

DEVELOPMENT AND VALIDATION OF A DRIVER DISTRACTION IMPACT ASSESSMENT TEST

Hallett, C., Regan, M. A., & Bruyas, M-P.

Acknowledgements:

Supervisors: Michael Regan and Marie-Pierre Bruyas

LESCOT team, in particular:

Technical team: Arnaud Bonnard; Odette Chanut;
Daniel Nydiaye; and Damien Sornette

International advisor: Kristie Young

Our objectives

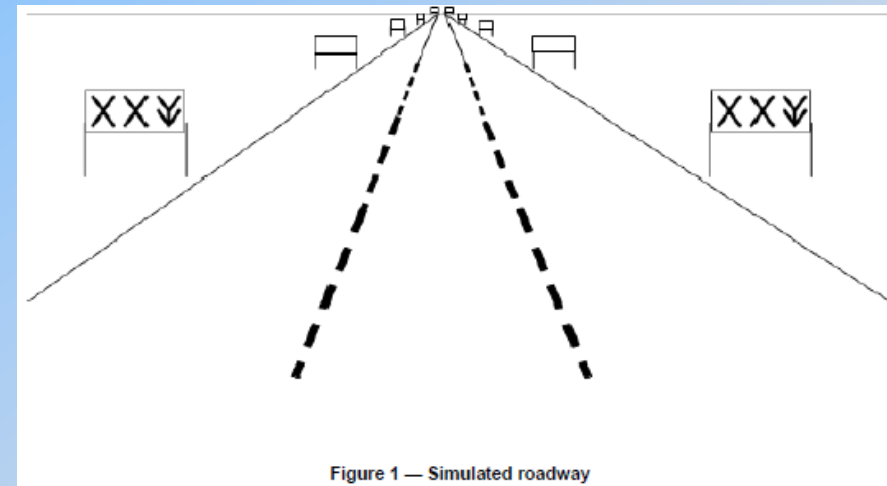
- Develop a valid, reliable, and practical test
- Measure the impact of driver distraction on activities critical for safe driving when the driver engages in a secondary activity
- Overcome some of the limitations of existing tests and methods

Previous tests

- Lane change test (LCT)
- Visual occlusion technique
- MUARC naturalistic driver distraction test
- Peripheral detection task (PDT)

Lane change test (LCT)

- Aim: Measure the impact performing secondary activities has on the ability to change lanes
- PC or driving simulator
- 3 mins; 3-lane highway
- MDEV – mean deviation in lane change path
- Standardised – ISO 26022 (2010) TC 22/SC 13/WG 8



MUARC naturalistic driver distraction test

- Aim: Measures simulated driving performance whilst a driver concurrently performs a secondary task
- PC or driving simulator
- 6.6km long urban driving environment
- Range of driving scenarios
- Expected, unexpected and control events
- Various driving performance measures

Peripheral Detection Task (PDT)

- Aim: Measure the amount of cognitive attentional resources that are available to drivers (i.e., spare cognitive capacity)
- Detect and response to stimuli presented in periphery while driving *and* engaging in a secondary task (e.g., a navigation task)
- Reaction time and response accuracy

Visual Occlusion Technique

- Aim: Determine if engaging with an activity (e.g., a navigation task) can be completed successfully using only short glances *and* if the task can be easily resumed after interruption
- Vision controlled with goggles intermittently
- Not a driving task
- Standardised - ISO 16673 (2006)



An overview of previous tests and methods

- An important first step, however there are some shortcomings:
 - Issues of construct validity – measuring driver distraction
 - Limited range of driving activities/scenarios (excl. MUARC test)
 - Do not measure the covert effects of distraction
 - Driving activities not are not necessarily those that are critical for safe driving (possible exception: MUARC test)
 - Predictable events

1. Define driver distraction



2. Identify activities critical for safe driving



3. Identify the mechanisms of driver distraction



4. Select, design and programme scenarios



5. Implement the test



6. Evaluate the test

Critical steps in developing and validating the driver distraction impact assessment test

Defining driver distraction

● Driver diverted attention: “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, M. A., Hallett, C., & Gordon, C. P. (2011). Driver distraction and driver inattention: Definition, relationship and taxonomy. *Accident Analysis and Prevention*, 43, 1771-1781.

