

# Driver Distraction: Toward A Common Definition

\*Michael A. Regan<sup>1</sup>, John D. Lee<sup>2</sup> & Kristie L. Young<sup>3</sup>

<sup>1</sup>Institut National de Recherche sur les Transports et leur Sécurité (INRETS), 25 Avenue  
François Mitterrand, 69675 BRON cedex  
France.

P +33 4 72 14 23 21

F +33 4 72 14 24 37

<sup>2</sup> College of Engineering, University of Wisconsin-Madison, USA

<sup>3</sup> Monash University Accident Research Centre, Australia

michael.regan@inrets.fr

kristie.young@muarc.monash.edu.au

jdlee@engr.wisc.edu

\*Corresponding Author

## ABSTRACT

Driver distraction, as an applied psychological construct, has been variously, and often poorly, defined in the research literature. There is a critical need for a valid definition of driver distraction that supports the development of common taxonomies for coding and categorising crash data and which enables researchers to compare research findings across studies. This paper reviews a sample of previous definitions, distils from these and other relevant literature key issues that are relevant to defining driver distraction, and proposes a definition of driver distraction that is distinguishable from driver inattention and driver workload. A definition of driver inattention is also proposed.

## KEYWORDS

Distraction, driver distraction, distracted driving, driver inattention, definition

## INTRODUCTION

Driving an automobile is a complex activity. For many people, it is the most complex and potentially dangerous activity they will perform during their life. Yet, despite the complexity of the task, it is not uncommon for drivers to engage, involuntarily or voluntarily, in activities that divert their attention away from the appropriate course of action.

There is increasing evidence that distraction is a significant contributing factor in road crashes, and driver distraction is now an important issue on many road safety agendas world wide. The last decade has seen an explosion in research on the topic, enough to warrant the publication of

an entire book (Regan, Lee & Young, 2008), and several conferences, summits and expert working groups have been convened to workshop the issues and formulate countermeasures. There has been much publicity associated with distraction, especially in relation to the use whilst driving of mobile phones and other portable information, communication and entertainment devices.

The term “driver distraction” is now part of the vernacular in most developed countries. People talk about it (or “distracted driving”; the two terms are not necessarily synonymous) as if they know what it means. However, as an applied psychological construct it has been variously, and often poorly, defined. To some, this may come as a surprise given the considerable amount of research that has now been generated on the topic.

Many definitions of distraction, in the context of driving, have been coined. Lee, Young and Regan (2008) reviewed a sample of distraction definitions which have emerged from the literature over the last 20 years, which are referred to in the next section of this paper. While there are some commonalities, they noted much inconsistency between the definitions that exist. Striking, also, is the number of existing research papers that have been devoted to the understanding of driver distraction that are devoid of any definition of the construct. To further our understanding of distraction, and its impact on driving performance and safety, it is necessary to develop a precise, broadly applicable, and easily interpretable definition of what it is and how it is distinct from other related terms such as driver inattention and workload.

It is also important as a research community, that we embrace a common definition of driver distraction; so that, when we talk about it, we are talking about the same thing. The use of different, and often inconsistent, definitions of driver distraction can be problematic. The lack of common definitions across studies can make the interpretation and comparison of research findings difficult, or even impossible. Different definitions can also lead to different taxonomies for coding and classifying crash data; and, ultimately, to different estimates of the role of distraction in crashes (Pettitt, Burnett and Stevens, 2005; Gordon, 2008; Lee, Young and Regan, 2008).

The purpose of this paper is to canvass and discuss critical issues relevant to the definition of distraction in the context of driving and, following that, to distil a suggested definition of driver distraction that can better serve the needs of those stakeholders with a vested interest in mitigating its effects.

## **DRIVER DISTRACTION AND DISTRACTED DRIVING**

The Macquarie dictionary (1988) defines distraction as the “act of distracting” and the “state of being distracted”. To distract, according to this definition, is to “draw away or divert, as the mind or attention” (p.532). The Oxford dictionary (1994) offers a similar definition, defining distraction as “Something that distracts the attention and prevents concentration”. The New Oxford American dictionary describes distraction as “a thing that prevents someone from giving full attention to something else.”

It is reasonable, from this starting point, to suppose that distraction involves a diversion of attention away from something, toward something else. The dictionary definitions of distraction

are devoid of context; they are not driving-related. The International Organization for Standardization (ISO) defines distraction as “attention given to a non-driving related activity, typically to the detriment of driving performance” (ISO, 2004; cited in Pettitt, Burnett and Stevens, 2005). This definition highlights the impact of distraction on the driving task – it suggests that, to be distracting, “there must be some form of measurable change in driving task as a result of a driver’s engagement in a secondary task or activity.” (Pettitt et al., 2005). It also suggests that, to be distracting, an activity must be non-driving related.

As previously noted, Lee, Young and Regan (2008, pp 32-33) reviewed a sample of 14 distraction definitions which have emerged from the literature over the last 20 years. These are reproduced below.

