Theater-system Technique and Model-based Attention Prediction for the Early Automotive HMI Design Evaluation

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Overview

- Theater system technique
- Model-based attention prediction
- Case study system: Traffic light assistance
- Results of system analysis

Theater-system technique

Model-based attention prediction

Simulated SEEV model

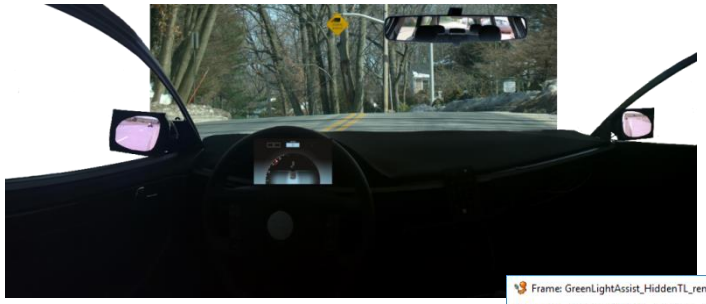
- SEEV model (Wickens et al., 2001)

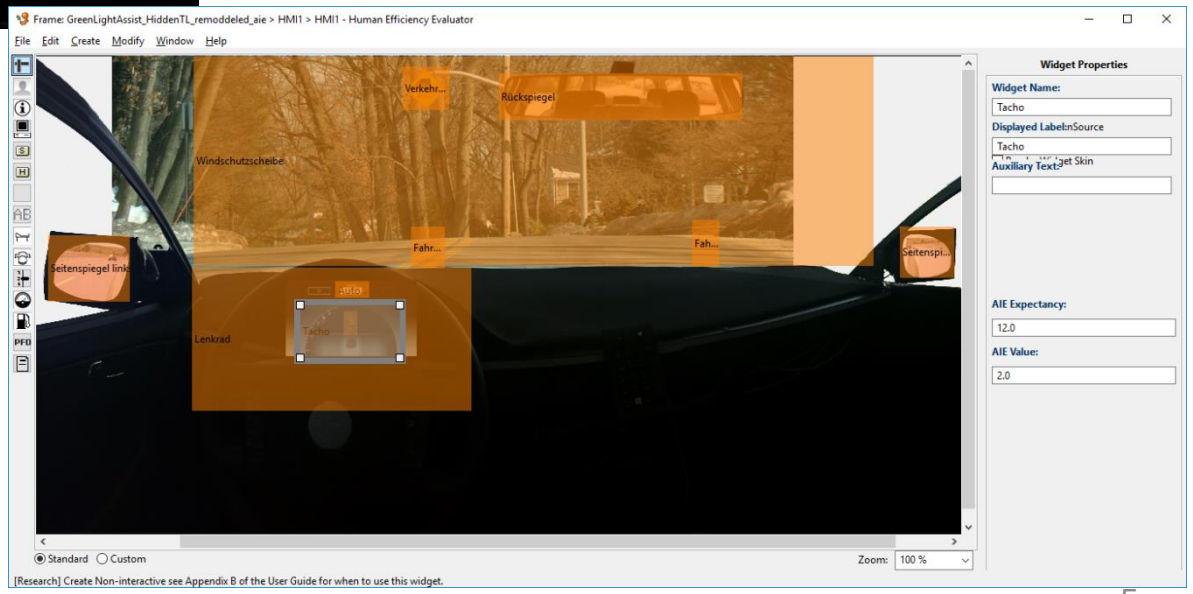
Attention = Saliency - Effort + **Expectancy · Value**

Model-based attention prediction

Simplifying model generation with the Human Efficiency Evaluator (HEE)