1. Define driver distraction



**2. Identify activities critical for
safe driving**



3. Identify the mechanisms of
driver distraction



4. Select, design and programme
scenarios



5. Implement the test



6. Evaluate the test

Critical steps in developing and validating the driver distraction impact assessment test

Activities critical for safe driving (1/2)

- Not previously determined in the literature
- Hindsight allows us to determine what critical activity (activities) should have been attended to (Hancock, Mouloua, & Senders, 2009; Regan, et al., 2011)
- Analyses focus on what a driver failed to do in the event of a collision rather than on what activity they should have engaged in

Activities critical for safe driving (2/2)

Framework:

- Identify driving activities and tasks (e.g., Brown, 1986)
- Identify most common collision types attributed to distraction
- Video and accident data:
 - “What activity critical for safe driving was not attended to?”

1. Define driver distraction



2. Identify activities critical for safe driving



3. Identify the mechanisms of driver distraction



4. Select, design and programme scenarios



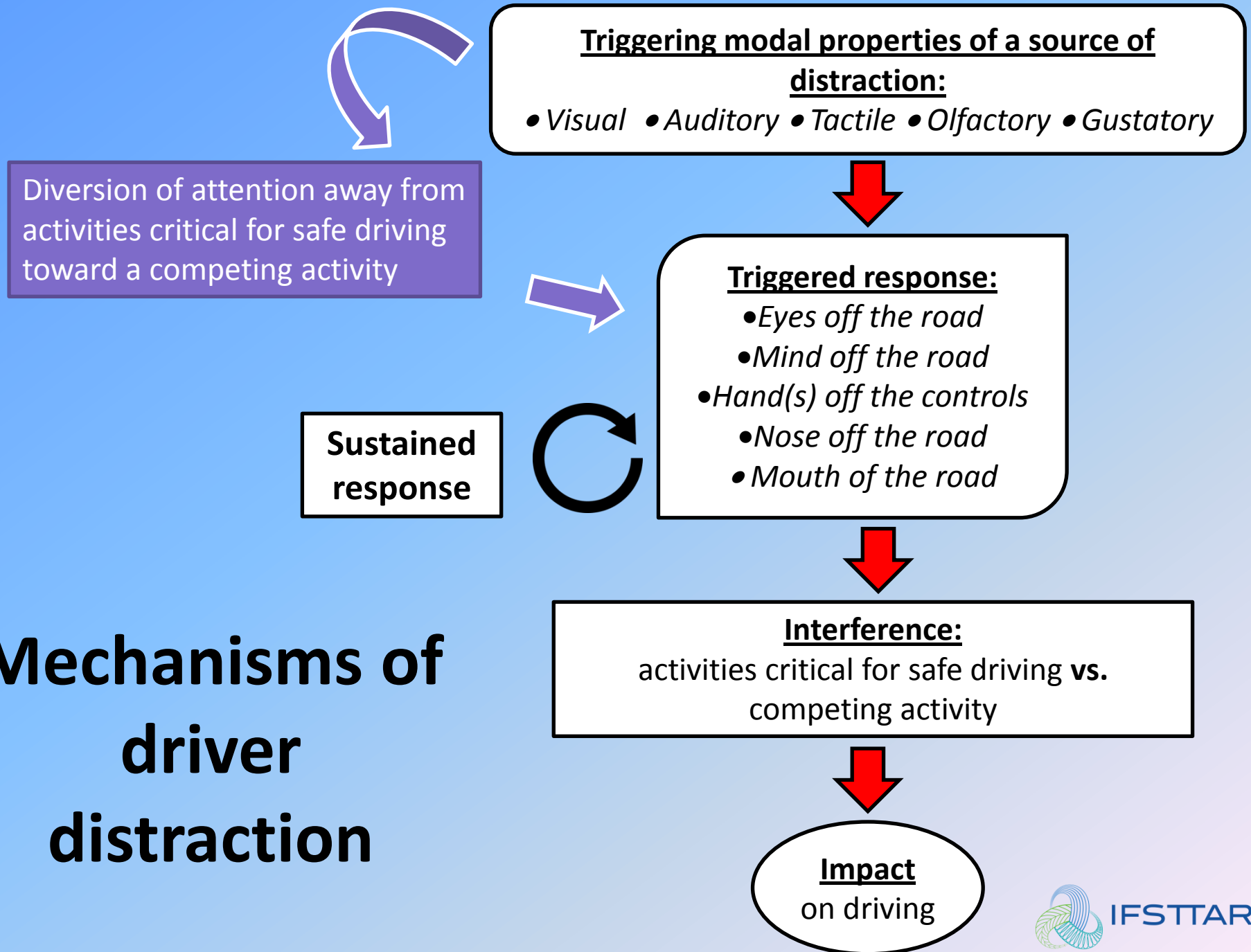
5. Implement the test



6. Evaluate the test

Critical steps in developing and validating the driver distraction impact assessment test

Mechanisms of driver distraction



Mechanisms of driver distraction

- The test must be :
 - Capable of distinguishing between the impact of the different sources of distraction
 - It is not necessary to test all of the potential *sources of distraction* (that exist or will exist); **rather** the test should be sensitive to all of the *triggered responses*

1. Define driver distraction



2. Identify activities critical for safe driving



3. Identify the mechanisms of driver distraction



4. Select, design and programme scenarios



5. Implement the test



6. Evaluate the test

Critical steps in developing and validating the driver distraction impact assessment test

Selection and design of scenarios

Guiding questions:

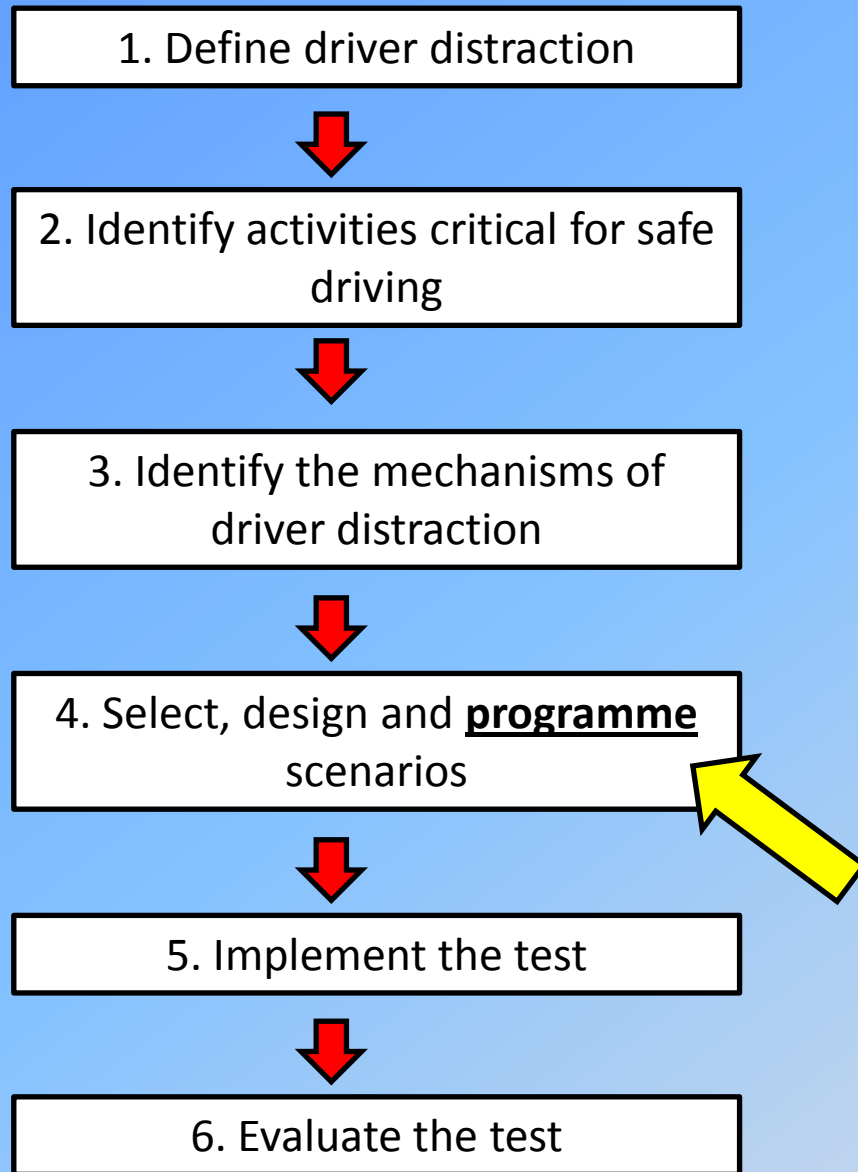
- 1) Is the scenario one in which driver distraction is over-represented?
- 2) Has driving performance in the scenario been shown to be adversely affected by driver distraction?