1. “diversion of attention from the driving task that is compelled by an activity or event inside the vehicle” (Treat, 1980, p. 21).
2. “a shift in attention away from stimuli critical to safe driving toward stimuli that are not related to safe driving” (Steff & Spradlin, 2000).
3. “any activity that takes a driver’s attention away from the task of driving” (Ranney et al., 2000).
4. “driver distraction occurs when a driver is delayed in the recognition of information needed to safely accomplish the driving task because some event, activity, object or person within or outside the vehicle compelled or tended to induce the driver’s shifting attention away from the driving task.” (Stutts et al., 2001).
5. “any driver involvement that takes his or her attention away from their intended driving task.” (McAllister, Dowsett, & Rice, 2001).
6. “Driver distracters include those objects or events both inside and outside the vehicle that serve to redirect attention away from the task of driving or capture enough of the driver’s attention such that there are not enough attentional resources for the task of driving” (Manser et al., 2004).
7. “a disturbance imposed within a lateral or longitudinal control vehicle loop” (Sheridan, 2004).
8. “driver distraction implies that drivers do things that are not primarily relevant to the driving task (driving safely) and that this disturbs attention needed when driving safely” (Patten et al., 2004).
9. “Distraction occurs when attention is withdrawn from the driving task, which results in delayed responses to driving events, increased perceptions of workload, and, in some cases, disruptions of speed and lane maintenance” (Laberge et al., 2004).
10. “distraction can be defined as misallocated attention” (Smiley, 2005).
11. “Distraction occurs when a triggering event induces an attentional shift away from the task, in this case driving” (Horbey et al., 2006).
12. “a diversion of attention from driving, because the driver is temporarily focusing on an object, person, task, or event not related to driving, which reduces the driver’s awareness, decision-making, and/or performance, leading to an increased risk of corrective actions, near-crashes, or crashes” (Hedlund et al., 2006).
13. “any event or activity that negatively affects a driver’s ability to process information that is necessary to safely operate a vehicle (Drews & Strayer, 2008)”.
14. “a form of inattention that shifts attention away from the task at hand (Williamson, 2008).”

Although this list of definitions is by no means exhaustive, it serves to identify key issues to be considered in framing a suitable definition of distraction, which are considered below

### **Labelling**

Up to this point we have used the term “driver distraction” when referring to distraction that occurs in the context of driving a motor vehicle, and to the definitions coined above. The expressions “driver distraction” *and* “distracted driving”, however, are often used in the literature, and other forums, synonymously. However, they are not necessarily synonymous. Hancock, Mouloua and Senders (2008) are the only researchers known to have attempted to draw a distinction between the two. They assert that “...“driver distraction” occurs when circumstances act to displace the primacy of the social role “driver” in the person’s on road behaviour. Thus, a woman turning around to reseat her unrestrained infant is now “attentive” to her role as mother but “distracted” from her role as driver.” (p.12). “Distracted driving”, according to Hancock et al., occurs when “...the individual retains the primary role as the “driver” but circumstances act to divert attention from the appropriate course of action to other momentarily inappropriate components of the driving task or the external environment.” (p. 12).

### **Mechanism**

Most of the definitions invoke the construct of attention. However, depending on the definition, the process of being distracted can involve the shifting, diversion, taking, re-directing, withdrawal or disturbance of attention. Only one definition (7 above), derived from control theory, posits that driver distraction is “a disturbance imposed within a lateral or longitudinal control vehicle loop”. Pettitt, Burnett and Stevens (2005) assert (p. 3) that definitions of distraction “...must consider the presence of an event or occurrence that causes a driver to allocate attention, which might otherwise be focused on the driving task, to a separate activity.” The key consideration, according to these authors, is “...that the result of distraction is inattentive driving; however inattention is not always caused by distraction.” Interestingly, only 6 of the 14 definitions cite the presence of such an event or occurrence that causes a driver to divert attention away from driving.

### **Intentionality of engagement**

Several of the definitions invoke the words “compelled” and “induced” in a way that suggests that driver distraction pertains only to situations in which the driver’s attention is captured involuntarily by a source of distraction. Definition 10 states that distraction is no more than “misallocated attention”. This implies that distraction, when it occurs, occurs because the driver has misallocated attention, deliberately or inadvertently.

### **Source of distraction**

The definitions vary in terms of what are regarded as sources of distraction, and most cite no specific or general source of distraction. Sources that are cited vary and include events, objects, activities and people, “stimuli that are not related to safe driving” and “things that are not primarily relevant to the driving task (driving safely)”. Clearly, the definitions vary on the point of whether sources of distraction can be driving-related. Definitions also vary according to whether a source of distraction resides within or outside the vehicle.

