



DRIVER COGNITION SEMINAR  
PSYCHOLOGY 734  
FALL 2006



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<b>Instructor:</b>	Chris Monk	<b>Office Hours:</b>	Wed. 3:15-4:15pm; by appoint.
<b>Phone:</b>	(703) 993-3408	<b>Class Time:</b>	Wed. 4:30-7:10pm
<b>Email:</b>	cmonk@gmu.edu	<b>Class Location:</b>	Research I 201
<b>Office:</b>	2059 David King	<b>Website:</b>	<a href="http://hfac.gmu.edu/~cmonk/734F06.html">http://hfac.gmu.edu/~cmonk/734F06.html</a>

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### Course Objectives

The goal of this seminar is to expose students to the cognitive processing issues involved in the driving task. Key topics include perception, visual search, distraction, workload, capturing attention (i.e., alarms), situation awareness, decision-making, strategy, risk, behavioral adaptation, individual differences, altered states (i.e., fatigue, alcohol, and mental disease), models of driver cognition, and newer research methods. The selected readings are intended to balance depth with breadth in the literature; though there are many, many relevant articles that are not included. Although the focus is exclusively on driving-related articles, many of the theories and empirical findings also apply to other dynamic contexts. Each student should expect to:

- Gain an appropriately deep and wide understanding of the current driver cognition literature;
- Continue to develop critical thinking skills as we discuss and criticize the articles we read;
- Develop a research proposal addressing a question arising from the literature.

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### Readings

The readings for this seminar consist primarily of peer-reviewed journal articles. Because the majority of class will be spent discussing these articles, it is imperative that students read all the assigned articles prior to class. Students should expect to read 40-60 pages of articles *per week*. Most articles are available electronically through the GMU Library's e-Journal site (<http://library.gmu.edu/phpzone/ej.php>). I will make older articles available electronically. *See Readings List for articles by week and topic.*

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### Course Requirements and Grading

Course grades will be assessed based on leading the in-class discussion of readings (30%), participation in class discussions (20%), a research proposal (30%), and four (4) one-page critiques of selected readings (20%). Details are as follows:

*Discussion Lead:* Each student will lead the discussion of a few research articles over the semester (the number will depend on the number of students registered). I will provide detailed guidance for what I expect from discussion leaders. Leading the discussion does NOT entail making a slide presentation.

*Participation:* Class participation in the seminar format is essential. The principle activity in class will be discussion of the readings. Your contribution to the discussion will demonstrate both your understanding of the material and your desire to understand it better.

*Research Proposal:* Each student will develop a research question based on the class readings and a research proposal to answer that question. Students will participate in the grading of their peers' proposals. Details will be provided in class.

*Critiques:* Each student may select any four (4) individual articles from the reading list to critique over the semester, but not an article for which the student led the discussion. Critiques should be limited to no more than one page in single-spaced type. Detailed guidance for these critiques will be provided in class.

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**Attendance**

This seminar will be discussion-based; therefore attendance is essential. Lack of attendance will affect a student's Class Participation grade. Please let me know in advance if you will miss class, excluding emergencies or unforeseen circumstances.

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**Honor Code**

George Mason University has an Honor Code that each student accepts as a condition of enrollment. This code is consistent with APA's ethical principles for working professionals, and it is important that each student adhere to the Honor Code. For this course, each student will produce his or her own papers and critiques. If you have any questions about what is permitted and what is not, please ask me.

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**Special Accommodations**

If you are a student with a disability and you need academic accommodations, please see me and contact the Disability Resource Center (DRC) at 703-993-2474. All academic accommodations must be arranged through that office.

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**Course Outline**

Any schedule changes or changes in assignments will be announced in class in advance. After an absence, students are responsible for contacting the instructor to obtain accurate information.