Selection and design of scenarios

Guiding questions (cont.):

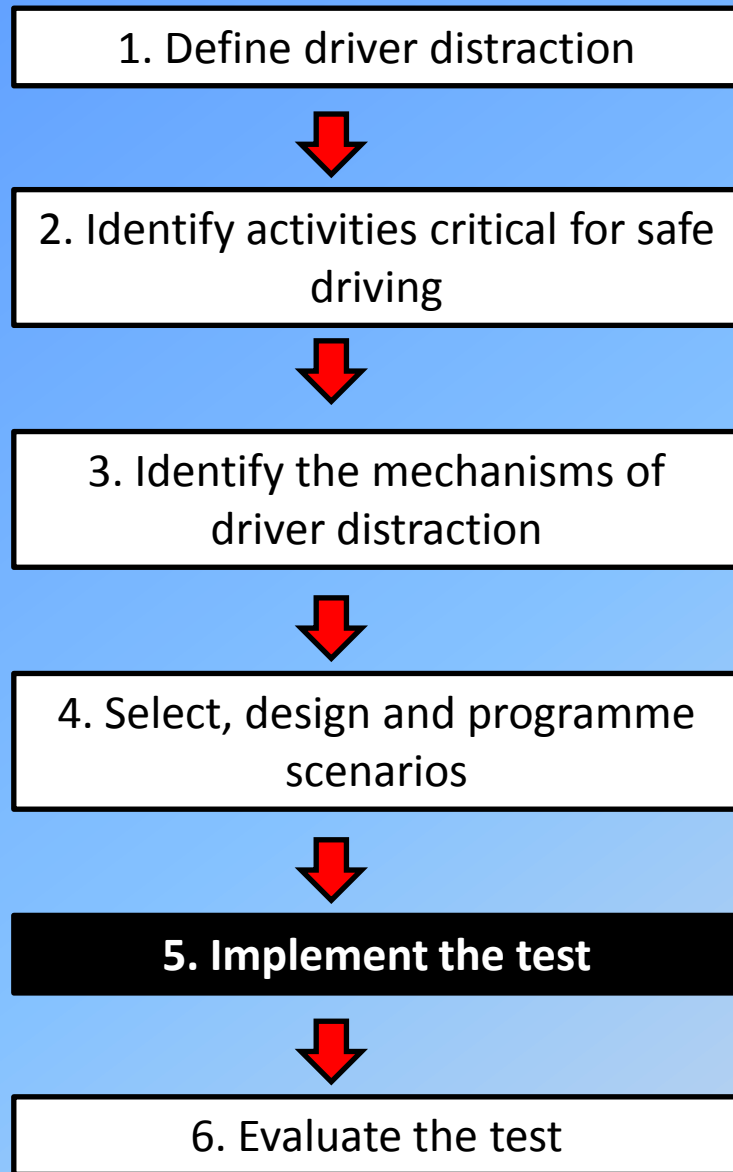
- 3) Does the scenario involve activities critical for safe driving?
- 4) Do the scenarios, in combination, address all of the triggered responses of driver distraction?