## **Distracted from what?**

The definitions vary in terms of what it is that a driver is distracted from when they are distracted. Examples include “the driving task” (a task), “stimuli critical to safe driving” (stimuli), “driving (an activity)”, “driving safely” (an activity), and “the task at hand” (a task). As noted, these examples confound tasks, stimuli and processes.

## **Impact**

Generally the definitions highlight the impact of distraction on something, whether it is “the driving task”, “stimuli critical to safe driving” or some other activity, task or stimulus. The examples reviewed vary widely in their degree of specificity.

In short, there appears to be considerable variation between definitions, and even some variation between the labels assigned to definitions. Generally, the small sample of definitions reviewed invoke the construct of attention as the mechanism underlying distraction, imply that distraction can occur voluntarily or willingly, suggest that sources of distraction can reside within and outside the vehicle, and assert that distraction has a negative impact on driving performance and safety. There is considerable variation across definitions, however, as to what it is that drivers are distracted from and what distracts them.

In the following sections we discuss each of these issues distilled from the definitions presented and, drawing also on other relevant literature, distil from the discussion a suggested definition of driver distraction that we believe can better serve the needs of those stakeholders with a vested interest in mitigating its effects.

## **LABELING: DRIVER DISTRACTION OR DISTRACTED DRIVING?**

As noted above, the expressions “driver distraction” and “distracted driving” are often used synonymously in the literature. However, as argued by Hancock, Mouloua and Senders (2008), they are not necessarily the same. They assert that “...“driver distraction” occurs when circumstances act to displace the primacy of the social role “driver” in the person’s on road behavior” and that “... “distracted driving”, occurs when “...the individual retains the primary role as the “driver” but circumstances act to divert attention from the appropriate course of action to other momentarily inappropriate components of the driving task or the external environment.” (p. 12).

The distinction made between the two terms by Hancock, Mouloua and Senders (2008) seems appropriate - although, in practice, any woman (or man for that matter) is likely to be distracted to some degree by an unrestrained infant regardless of whether or not she is the mother of the infant, especially in countries in which it is illegal to travel with an unrestrained infant. This distinction is certainly relevant in considering the motivations (in this case different social roles) that may influence one’s engagement in distracting activities, but does little to facilitate the development of a common, practical, taxonomy for coding and classifying sources of distraction. “Driver distraction”, as defined by Hancock et al., can be considered for practical purposes as a sub-set of “distracted driving”, in which the presence of a source of distraction, and its effect on driving, is contingent on the social role of the driver. For practical reasons, therefore, we will

continue in this paper to use the expression “driver distraction”; but in doing so, acknowledge that the expression can apply both to the individual in their primary role as “driver” and to any other roles the individual may revert to during the course of driving.

## MECHANISM

When attention is diverted away from driving towards something else, there are different sensory modalities through which this diversion of attention may occur.

Things that we *see* can attract our attention, like a billboard; things that we can *hear* can attract our attention, like a Police siren; things that we can *smell* can attract our attention, like fire or a dead animal on the side of the road; things we can *feel* can attract our attention, like an unusually rough road surface, or burning hot coffee on our lips; things that we can *taste* can attract our attention, like the aftertaste of something we have just eaten that was rotten; and, finally, things we can *think* about inside our heads can attract our attention, like the argument we just had with a spouse, partner or boss. Thinking about things, or preoccupying oneself in internal thought, is often referred to as “cognitive distraction”. This is unfortunate, however, as it confounds the modality through which our attention is attracted with the process by which the sensation is subsequently processed.

In thinking about these different “modalities of distraction” that may have an impact on driving, we propose the use of the following terms: “visual distraction”; “auditory distraction”; “olfactory distraction”; “tactile distraction”; “gustatory distraction”; and “internal distraction”. The latter term is meant to encompass internally generated activities such as daydreaming. Ranney, Mazzae, Garrott and Goodman (2000) make reference to four “types” of distraction - “visual”, “cognitive”, “biomechanical” and “auditory”. These distraction “types” appear to have been deemed acceptable by some others (e.g., Basicik & Stevens, 2008). These terms are, however, problematic, in that they confound the modality of distraction as defined here (e.g., visual distraction), with the mechanisms that mediate the impact of distraction (e.g. biomechanical interference). Further, these four “types” of distraction exclude the other modalities of distraction defined here (e.g., tactile distraction) as well as a wide range of other important mechanisms that mediate the impact of distraction (see Lee, Regan and Young, 2008; Regan, Young, Lee and Gordon, 2008). Describing distraction in terms of the surface features associated with modality may mask important differences and similarities.

It is important to distinguish between distraction and inattention. A landmark study by Klauer, Dingus, Neale, Sudweeks and Ramsey (2006) found that almost 80 percent of crashes and 65 percent of near-crashes involved inattention as a contributing factor. As noted by Lee, Young and Regan (2008), those authors defined inattention as including general inattention to the road, fatigue and secondary task demand. Lee et al. argue, (p. 32) however, that it is inappropriate to include “secondary task demand” as a source of inattention. They define inattention as “...diminished attention to activities critical for safe driving in the absence of a competing activity”. They assert (p. 32) that “...one way to distinguish between inattention and distraction is that distraction involves an explicit activity (e.g., dialling a cell phone or daydreaming) that competes for the attention of the driver, as compared with a cognitive state (e.g., drowsiness or fatigue) that leads to diminished capacity to attend to the roadway.”

