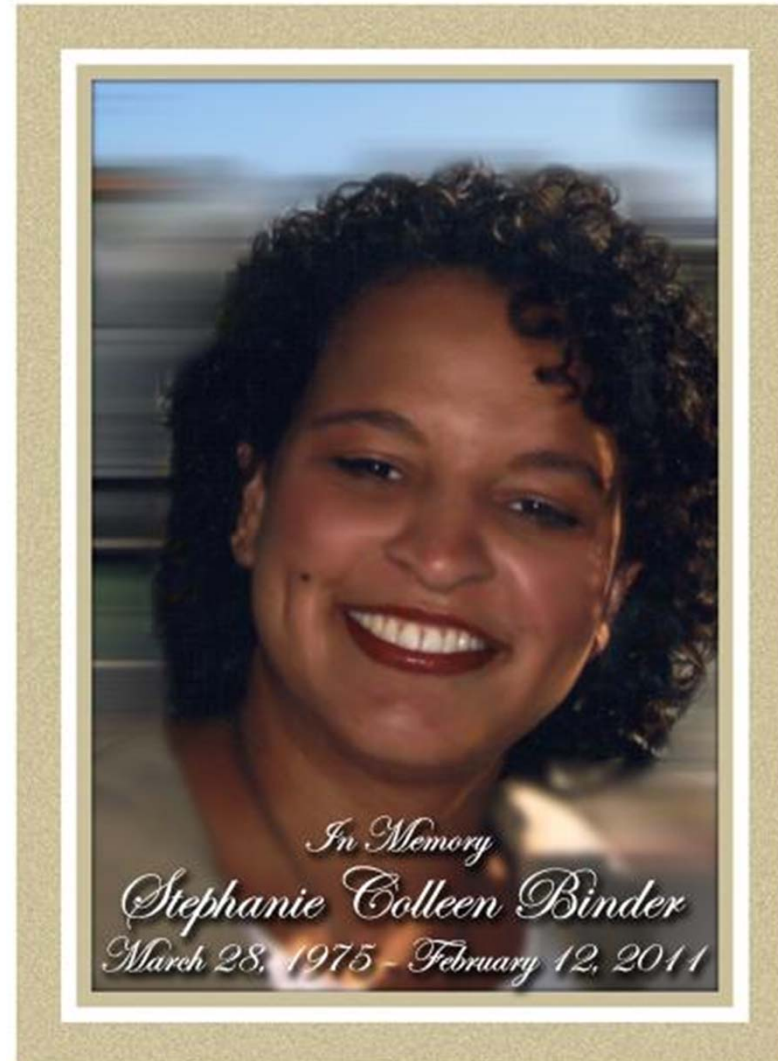


Stephanie Binder Memorial Lecture

- Introduction
 - Chris Monk
- **Challenges in the prevention and mitigation of driver distraction**
 - Trent Victor and Mike Regan





Challenges in the Prevention and Mitigation of Driver Distraction and Inattention

Stephanie Binder Memorial Lecture

Trent Victor^{1,2} and Michael Regan^{2,3}

¹Volvo Technology, ²SAFER, ³IFSTTAR

Driver Distraction and Inattention 2011

Driver Distraction and Inattention



- Big-ticket problem, major challenge



SAFER

Outline

1. Challenges in Theory and Modelling
2. Methodological Challenges
3. Countermeasure Challenges

1. Challenges in Theory and Modelling

Creating a Viable Taxonomy

- Mike – on defining distraction and inattention

The Consequences

- tests and protocols to measure driver distraction and inattention will have no construct validity
- comparisons of research findings across studies for a given form of driver inattention will be difficult or impossible
- different definitions of these constructs will 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
- this has, in turn, important implications for countermeasure development



What is driver distraction?

- ***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
- “driver distraction is the diversion of attention away from activities critical for safe driving to a competing activity”
- (US-EU Expert Focus Group on Driver Distraction)



What is driver distraction? The challenges?

- are driving –related activities (e.g., an unexpected low fuel warning light) potential sources of distraction?
- do activities with potential to distract have to be covert and identifiable (e.g., an advertising billboard), or can they include activities not associated with any identifiable source (e.g. daydreams?)
- are competing activities over which the driver has no control (eg the unexpected appearance a moose) potential sources of distraction?
- Are driver states (e.g. bored, drowsy, upset) and conditions (e.g., young, inexperienced) sources of distraction?
- What are activities critical for safe driving? Some are identifiable (eg stop at red traffic light), but some depend on the situation.



What is driver inattention?

Driver inattention, like driver distraction, has been inconsistently defined – even more so.

Key elements:

- a lack of attention
- insufficient attention
- cursory attention
- the selection of irrelevant information
- the orienting of attention on internalised thoughts
- engagement in activities secondary to driving
- Induced by a condition, state or event
- looking away from the forward roadway.



What is the relationship between driver distraction and inattention?

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



One View of the World

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.”