Critical steps in developing and validating the driver distraction impact assessment test



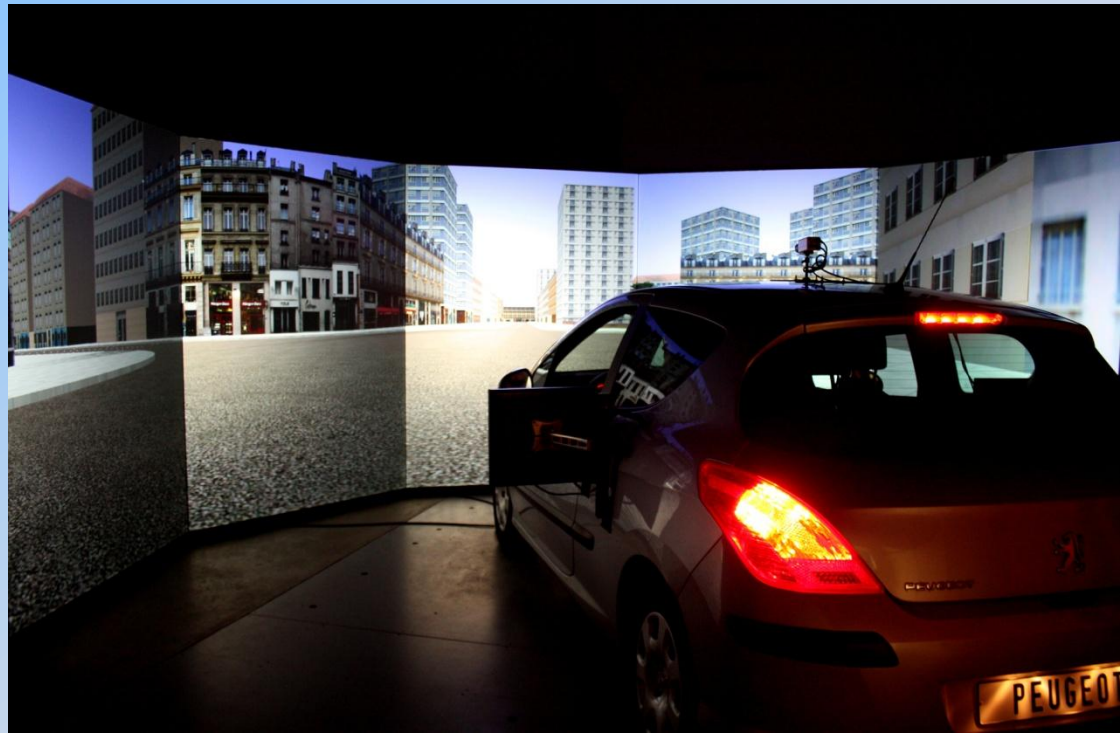
CURRENT STATUS

Critical steps in developing and validating the driver distraction impact assessment test



Test implementation

- IFSTTAR mid-level fixed-based driving simulator
- 3 drives; 9 scenarios
- 2 testing phases:
 - Pilot
 - Validation



Important considerations in the development and validation of a test

Test administration

- The administration instructions of the test must be standardised
- Standardised instructions:
 - Will be examined in the pilot testing phase
 - Must be appropriate, understandable and easy to follow

Psychometric properties of a well-designed test: Overview

● Test Validity

● Reliability

● Discriminability

● Practicality

● Forms of Validity:

- Construct: does the test measure driver distraction?
- Criterion: can the test effectively predict an individual's behaviour in a driving scenario?
- Predictive: can it predict with some certainty which competing activities are more likely to have an impact on activities critical for safe driving in the real-world?
- Content: is the test representative of the behaviours it is designed to test?

❁ Test-retest reliability: if the test is repeated in the future with the same subjects will the results be consistent?

❁ Discriminability (Angell, 2010)

❁ Can the test determine if there is any interference of a task with driving?

❁ Can the test discriminate between levels of interference of the same competing task

❁ Practicality (Angell, 2010)

❁ Is the final test cheap, quick to complete and easy to administer?

Conclusion

- There is a need to develop a tool that includes a range of driving scenarios and activities critical for safe driving that have been shown to be sensitive to the effects of distraction
- Valid, reliable and practical
- The completed test should be useful for both product developers and researchers

Thank you for your attention

- For further information please feel free to contact the first author, Charlene Hallett, at charlene.hallett@ifsttar.fr