Some (e.g., Basacik, & Stevens, 2008) argue that to preoccupy oneself in internal thought (e.g., to daydream) is to be inattentive rather than distracted; the argument being that, unlike other sensory modalities of distraction, there is no triggering event or activity that diverts attention away from driving towards internal preoccupation with thought. Those who have attempted to meditate, by attempting to focus on a sound, or a visual object - or on an imaginary object(s) inside the head (e.g., when “counting sheep”) - know how difficult it is to suppress competing thoughts that compete for attention. Such competing thoughts are triggered internally, and involuntarily, by the mind, and the mental abstractions themselves may involve people, objects, events and activities. Whilst the triggering events and activities are not overt, they exist internally.

As noted, less than half of the definitions reviewed earlier made reference to the presence of an event or occurrence that causes a driver to divert attention away from driving toward a source of distraction. A suitable definition of distraction should, therefore, consider this aspect (Pettitt, Burnett and Stevens, 2005). Whether the diversion of attention away from driving should be regarded in a definition as a “diversion”, a “shifting” or a “re-directing” of attention is not as critical as the need to acknowledge in the definition the process itself. Nevertheless, we prefer the term “diversion”, as it implies that the distributing of attention is a dynamic process.

## **INTENTIONALITY OF ENGAGEMENT**

Human attentional capacity is limited and so directing attention to one part of the environment means removing it from another. Consequently people are inherently vulnerable to situations that require their attention to two things at the same time. Attention often shifts without the intention of the person. From an evolutionary perspective, this is advantageous (Regan, Lee and Young, 2008a). There is biological advantage in having the mind unwittingly orient itself towards sources of attraction that, for example, signify danger (e.g. a spider) or have potential to perpetuate the species (e.g. a person deemed to be attractive). In some situations this makes it difficult to resist distraction. Anyone who has tried to meditate can attest to this. To learn to meditate is to learn to resist distraction. To learn to meditate is to learn to focus attention on something (e.g., a pencil) to the exclusion of all other stimuli impinging on the organism (i.e., sights, sounds, feelings, tastes, smells and internal thoughts) that compete for attention.

When a driver is distracted by a billboard, it is usually an involuntary act – there is something about the billboard that attracts their attention. They cannot help but to look at it. Several of the definitions reviewed earlier captured this element of distraction. But what if a diversion of attention away from driving is a voluntary act on the part of the driver – such as when a driver decides to make a call on a cell phone? Should we regard that as distraction? Regan, Young, Lee and Gordon (2008) estimate that 55 percent of all known sources of distraction are avoidable. It seems that most individuals in the research community do regard avoidable distraction as distraction, given that most papers on the topic relate to driver engagement with cell phones, driver assistance systems and other technologies with which the driver can voluntarily choose to interact.

At a micro level, the mechanisms by which the voluntary diversion of attention is initiated are probably no different from those that involuntarily divert our attention. We may, for example, *think* about something that reminds us of the need to make a telephone call. We may, alternatively, *see* something while driving that reminds us to make the call. The *smell* of someone in the car with us may remind us to make the call; and so on. So, in one sense we might argue that the decision to make a phone call is voluntary. However the mechanisms that trigger the decision to divert attention from driving to initiate the phone call may be involuntary.

One of the definitions reviewed in this paper states that distraction is simply “misallocated attention” (Smiley, 2005). This implies that distraction, when it occurs, occurs because the driver has misallocated attention, deliberately or inadvertently, and that an appropriate allocation of attention could be defined.

A suitable definition of distraction should recognize that distractions might be both driver-initiated and non-driver initiated, that being attentive to one thing means being distracted from another, and that identifying a distraction requires that one identify the appropriate distribution of attention.

## **ATTRACTED TO WHAT?: SOURCES OF DISTRACTION**

As noted previously, most of the definitions reviewed earlier vary (a) in terms of whether the driver intentionally or unintentionally becomes distracted the distraction (with some citing no locus of control of distraction), (b) whether a source of distraction can derive from within or outside the vehicle, and (c) whether sources of distraction can in fact be driving-related. Activities that distract can derive from within or outside the vehicle. In one study (Stutts et al., 2001) it was estimated that almost one-third of drivers who crashed due to distraction were distracted by something outside the vehicle. For the purposes of defining distraction, however, it does not really matter where the source is located (Lee, Young and Regan, 2008).

As drivers, our attention can be diverted away from activities critical for safe driving towards many things that we can see, hear, feel, smell, taste and think about. The sources of distraction to which our attention is attracted via these sensory modalities are many and varied and will change as the driving task, and indeed society itself, continues to evolve. The recent emergence of mp3 players and text messaging demonstrates the rapidly changing landscape of potential distractions.

