **8**, 1980, p. 18–21.
14. HILLS, B.L. & BURG, A., *A Reanalysis of Californian Driver Vision Data: General Findings*, TRRL Laboratory Report 768, Crowthorne, Berks, HILLS, B.L., *Vision, Visibility and Perception in Driving*, *Perception* **10**, 1977, p. 183–216.
15. HINGSON, R., HOWLAND, J., *Promoting Safety in Adolescents*, in MILLSTEIN, S., PETERSON, A., NIGHTENGALE, E., *Promoting the Health of Adolescents: New Directions for the 21st Century*, New York, NY: Oxford Press, 1993, p. 305–327.
16. HOWAT, P., SLEET, D., SMITH, I., *Alcohol and Driving: Is the 0.05 Percent Blood Alcohol Concentration Limit Justified?*, *Drug and Alcohol Review*, **10**, 2, 1991, p. 151–166.
17. HUMPHRIES, D., *Three South African Studies on the Relation between Road Accidents and Drivers' Vision*, *Ophthal. Physiol. Opt.* **7**, 1987, p. 73–79.
18. JOHNSON, D. & FELL, J., *The Impact of Lowering the Illegal BAC Limit to 0.08 in Five States in the U.S. The 39 Annual Proceedings, Oct. 16–18, 1995, Chicago, IL*, Des Plains, IL: Association for the Advancement of Automotive Medicine, 1995, p. 1–20.
19. JONAH, B., *Sensation Seeking and Risky Driving*, in Talib ROTHENGATTER (Ed.), *Traffic and Transport Psychology: Theory and Application*, Oxford, Pergamon, 1997, p. 259–267.
20. KLEIN, K., *Prediction of Flight Safety Hazards from Drug Induced Performance Decrements with Alcohol as a Reference Substance*, *Aerospace Medicine*, **43**, 1972, p. 1207–1214.
21. LEVITT, J.G., *Vision and Driving*, *Ophthalmic Optician*, **15**, 1975, p. 1109–1116.
22. LONERO, L. P., *A Preliminary Heuristic Model of Aggressive Behaviour in Drivers*, 2000.
23. MIZELL, L., *Aggressive Driving*, *AAA Foundation for Traffic Safety*, 1997, <http://www.aaafoundation.org/Text/research/agdrtext.htm>.
24. MOSKOWITZ, H., BURNS, M.M., WILLIAMS, A.F., *Skills Performance at Low Blood Alcohol Levels*, *Journal of Studies on Alcohol*, **46**, 6, 1985, p. 482–485.
25. National Highway Traffic Safety Administration, *The Effects Following Implementation of an 0.08 BAC Limit and Administrative Per Se Law in California*, DOT HS No. 807–771, Washington, DC: National Highway Traffic Safety Administration, 1991.

26. National Highway Transportation Safety Administration, National Center for Statistics and Analysis, Traffic Safety Facts, 2005, <http://www.nhtsa.dot.gov/>.
27. NORTH, R.V., *Work and the Eye*, Oxford Medical Publications, Oxford, Chapter 10, 1993.
28. PARRY, M.H., *Aggression on the Road*, London, Tavistock, 1968.
29. Prévention Routière Internationale, *Reports of 1st International Conference on Vision and Road Safety*, Paris, 1974, Prévention Routière Internationale, Linas-Montlhéry.
30. SARKAR, S., MARTINEAU, A., EMAMI, M., KHATIB, M., WALLACE, K., *Spatial and Temporal Analyses of the Variations in Aggressive Driving and Road Rage Behaviors Observed and Reported on San Diego Freeways*, 2000, <http://www.aggressive.drivers.com/board/messages/25/50.html>.
31. SCHUHFRIED, G., *The Peripheral Perception Test*, 1992, SCHUHFRIED, G., PRIELER J., BAUER W., *Manual Peripheral Perception (PP)*, Modling: SCHUHFRIED GmbH, 2002.
32. SHINAR, D., *Aggressive Driving: The Contribution of the Drivers and the Situation*, Transportation Research Part F: Traffic Psychology and Behaviour, **1**, 1998, p. 137–160.
33. Steel Alliance, Canada Safety Council, *Americans Attitudes toward Aggressive Driving*, 2000, <http://www.safety-council.org/>.
34. STARMER, G.A., *Effects of Low to Moderate Doses of Ethanol on Human Driving-Related Performance*, in CROW, K.E., BATT, R.D. (Eds.), *Human Metabolism of Alcohol*, Vol. I, Pharmacokinetics, Medicolegal Aspects, and General Interests. Boca Raton, FL: CRC Press, 1989. p. 101–130.
35. TASCA, L., *A Review of the Literature on Aggressive Driving Research*, Aggressive Driving Issues Conference, 2000, <http://www.aggressive.drivers.com/papers/tasca/tasca-paper.html>.
36. WILLIAMSON, A., FEYER, A.M., FRISWEL, R., FINALY-BROWN, S., *Developing Measures of Fatigue Using an Alcohol Comparison to Validate the Effects of Fatigue on Performance*, Accident Analysis and Prevention, **33**, 2001, p. 313–326.
37. WILLETTE, R.E. & WALSH, J.M., *Drugs, Driving, and Traffic Safety*, Geneva, World Health Organization, 1983.

REZUMAT

O aptitudine a șoferilor constă în ditributivitatea atenției între doi sau mai mulți stimuli vizuali (Starmer, 1989; Howat *et al.*, 1991; Moskowitz *et al.*, 1985). Având în vedere consumul de alcool și atenția distributivă, studiul de față evidențiază influența alcoolului asupra timpului de reacție. Astfel au fost alese două grupuri, experimental și de control, pentru grupul experimental selectându-se acei participanți ce au putut consuma alcool benevol. Rezultatele cercetării au evidențiat faptul că vinul consumat influențează semnificativ statistic timpul de reacție și aprecierea vitezelor și distanțelor.