

Definition and Taxonomic Description of Driver Inattention and Driver Distraction

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References

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Overview

- Introduction
- What is driver distraction?
- What is driver inattention?
- Previous taxonomies of driver inattention
- Distinguishing between driver inattention and driver distraction
- A taxonomy of driver inattention
- Conclusion



Introduction

- driver distraction and driver inattention are inconsistently defined, and the relationship between them is unclear
- Lack of agreement on definitions:
 - can make the comparison of research findings across studies for a given form of driver inattention difficult or impossible
 - different definitions can lead to different classification schemes for coding crash data, resulting in different estimates of the role of driver distraction and inattention in crashes and critical incidents



What is distraction? (1)

“diversion of the mind, attention, etc., from a particular object or course; the fact of having one’s attention or concentration disturbed by something”

(Shorter Oxford English Dictionary on Historical Principles, 2002, p. 716).



What is driver distraction? (2)

- ***driver*** distraction has been variously defined
- for scientific purposes, a precise definition that is used consistently across research studies is desirable
- a more operational definition may be required in other situations; for example, when coding video footage from instrumented vehicles
- could a generally accepted definition be developed that is suitable enough for both scientific and operational purposes?



What is driver distraction? (3)

- *assemble a group of experts.....*

(1) “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 ability and/or performance, leading to an increased risk of corrective actions, near-crashes, or crashes.”

(Hedlund et al., 2005, p. 2)



What is driver distraction? (4)

- systematically review, compare, and analyse definitions cited in the literature to reveal critical elements in defining the construct.....
 2. *Driver distraction is the diversion of attention away from activities critical for safe driving toward a competing activity” (Lee, Regan & Young., 2008, p. 34).*
 3. *“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., 2005, p. 11).*



What is driver distraction? (5)

- accidentological approach - define driver distraction in terms of the human functional failures that it is observed to give rise to in road crashes.

(4) *Driver distraction occurs “whenever 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] his vehicle, compelled or tended to induce the driver’s shifting of attention away from the driving task”*

(Treat, 1980, p. 21).



What is driver distraction? (6)

Key elements:

- there is a diversion of attention away from driving, or safe driving;
- attention is diverted toward a competing activity, inside or outside the vehicle, which may or may not be driving-related;
- the competing activity may compel or induce the driver to divert attention toward it; and
- there is an implicit, or explicit, assumption that safe driving is adversely effected.



What is driver inattention? (1)

- Driver inattention, like driver distraction, has been inconsistently defined – even more so.
- **attention** - “concentration of the mind upon an object; maximal integration of the higher mental processes” (Macquarie Dictionary, 1988, p. 147).
- **Inattention** - “failure to pay attention or take notice” (Shorter Oxford English Dictionary on Historical Principles, 2002, p. 1340).
- implies that people have control of their attention and that to be inattentive is to be somehow negligent



What is driver inattention? (2)

- *Very few definitions of driver inattention exist in the literature eg:*
- “diminished attention to activities critical for safe driving in the absence of a competing activity” (Lee, Young & Regan, 2008, p. 32).
- “improper selection of information, either a lack of selection or the selection of irrelevant information” (Victor, Engstrom and Harbluk (2008), p.137).
- “whenever a driver is delayed in the recognition of information needed to safely accomplish the driving task, because of having chosen to direct his attention elsewhere for some non-compelling reason” (Treat, 1980, p. 21).



What is driver inattention? (3)

- *“any point in time that a driver engages in a secondary task, exhibits symptoms of moderate to severe drowsiness, or looks away from the forward roadway” (Klauer, et al., 2006, p. 21)*
- *“when the driver’s mind has wandered from the driving task for some non-compelling reason” such as when the driver is “focusing on internal thoughts (i.e., daydreaming, problem solving, worrying about family problems, etc.) and not focusing attention on the driving task” (Craft & Preslopsky, 2009, p. 3).*



What is driver inattention? (4)

Key elements:

- a lack of attention
- insufficient attention
- cursory attention
- the selection of irrelevant information
- the orienting of attention on internalised thoughts and daydreams
- engagement in activities secondary to driving
- exhibiting symptoms of drowsiness
- looking away from the forward roadway.



Previous taxonomies of driver inattention (1)

- *The detailed analysis of data from in-depth crash studies has provided important insights into the role of driver inattention in vehicle crashes.*
- *These insights have led some researchers to differentiate taxonomically between different “failures” or “perturbations” of attention which have found to be contributing factors to crashes.*



Previous taxonomies (2) – Hoel et al

Hoel, Jaffard and Van Elslande (2010):

- “inattention” - interference between a driving activity and “personal concerns” (i.e., internalised thoughts).
- “attentional competition” - interference between tasks that are relevant for driving, such as controlling the vehicle and navigating
- “distraction” - interference between a driving activity and a non-driving-related activity.