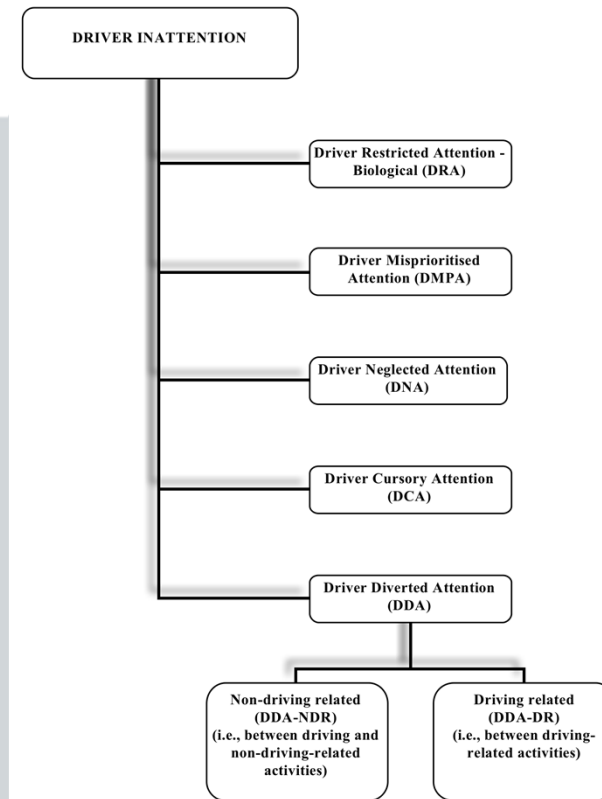
Hence, driver distraction may lead to driver inattention.

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



A new taxonomy of driver Inattention (2)

Figure 1: Taxonomy of Driver Inattention



Source: Regan, Hallet & Gordon, 2011

Internal competing activities

- | Task-unrelated thoughts: | Task-related thoughts |
|--|-----------------------|
| <ul style="list-style-type: none">○ Internal/Intentional○ Internal/ Unintentional○ External/Intentional○ External/Unintentional | |
| • Daydreams | |



A taxonomy of driver inattention: Challenges

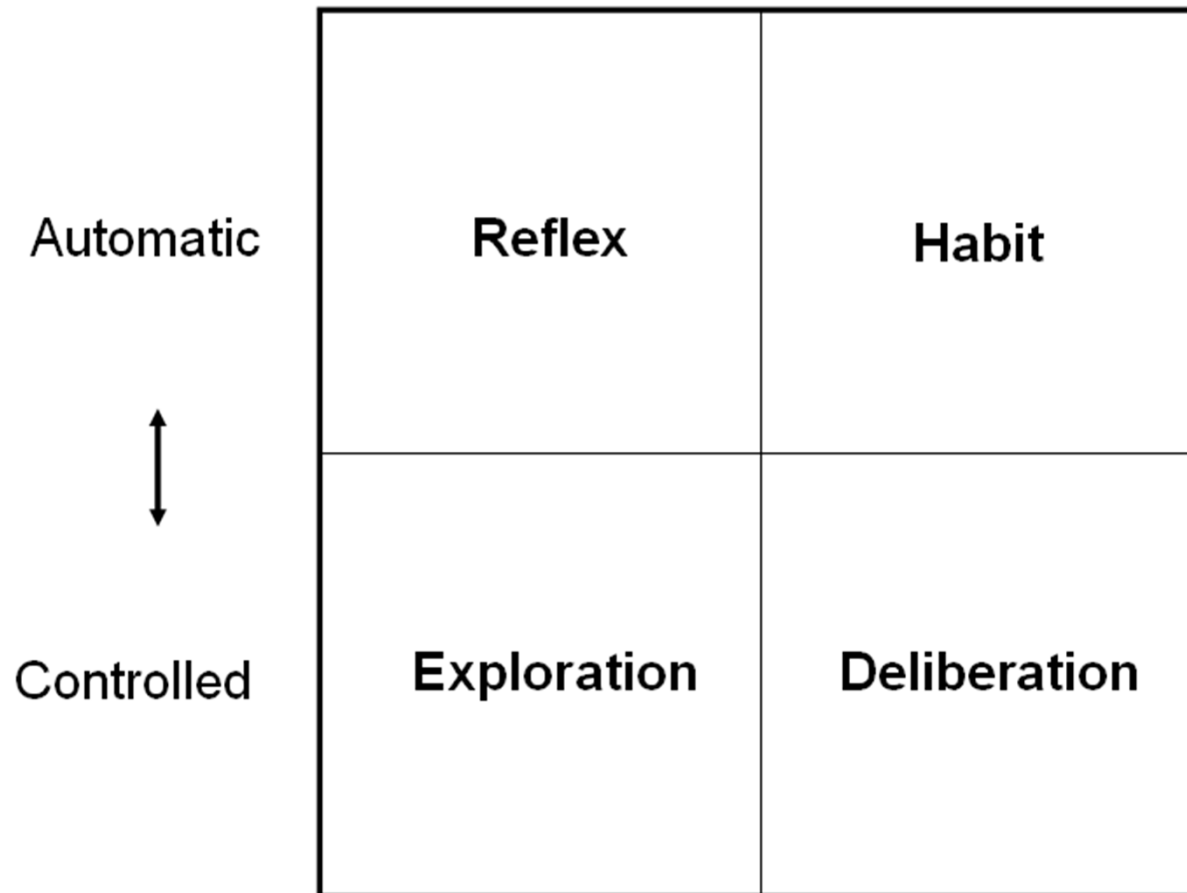
1. Do researchers and transport safety authorities have currently the data collection methods to be able to code for the different categories of driver inattention proposed here?
2. Can the different categories of attentional failure be operationally distinguished?
3. How can you develop a taxonomy of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