Known sources of distraction are thought to comprise two elements: a physical event or object (e.g., mobile phone; an advertising billboard) and an action of some kind that is performed on it (e.g., talking; looking) (see Regan, Young, Lee & Gordon, 2008). Regan et al. have distilled these sources into five major sources of distraction: “things brought into the vehicle” (e.g., cell phone); “vehicle systems” (e.g., mirror, speedometer, or radio); “vehicle occupants” (e.g., adult front); moving object or animal in vehicle” (e.g., insect); “internalized activity” (e.g., daydreaming); and “external objects, events and activities” (e.g., crash scene).

Although distraction may derive from different objects, persons, events and activities, some activity ultimately contributes to distraction. The type of activity can engage qualitatively



different distracting processes. Reaching, for example, removes the eyes and hands from the road, reading removes the eyes from the road, and ruminating removes the mind from the road. Reaching can be particularly dangerous because it can directly interfere with vehicle control particularly if the driver inadvertently pulls the steering wheel as s/he leans and reaches.

It is often assumed that, when a driver is distracted, the source of distraction must be unrelated to driving. The term “secondary task” is frequently used in the literature to describe such sources of distraction. Driving is, however, a complex, multi-task, activity, making it likely that the demands of one element of driving will interfere with another, more critical, element (Lee et al. , 2008). A poorly timed glance at a rear vision mirror, for example, could divert attention away from a pedestrian about to cross the road or from a critical navigation waypoint such as a street sign. Considering “driving” as a single activity in defining distraction “...oversimplifies a complex activity and neglects important driving-related distractions that drivers must manage.” (Lee et al., p. 35). Assuming that driving-related activities may themselves constitute sources of distraction can have an enormous impact on estimates of the role of distraction in road crashes, and has been shown to change the estimate of the role of distraction in crashes by up to one-third (see Gordon, 2008).

Attributing crashes to distraction can be problematic - one needs to be very careful not to fall prey to hindsight bias and use distraction as a vacuous explanation that can account for any failure to perceive and respond to threats. This challenge is illustrated in discriminating between generally effective and deficient scanning strategies. An effective strategy can lead an unlucky driver to direct attention to the wrong thing at the wrong time, such as when a driver happens to glance at the rear view mirror at the precise time a vehicle ahead begins to brake. In contrast, a deficient scanning strategy might involve a driver habitually texting, but by luck avoiding mishaps. Hindsight bias might lead people to attribute crashes to distraction where none exists.

## **DISTRACTED FROM WHAT?**

In developing a definition of distracted driving, it is necessary to consider from what the driver is being distracted. The definitions reviewed previously in this paper vary considerably in terms of what it is that a driver is distracted from when they are distracted. Furthermore, they confound tasks, stimuli and processes. Most definitions, however, tend to cite “driving” as the activity from which they are distracted. But what do we really mean by “driving”?

Hancock, Mouloua and Senders (2008) argue that “...defining distraction is akin to defining a negative, since distraction not only has the connotation of a negative activity but also clearly implies a more important positive state of attraction.” (p. 19). They assert that if we are able to specify what drivers should be attracted to, then we can specify when and where distraction occurs, but concede (p. 19) that “There is currently “no assured method of specifying, apriori, what any particular driver in any particular situation should necessarily be paying attention to.”

In short, we do not currently know exactly what each driver should be paying attention to at each and every moment in time, and hence what they should be attracted to (Hancock et al, 2008).

Given that driving involves multiple tasks, with different goals and priorities, the appropriate focus of attention will necessarily vary over time.

Some years ago, Brown (1986; cited in Falkmer & Gregerson, 2003) characterized driving, at a more general level, as comprising six principal tasks: *finding your way, following the road; monitoring your speed; avoiding collisions; following traffic rules; and being in normal control of the vehicle*. Although this taxonomy may seem a little over-simplified, it is sufficiently parsimonious for present purposes. If we assume that distracted driving involves a diversion of attention away from driving, it is reasonable to suppose that it could involve the diversion of attention away from any one of these driving sub-tasks. A mistimed glance at an advertising billboard, for example, could divert attention away from a pedestrian about to cross the road (avoiding crashes) or from a critical navigation waypoint such as a street sign (finding your way).

At this level of generality, using this simple taxonomy, it might reasonably be argued that, for most of the time, drivers should pay attention to those things that help them to avoid crashes and follow the road - and, for at least some of the time, to pay attention to those things that help them to find their way, control their vehicle, obey traffic rules, and monitor their speed.

For the purposes of deriving a useful definition of driver distraction, we believe it is sufficient to say that distraction involves a failure to pay attention to “activities critical for safe driving”, whatever they may be at a particular point in time.

