Judging Thieves of Attention: Commentary on "Assessing Cognitive Distraction in the Automobile," by Strayer, Turrill, Cooper, Coleman, Medeiros-Ward, and Biondi (2015)

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The laudable effort by Strayer and his colleagues to derive a systematic method to assess forms of cognitive distraction in the automobile is beset by the problem of nonstationary in driver response capacity. At the level of the overall goal of driving, this problem conflates actual on-road behavior; characterized by underspecified task satisficing, with our own understandable, scientifically inspired aspiration for measuring deterministic performance optimization. Measures of response conceived under this latter imperative are, at best, only shadowy reflections of the actual phenomenological experience involved in real-world vehicle control. Whether we, as a research community, can resolve this issue remains uncertain. However, we believe we can mount a positive attack on what is arguably another equally important dimension of the collision problem.

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The target article reflects the programmatic, systematic, and indeed impactful work by Strayer and his colleagues (2015), now across a span of years, concerning driver distraction in road vehicles. The integrative effort offered here seeks to derive a comprehensive method through which to assess the cognitive dimension of driver distraction as a tool to mitigate (through either design or training) the adverse effects of contingent vehicle collisions. These are laudable and valuable endeavors of both scientific and social import (see also Hancock, 2009; Hancock & de Ridder, 2003). Hence, the work by Strayer et al. demands our attention, our deliberation, and our best response.

Let us begin with the most foundational predicate of this overall genre of work that can, in part, be addressed by ongoing epidemiological information. If in-vehicle devices do cause distraction and such distraction is implicated as a cause of collisions, then we should see evidence of a commensurate increase in collision frequency with the penetration of ever-greater numbers of such in-vehicle systems (the boundaries of such technologies being writ large, e.g., OEM devices, ported devices, handheld PDAs, etc.). Although the picture, at this more global level analysis, is not transparently clear (and indeed, one might argue that it necessarily cannot be completely unambiguous), as is shown in Figure 1, the current trends do not appear to indicate a commensurate increase of collision frequency with device penetration. As with all such epidemiological arguments (e.g., see Redelmeier & Tibshirani, 1997), there are so many moving parts that the available degrees of post hoc rationalization can always be invoked, contingent upon researchers' respective persuasions, beliefs, and perspectives.

However, if we suppose that the aformentioned apparent dissociation may be resolved positively (i.e., distraction need not *necessarily* cause a

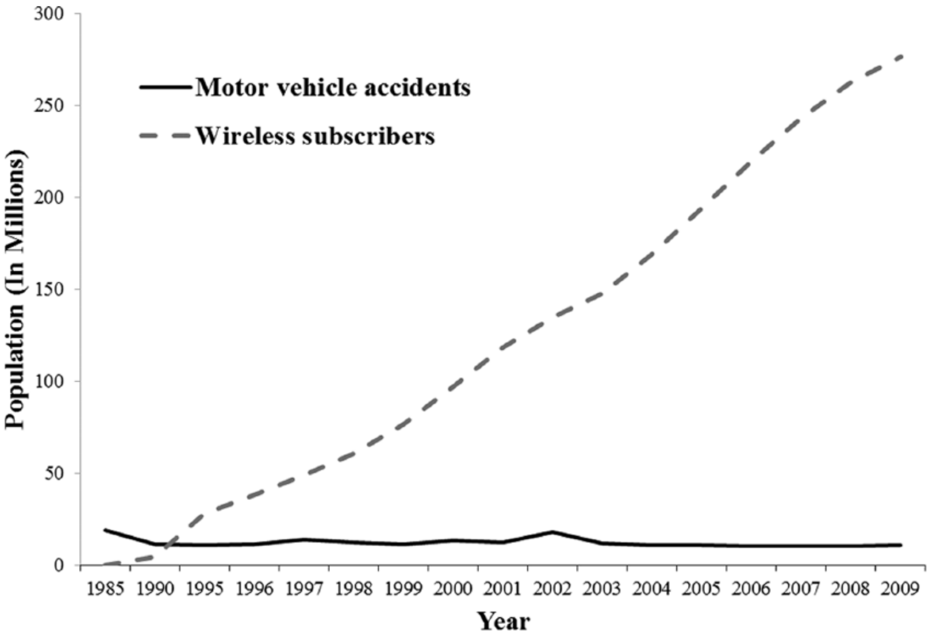

Figure 1. Illustrative representation of growth in one handheld device versus the rate of motor vehicle accidents. We trust that criticasters can extrapolate beyond the specific exemplars presented here.
Source. U.S. Census Bureau (2012) and Cellular Telephone Industry Association (2012).

