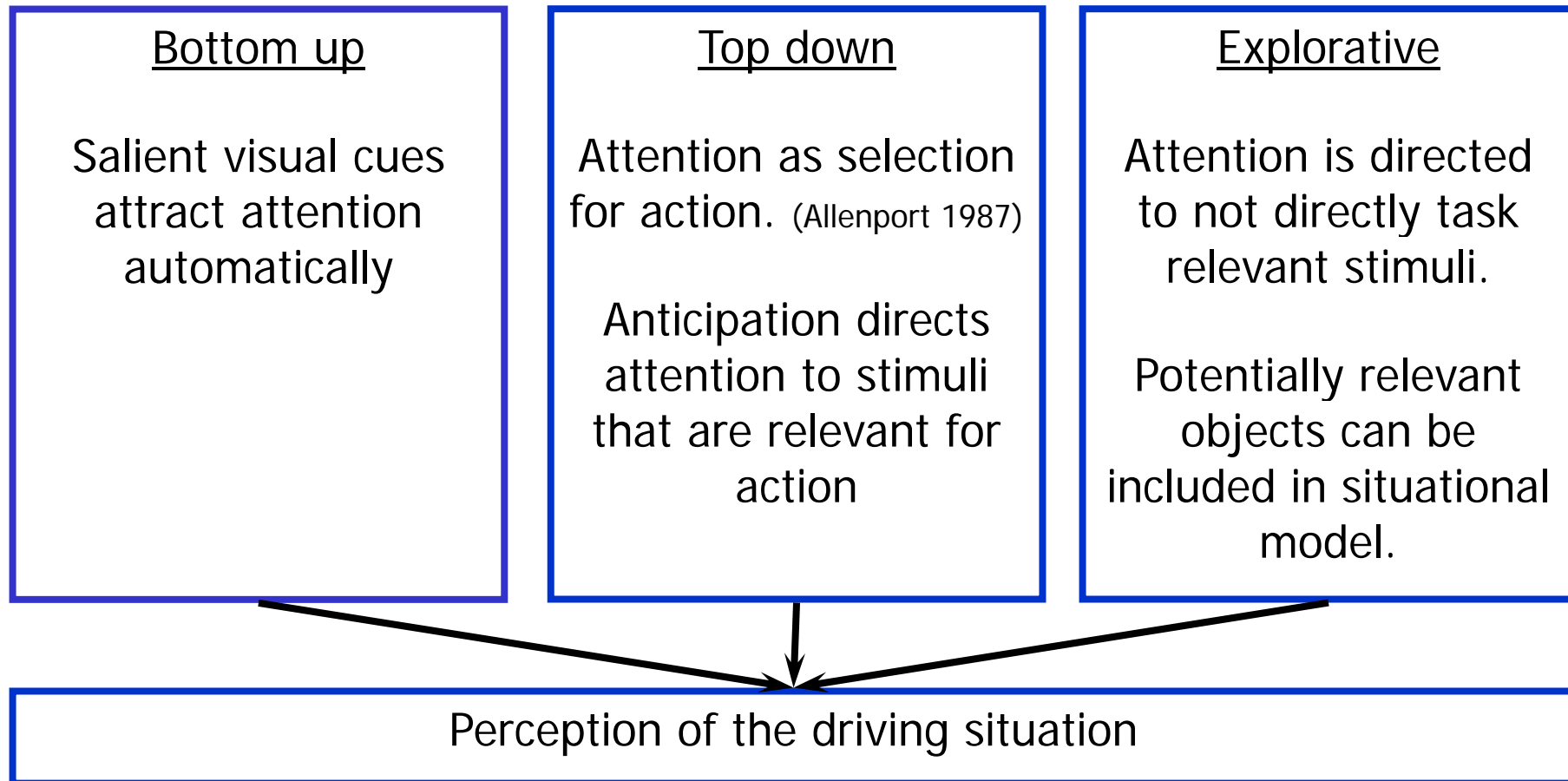


***How is driving related attention in driving with visual
secondary tasks controlled?
Evidence for top-down attentional control***

