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Drivers' expectations and the influence on gaze and driving behavior

Julia Werneke, Mark Vollrath

Driver Distraction and Inattention, Gothenburg, 9/21/2011

Background

ANALYSIS OF INTERSECTION ACCIDENTS



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Causes of car accidents

Data-
bases

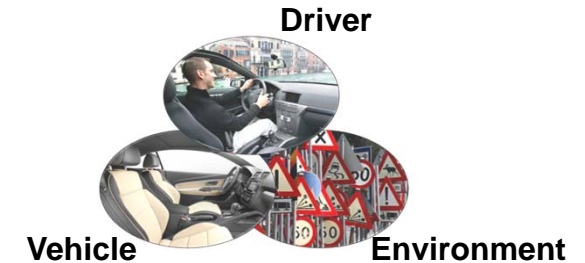
In-depth analyses

Human Error

- 95% of accidents

Perceptual Error

- At intersections: above 90% of accidents
- Post-hoc analysis (e.g. police officer reports)



**Looked-but-
failed-to-see**



**Failure of
optimal scanning**



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Causes of car accidents

Data-
bases

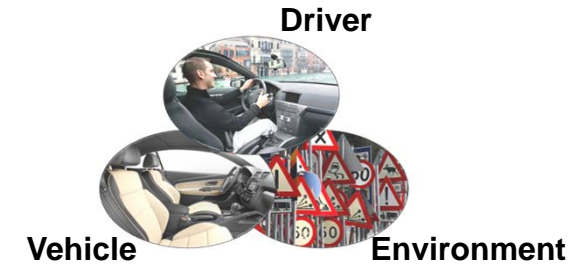
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Causes of car accidents

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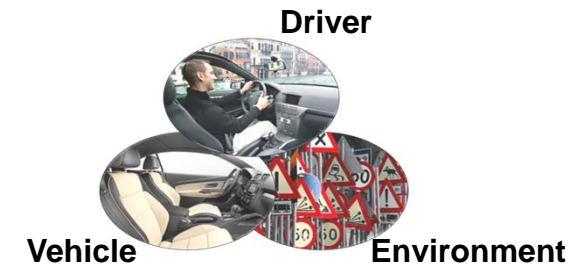
In-depth analyses

Perceptual Error

- At intersections: above 90% of accidents
- Post-hoc analysis (e.g. police officer reports)

Simu-
lator

Simulator studies are needed to establish causal relationships



Failure of
optimal scanning



Intersection
scenario



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Causes of car accidents

Data-
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In-depth analyses

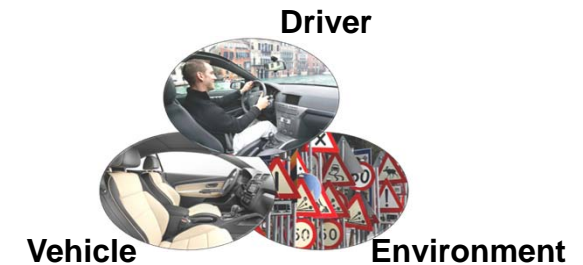
Simu-
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Failure of
optimal scanning

In which situations?



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Intersection situation

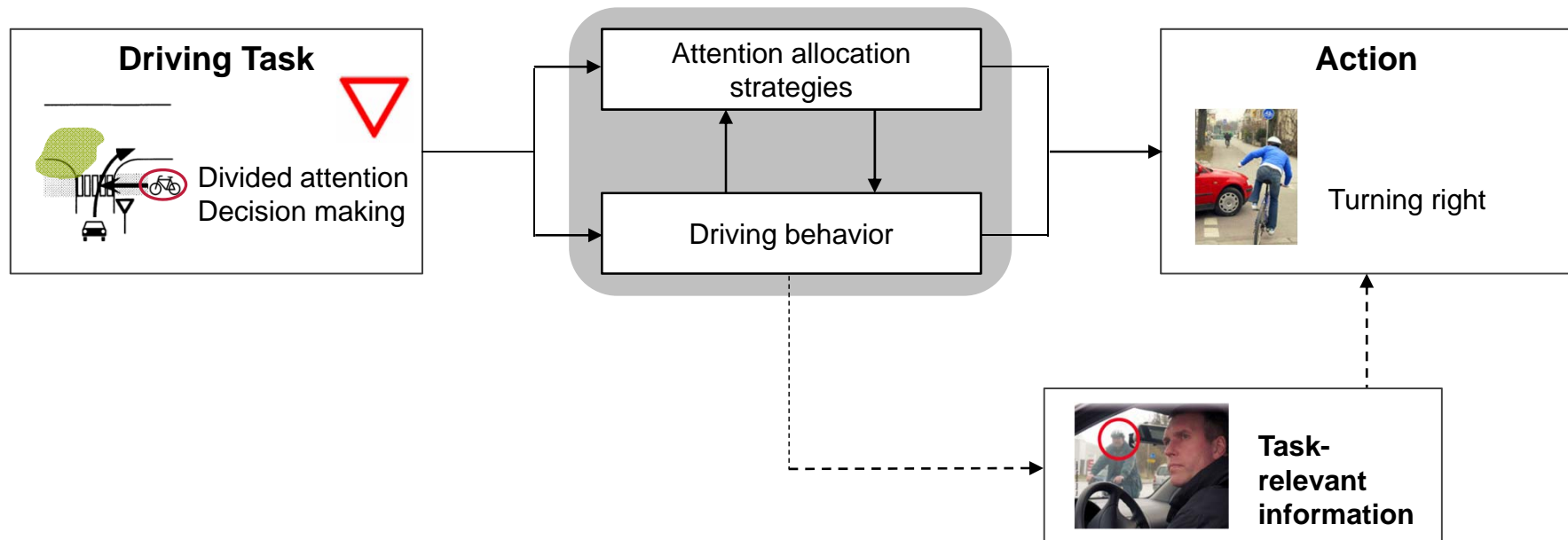
In-depth analyses

Turning right at T-intersections

- Analyses of bicycle-car accidents (e.g. Räsänen & Summala, 1998)



