

CONFORM – A visualization tool and method to classify driving styles in context of highly automated driving

CONFORM (Conflict recognition by image processing methods) is a tool and method for a system designer to improve the cooperation between a human driver and a highly automated vehicle by recognizing conflicts between human and automation and avoiding them afterwards. Therefore CONFORM is able to:

- analyze the conflict potential between driver and automation behavior situation dependently
- visualize and cluster inter and intra

individual differences in driving styles

- identify system and interaction parameters for an context specific adaptation based on the classified driving style

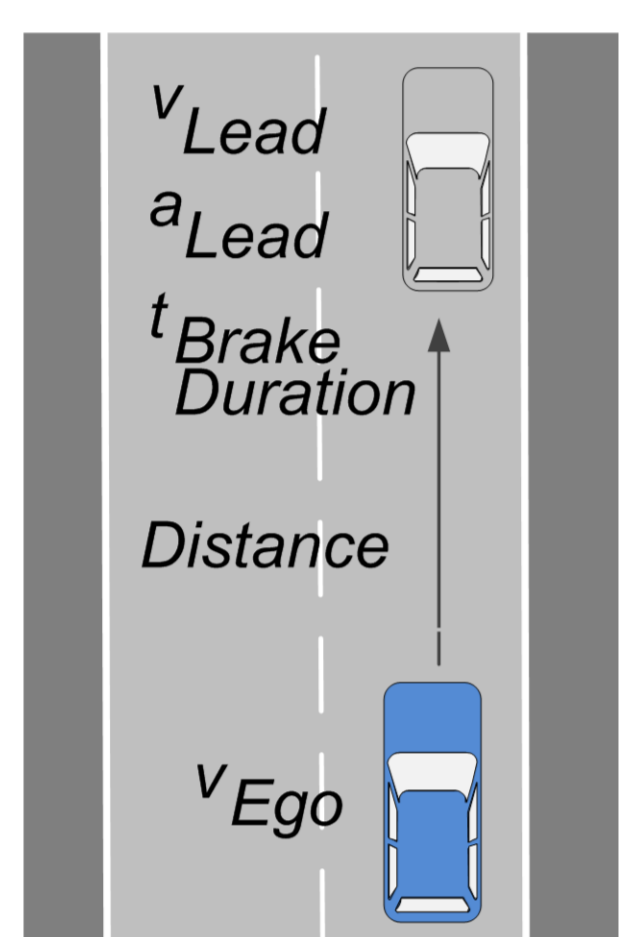
The central idea of CONFORM is to transform multivariate time series into data images. This allows us to introduce the human memory and its ability to build mental representation as a design metaphor for the organization of data images. Moreover we are able to use

image processing methods for the comparison between driver and automation behavior.

CONFORM is currently supported through the EU-Project HoliDes. During the project phase we will integrate CONFORM as driver model into a highly automated test vehicle.

Situation Classifier

Example: State Transformation



State Vector (SV)

Parameter	Value	State
v_Ego	24m/s	4
v_Lead	19m/s	3
a_Lead	-6m/s ²	4
t_Brake	2.1s	3
Distance	37m	1