Identifying information sources

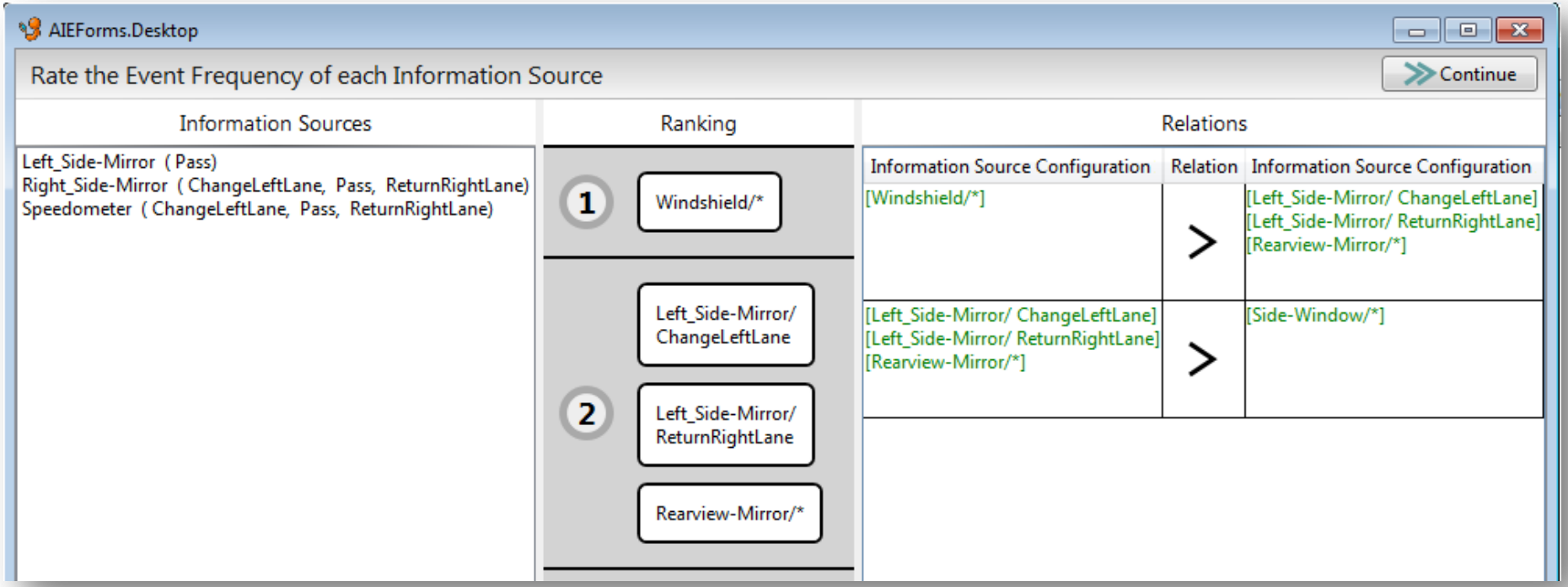




Model-based attention prediction

Simplifying model generation with the Human Efficiency Evaluator (HEE)

Identifying Expectancy coefficients

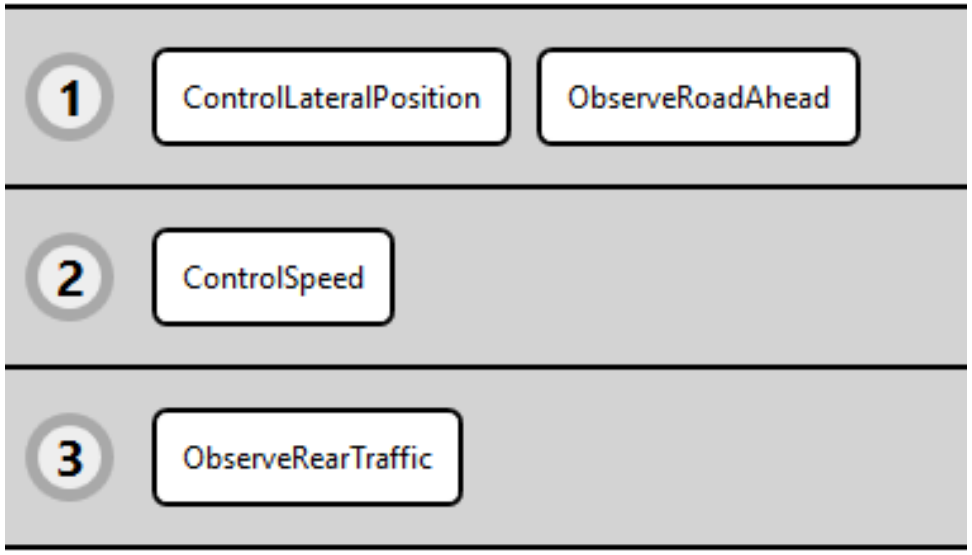


Model-based attention prediction

Simplifying model generation with the Human Efficiency Evaluator (HEE)

Identifying task importance

Value of information source i: $\sum_{tasks}$ relevance of i for task $\cdot$ importance of task



Model-based attention prediction

Simplifying model generation with the Human Efficiency Evaluator (HEE)