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Theoretical background



Based on Hoffmann (1993)

Influence of visual secondary tasks

		Attentive driving	Distracted driving
Salient stimuli		+ (bottom-up)	+ (bottom-up)
Driving related stimuli	Directly task relevant	+ (top-down)	+ (top-down)
	Potentially task relevant	+ (explorative)	_____
Other objects in the environment			

During visual secondary tasks:

- Driving related attention is focused on directly task relevant objects
- Other potentially task relevant objects are neglected

**„Change Blindness is the inability to detect changes to an object or scene.“
(Simons & Levin, 1997)**

- **Less change blindness for objects which are relevant for the scene
(Velichkovsky, Dornhoefer et al., 2002)**
- **Active involvement reduces changes blindness for objects which are relevant
for action (Wallis u. Bühlhoff, 2000)**

**„Visual perception of change in an object occurs only when that object is
given focused attention.“ (Rensink, O'Regan u. Clark, 1997)**

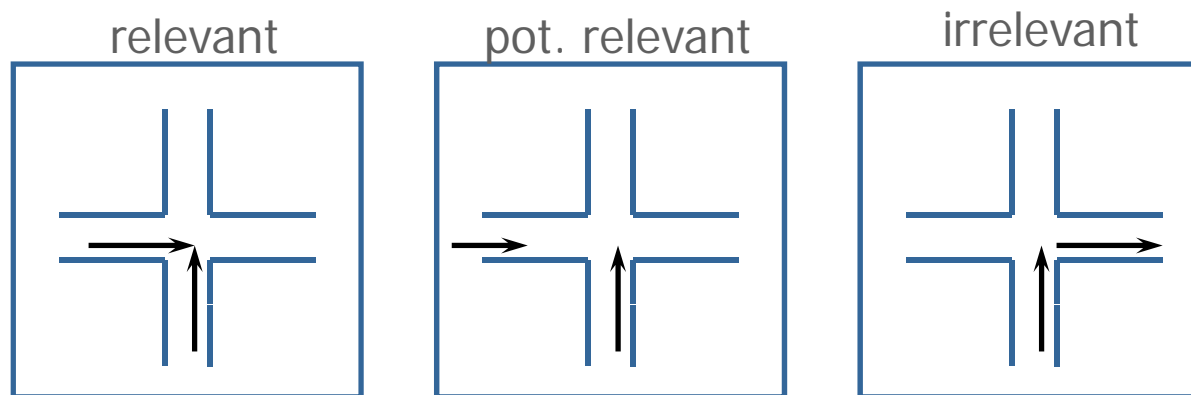
Change blindness only occurs for masked changes:

- **Unmasked changes attract attention through bottom up processes (motion
transient).**

- **Static driving simulation with 300° field of view (www.wivw.de).**
- **Repeated approach to crossing**
 - **X-crossing with 3 approaching trucks (left, right, frontal)**
 - **Driver has to give right of way**
- **During each approach to a crossing:**
 - 1. Drivers need to maintain driving safety (e.g. give right of way)**
 - 2. Drivers solve secondary task (read numbers aloud)**
 - 3. Drivers look for sudden changes (e.g. vehicle disappears)**