Accounting for Automatic & Controlled AND

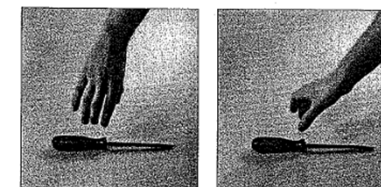
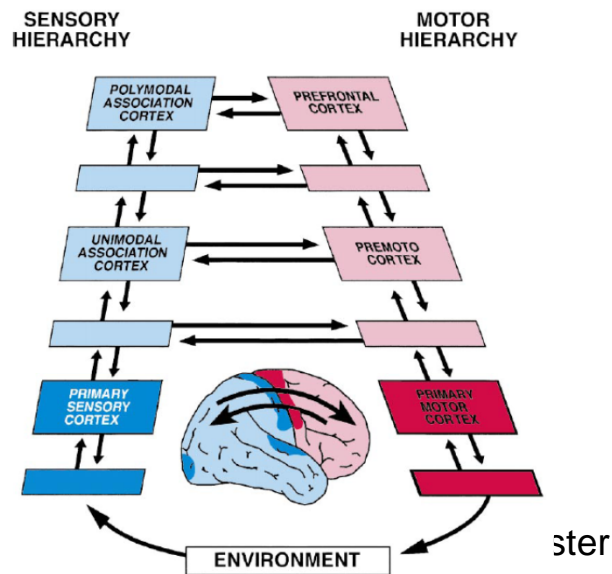
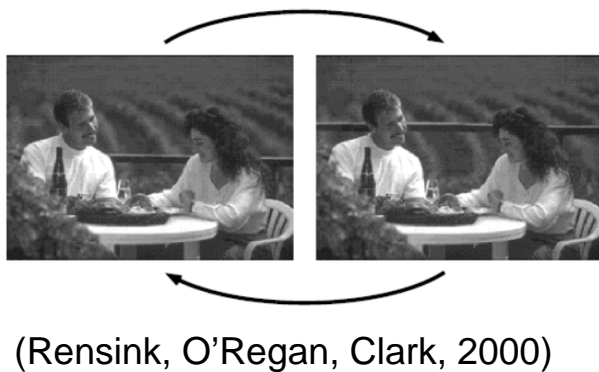
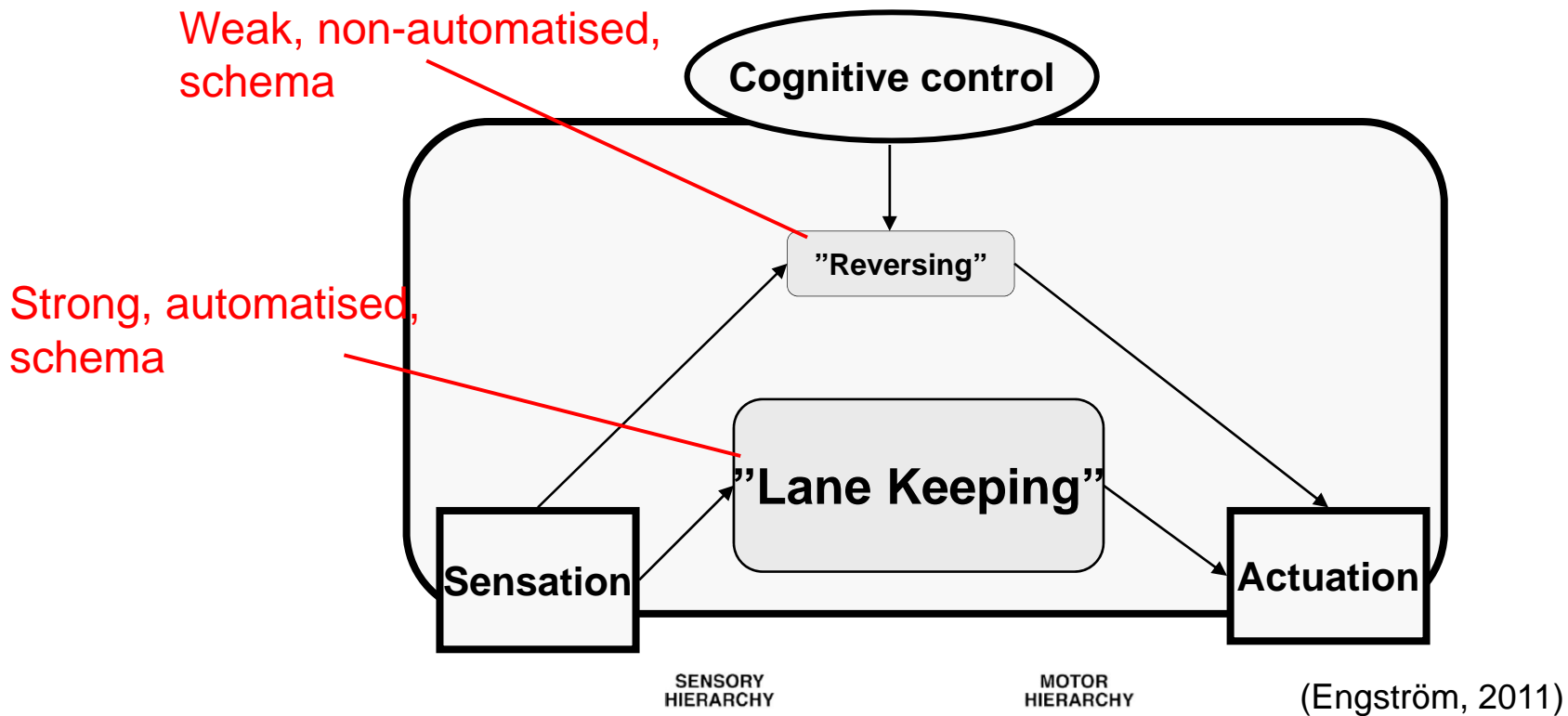
Bottom-up & Top-down