Identifying relevance of each information source for each task

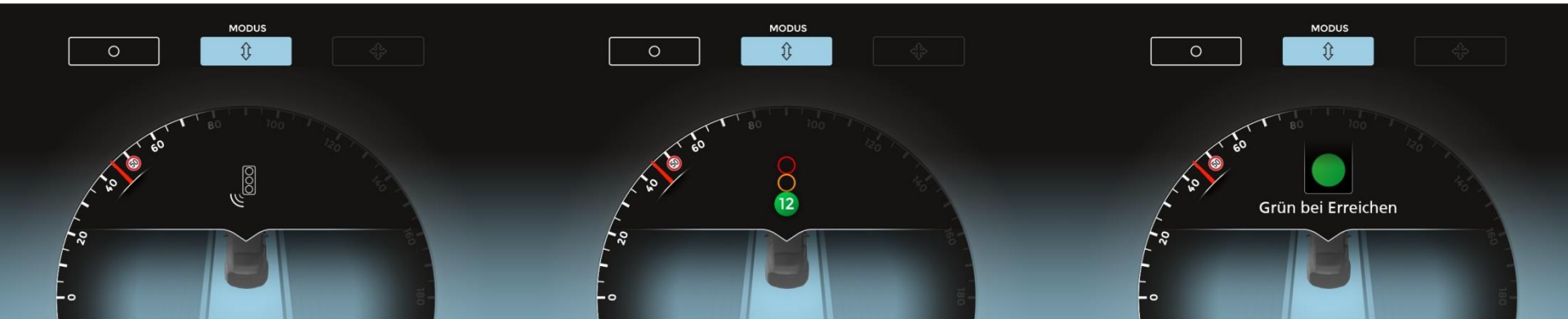
AIEForms.Desktop

Bestimmung des Werts der Informationsquellen in Bezug zu den Aufgaben

Information Source		Task: ObserveRoadAhead (3)			Task: ControlSpeed (2)			T
- Text_Ampel_bei_Erreichen		Necessary	Helpful	Not Relevant	Necessary	Helpful	Not Relevant	Neces
HMI3	(2.5)	Necessary	**Helpful**	Not Relevant	Necessary	**Helpful**	Not Relevant	Neces
- Verkehrszeichen		Necessary	Helpful	Not Relevant	Necessary	Helpful	Not Relevant	Neces
HMI1	(1.5)	Necessary	**Helpful**	Not Relevant	Necessary	Helpful	**Not Relevant**	Neces
HMI2	(3.5)	Necessary	**Helpful**	Not Relevant	**Necessary**	Helpful	Not Relevant	Neces
HMI3	(2.5)	Necessary	**Helpful**	Not Relevant	Necessary	**Helpful**	Not Relevant	Neces
+ Windschutzscheibe		Necessary	Helpful	Not Relevant	Necessary	Helpful	Not Relevant	Neces

Case Study

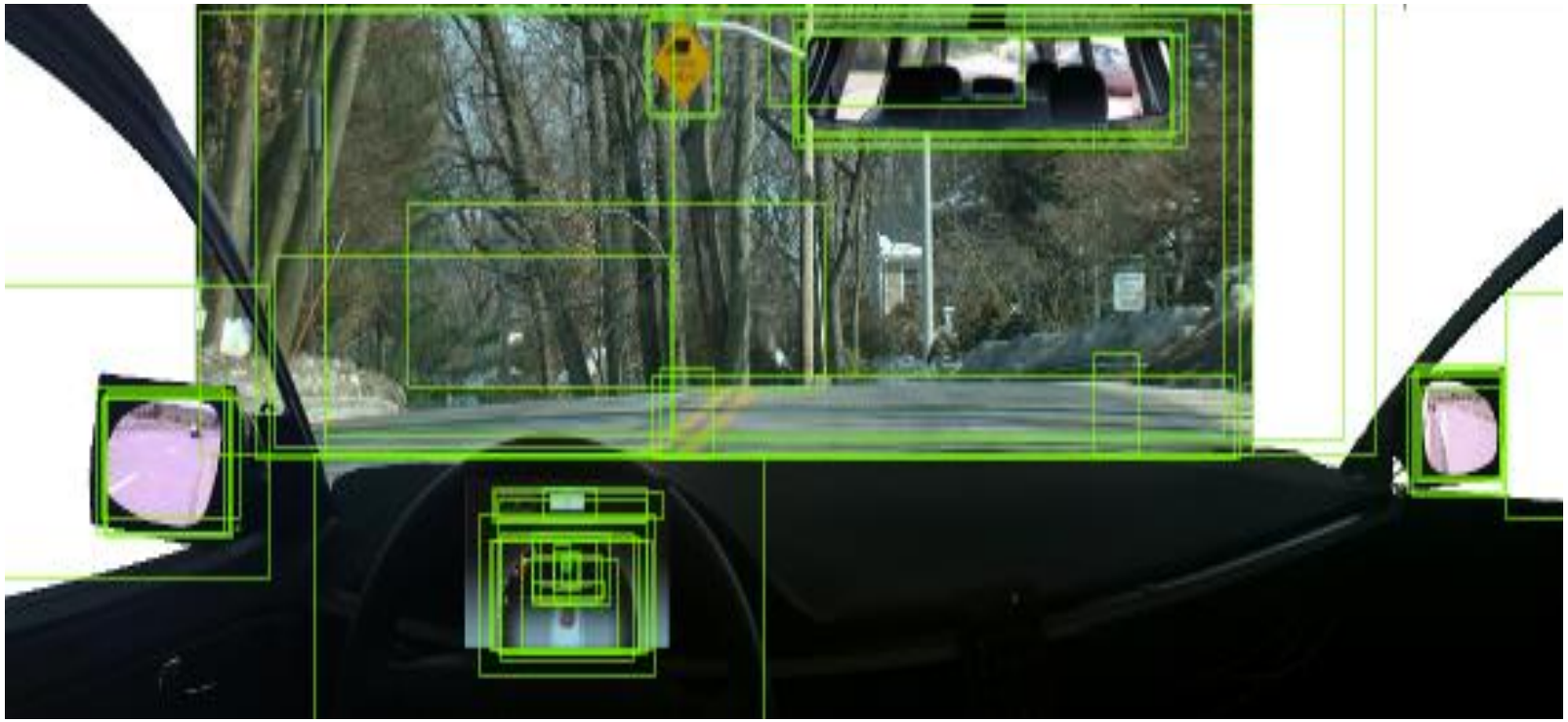
- 3 HMI designs
- Longitudinal control automation
- Green traffic light assistance