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<b>Date</b>	<b>Topic</b>
08/30	Introduction
09/06	Perception in Driving
09/13	Visual Attention and Visual Search
09/20	Divided Attention and Distraction
09/27	Workload and Workload Management
10/04	Capturing Attention Pt. 1: Auditory and Tactile Alerts and Alarms
10/11	Capturing Attention Pt. 2: Driver Response to Alerts and Alarms
10/18	HFES Conference - No class
10/25	Higher Cognition Pt. 1: Situation Awareness and Decision-Making
11/01	Higher Cognition Pt. 2: Strategy, Risk, and Behavioral Adaptation
11/08	Individual Differences: Age and Experience
11/15	Altered States: Fatigue, Alcohol, and Mental Disease / Draft proposals due
11/22	Thanksgiving Break - No class / Peer reviews due
11/29	Models of Driver Behavior
12/06	Methods and wrap-up / Final proposals due

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**Important Dates**

<i>Schedule</i>		<i>Research Proposal Due Dates</i>	
First Day of Class	Aug. 28	First Draft Due	11/15
Last Day to Add	Sept. 12	Peer Reviews Due	11/22
Last Day to Drop	Sept. 29	Final Draft Due	12/06
Elective Withdrawal Period	Sept. 30 - Oct. 27		
Thanksgiving Break	Nov. 22-26		

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**Seminar Reading List (Subject to revision)**

Date	Topic and Articles (page count)
08/30	<p><b>Introduction (11)</b></p> <p>Brown, I.D., Tickner, A.H., Simmonds, D.C.V. (1969). Interference between concurrent tasks of driving and telephoning. <i>Journal of Applied Psychology</i>, 53, 419-424. (6) **</p> <p>Strayer, D.L., Johnston, W.A. (2001). Driven to distraction: dual-task studies of simulated driving and conversing on a cellular telephone. <i>Psychological Science</i>, 12, 462-466. (5)</p>
09/06	<p><b>Perception in Driving (54)</b></p> <p>Green, M. (2000). "How long does it take to stop?" Methodological Analysis of Driver Perception-Brake Times. <i>Transportation Human Factors</i>, 2, 195-216. (22) **</p> <p>Gray, R. and Regan, D. (2005). Perceptual processes used by drivers during overtaking in a driving simulator. <i>Human Factors</i>, 47, 394-417. (24)</p> <p>Kemeny, A., and Panerai, F. (2003). Evaluating perception in driving simulation experiments. <i>TRENDS in Cognitive Science</i>, 7, 31-37. (7)</p> <p>Snowden, R. J., Stimpson, N., and Ruddle, R. A. (1998). Speed perception fogs up as visibility drops. <i>Nature</i>, 392(6675), 450. (1)</p>
09/13	<p><b>Visual Attention and Visual Search (41)</b></p> <p>Hughes, P.K., Cole, B.L. (1986). What attracts attention when driving? <i>Ergonomics</i>, 29, 311-391. (7) **</p> <p>McCarley, J., Vais, M., Pringle, H., Kramer, A., Irwin, D., and Strayer, D. (2004). Conversation disrupts change detection in complex traffic scenes. <i>Human Factors</i>, 46, 424-436. (13) **</p> <p>Strayer, D. L., Drews, F. A., and Johnston, W. A. (2003). Cell phone induced failures of visual attention during simulated driving. <i>Journal of Experimental Psychology: Applied</i>, 9, 23-32. (10)</p> <p>Underwood, G., Chapman, P., Bowden, K. and Crundall, D. (2002). Visual search while driving: skill and awareness during inspection of the scene. <i>Transportation Research Part F</i>, 5, 87-97. (11)</p>
09/20	<p><b>Divided Attention and Distraction (53)</b></p> <p>Lansdown, T. C., Brook-Carter, N., and Kersloot, T. (2004). Distraction from multiple in-vehicle secondary tasks: Vehicle performance and mental workload implications. <i>Ergonomics</i>, 47, 91-104. (14)</p> <p>Levy, J., Pashler, H., and Boer, E. (2006). Central interference in driving: Is there any stopping the psychological refractory period? <i>Psychological Science</i>, 13, 228-235. (8)</p> <p>Spence, C., and Read, L. (2003). Speech shadowing while driving: on the difficulty of splitting attention between eye and ear. <i>Psychological Science</i>, 14, 251-256. (6)</p> <p>Rakauskas, M., Gugerty, L., and Ward, N. (2004). Effects of naturalistic cell phone conversations on driving performance. <i>Journal of Safety Research</i>, 35, 453-464. (12)</p> <p>Recarte, M. A., and Nunes, L. M. (2000). Effects of verbal and spatial-imagery tasks on fixations while driving. <i>Journal of Experimental Psychology: Applied</i>, 6, 31-43. (13)</p>
09/27	<p><b>Workload and workload management (59)</b></p> <p>Patten, C., Kircher, A., Ostlund, J., Nilsson, L., and Svenson, O. (in press). Driver experience and cognitive workload in different traffic environments. <i>Accident Analysis and Prevention</i>. (8)</p> <p>Piechulla, W., Mayser, C., Gehrke, H., and Konig, W. (2003). Reducing drivers' mental workload by means of an adaptive man-machine interface. <i>Transportation Research Part F</i>, 6, 233-248. (16)</p> <p>Recarte, M., and Nunes, L. (2003). Mental workload while driving: effects on visual search, discrimination, and decision making. <i>Journal of Experimental Psychology: Applied</i>, 9 (2), 119-137. (19)</p> <p>Verwey, W. B. and Veltman, H. A. (1996). Detecting short periods of elevated workload: A comparison of nine workload assessment techniques. <i>Journal of Experimental Psychology: Applied</i>, 23, 270-285. (16)</p>