Failure of optimal scanning



Intersection situation

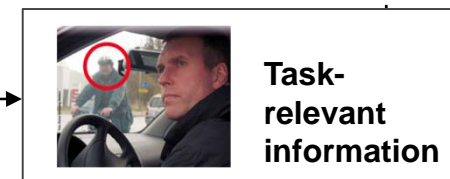
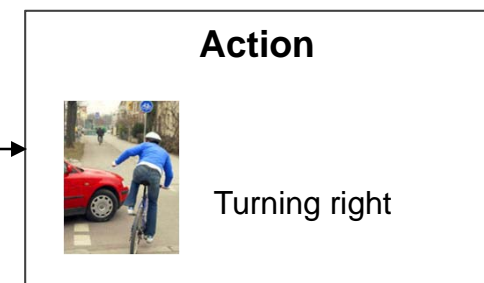
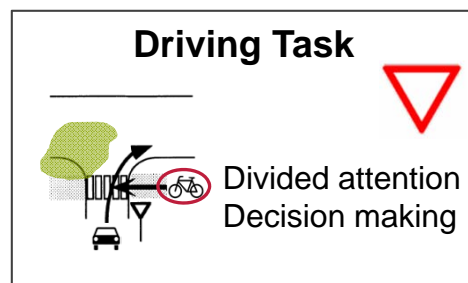
In-depth analyses

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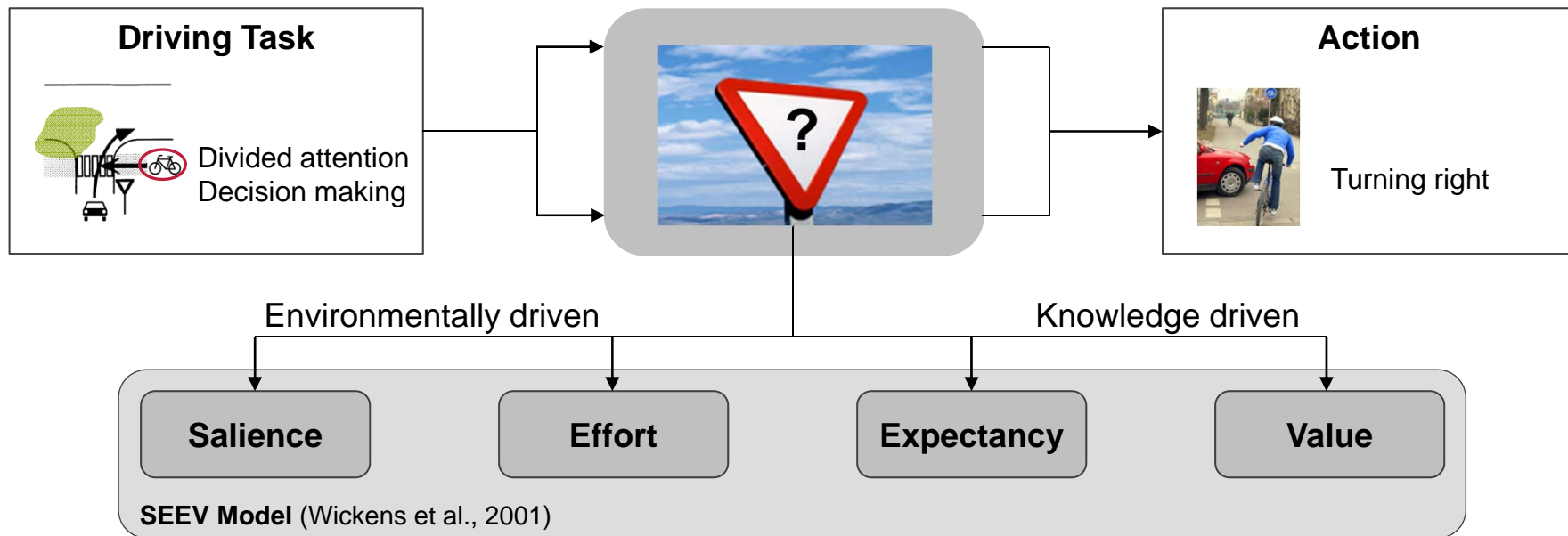
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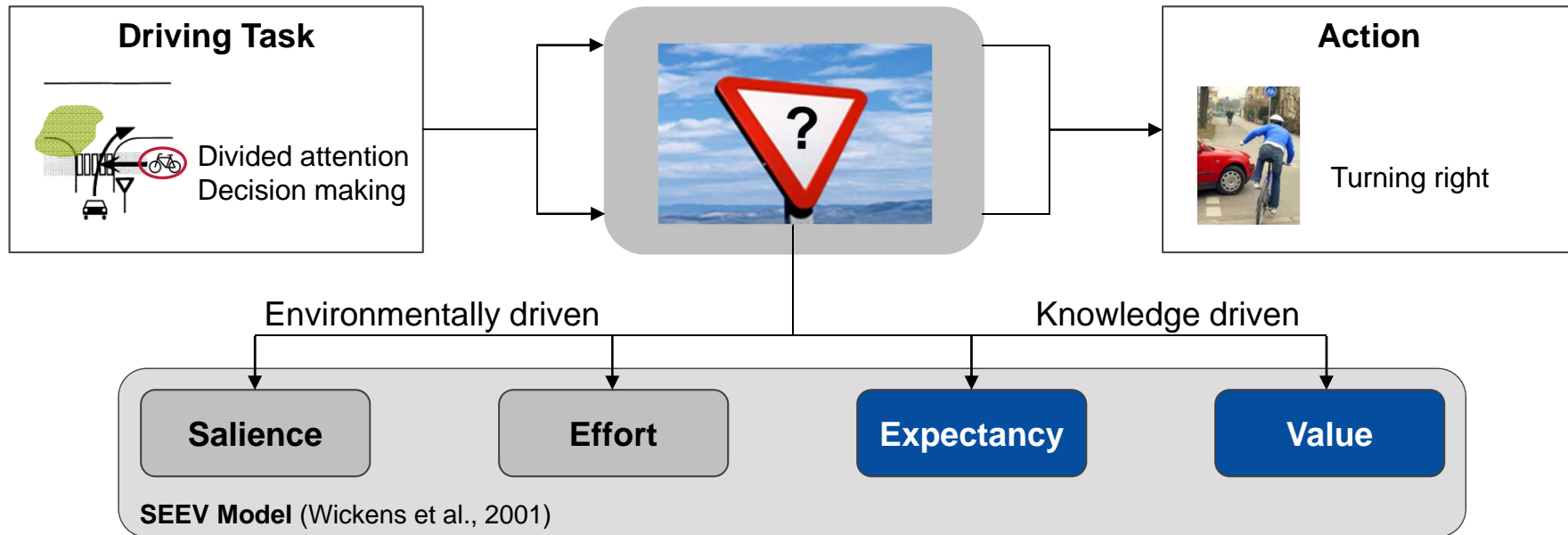
Failure of optimal scanning