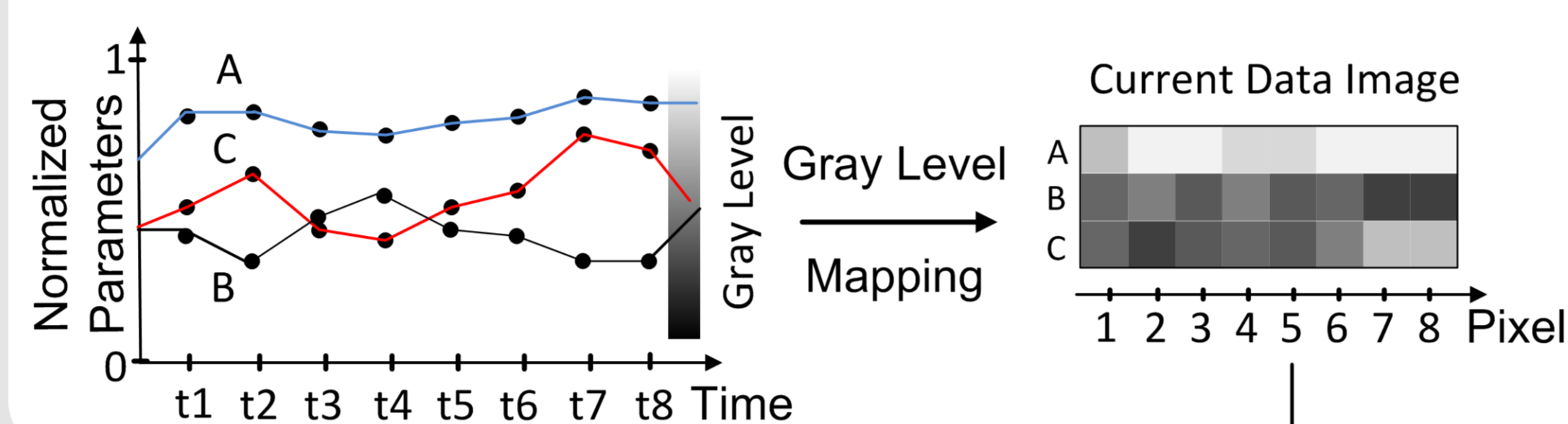
Criticality

A prediction ($t = 3s$) of the rel. distance is used to visualize the criticality.

- green upto yellow: no collision upto almost collision
- orange upto red: collision

