Tenth International Conference on Managing Fatigue: Abstract for Review
Driver Distraction—Confusing "Cause" with "Effect"

Author #1: David Curry, Packer Engineering Group, dcurry@packereng.com
Author #2: John Meyer, Edison Engineering, john@edieng.com
Corresponding Author: David Curry

Background
For at least the past 15 years, there has been increased attention within the transportation research community (as well as the popular press and the general public) on the potential impact of distraction on both driver behavior and the potential for accidents. Much of this debate has been focused on the impact of such activities as in-vehicle cellular telephone calls or texting, with numerous states outright banning or legislatively limiting such activities by drivers.

Discussion
Examination of more than fifty years of vigilance research suggests that our entire perspective on the driver "distraction" problem may have been in error. The underlying assumption behind most of the recent focus on driver distraction seems to be that the advent of cellular communications and prevalence of portable consumer electronics has effectively created an "attractive nuisance" that is somehow magnetically drawing drivers' attention away from their normally exclusive focus on the driving task and diverting it to the electronic devices. Such a perspective *assumes* a cause/effect relationship necessarily exists between the diminishment of focus on the driving task and an increased focus on electronic devices or other non-driving-related activities. To date we have seen no attempts to determine whether such causal relationship *actually* exists.

Based on examination of workload research performed by the aviation and railroad communities, it is quite possible that the true relationship is simply inversely covariant, rather than causative. While research has repeatedly demonstrated that excessively high arousal levels negatively affect performance, what is less well-recognized is that excessively *low* arousal levels produce virtually the same negative performance impact (see Figure 1).

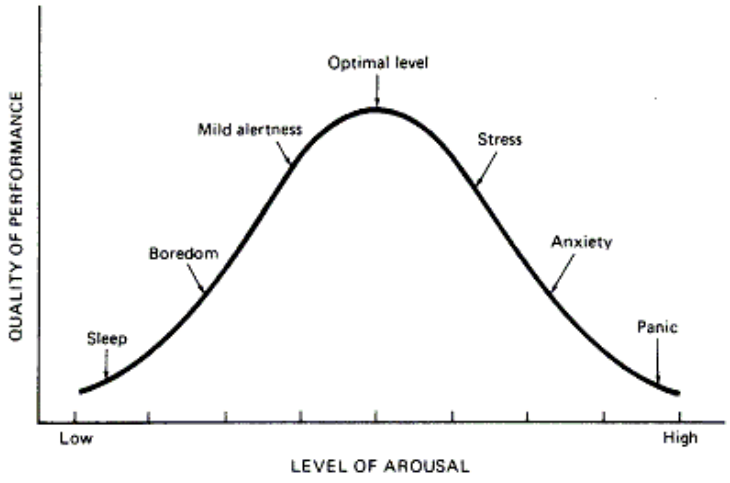

Figure 1 Yerkes-Dodson Curve

Naturalistic driving studies have demonstrated both that conversations on cellular telephones typically occur during periods of low driver demand and that the such conversations do not significantly affect the likelihood of the occurrence of safety-critical events in passenger vehicles (and that the likelihood of such events significantly decreases during cellphones conversations for the operators of commercial vehicles). Further, if the result of such conversations were a shift in attention away from the driving task, there should exist a significant increase in accident frequency as the utilization of cellular devices has become progressively more ubiquitous (research published by the U.S. Department of Transportation currently estimates that more than 10% of the driving public is on a cellular telephone at any given point in time). In reality, as cellular telephone use behind the wheel has become more common, the rate of police reportable accidents per mile has continued to diminish steadily. Unlike injury-related or fatal accidents, this statistic is unlikely to have been influenced by the inclusion of more effective occupant protection systems that have been increasingly incorporated into vehicles during the same time frame. This lack of increase in accidents suggests that a progressively larger percentage of what has been administratively designated as "distracted drivers" are somehow not experiencing an increased number of accidents. Absent some type of countervailing reduction in the accident propensity of drivers not "on the phone" to skew the overall accident rate downward, this suggests that either phone-using drivers are not unreasonably distracted or that a large percentage of those drivers were "distracted" before the advent of cellular phones and were simply engaged in other activities that were not as easy to classify as "distracting" per se (e.g., day dreaming, mind wandering, focusing on other tasks or situations, etc.) The latter scenario is obviously the more likely alternative.

The last fifty years have seen a steady decline in driver workload through the improvement of both the vehicle and the roadway infrastructure. This begs the question, *has the driver workload level been reduced so far that the driving task now results in insufficient workload to keep the operator's mind actively engaged in the task?* If so, the current "increase" in "driver distraction" may simply indicate that we have reduced the vehicle-related driver workload to such a level that drivers are actively seeking additional attention-demanding tasks in order to raise themselves back to a more optimal arousal level on the Yerkes-Dodson Curve. If this is the case, a reduction in driver "distraction" can only be accomplished by focusing on determining the *optimal* workload level for a driver, likely resulting in an *increase* in designed driver workload across the road-vehicle system. Such an increase would be directly contradictory to the approach taken throughout the course of development of virtually all consumer products (i.e., continuous workload reduction).

Such a perspective also calls into question the developmental focus of semi-autonomous and self-driving vehicles, which promises to reduce driver workload even further. Since semi-autonomous vehicles cannot perfectly predict and respond to every possible roadway scenario (particularly given that their introduction will result in *both* automated and non-automated vehicles *sharing* the same roadway), many developers have suggested that it will be the driver's task to monitor and oversee the computer control of the vehicle, ready to resume manual control whenever necessary. Such a position flies directly in the face of decades of vigilance- and automation-related research which has amply demonstrated that human "monitoring" of automated systems rapidly degenerates into occasional "sampling" of the systems, with the sampling rate be roughly commensurate to the failure rate of the automation. The chance that such a "sample" will occur at same time as a "failure" in the automation are, at best, remote.