## IMPACT

Distraction has the connotation of a negative activity (Hancock, Mouloua & Senders, 2008); although there is some recent research that suggests that it may actually enhance driving performance under some circumstances. Specifically, a potentially distracting activity might keep someone awake so that the risk of failing to attend to the roadway due to the distraction would be less than the risk of a similar failure due to the onset of sleep (Takayama & Nass, 2008; <http://hfs.sagepub.com/cgi/content/abstract/50/5/772>). The definitions reviewed earlier attest to this. Most highlighted the impact of distraction on something, whether it is “driving”, “the driving task”, “stimuli critical to safe driving” or some other activity, task or stimulus. Examples varied widely in their degree of specificity.

In some circumstances a momentary diversion of attention away from driving, for example towards a billboard, may have no effect on driving. In other circumstances, the diversion might lead to a fatal crash. The impact on driving of diverting attention towards something else depends on many factors – the characteristics of the driver (e.g., driving experience, driver state), driving task demand (e.g., traffic conditions, vehicle speed) and the demands of the task to which attention is attracted (e.g., complexity, ignorability, duration) (see Young, Regan & Lee, 2008, p. 337). Is it reasonable, therefore, to define distraction in a way that makes no assumptions about its impact on driving performance and safety? Or, put another way, does a distracting activity have to have some measurable impact on driving in order to be classified as distracting? (Pettitt et al., 2005).

It probably depends on the purpose to which the definition will be put (Basacik & Stevens, 2008). A road safety practitioner might justifiably favour a definition of distracted driving that assumes that a distracting activity has some measurable impact on driving, if the definition is to be used primarily to code and classify crash data. A researcher, however, might think differently. Most existing definitions consider distraction in terms of its effect on driving performance. However, as noted by Lee, Young and Regan (2008), "...Defining distraction in terms of specific outcomes is problematic because the presence or absence of distraction then depends on a somewhat arbitrary selection of measures and combination of roadway events." (p. 34). This point has also been made by Basacik and Stevens (2008).

In our view, it is not necessary, in defining driver distraction, to define it in a way that assumes that it has an impact on driving performance. The fact is that, in some circumstances, it does not; although, in the absence of any overt impact, distraction likely increases the risk of adverse consequences (Basacik & Stevens, 2008). The probabilistic elements of driving (e.g., the somewhat unpredictable braking behaviour of a vehicle ahead) mean that any particular instance of distraction might not degrade driving performance or lead to a crash, but that distraction will increase the risk of a crash all things being equal. A definition of driver distraction should describe the process by which a diversion of attention may, or may not, compromise performance.

## CONCLUSION AND DEFINITIONS

The purpose of this paper has been to derive a definition of driver distraction that supports the development of common taxonomies for coding and categorising crash data and which enables researchers to compare research findings across studies.

The issues highlighted and discussed in this paper have served to illustrate the need for an agreed definition of driver distraction that is both distinguishable from driver inattention and workload and is embraced broadly by those with a vested interest in the issues of driver distraction and inattention. The relevant issues were discussed under six general headings, which derived from a comparison of a sample of definitions of driver distraction reviewed previously by Lee, Young and Regan (2008): labelling; mechanism; intentionality of engagement; source of distraction; distraction from what?; and impact.

Based on the preceding discussion, we propose the following two definitions, which have been coined previously by the authors:

- ***"Driver distraction"** is a diversion of attention away from activities critical for safe driving toward a competing activity.* (Lee, Young & Regan, 2008, p. 34)
- ***"Driver inattention"** represents diminished attention to activities that are critical for safe driving in the absence of a competing activity.* (see Lee, Young & Regan, 2008, p. 32)

It is also important to distinguish driver distraction from the related concept of driver workload. Workload can be defined by the relationship between cognitive resource supply and the level of demand placed on the human by a task (Wickens & Hollands, 2000). Driver workload and

distraction are thus related, but separate, concepts, where workload refers to the *amount* of attention required for performance of an activity, while distraction relates to the *distribution* of attention between competing activities.

Building on a conceptual presentation framework presented in an earlier paper by Pettitt et al. (2005), the distinguishing features of the first definition, which has been the main focus of this paper, can be summarised as follows.

- The *label* “driver distraction” is used and applies both to individuals in their primary social role as “driver” and to any other roles they may revert to during the course of driving;
- The *mechanism* of distraction is a “diversion of attention”;
- There is no distinction between competing activities that are driver-initiated or non-driver initiated (*intentionality of engagement*);
- There is a defined *source* of distraction (a “competing” activity) which triggers the diversion of attention away from activities critical for safe driving. The source can (a) derive from actions performed on sources of distraction residing inside or outside the vehicle, (b) include both driving and non-driving-related activities that compete for the driver’s attention, and (c) include internal distractions such as daydreaming, which may also compete for the driver’s attention;
- “Activities critical for safe driving” are what the driver is distracted from (**distracted from what?**); and
- There is no explicit assumption that the diversion of attention away from activities critical for safe driving toward a competing activity will have an *impact*, positive or negative, on activities critical for safe driving. However, the reference to “activities critical for safe driving” rather than to “driving” implies that the diversion increases crash risk and hence has potential to impact on driving performance.