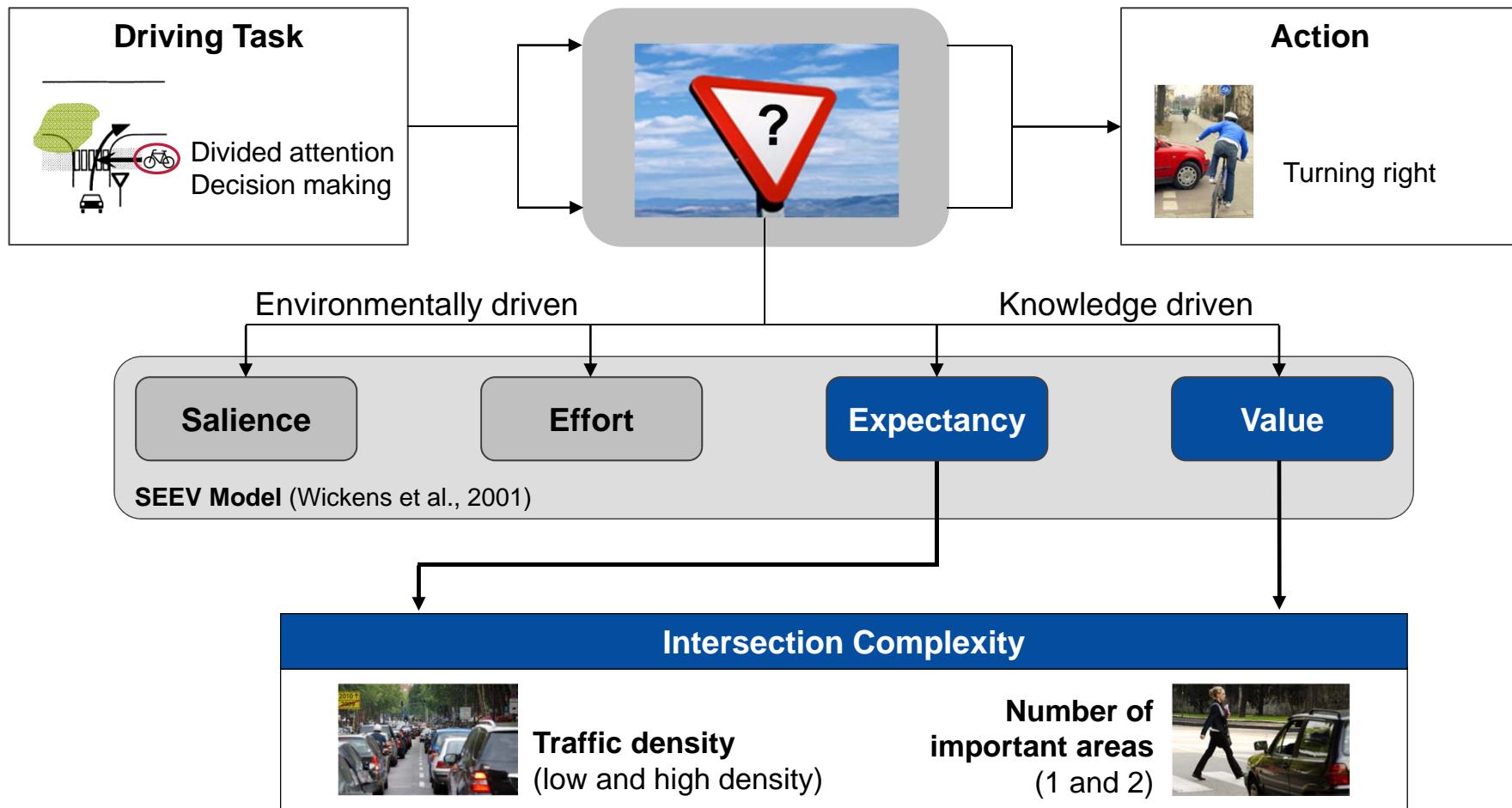
Attention allocation at intersections



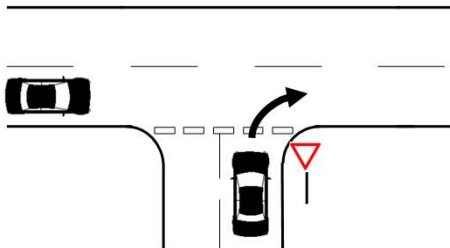
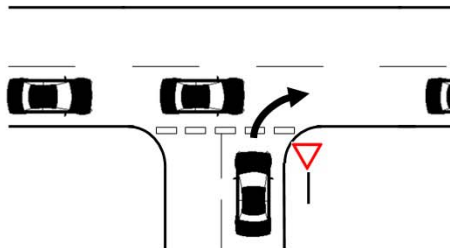
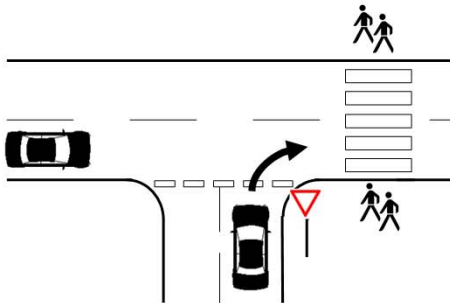
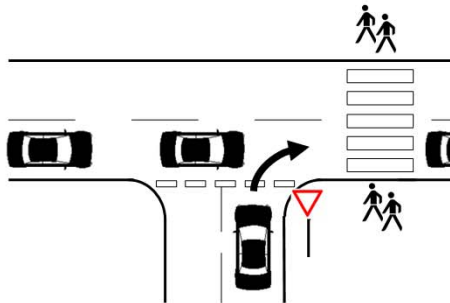
Attention allocation at intersections



Attention allocation at intersections



Intersection types

		Expectancy	
		Traffic Density	
		Low (1/110 m)	High (1/70 m)
Value	Number of Important Areas		
	1 IA		
	2 IAs		