Bottom-up \longleftrightarrow Top-down



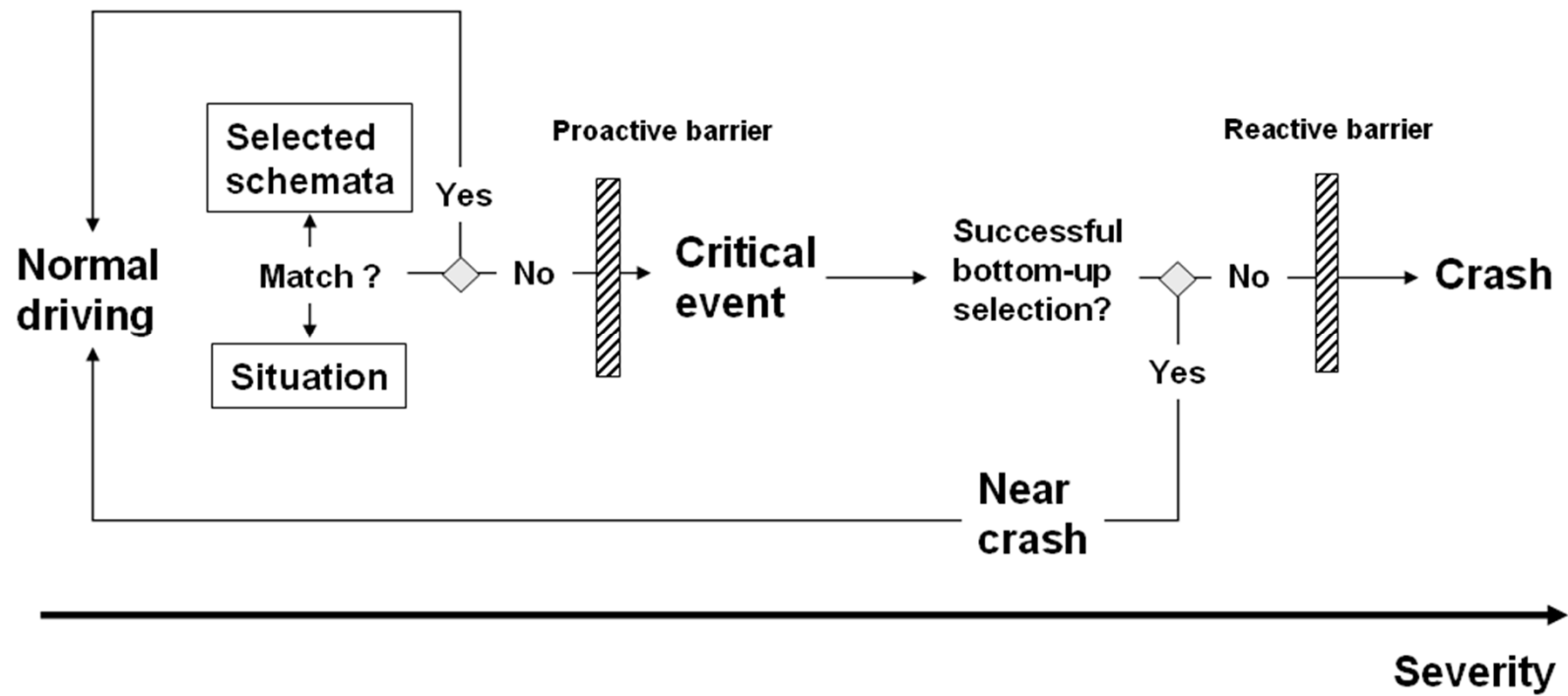
Trick & Enns, 2009

SAFER



Creem & Proffitt

SAFER



Engström, Victor, Markkula (2011)

SAFER

Accounting for Motivations

- Why do people look away in the first place?
 - Expectancy, scheduling, social setting
 - E.g. Texting risk