According to this definition, then, driver distraction is a *process*.

We have said nothing in this paper about the psychological mechanisms by which activities critical for safe driving may be impacted by this process (e.g., via “resource competition”; “response selection bottleneck”; breakdowns in control, etc), the impact of the process on activities critical for safe driving (e.g., delayed reaction time to a braking lead vehicle; reduced or increased time headway), or the factors that moderate the impact of the process on safe driving (e.g. secondary task demand, driver characteristics, driving task demand). These are complex issues that are discussed elsewhere (see, for example, Lee, Young and Regan, 2008; Hancock et al., 2008; Lee, Regan and Young, 2008; Wickens and Horrey, 2008; Regan, Young, Lee and Gordon, 2008). The impact of distraction has been considered here only as it pertains to framing the definition of the process itself.

The definition presented here, although derived and reported by the authors in an earlier publication (see Lee, Young and Regan, 2008), has been discussed here using a conceptual approach employed in an earlier paper by Pettitt et al. (2005). That paper was singled out because it is the only paper known by the authors to have been devoted specifically to the development of a suitable definition of driver distraction. Those authors also considered a

number of extant definitions of driver distraction available at the time and argued (p. 11) that “...a reasonable, comprehensive definition of distraction is comprised of four components: impact, agent, mechanism and type (p. 11). Their proposed definition was presented as follows:

*“Driver distraction:*

- *Delay by the driver in the recognition of information necessary to safely maintain the lateral and longitudinal control of the vehicle (the driving task) (Impact)*
- *Due to some event, activity, object or person, within or outside the vehicle (Agent)*
- *That compels or tends to induce the driver’s shifting attention away from fundamental driving tasks (Mechanism)*
- *By compromising the driver’s auditory, biomechanical, cognitive or visual faculties, or combinations thereof (Type).”*

Pettitt et al.’s definition is rather more specific, but also somewhat more limited, than that presented here, and makes explicit reference to both the impact of distraction and to the manner (which they call “type”) in which an “agent” (referred to in the present paper as a “source”) may interfere with driving. Distraction affects driver response by more than just delaying the recognition of critical information. It can also interfere with response selection and control. On the other hand, they make no explicit reference in their definition to the labelling of the definition. It is difficult to know, therefore, what assumptions have been made about the intentionality of the engagement. At one extreme the driver lacks control and the distraction “compels” attention. At the other extreme, the distraction only “affords” the diversion of attention and between the distraction “tends to induce” a shift of attention. As noted above, we do not believe it is necessary to embody within a definition of distraction reference to what might be called “mechanism of interference” (or “type”, as in the definition above). Distraction is a process, and the effects that it may have on driving, and the manner in which these effects are brought about, are not necessary ingredients in defining the process itself.

There is much that can be done to manage driver distraction and prevent it from escalating into a more serious road safety problem. Properly defining it is arguably one of the most important first steps in this process.

## REFERENCES

1. Basacik, D., & Stevens, A. (2008). Scoping study of driver distraction. Road safety research report No. 95. London, England: Department for Transport.
2. Brown, I. (1986). Functional requirements of driving. Paper presented at the Berzelius symposia Cars and Casualties, Stockholm, Sweden (cited in Falkmer, T., & Gregersen, N.P, 2005, The TRAINER project – the evaluation of a new simulator-based driver training methodology. In Dorn, L (Ed) Driver behaviour and training. Aldershot, England: Ashgate)