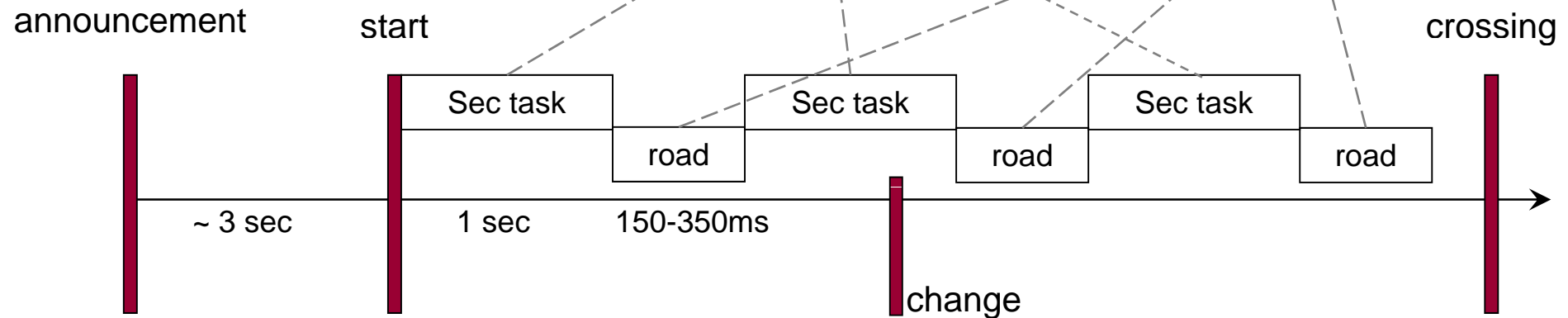
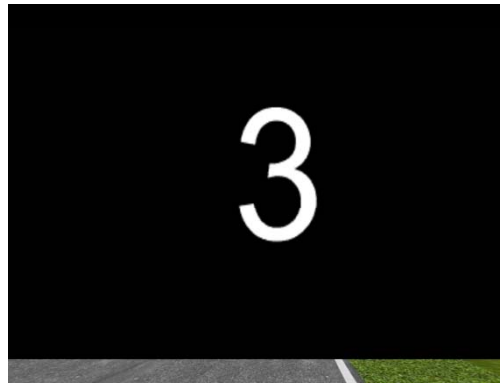
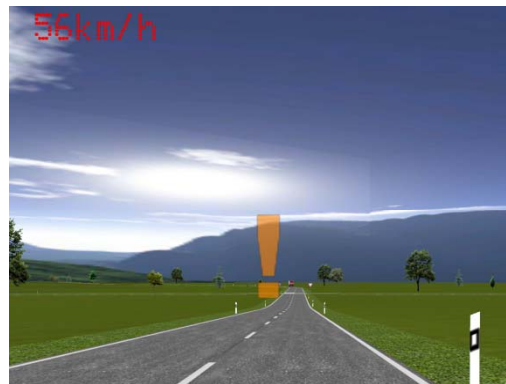


- **Relevance of approaching vehicles is manipulated via speed and heading:**
 - **Vehicles reaching the crossing simultaneously with the driver are believed to be task-relevant**



- **It is expected that changes to relevant objects are detected better than changes to irrelevant objects**

Timeline during one trial



1. Masking of change

- **During secondary task (occlusion) vs. during road glance (unmasked)**
- **Independent factor**

2. Relevance of changed object

- **Relevant - potentially relevant - irrelevant**

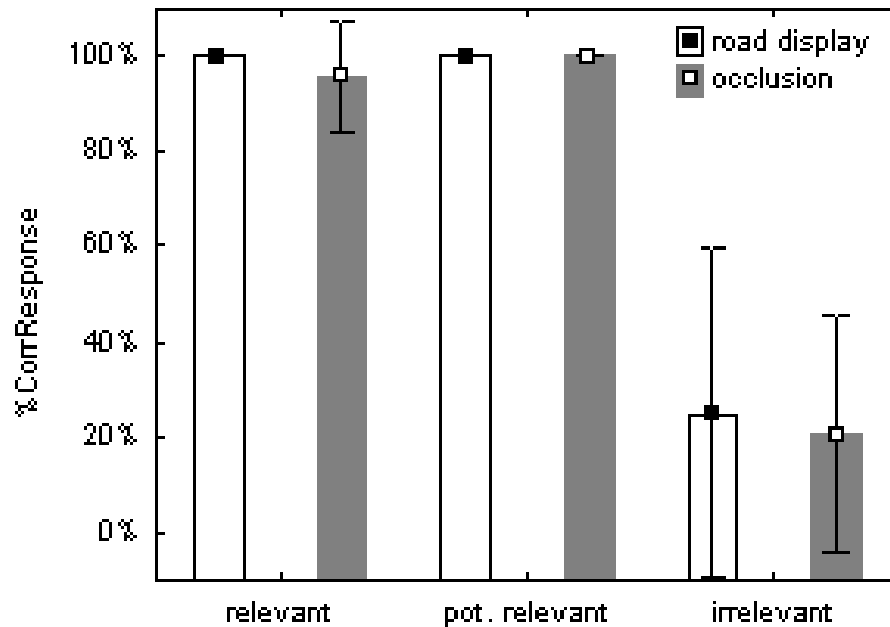
3. Type of change

- **Disappearance or jump of vehicle**

4. Duration of road display

- **Duration of occlusion 1000ms**
- **Duration of road display 150, 250 or 350ms**