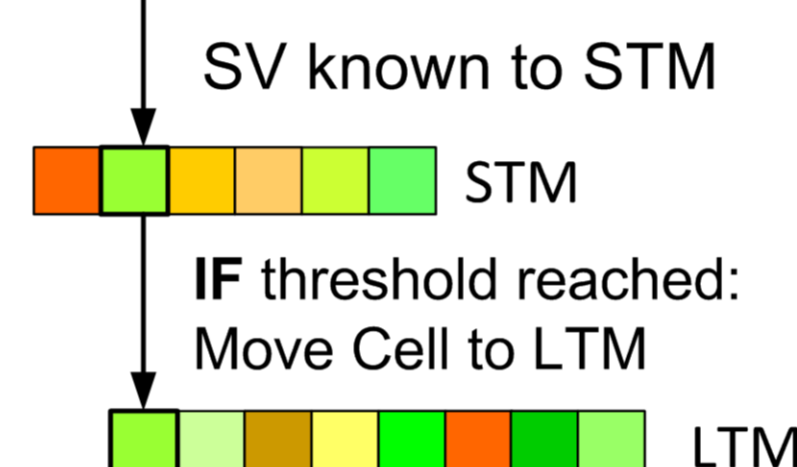
Memory

Sensory Memory

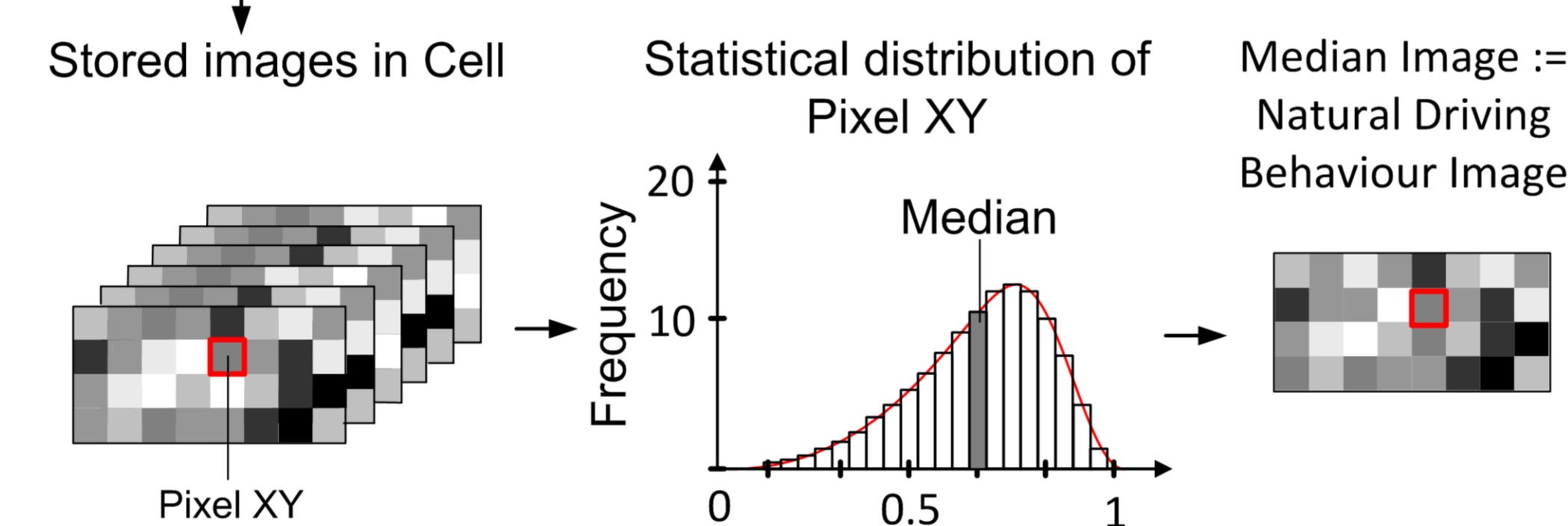


Short and Long Term Memory

In a memory cell the current data image is linked to the current state vector. The frequency of the different state vectors is used to organize the cells rule based in a short and long term memory.

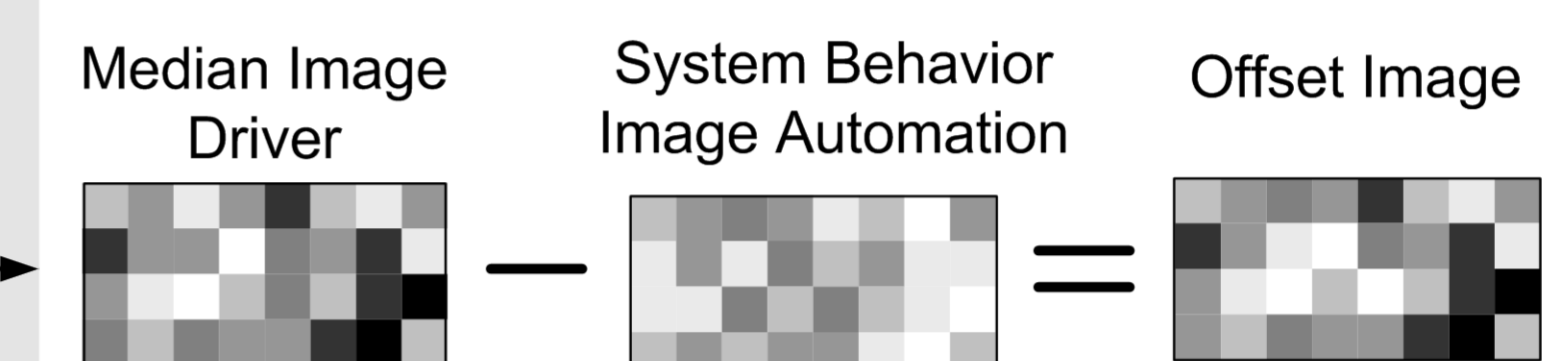


Mental Representation



Conflict Handling

Conflict Analyzer



Analyse offset image by image processing methods to obtain a conflict potential and to see if driver behavior is conform to automation behavior

IF conflict potential above threshold ↓

Driving Style Classification

Macro View: General driving style
Analyse the memory with regard to the frequency and distribution of critical situations

Micro View: Situation specific driving style
Analyse the median image with regard to manoeuvre preferences and trajectory related parameters

Adaptation

Update Automation knowledge
The classified driving style is used to adapt automation and interaction parameters situation dependently