Case Study

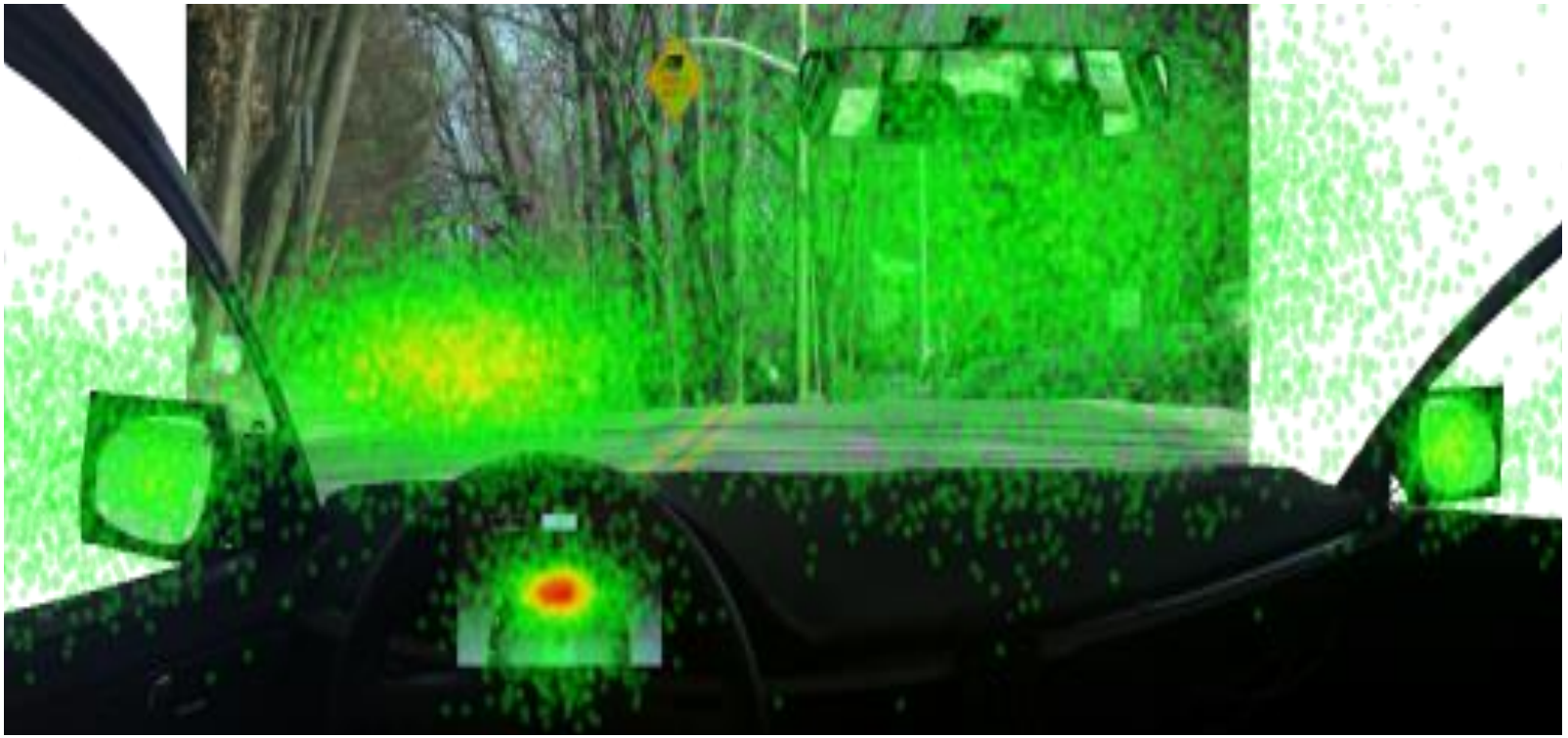
Results

Information sources

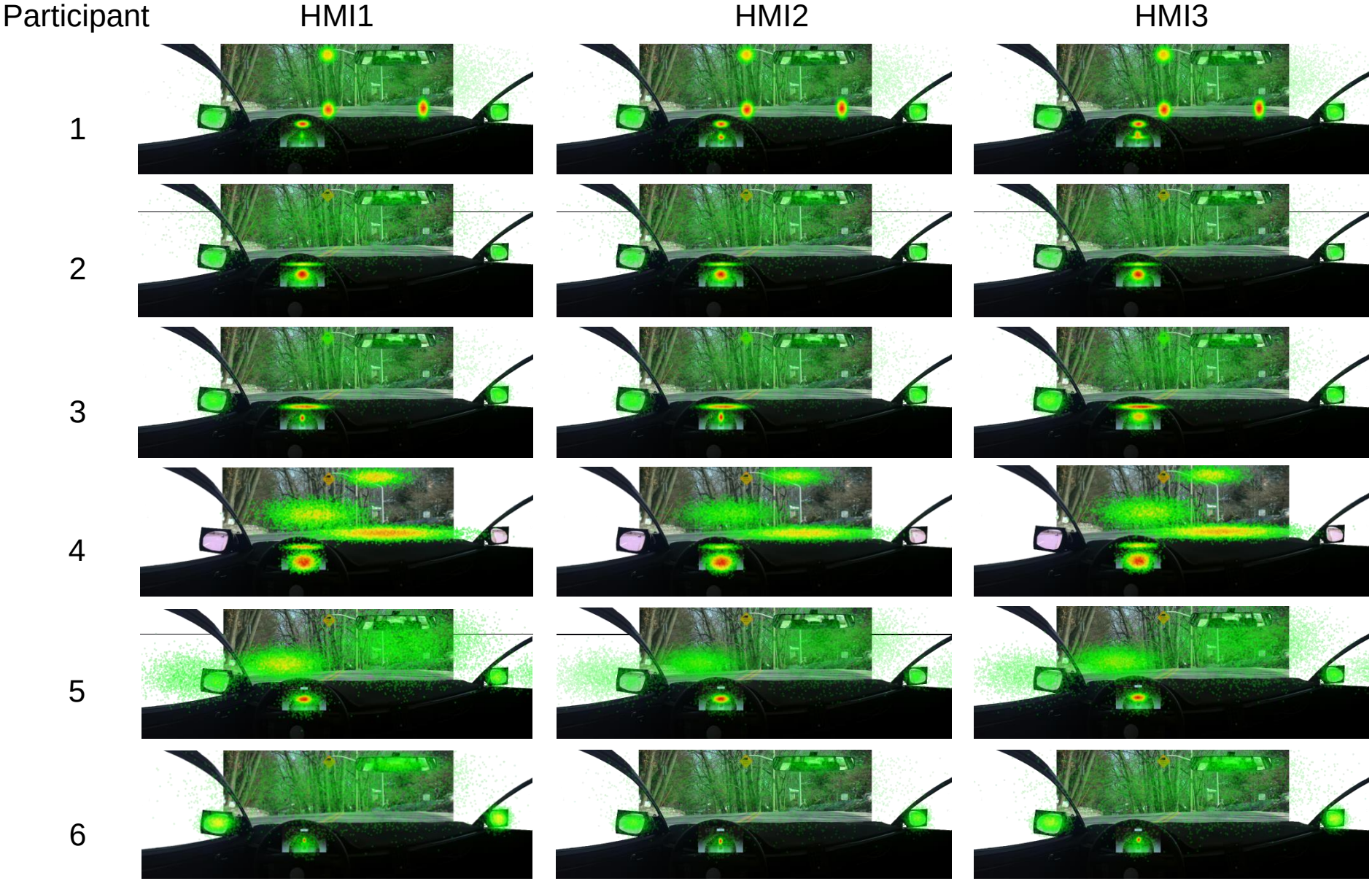