3. Drews, F.A., & Strayer, D.L. (2008). Cellular phones and driver distraction. In Regan, M.A., Lee, J.D. & Young, K. (Eds) (2008). *Driver distraction: Theory, Effects and Mitigation*. Florida, USA: CRC Press (Chapter 11).
4. Gordon, C. P (2008). Crash studies of driver distraction. In Regan, M.A., Lee, J.D. & Young, K. (Eds). *Driver distraction: Theory, Effects and Mitigation*. Boca Raton, FL: CRC Press (Chapter 16)
5. Hancock, P.A., Mouloua, M. & Senders, J.W. (2008). On the Philosophical foundations of the distracted driver and driving distraction. In Regan, M.A., Lee, J.D. & Young, K. (Eds). *Driver distraction: Theory, Effects and Mitigation*. Boca Raton, FL: CRC Press (Chapter 2)
6. Hedlund, J., Simpsom, H., & Mayhew, D. (2006). International Conference on Distracted Driving. Summary of Proceedings and Recommendations. *International Conference on Distracted Driving*, Toronto, Canada.
7. Horberry, T., Anderson, J., Regan, M. A., Triggs, T. J., & Brown, J. (2006). Driver distraction: The effects of concurrent in-vehicle tasks, road environment complexity and age on driving performance. *Accident Analysis & Prevention* 38 (1), 185-191.
8. ISO (2004). *Road vehicles – Ergonomic aspects of transport information and control systems – Occlusion method to assess visual distraction due to the use of in vehicle systems*. ISO TC 22/SC 13 N 763 R.
9. Klauer, S. G., Dingus, T. A., Neale, V. L., Sudweeks, J. D., & Ramsey, D. J. (2006). The Impact of Driver Inattention on Near-Crash/Crash Risk: An Analysis Using the 100-Car Naturalistic Driving Study Data, Report No. DOT HS 810 594. Washington, DC: National Highway Traffic Safety Administration.
10. Laberge, J., Scialfa, C., White, C., & Caird, J. (2004). Effects of passenger and cellular phone conversations on driver distraction. *Transportation Research Record: Journal of the Transportation Research Board*, 1899, 109-116.
11. Lee, J.D, Young, K L. & Regan, M.A. (2008). *Defining Driver Distraction*. In Regan, M.A., Lee, J.D. & Young, K. (Eds). *Driver distraction: Theory, Effects and Mitigation*. Boca Raton, FL: CRC Press (Chapter 3).
12. Manser, M. P., Ward, N.J., Kuge, N., & Boer, E.R. (2004). Influence of a driver support system on situation awareness and information processing in response to lead vehicle braking, Human Factors and Ergonomics Society 48th Annual Meeting, New Orleans, Louisiana, pp. 2359-2363.
13. McAllister, D., Dowsett, R., & Rice, L. (2001). *Driver Inattention and Driver Distraction* (No. 15): Virginia Commonwealth University Transportation Safety Training Center (Crash Investigation Team).

14. Patten, C. J. D., Kircher, A., Ostlund, J., & Nilsson, L. (2004). Using mobile telephones: cognitive workload and attention resource allocation, *Accident Analysis & Prevention* 36 (3), 341-350.
15. Pettitt, M., Burnett, G., & Stevens, A. (2005). Defining driver distraction. In the proceedings of the 12<sup>th</sup> ITS World Congress, San Francisco. USA: ITS America.
16. Pollard, E. (Ed) (1994). *The Oxford Paperback Dictionary*. Oxford University Press. Oxford. United Kingdom. 234
17. Ranney, T., Mazzae, E., Garrott, R. and Goodman, M.J. (2000). NHTSA driver distraction research: past, present and future. The driver distraction internet forum. [www-nrd.nhtsa.dot.gov/departments/nrd-13/driver-distraction/Papers20233.html](http://www-nrd.nhtsa.dot.gov/departments/nrd-13/driver-distraction/Papers20233.html)A233 (cited in Basacik and Stevens, 2008).
18. Regan, M.A., Lee, J.D. & Young, K.L. (Eds). (2008). *Driver distraction: Theory, Effects and Mitigation*. Florida, USA: CRC Press.
19. Regan, M.A., Young, K L, Lee, J.D. and Gordon, C. (2008) *Sources of driver distraction*. In Regan, M.A., Lee, J.D. & Young, K. (Eds). *Driver distraction: Theory, Effects and Mitigation*. Boca Raton, FL: CRC Press (Chapter 15).
20. Regan, M.A., Young, K L. and Lee, J.D. (2008). *Introduction*. In Regan, M.A., Lee, J.D. & Young, K. (Eds). *Driver distraction: Theory, Effects and Mitigation*. Boca Raton, FL: CRC Press (Chapter 1).
21. Sheridan, T. B. (2004). Driver distraction from a control theory perspective, *Human Factors* 46 (4), 587-599.
22. Smiley, A. (2005). What is distraction? International Conference on Distracted Driving, Toronto, Ontario.
23. Steff, F. M. & Spradlin, H. K. (2000). Driver distraction, aggression and fatigue: A synthesis of the literature and guidelines for Michigan planning. Report No. Report UMTRI-2000-10. The University of Michigan Transport Research Institute, Ann Arbor, MI.
24. Stutts, J. C., Reinfurt, D. W., Staplin, L., & Rodgman, E. (2001). *The role of driver distraction in traffic crashes*. Washington DC: AAA Foundation for Traffic Safety.
25. The Macquarie dictionary (2<sup>nd</sup> Ed). (1988). NSW, Australia: The Macquarie Library Pty Ltd
26. Treat, J. R. (1980). *A study of pre crash factors involved in traffic accidents*. Centre for Automotive Safety Research, Adelaide.
27. Wickens, C.D., & Hollands, J.G. (2000). *Engineering psychology and human performance* (3rd ed.). New Jersey, USA: Prentice Hall.

28. Williamson, A. (2008). The relationship between driver fatigue and driver distraction. In Regan, M.A., Lee, J.D. & Young, K. (Eds). *Driver distraction: Theory, Effects and Mitigation*. Florida, USA: CRC Press (Chapter 21).