(Hoel, et al., 2010, p. 595)



Previous taxonomies (3): DREAM

Driver Reliability and Error Analysis Method (DREAM):

(Wallén Warner, Ljung Aust, Sandin, Johansson, & Björklund, 2008)

driver inattention - “Any condition, state or event that causes the driver to pay less attention than required for the driving task” (Wallén Warner, et al., 2008, p.12)

Can be brought about by any of several “Specific Genotypes”:

- “driving-related distractors inside vehicle”;
- “driving-related distractors outside vehicle”;
- “non-driving-related distractors inside vehicle”;
- “non-driving-related distractors outside vehicle”; and
- “thoughts/daydreaming”.

In the DREAM model, driver engagement in internalised thought is regarded as distraction, which can lead to inattention.



Previous taxonomies (4): Treat

Treat (1980):

- **1) *Inattention*** – “*whenever a driver is delayed in the recognition of information needed to safely accomplish the driving task, because of having chosen to direct his attention elsewhere for some non-compelling reason*” (p. 21).
- **2) *Internal distraction*** – “*whenever a driver is delayed in the recognition of information needed to safely accomplish the driving task, because some event, activity, object, or person within his vehicle, compelled or tended to induce the driver’s shifting of attention away from the driving task*” (p. 21).



Previous taxonomies (5): Treat

Treat (1980) Cont....

- **3) External distraction** – “whenever a driver is delayed in his recognition of information needed to safely accomplish the driving task, because some event, activity, object or person outside his vehicle compelled, or tended to induce, the driver’s shifting of attention away from the driving task” (p. 22).
- **4) Inadequate or improper lookout** – “whenever a driver is delayed in his recognition of information needed to safely accomplish the driving task, because he encountered a situation requiring a distinct visual surveillance activity (for safe completion of the driving task), but either did not look or did look, but did so inadequately” (p. 22).



Distinguishing between driver distraction and driver inattention (1)

Taxonomically, two points of view:

- driver distraction is a form of driver inattention; conceptually, the two constructs exist taxonomically at different levels (e.g. DREAM)
- driver distraction is different from driver inattention; the constructs exist taxonomically at the same level (e.g. Hoel et al, 2010; Treat, 1980)

Those in the latter camp say that, for driver distraction:

- there is a triggering event, there is a competing activity, the competing activity may compel and induce an attentional shift, and the competing activity is externally generated (i.e., is not generated from within the mind)



Distinguishing between driver distraction and driver inattention (2)

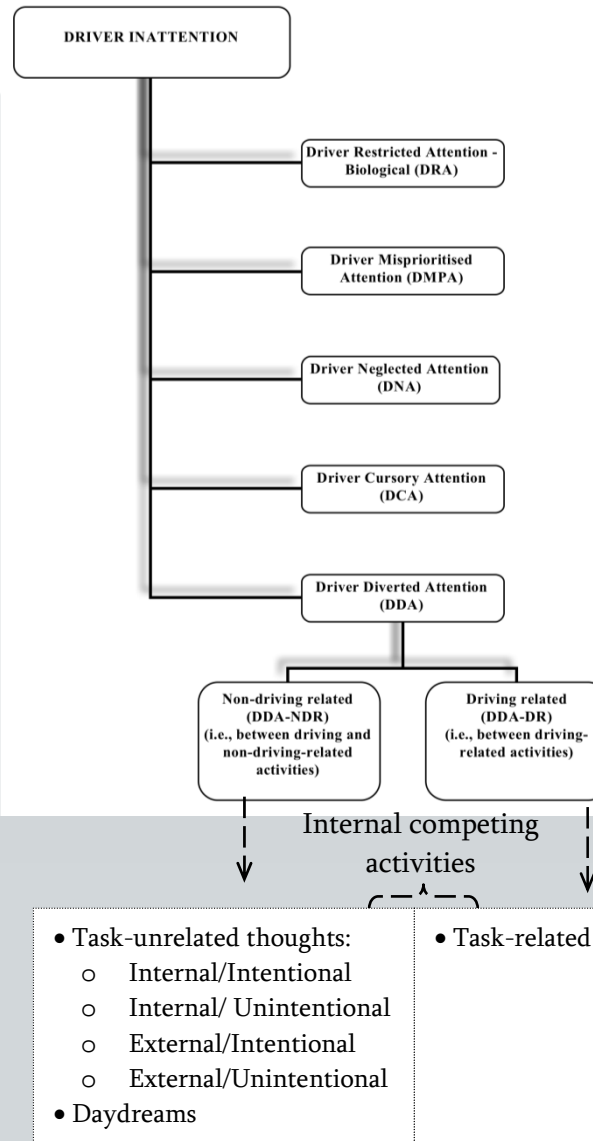
Pettitt et al. (2005) - “...the result of distraction is inattentive driving, however inattention is not always caused by distraction” (p. 4).