Method

ATTENTION ALLOCATION



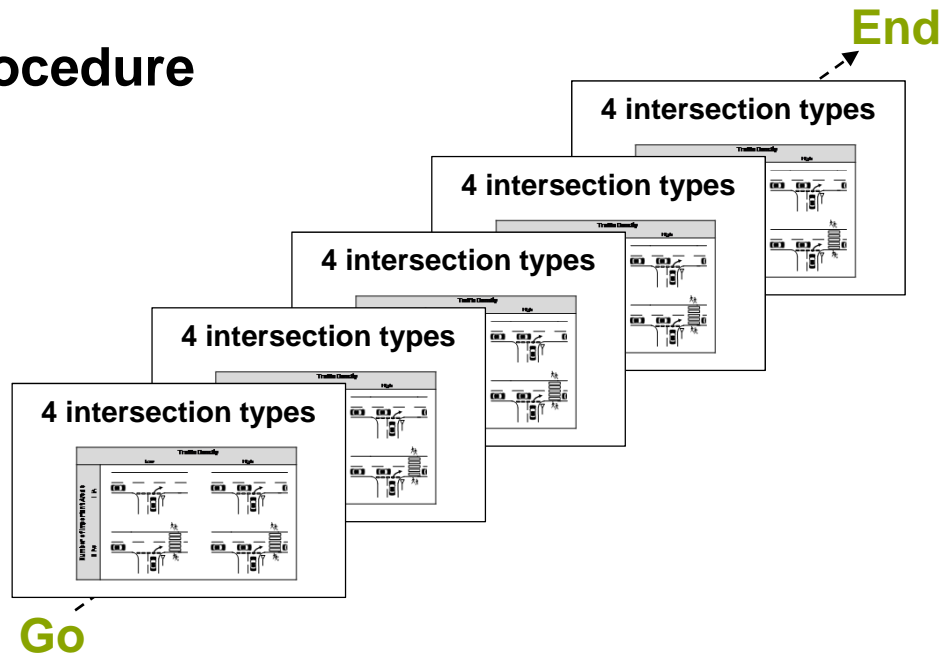
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Method

Procedure



Urban road



Rural road

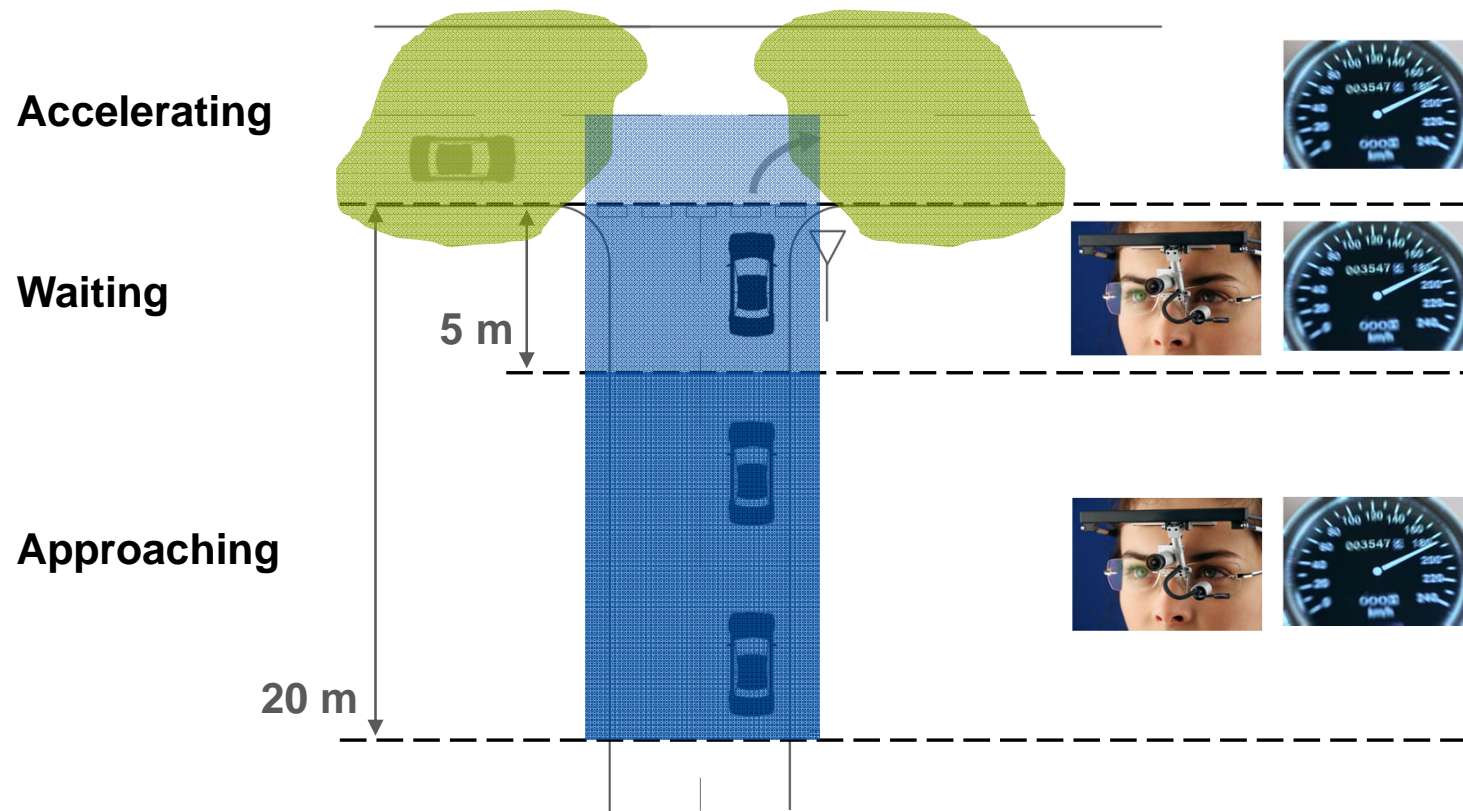
Participants

- N = 40 (14 women)
- Age: M = 31.0 years (SD = 11.9 years)
- Possession of driving license: M = 12.3 years (SD = 11.4 years)

Data

- Gaze behavior recorded with Dikablis (Lange, 2005)
- Driving behavior

Analysis



Results

WHAT DID THEY LOOK AT?