Influence of relevance & masking



- **Factor relevance:**
 - **Changes of relevant / potentially relevant objects detected with nearly 100%**
 - **Changes of irrelevant objects detected in about 20%**
- **Factor masking of change:**
 - **No influence**

Evidence for top-down control of attention:

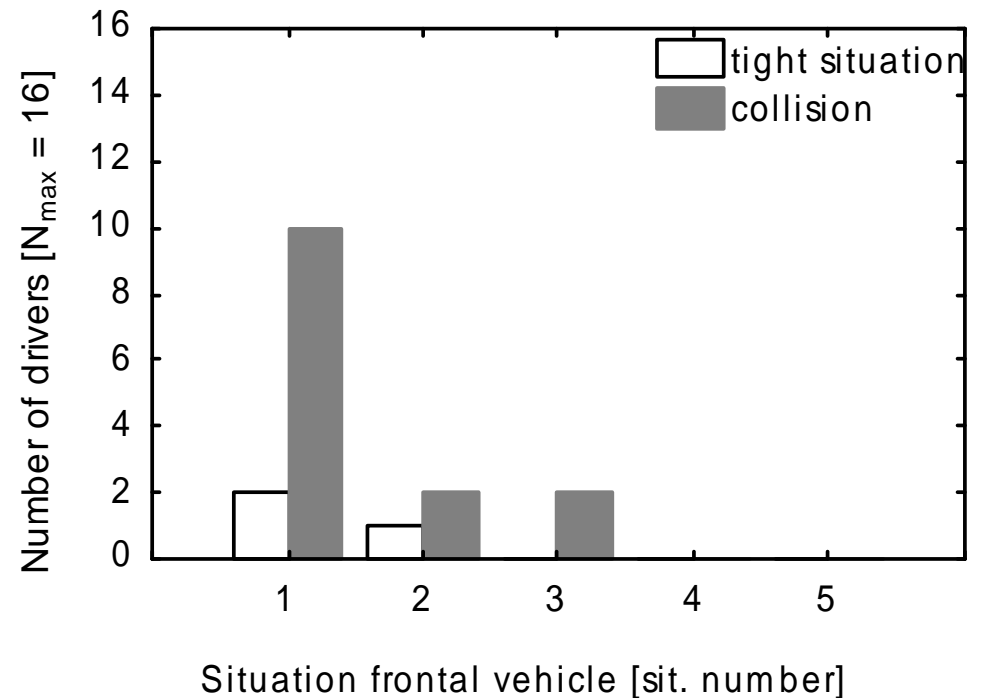
- Drivers focus on driving relevant objects.
- Changes to relevant objects are detected better.

No evidence for bottom-up controlled attention:

- Unmasked changes are not detected better than masked changes.

Situation “frontal vehicle”

- Situation “frontal vehicle”:
 - Oncoming vehicle changes lane
 - Approaches driver on his / her own lane
 - Driver needs to change lanes to avoid collision
 - N = 5 crossings
- Results:
 - First time, drivers see approaching vehicle too late, react not appropriately
 - After that, situation can be handled safely by most drivers



Attention is top-down focused on parts of the scenery that are relevant for driving.

This is done based on the situational model of the driver.

Advantage:

In general, situational model is good enough to ensure that attention is focused on relevant objects.

Efficient strategy to use attentional resources.

Disadvantage:

Unexpected situational development is difficult to perceive

Danger of looked-but-failed-to-see error

e.g. situation "frontal vehicle"

Thank you for your attention!

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Manipulation check - I