If you believe that driver distraction may lead to driver inattention then, taxonomically, there is no logic in seeking to differentiate between driver inattention and driver distraction as separate constructs.



A Taxonomy of Driver Inattention (1)

Figure 1: Taxonomy of Driver Inattention



Source: Regan, Hallet & Gordon, 2011



A taxonomy of driver inattention (2) - Definitions

Driver Restricted Attention (DRA) - Insufficient or no attention to activities critical for safe driving brought about by something that physically prevents (due to biological factors) the driver from detecting (and hence from attending to) information critical for safe driving.

Driver Misprioritised Attention (DMPA) - Insufficient or no attention to activities critical for safe driving brought about by the driver focusing attention on one aspect of driving to the exclusion of another, which is more critical for safe driving

Driver Neglected Attention (DNA) - Insufficient or no attention to activities critical for safe driving brought about by the driver neglecting to attend to activities critical for safe driving.

Driver Cursory Attention (DCA) - Insufficient or no attention to activities critical for safe driving brought about by the driver giving cursory or hurried attention to activities critical for safe driving.

Driver Diverted Attention (DDA) – The diversion of attention away from activities critical for safe driving toward a competing activity, which may result in insufficient or no attention to activities critical for safe driving.

Regan, Hallett & Gordon, 2011, p. 1775-1776)



A taxonomy of driver inattention (3): Driver Inattention and Distraction

driver inattention:

“insufficient, or no attention, to activities critical for safe driving.”

driver diverted attention (ie distraction):

“The diversion of attention away from activities critical for safe driving toward a competing activity, which may result in insufficient or no attention to activities critical for safe driving.”

We are clear, in defining driver distraction, that it may lead to driver inattention.

(Regan, Hallett & Gordon, 2011, p. 1775)



A taxonomy of driver inattention

(4a): Examples

- Driver dozes off momentarily, with closed eyes, and almost hits a pedestrian crossing the street ahead (**driver restricted attention**)
- Driver looks over their shoulder for too long while merging and fails to see a lead vehicle rapidly braking (**driver misprioritised attention**)
- Driver neglects to scan to the left for approaching trains at a railway level crossing, because he does not expect trains to be there (because they are rarely or never seen) (**driver neglected attention**)
- Driver in a hurry does not complete a full head check when merging onto a highway and collides with a merging car (**driver cursory attention**)
- Driver looks at cell phone while dialing a friend (**driver diverted attention** – non-driving related)



A taxonomy of driver inattention

(4b): Examples

- Driver looks at unexpected flashing fuel warning light (**driver diverted attention** – driving-related)
- Driver thinks about what needs to be done when she gets to work (**driver diverted attention** – non driving related)
- Driver thinks constantly about where to find nearest service station, because the fuel tank is almost empty (**driver diverted attention** – driving related)
- Driver *daydreams* about a romantic holiday in Paris (**driver diverted attention** – non driving-related)



A taxonomy of driver inattention (5): Relationships between Attentional Failures

The taxonomy is also important in thinking about relationships between different forms of driver inattention:

- It is possible for more than one category of inattention to derive from the same activity. e.g. sun strike
- The same behavioural outcome can be generated by different forms of driver inattention e.g. the “looked but failed to see” phenomenon



A taxonomy of driver inattention (6): Driver States and Conditions

- There is confusion in the literature about the relationship between driver states, driver conditions, and driver inattention.
- driver conditions and states are factors that can:
 - (a) give rise to different forms of inattention
 - (b) moderate the impact of a given form of inattention when it is manifest
- But – someone who is sleepy, distressed or elated may not necessarily be inattentive to activities critical to safe driving.



A taxonomy of driver inattention (7): DMA and DDA

- DMA - inattention arises from a failure to effectively distribute attention between multiple driving activities which are ongoing, both of which may be equally (or almost equally) critical for safe driving.
- DDA (between driving tasks) - inattention arises from the voluntary or involuntary diversion of attention away from activities critical for safe driving toward a competing, driving-related activity, that is less safety-critical at that moment in time.



A taxonomy of driver inattention (8): Critical Questions

1. Do researchers and transport safety authorities have currently the data collection methods to be able to code for the different categories of driver inattention proposed here?
2. Can the different categories of attentional failure be operationally distinguished?
3. How can you develop a taxonomy of inattention that does not suffer from hindsight bias?