SAFER

Connecting with Cognitive Neuroscience Research

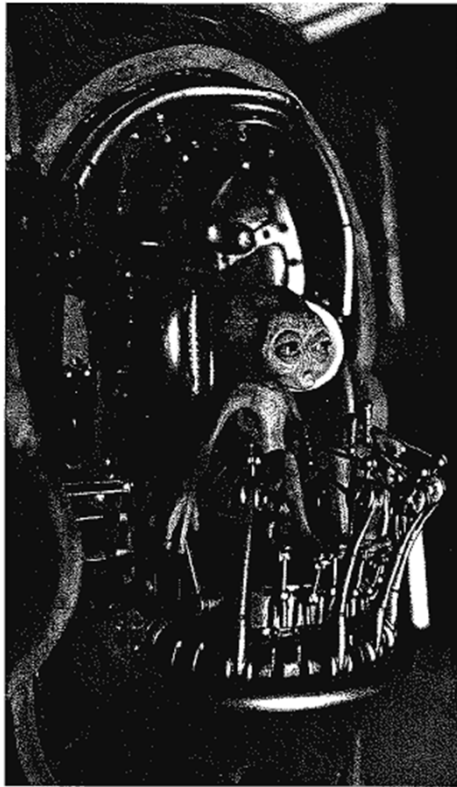
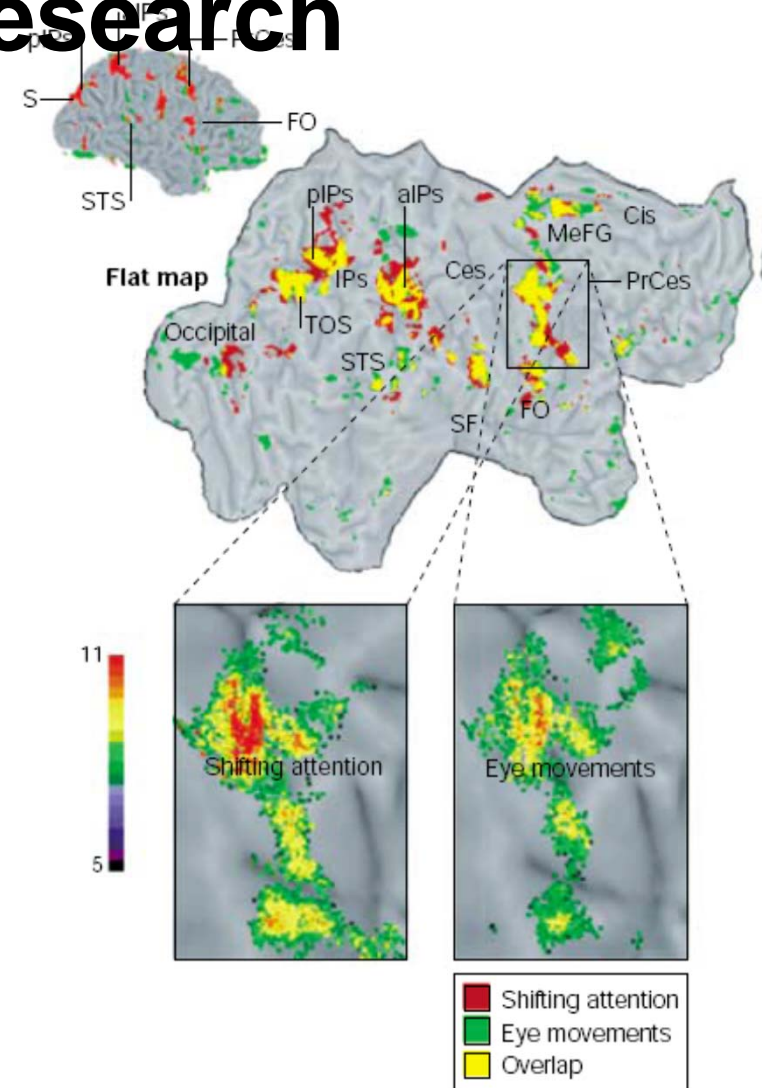


FIGURE 18.1 The homunculus that sits inside Rosenberg's head. Reproduced with permission from Men in Black (Columbia Pictures, 1997).



Corbetta, et al, 2000

SAFER

Accounting for Interactions

- Distraction and Alcohol/Drugs
- Distraction and Drowsiness
- Distraction and Emotions



SAFER

2. Methodological Challenges



Methodology Chain



Simulator/
Controlled Experiment



Real World –
Naturalistic/Epidemiology

Look/
Handle



Poor
Performance

High Risks

Talk/
Listen



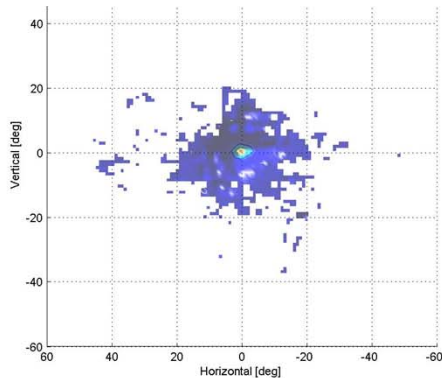
Poor
Performance

Low/no/less
Risk

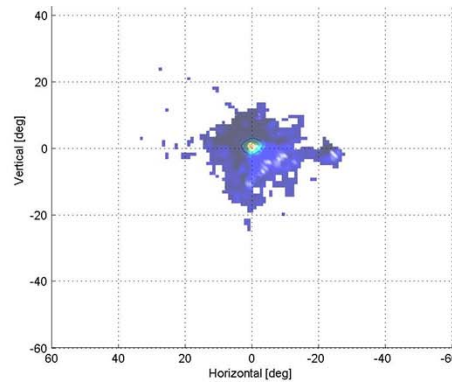
SAFER

How do we answer this question?