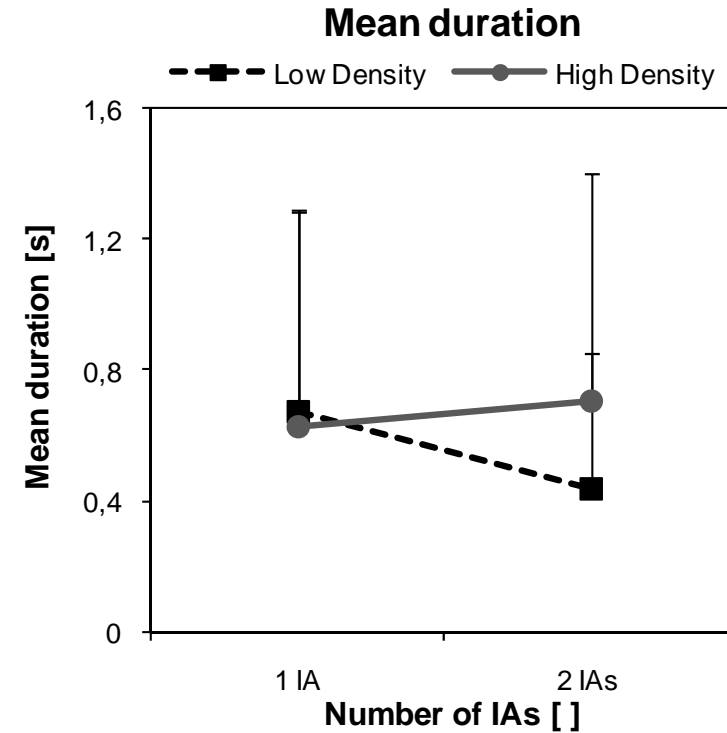
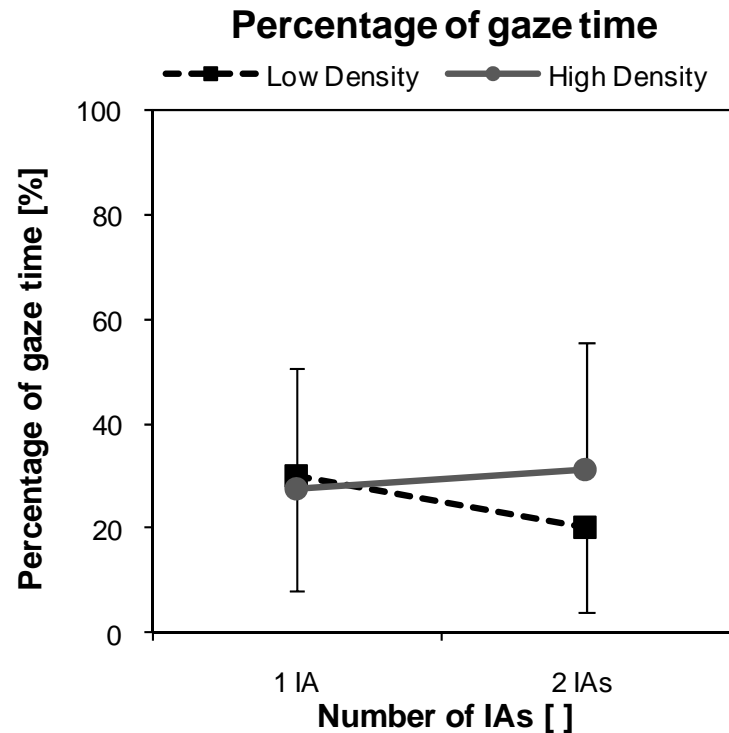
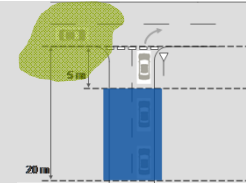
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Gazes to the left-hand side

Approaching

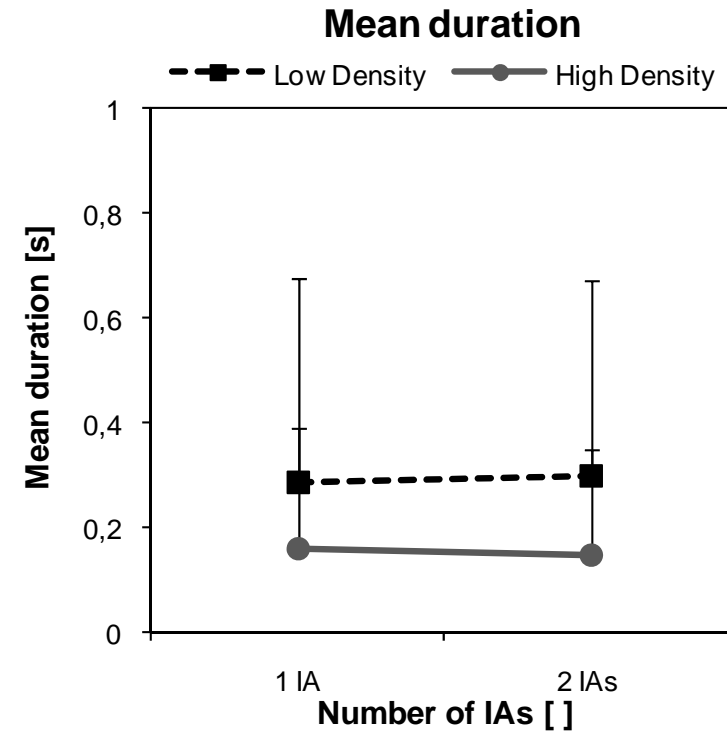
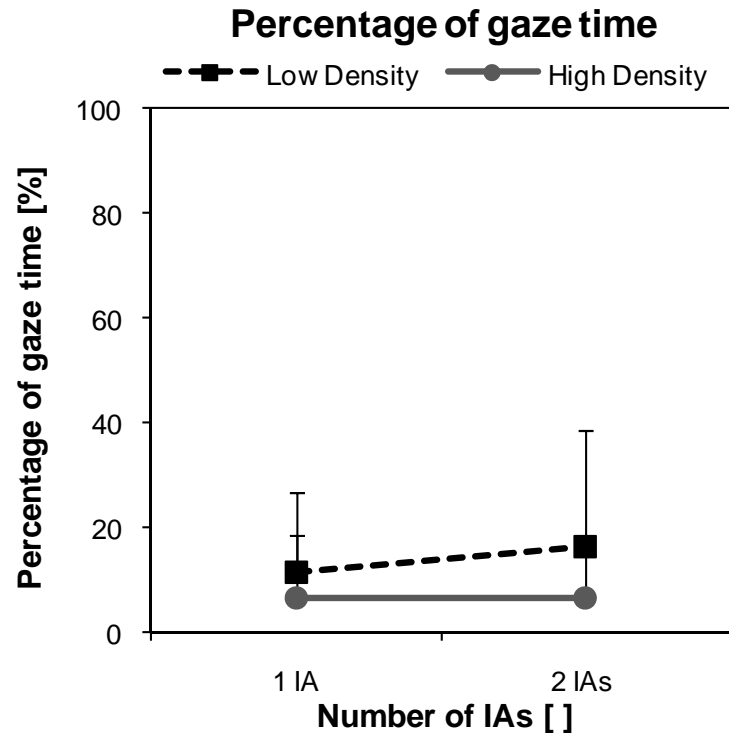
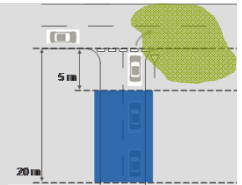


Traffic Density: $F(1, 39) = 2.5, p = .122$
 Number of IAs: $F(1, 39) = 1.4, p = .247$
Density x Number of IAs: $F(1, 39) = 5.0, p = .030$

Traffic Density: $F(1, 39) = 2.1, p = .152$
 Number of IAs: $F(1, 39) = 1.1, p = .300$
 Density x Number of IAs: $F(1, 39) = 2.5, p = .119$