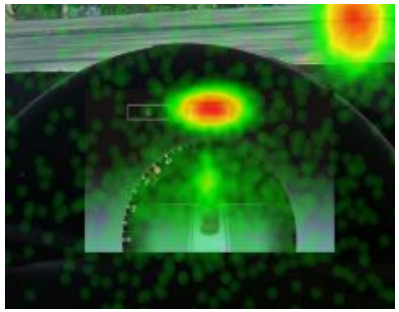
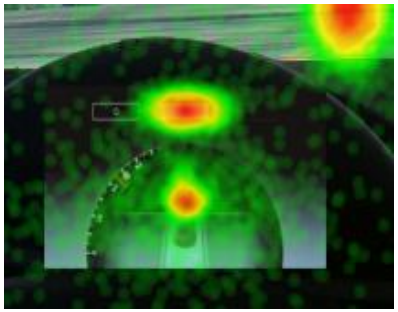
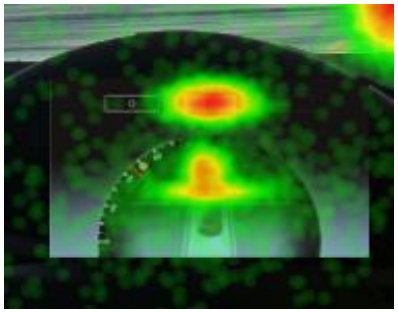
Results