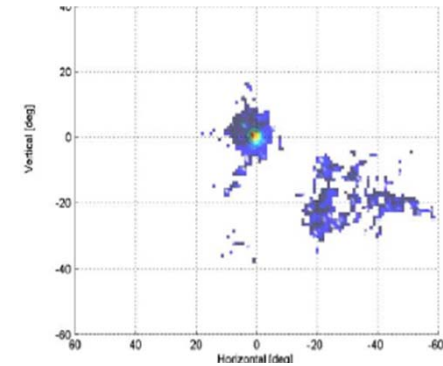
- How does working memory (cognitive) load affect **driving performance** and **crash risk**?
 - Cognitive load in Talking/listening
 - Cognitive load in Looking/Handling



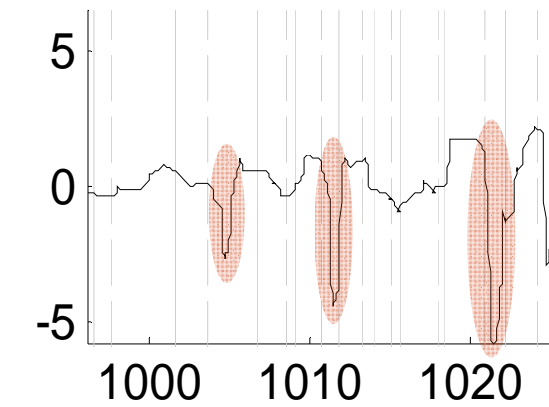
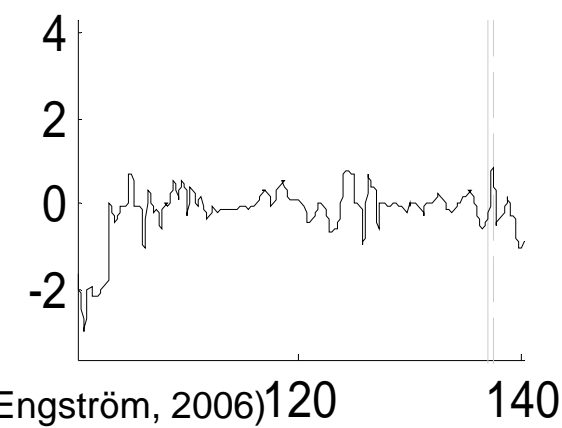
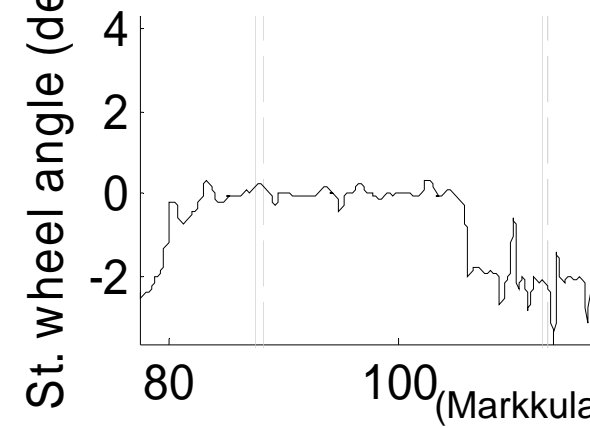
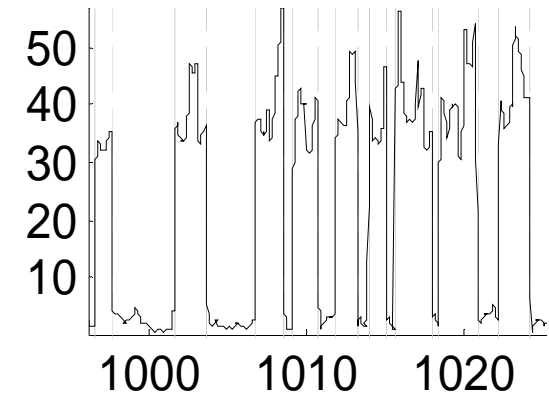
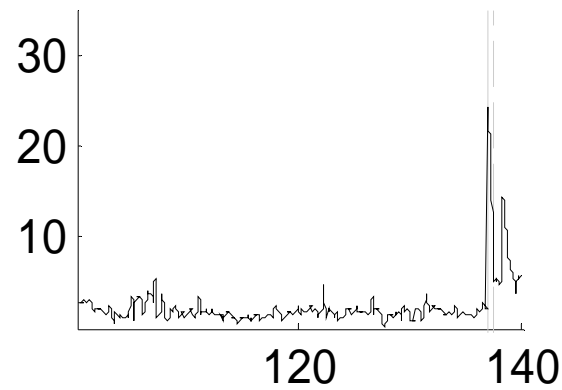
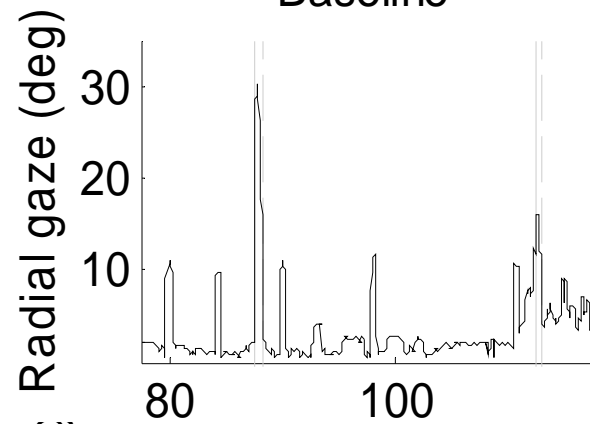
Baseline