commensurate increase in collision frequency), what could be the reason for this apparent fracture in the base logic that underpins Strayer et al.'s (2015) work? We believe that there is at least one such a reason that can be found in the acute observations of Herbert Simon (1969). Simon noted that individuals can behave under different basic imperatives. Rather infrequently, our real world demands our very best effort. At such moments, each individual must seek to *optimize* his or her response. Typically, these demands occur in highly stressful fight-or-flight situations, in which existence itself is put at threat. But, these occasions are, fortunately, rare. The vast majority of the rest of the time, individuals *satisfice* the task demands that face them (and see Hancock, 2013). By this, Simon meant that individuals do well enough to succeed, but quite rationally, they choose to invest no more effort than is necessary to "just get by," there being strong evolutionary imperatives to adopt this energy economizing tactic (Hancock, 2015).

The problem here is now laid bare. Everyday driving is a predominantly satisficed task in which individuals drive only well enough to successfully get them from their origin to destination. In normal driving, they retain much spare response capacity, which, as information-foraging animals (Pirolli & Card, 1999), they then employ on other tasks. Traditionally, these other tasks have been listening to the radio, talking to passengers—indeed, very much the sorts of pragmatic tasks that Strayer and his colleagues (2015) have examined empirically (and see Hancock, 1999; Hancock, Lesch, & Simmons, 2003; Hancock & Scallen, 1999). Our conceptual and methodological problem then lies in the instruction set. The real world almost never demands a zero level of standard deviation in lane position (i.e., an optimization imperative). In fact, in many circumstances, on an uncrowded, remote open road, one need not necessarily be in one's lane at all. And yet one might still be perfectly "safe" (whatever the nefarious term actually means). Strayer et al., as admittedly do virtually all who research in this particular domain (including ourselves and see Sawyer, Finomore, Calvo, & Hancock, 2014), predicate their assessment and, indeed, the very way that they look to measure performance on the optimized imperative. Yet, this optimal imperative does not "drive" the vast preponderance of normal transport operations or, indeed, the vast preponderance of all forms of human behavior. In more formal psychological terms, the result is that there is no effective hard ceiling to be established on driver capacity.

With the expenditure of greater "effort" (Wickens, 2014), the threshold for failure varies (Hancock & Caird, 1993; Hancock & Warm, 1989; Hockey, 1997). In situations when driver underload is an issue, additional tasks may even result in improved performance (as in Liu, 2003; Oron-Gilad, Ronen, & Shinar, 2008; Takayama & Nass, 2008). Thus, the most basic assumption that accompanies the strong interpretation of the secondary or dual-task methodology unfortunately fails. Our community has yet to resolve this impasse, yet it must if our knowledge is to transfer effectively to ameliorate the frequency of on-road collisions.

Having offered what appears to be a critical barrier to progress, it is perhaps incumbent upon us, even in this short commentary, to provide at least a glimpse of what we see as a positive future direction (and see Hancock, Mouloua, & Senders, 2008). One could pursue the driver "maximization-of-effort" approach, searching methodologically to attack the question of the "soft" ceiling as opposed to the "hard" ceiling, foundation of the strong interpretation of all secondary-task techniques. Yet, both theoretically and practically, we turn our heads here in another direction. Although it is apparently self-evident that the driver currently plays a critical role in collision events, we believe insufficient attention has been directed to the issue of context. It may well be the behavior of the driver that "proposes," but it is the condition of the environment that ultimately "disposes." In our view, the behavioral attack on the problem of vehicle collisions has an insufficient theoretical basis through which to assess the context of performance. Although researchers in disciplines such as civil engineering have studied extensively the physical configuration of roadways in order to optimize their design, the structure of the "affordance" of effective passage still lags behind other elements of a true systematic approach. In terms of an earlier parlance, neither the "minimum stopping zone" nor the "field of safe travel" is by itself sufficient to capture the full dynamics of the situation (and see Gibson & Crooks, 1938).

In an age in which our roadways are better documented than ever before, in which algorithmic solutions for route efficiency abound (see, e.g., Boriboonsomsin, Barth, Zhu, & Vu, 2012), it seems likely that the same tools can help researchers and designers understand moment-to-moment actions that underpin driving. We do not claim in any way that this is an original observation (see, for example, www.fhwa.dot.gov/advancedresearch/pubs/10060/10060.pdf), but it may be possible that the fracture of the Markov chain of collision is as well addressed by the roadside as it is behind the wheel. It is, of course, also quite feasible that the same technologies that drive us toward full vehicle automation will render such observations moot, but we do not envisage that this outcome will be so in the immediately approaching years.

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