Gazes to the right-hand side

Approaching

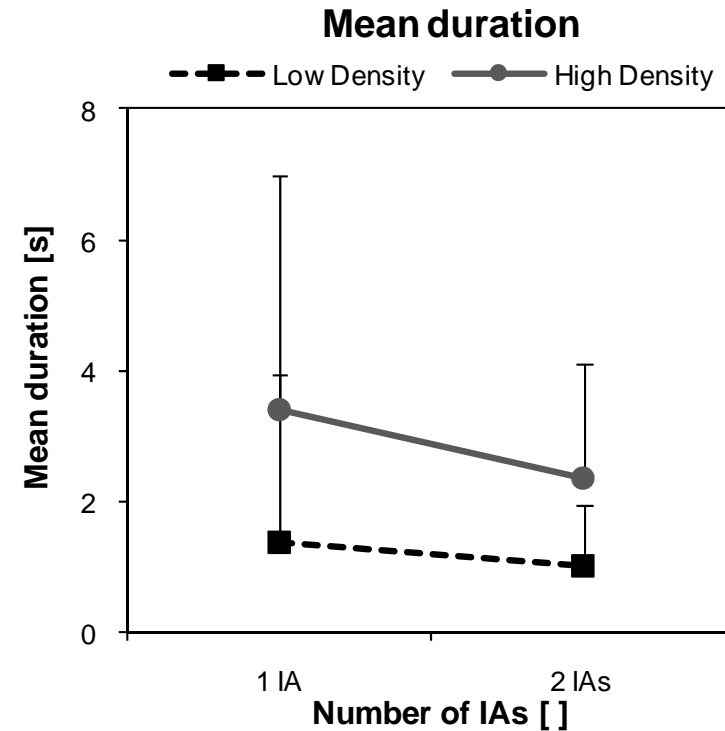
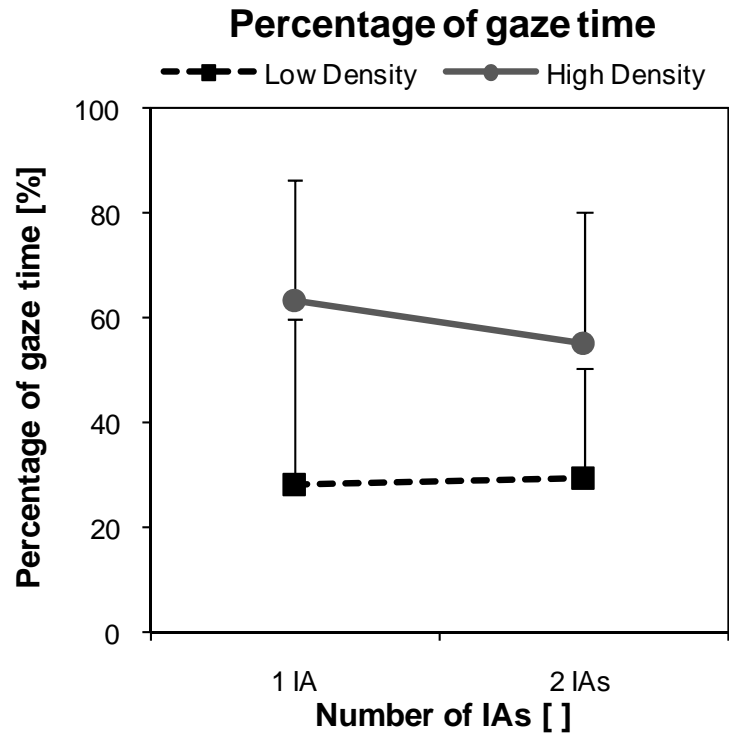
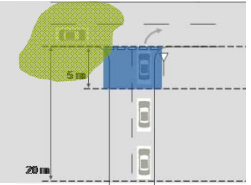


Traffic Density: $F(1, 39) = 9.9, p = .003$
 Number of IAs: $F(1, 39) = 1.4, p = .244$
 Density x Number of IAs: $F(1, 39) = 2.1, p = .157$

Traffic Density: $F(1, 39) = 7.1, p = .011$
 Number of IAs: $F(1, 39) = 0.1, p = .995$
 Density x Number of IAs: $F(1, 39) = 0.2, p = .698$

Gazes to the left-hand side

Waiting

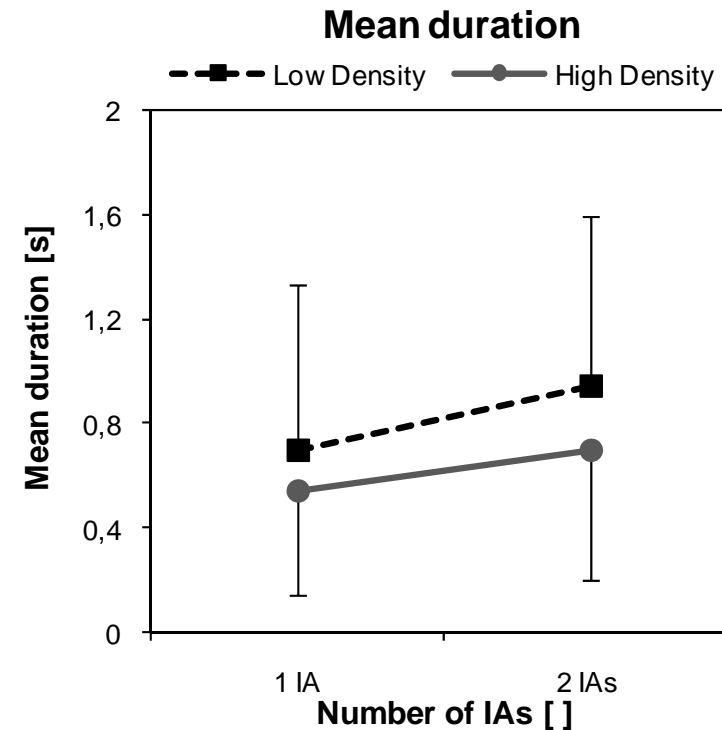
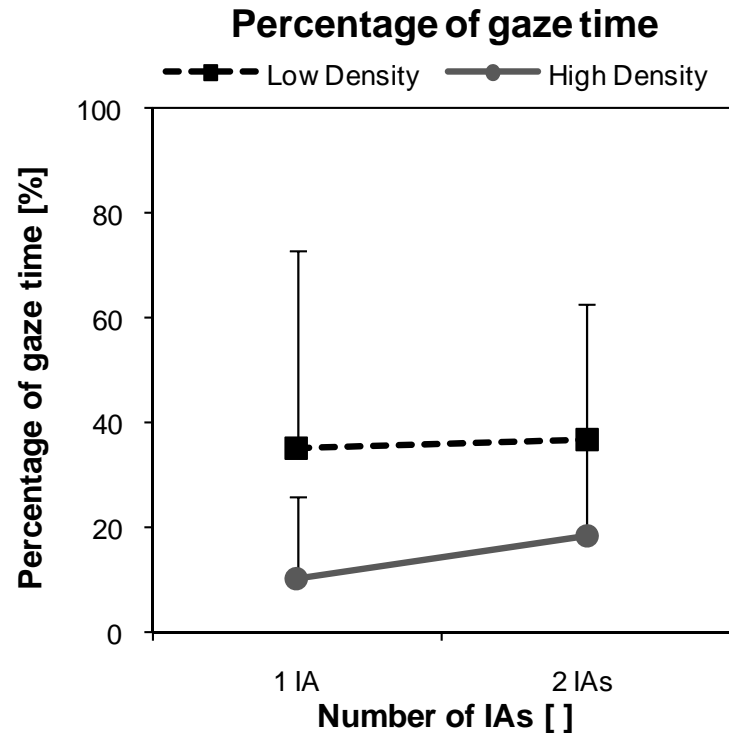
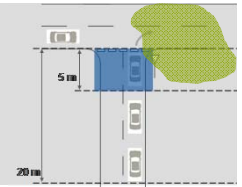