Date	Topic and Articles (page count)
10/04	<p><b>Capturing Attention Pt. 1: Auditory and Tactile Alerts and Alarms (38)</b></p> <p>Ho, C., and Spence, C. (2005). Assessing the effectiveness of various auditory cues in capturing a driver's visual attention. <i>Journal of Experimental Psychology: Applied</i>, 11, 157-174. (18)</p> <p>Ho, Reed, and Spence (in press). Assessing the effectiveness of "intuitive" vibrotactile warning signals in preventing front-to-rear-end collisions in a driving simulator. <i>Accident Analysis and Prevention</i>. (9)</p> <p>Wiese, E. E., and Lee, J. D. (2004). Auditory alerts for in-vehicle information systems: The effects of temporal conflict and sound parameters on driver attitudes and performance. <i>Ergonomics</i>, 47, 965-986. (21)</p>
10/11	<p><b>Capturing Attention Pt. 2: Driver Response to Alerts and Alarms (47)</b></p> <p>Hanowski, R. J., Dingus, T. A., Gallagher, J. P., Kieliszewski, C. A., and Neale, V. L. (1999). Driver response to in-vehicle warnings. <i>Transportation Human Factors Journal</i>, 1(1), 91-106. (16) **</p> <p>Lee, J.D., McGehee, D., Brown, T., and Reyes, M. (2002). Collision warning timing, driver distraction, and driver response to imminent rear-end collisions in a high-fidelity driving simulator. <i>Human Factors</i>, 44, 314-344. (21)</p> <p>Parasuraman, R., Hancock, P. A., and Olofinboba, O. (1997). Alarm effectiveness in driver-centered collision-warning systems. <i>Ergonomics</i>, 40, 390-399. (10)</p>
10/18	<p><b>HFES - No class</b></p>
10/25	<p><b>Higher Cognition Pt. 1: Situation Awareness and Decision-Making (51)</b></p> <p>Bar-Gera, H. and Shinar, D. (2005). The tendency of drivers to pass other vehicles. <i>Transportation Research Part F</i>, 8, 429-439. (11)</p> <p>Cooper, P.J., and Zheng, Y. (2002). Turning gap acceptance decision-making: the impact of driver distraction. <i>Journal of Safety Research</i>, 33, 321-335. (15)</p> <p>Gugerty, L. (1997). Situation awareness during driving: explicit and implicit knowledge in dynamic spatial memory. <i>Journal Experimental Psychology: Applied</i>. 3 (1), 42-66. (25)</p>
11/01	<p><b>Higher Cognition Pt. 2: Strategy, Risk and Behavioral Adaptation (47)</b></p> <p>Cnossen, F., Meijman, T., and Rothengatter, T. (2004). Adaptive strategy changes as a function of task demands: a study of car drivers. <i>Ergonomics</i>, 47, 218-236. (19)</p> <p>Horswill, M. and McKenna, F. (1999). The effect of interference on dynamic risk-taking judgments. <i>British Journal of Psychology</i>, 90, 189-196. (8)</p> <p>Lewis-Evans, B. and Charlton, S. (2006). Explicit and implicit processes in behavioural adaptation to road width. <i>Accident Analysis and Prevention</i>, 38, 610-617. (8)</p> <p>White, M.P., Eiser, J.R., and Harris, P.R. (2004). Risk perceptions of mobile phone use while driving. <i>Risk Analysis</i>, 24 (2), 323-334. (12)</p>
11/08	<p><b>Individual Differences: Age and Experience (63)</b></p> <p>Caird, J., Edwards, C., Creaser, J., and Horrey, W. (1995). Older driver failure of attention at intersections: Using change blindness methods to assess turn decision accuracy. <i>Human Factors</i>, 47, 235-249. (15)</p> <p>Crundall, D. E., and Underwood, G. (1998). Effects of experience and processing demands on visual information acquisition in drivers. <i>Ergonomics</i>, 41, 448-458. (11)</p> <p>Dingus, T., Hulse, M., Mollenhauer, M., Fleischman, R., McGehee, D., and Manakkal, N. (1997). Effects of age, system experience, and navigation technique on driving with an Advanced Traveler Information System. <i>Human Factors</i>, 39, 177-199. (23)</p> <p>Pradhan, A. K., Hammel, K. R., DeRamus, R., Pollatsek, A., Noyce, D. A., and Fisher, D. L. (2005). The use of eye movements to evaluate the effects of driver age on risk perception in an advanced driving simulator. <i>Human Factors</i>, 47(4), 840-852. (13)</p>