Cognitive task, level 3



Visual task, level 3



(Markkula & Engström, 2006)

SAFER

Can we Express Changes as Effects in Crash Outcomes soon?

Relative fatality risk/km/year

1



10



200



SAFER

The Holy Grail:



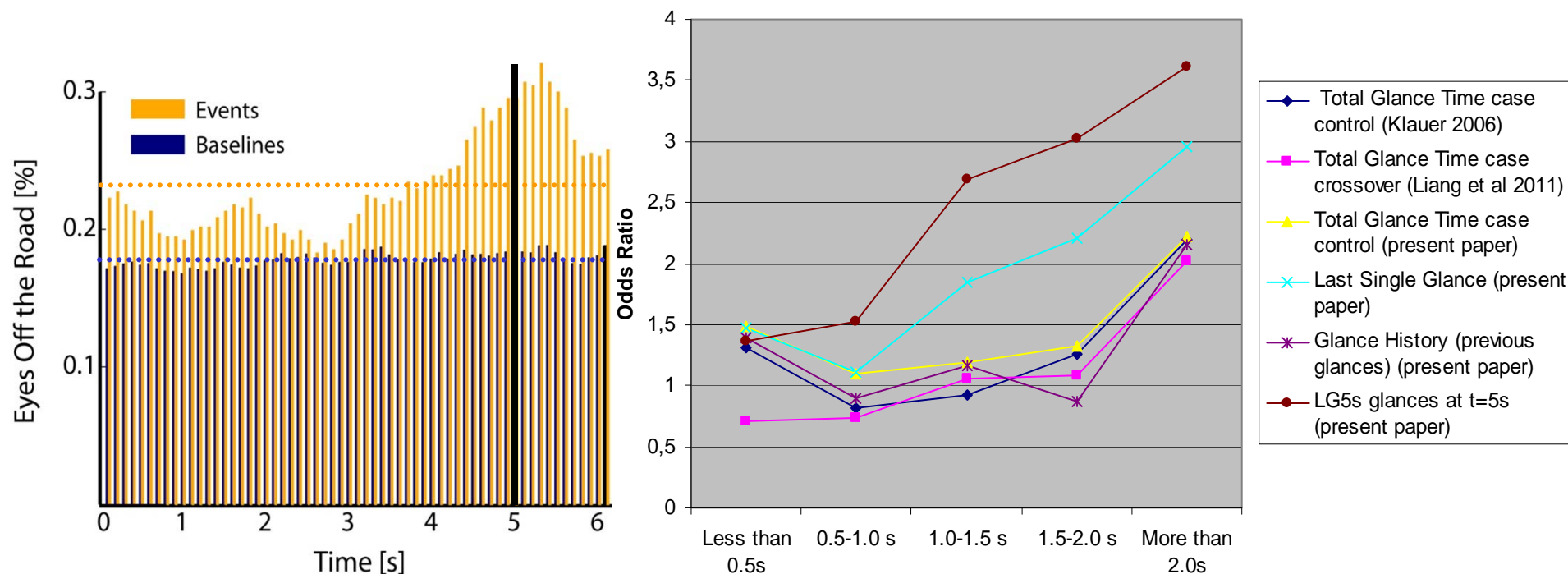
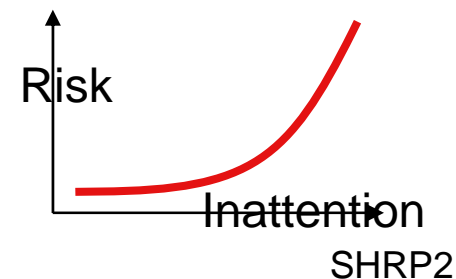
Inattention → Crashes

Crash substitutes → Crashes

Holy Grail to be found in SHRP2 data?

SAFER

Inattention & Risk example



Victor and Dozza, 2011

- The glance at precipitating event gives the highest ORs

SAFER

What is our Vision for Distraction and Inattention?

- 80% reduction in distraction events?
- Zero fatal and injured from distraction?
- Zero distraction-induced crashes?