Traffic Density: $F(1, 39) = 63.4, p < .001$
 Number of IAs: $F(1, 39) = 0.9, p = .339$
 Density x Number of IAs: $F(1, 39) = 1.6, p = .215$

Traffic Density: $F(1, 39) = 20.3, p < .001$
 Number of IAs: $F(1, 39) = 4.3, p = .046$
 Density x Number of IAs: $F(1, 39) = 0.8, p = .385$

Gazes to the right-hand side

Waiting



Traffic Density: $F(1, 39) = 38.9, p < .001$
 Number of IAs: $F(1, 39) = 2.0, p = .170$
 Density x Number of IAs: $F(1, 39) = 0.9, p = .349$

Traffic Density: $F(1, 39) = 8.4, p = .006$
 Number of IAs: $F(1, 39) = 6.4, p = .015$
 Density x Number of IAs: $F(1, 39) = 0.3, p = .575$



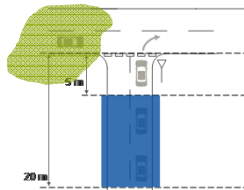
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To sum up ...

Gazes to the left

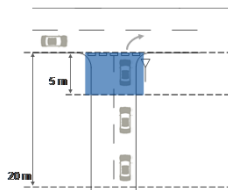
Gazes to the right

Approaching



- Less gazes to the left at intersections with **low traffic density** and **2 IAs**

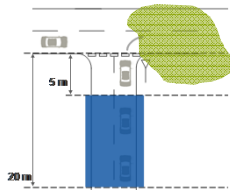
Waiting



To sum up ...

Gazes to the left

Approaching

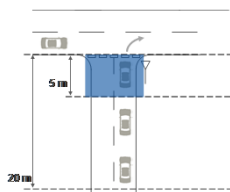


- Less gazes to the left at intersections with **low traffic density** and **2 IAs**

Gazes to the right

- More & longer gazes to the right at intersections with **low traffic density**
- Number of IAs is barely important!

Waiting

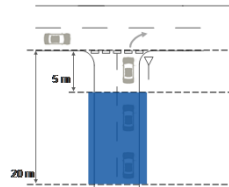


To sum up ...

Gazes to the left

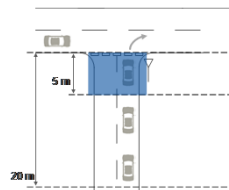
Gazes to the right

Approaching



Traffic density

Waiting

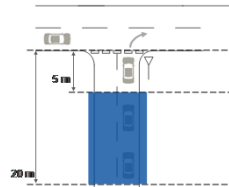


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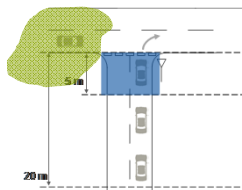
Gazes to the right

Approaching



Traffic density

Waiting



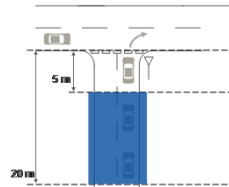
- More & longer gazes to the left at intersections with **high traffic density**
- Shorter gazes to the left at intersections with **2 IAs**

To sum up ...

Gazes to the left

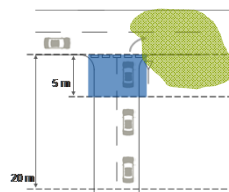
Gazes to the right

Approaching



Traffic density

Waiting



- More & longer gazes to the left at intersections with **high traffic density**
- Shorter gazes to the left at intersections with **2 IAs**

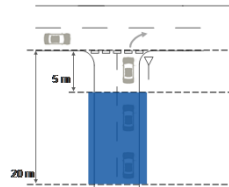
- More & longer gazes to the right at intersections with **low traffic density**
- Longer gazes to the right at intersections with **2 IAs**

To sum up ...