Simulator study

Design

14 Subjects (11m/3f)
average age: 28.9
age range: 19-44

Vehicle following scenario

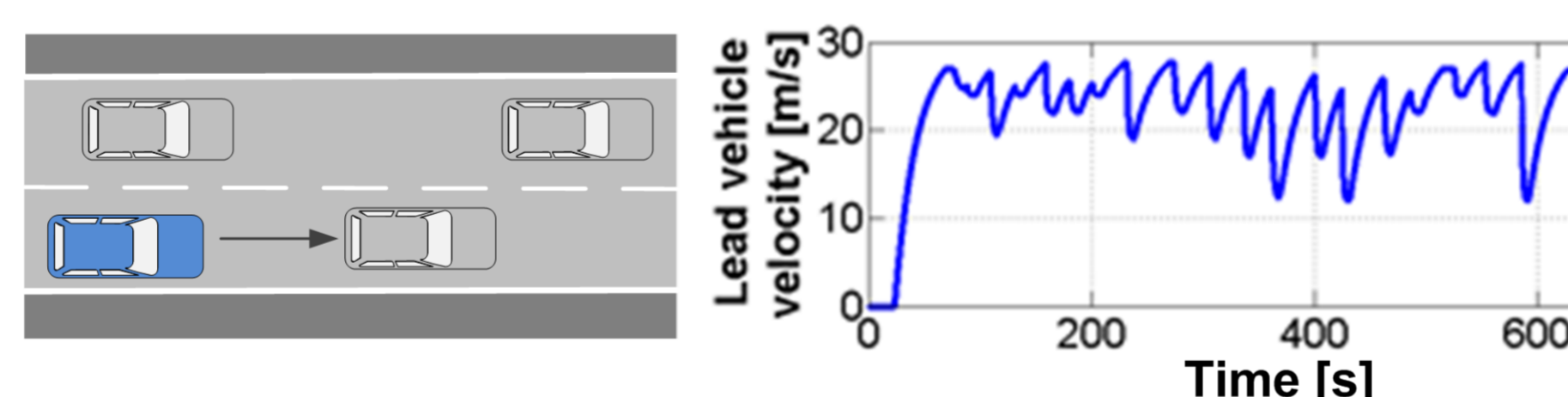
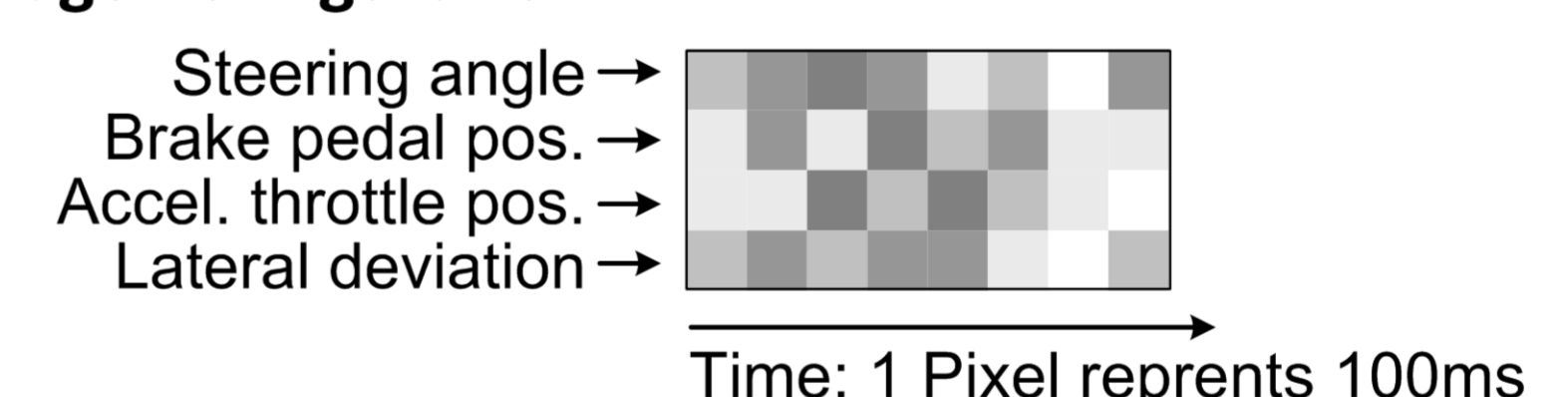
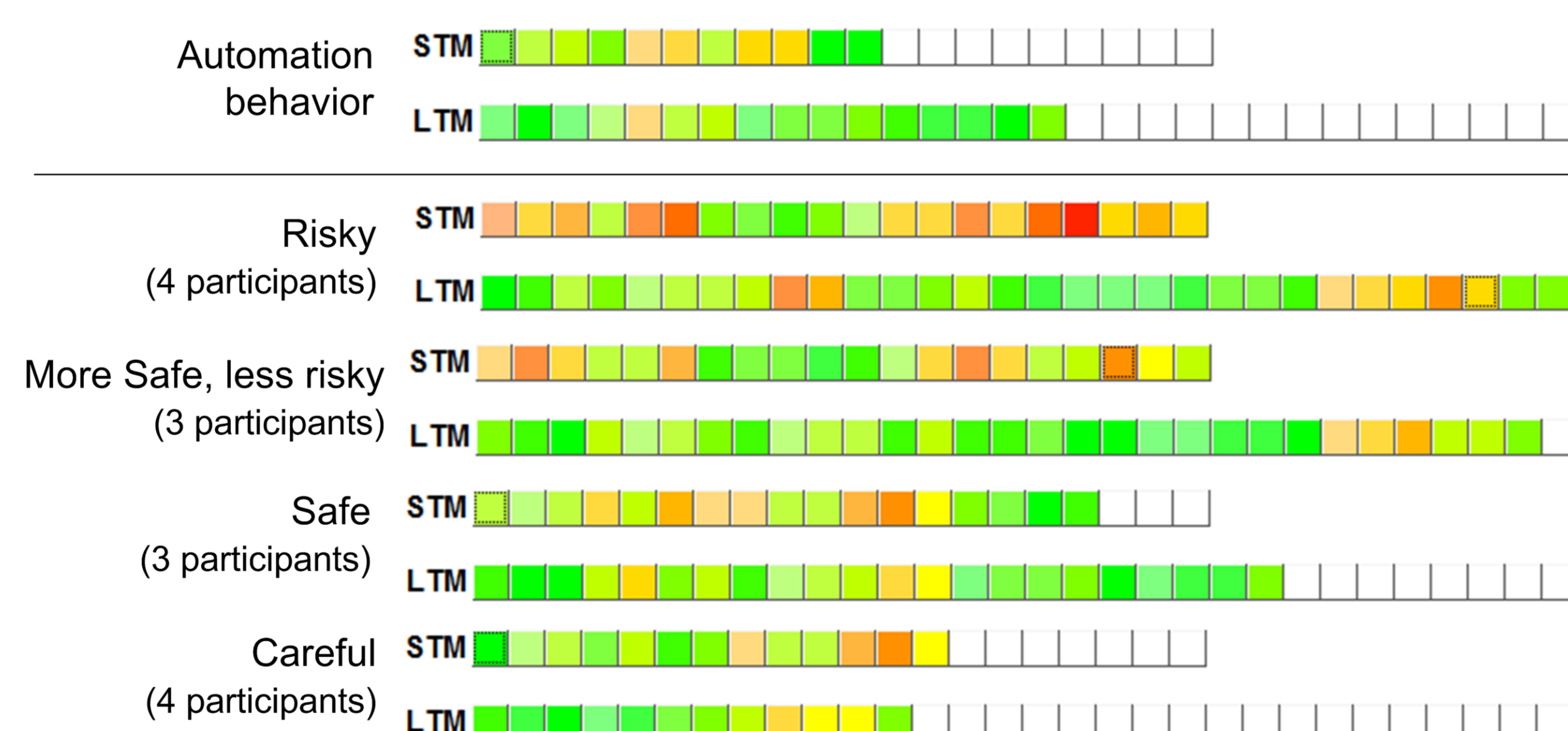


Image Configuration



Macro View: We observed four different general driving styles. Compared to them the implemented automation behavior shows a careful driving style



Micro View: Example - Less critical situation. We observed four different braking strategies. Compared to them the implemented automation behavior shows a early smoothing braking