Predicted attention distribution



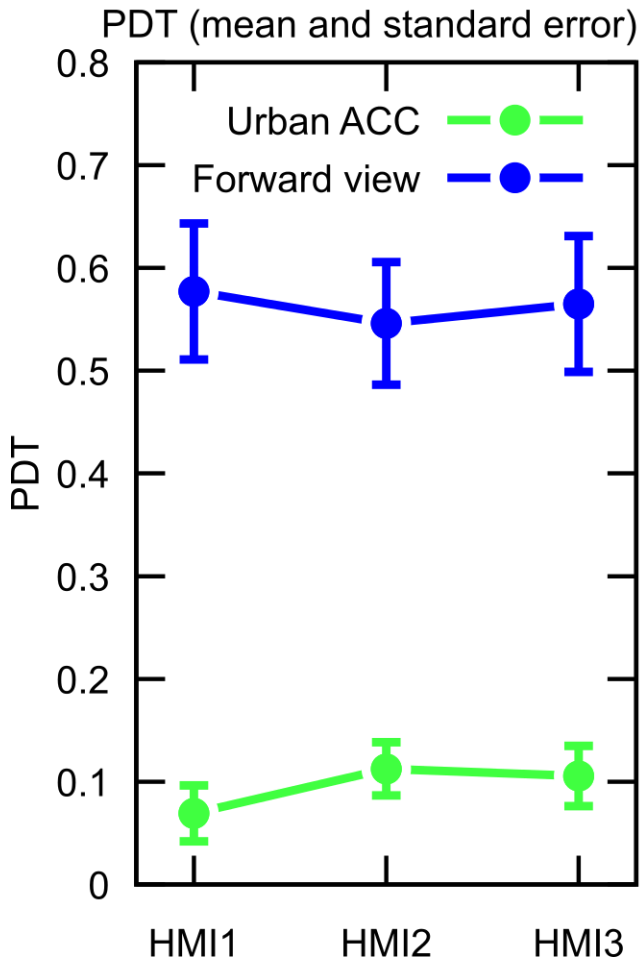
(HMI 1, participant 5)