Date	Topic and Articles (page count)
11/15	<p><b>Altered States: Fatigue, Alcohol, and Mental Disease (35)</b></p> <p>Brown, I. (1994). Driver fatigue. <i>Human Factors</i>, 36, 298-314. (17)</p> <p>Summala, H. and Mikkola, T. (1994). Fatal accidents among car and truck drivers: effects of fatigue, age, and alcohol consumption. <i>Human Factors</i>, 36, 315-326. (12)</p> <p>Uc, E., Rizzo, M., Anderson, S., Shi, Q, and Dawson, J. (2004). Driver route-following and safety errors in early Alzheimer disease. <i>Neurology</i>, 63, 832-837. (6)</p>
11/22	<p><b>Thanksgiving Break - No class</b></p>
11/29	<p><b>Models of Driver Behavior (49)</b></p> <p>Fuller, R. (2005). Towards a general theory of driver behaviour. <i>Accident Analysis and Prevention</i>, 37, 461-472. (12)</p> <p>Ranney, T. (1996). Models of driving behavior: a review of their evolution. <i>Accident Analysis and Prevention</i>, 26, 733-750. (18)</p> <p>Salvucci, D. (2006). Modeling driver behavior in a cognitive architecture. <i>Human Factors</i>, 48, 362-380. (19)</p>
12/06	<p><b>Methods and wrap-up (41)</b></p> <p>Garcia-Larrea, L., Perchet, C., Perrin, F., and Amenedo, E. (2001). Interference of cellular phone conversations with visuomotor tasks: an ERP study. <i>Journal of Psychophysiology</i>, 15, 14-21. (8)</p> <p>Neale, V., Dingus, T., Klauer, S., Sudweeks, J., and Goodman, M. (2005). <i>An overview of the 100-car naturalistic study and findings</i>. National Highway Traffic Safety Administration. (10) <a href="http://www-nrd.nhtsa.dot.gov/pdf/nrd-12/100Car_ESV05summary.pdf">http://www-nrd.nhtsa.dot.gov/pdf/nrd-12/100Car_ESV05summary.pdf</a></p> <p>Reed, M. P., and Green, P. A. (1999). Comparison of driving performance on-road and in a low-cost simulator using a concurrent telephone dialling task. <i>Ergonomics</i>, 42, 1015-1037. (23)</p> <p>van der Horst, R. (2004). Occlusion as a measure for visual workload: an overview of TNO occlusion research in car driving. <i>Applied Ergonomics</i>, 35, 189-196. (8)</p>

I reserve the right to change, omit, or add articles no less than one week prior to the discussion date.

I ask that each student download his or her own copy of the articles from the GMU e-Journals resource (<http://library.gmu.edu/phpzone/ej.php>) rather than sharing amongst each other. Doing so will give new students the chance to learn how to use e-Journals and it will also increase the Library's record of access-counts for the journals in the list, thereby helping to ensure subscriptions are maintained. All articles marked with double-asterisks (\*\*) are not available electronically and will be available on the course website.