Gazes to the left

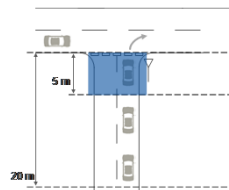
Gazes to the right

Approaching



Traffic density

Waiting

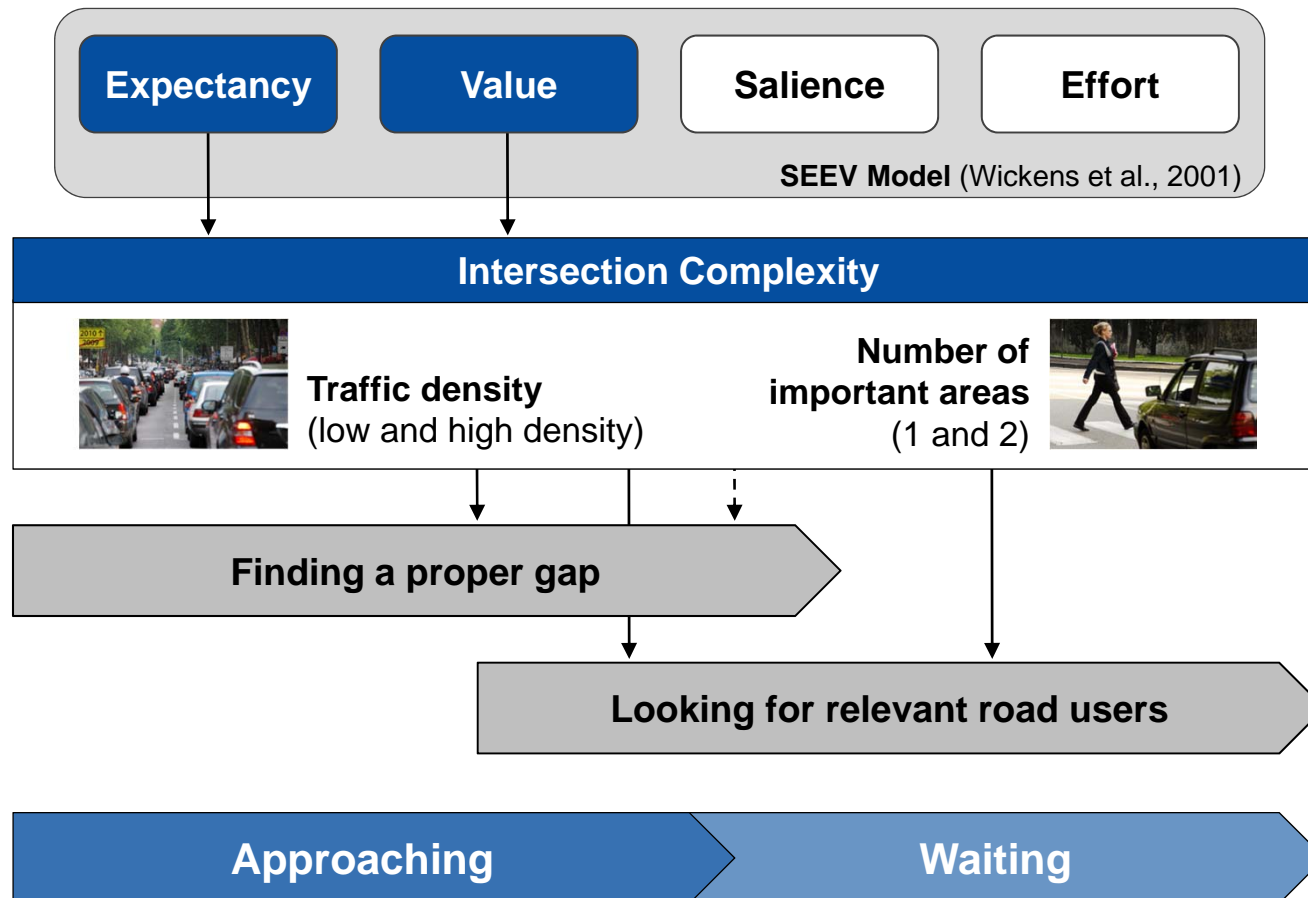


Traffic density

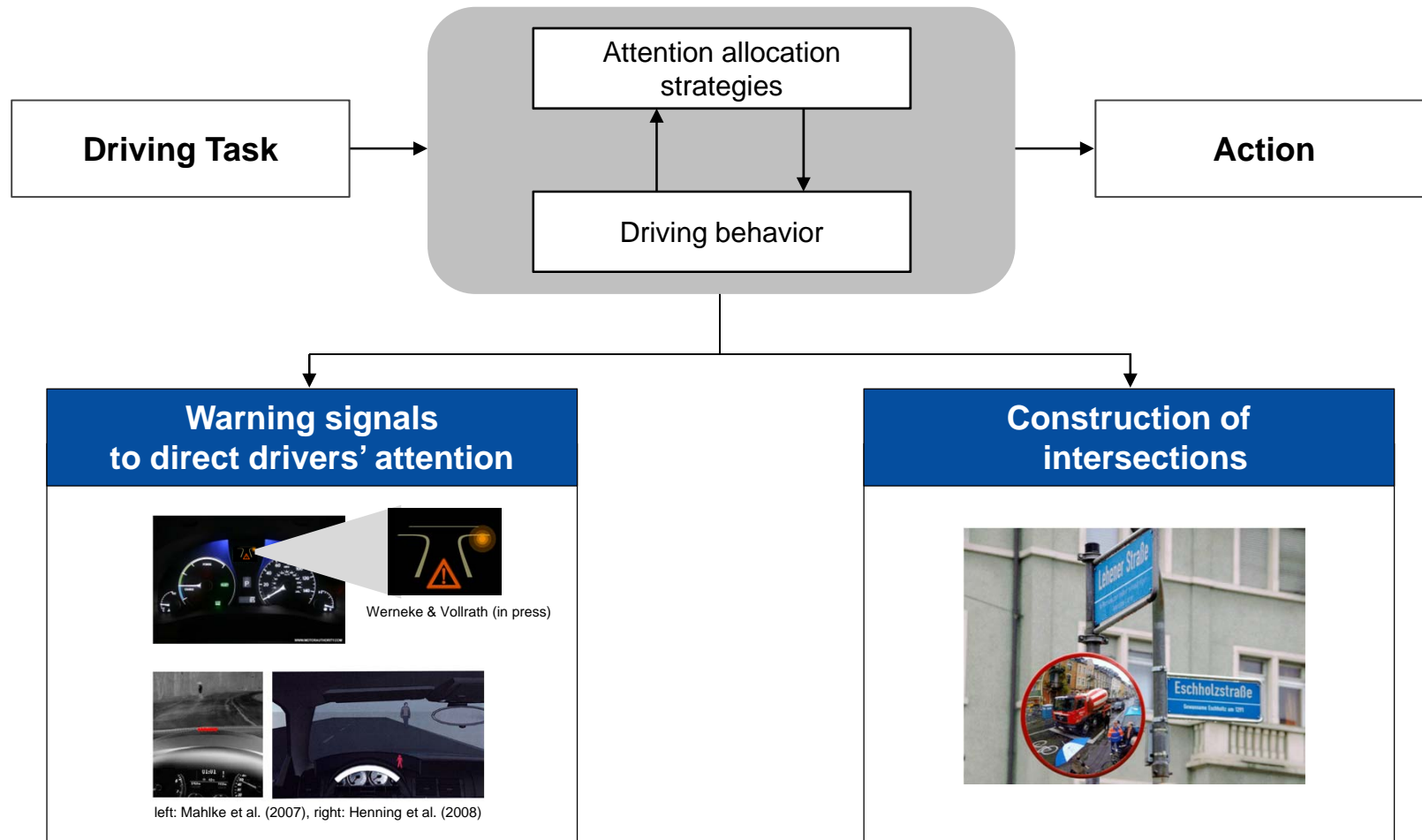


Number of important areas

To conclude ...



Practical use





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Thank you for your attention

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