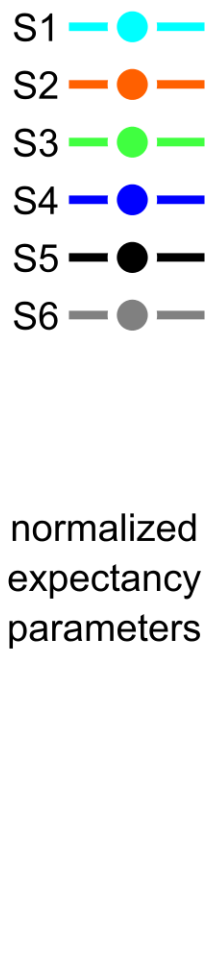

Participant
HMI1
HMI2
HMI3
1
2
3
4
5
6

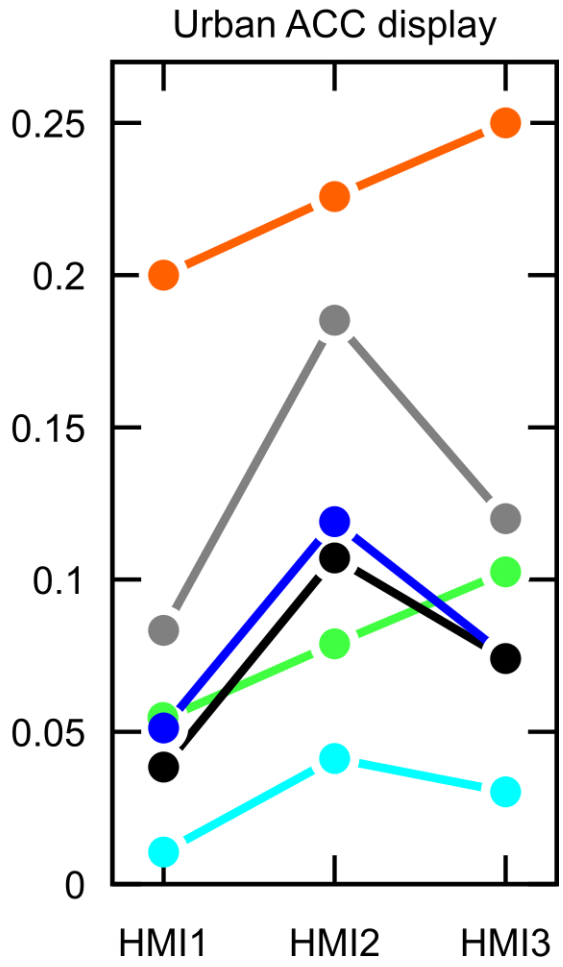
Participant	HMI1	HMI2	HMI3
			

Results

Predicted attention distribution



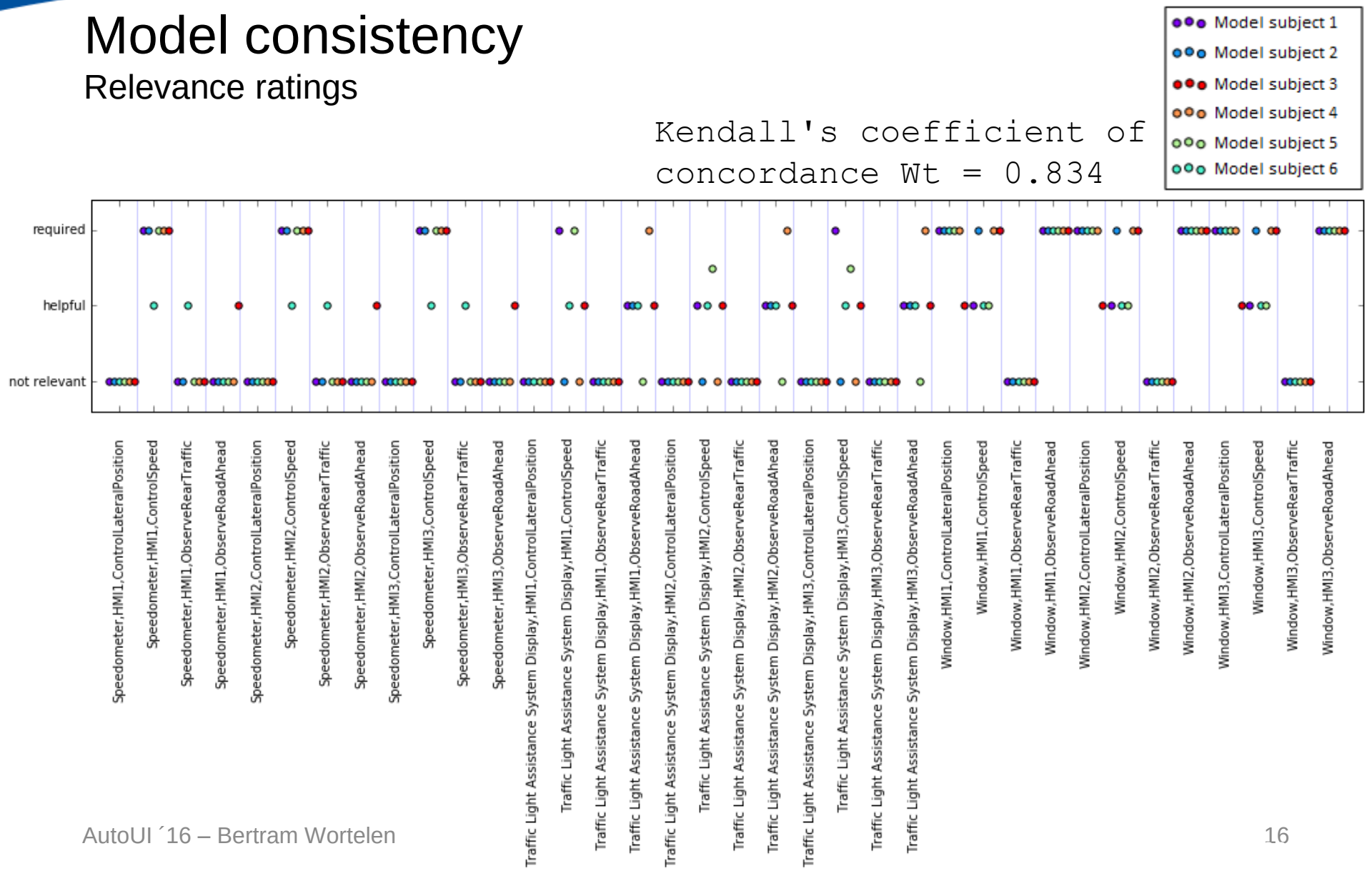




Model consistency

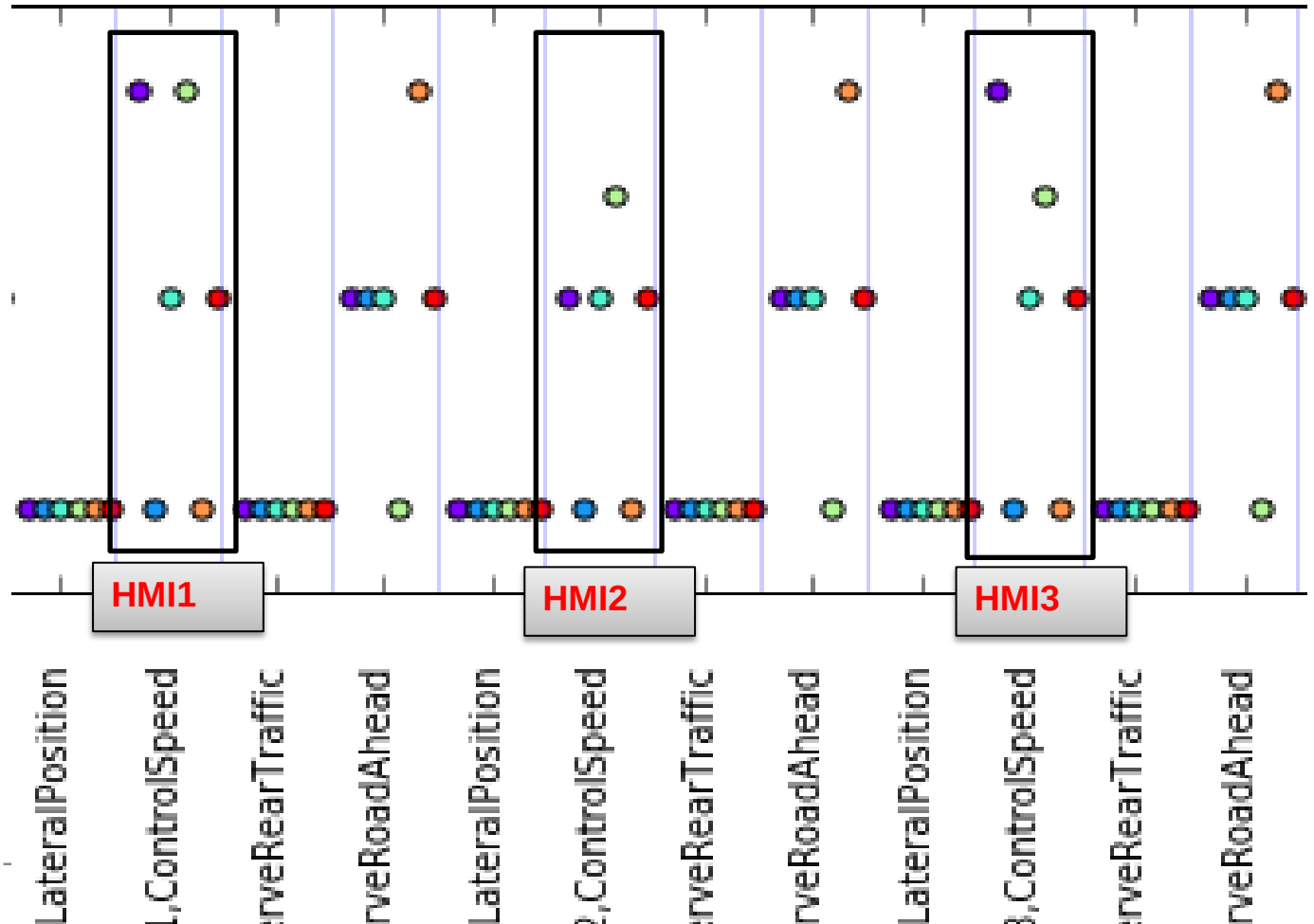
Relevance ratings

Kendall's coefficient of concordance Wt = 0.834



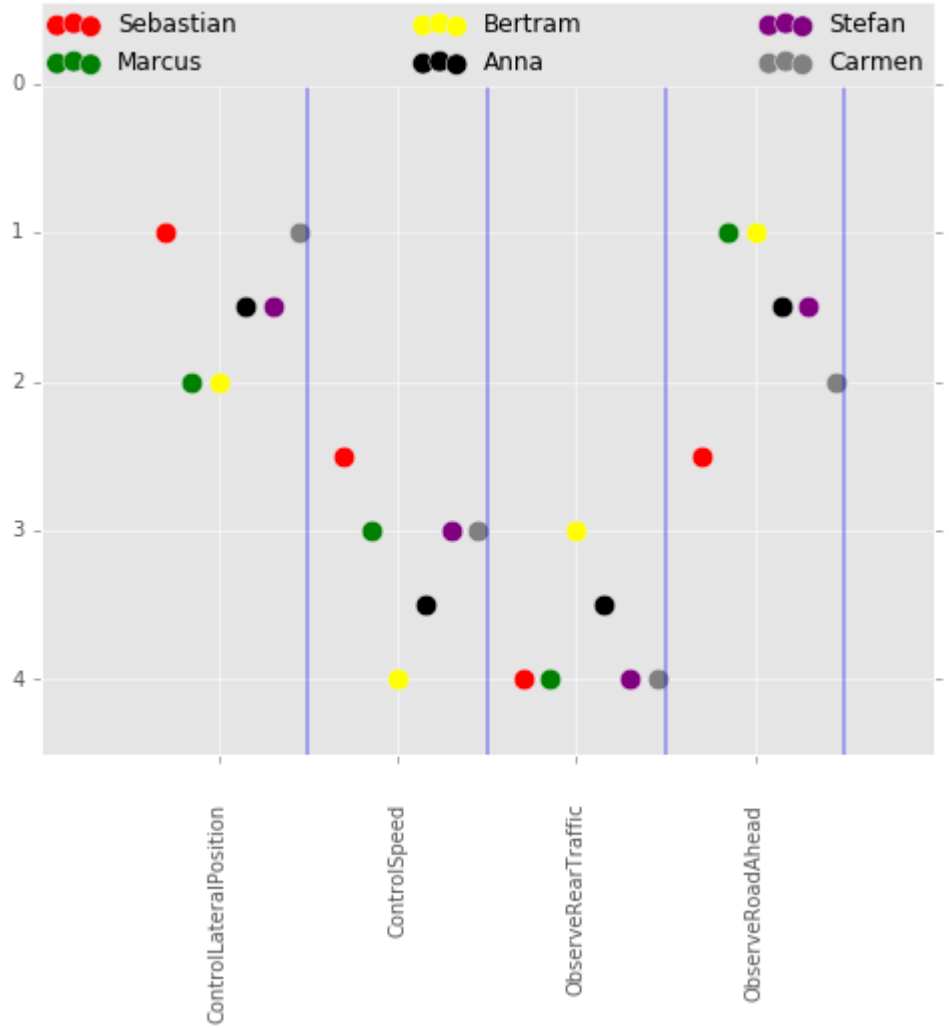
Model consistency

Relevance ratings



Model consistency

Task value ratings



Thank you

Human Efficiency Evaluator
http://hee.multi-access.de

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Model-based attention prediction

Simulated SEEV model

- SEEV model:
  (Wickens et al., 2001)
- Simulating human behaviour with cognitive architectures

Attention = Saliency - Effort + **Expectancy · Value**