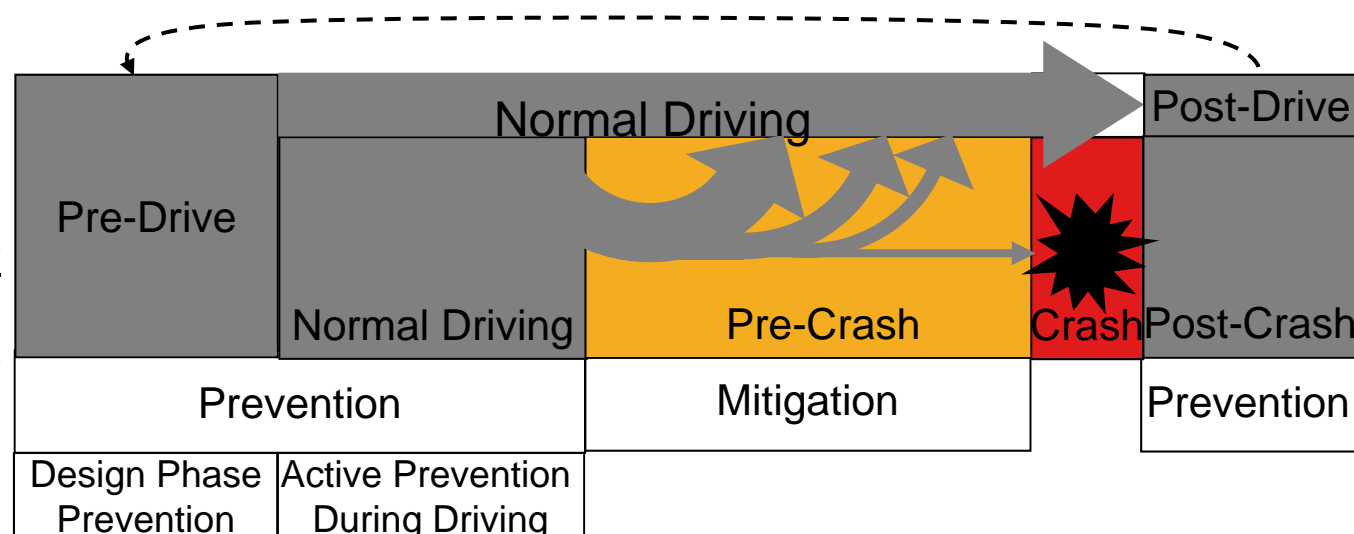
Vision Zero

SAFER

3. Countermeasure Challenges

Encourage Vehicle and Technology Design Countermeasures

1. Legislation and Enforcement
2. Driver Licensing
3. Education and Training
4. Vehicle and Technology Design
5. Vehicle and Technology distraction evaluation and ratings
6. Road Design Countermeasures
7. Employers



Victor, 2011

SAFER

Challenges in Design Phase Prevention

- Safe Designs according to Guidelines and Standards
- Integration
- Hard Function Lockout



SAFER

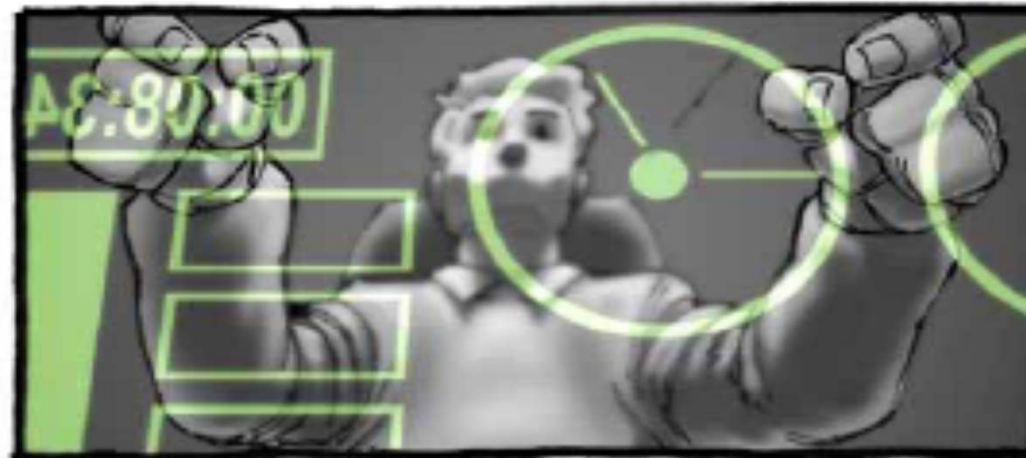
Challenges in Active Prevention During Driving

	OEM Equipment	Integrated Nomadic Devices	Nomadic Devices
Information Scheduling			
Adaptive (Soft) Function Lockout			
Adaptive Information Format			

SAFER

Challenges in Mitigation

- "Safety-net"
- Distraction-Adaptive Safety Systems (Warning and Avoidance)
- Real time Visual Distraction Feedback
- Real time Cognitive Distraction Feedback
- Real time Driving Performance Feedback



SAFER

Challenges in Driver Coaching

- In-vehicle Coaching
- Off-vehicle Coaching (Fleet Manager)
- In-vehicle Pre/Post trip Feedback
- Off vehicle Driver Coaching



SAFER

More and more and more...

- How to Enable Safe Communication – benefits & costs
- How to Reward good design (e.g. Driving Mode Apps)?
- How to encourage "Safety-net" technology and Distraction feedback technology?
- How to use laws?

Thank-you

SAFER