Conclusion (1)

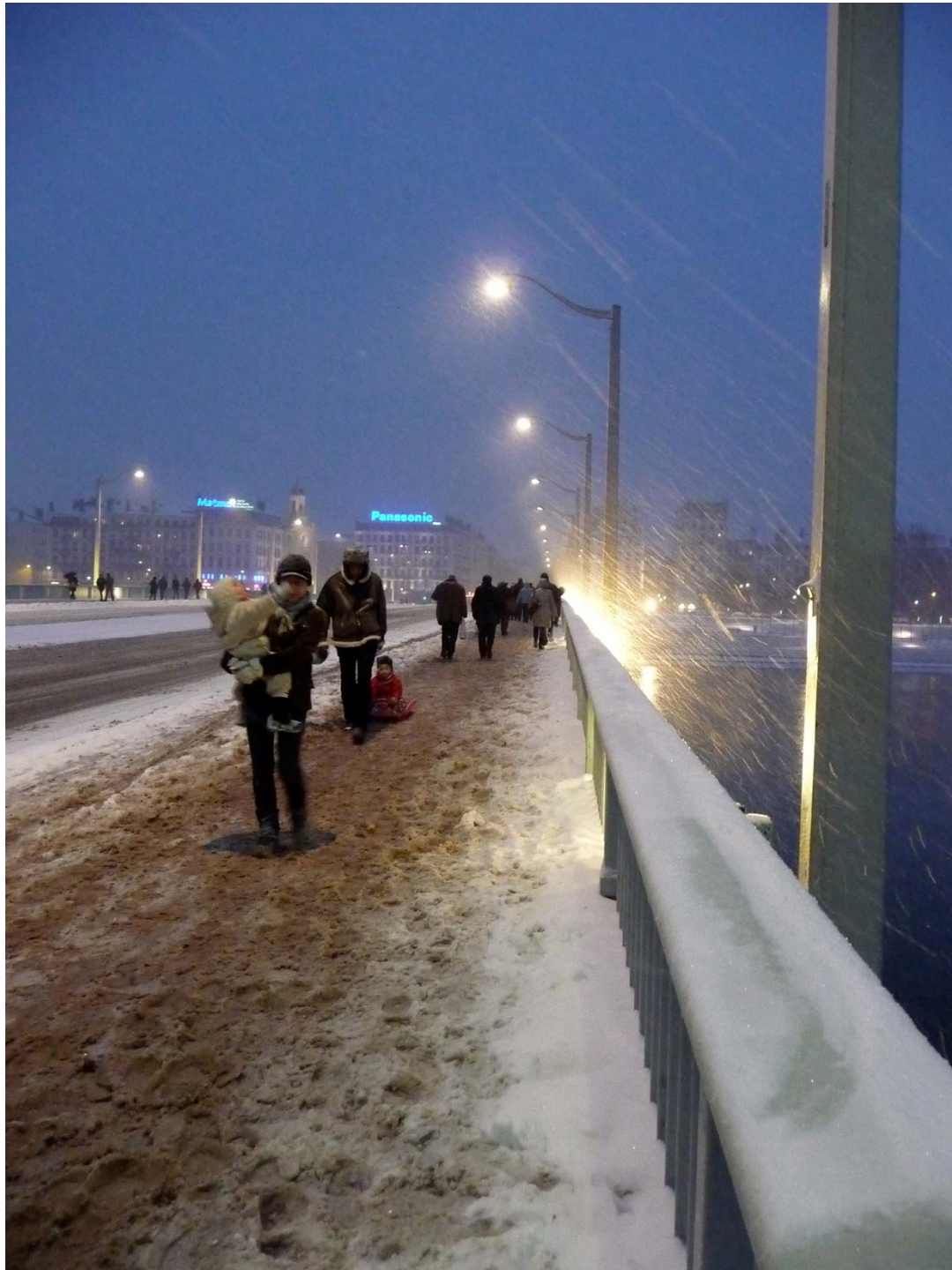
- There is a lack of consensus in the literature about what is meant by the terms “driver inattention” and “driver distraction”.
- We conclude that:
 - *Driver Inattention* means *insufficient or no attention to activities critical for safe driving*
 - *Driver Diverted Attention* (ie “driver distraction”) is just one form of attentional failure that can result in inattention.



Conclusion (2)

- **Next steps in development of taxonomy:**
 - **validate it theoretically** - by developing a comprehensive theoretical framework for understanding attentional failures in crash causation that can be used to fine tune it
 - **validate it practically** - by applying the taxonomy to the classification of a large pool of existing data. eg event descriptions derived from in-depth crash investigations and video data collected from instrumented vehicles.





THANKYOU FOR YOUR
ATTENTION

Pont de la Guillotiere -

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