

Virtual Final Event

The interACT scenarios – defining and documenting essential urban scenarios for the development and evaluation of interACT solutions

Marc Wilbrink
German Aerospace Center (DLR)
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5th Objective

Methodology for assessing the quality of interaction



The challenge

1st Objective

Psychological models



4th Objective

Novel HMI elements



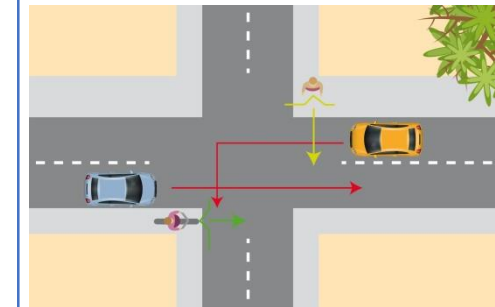
3rd Objective

CCPU & safety layer



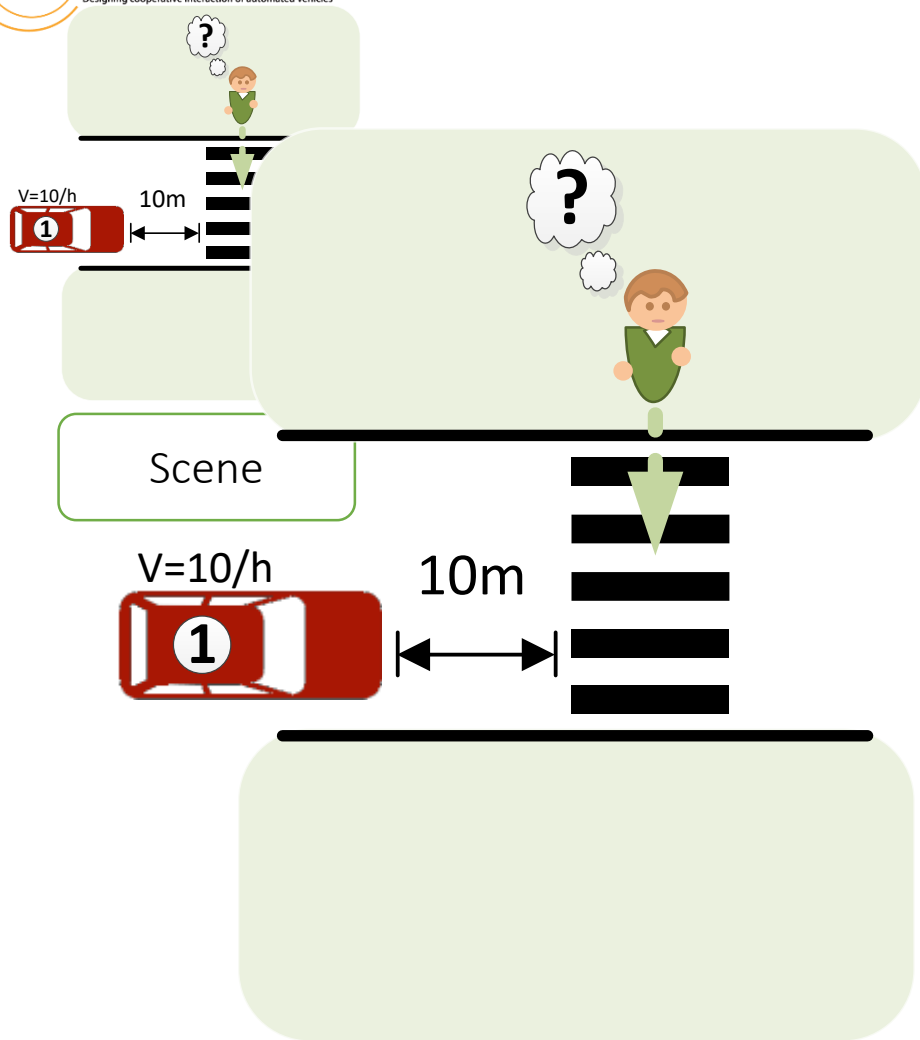
2nd Objective

Intention recognition & behavioural predictions



- 1 Taxonomy
- 2 interACT Scenarios and selection criteria
- 3 Format of standardized use case and scenario description

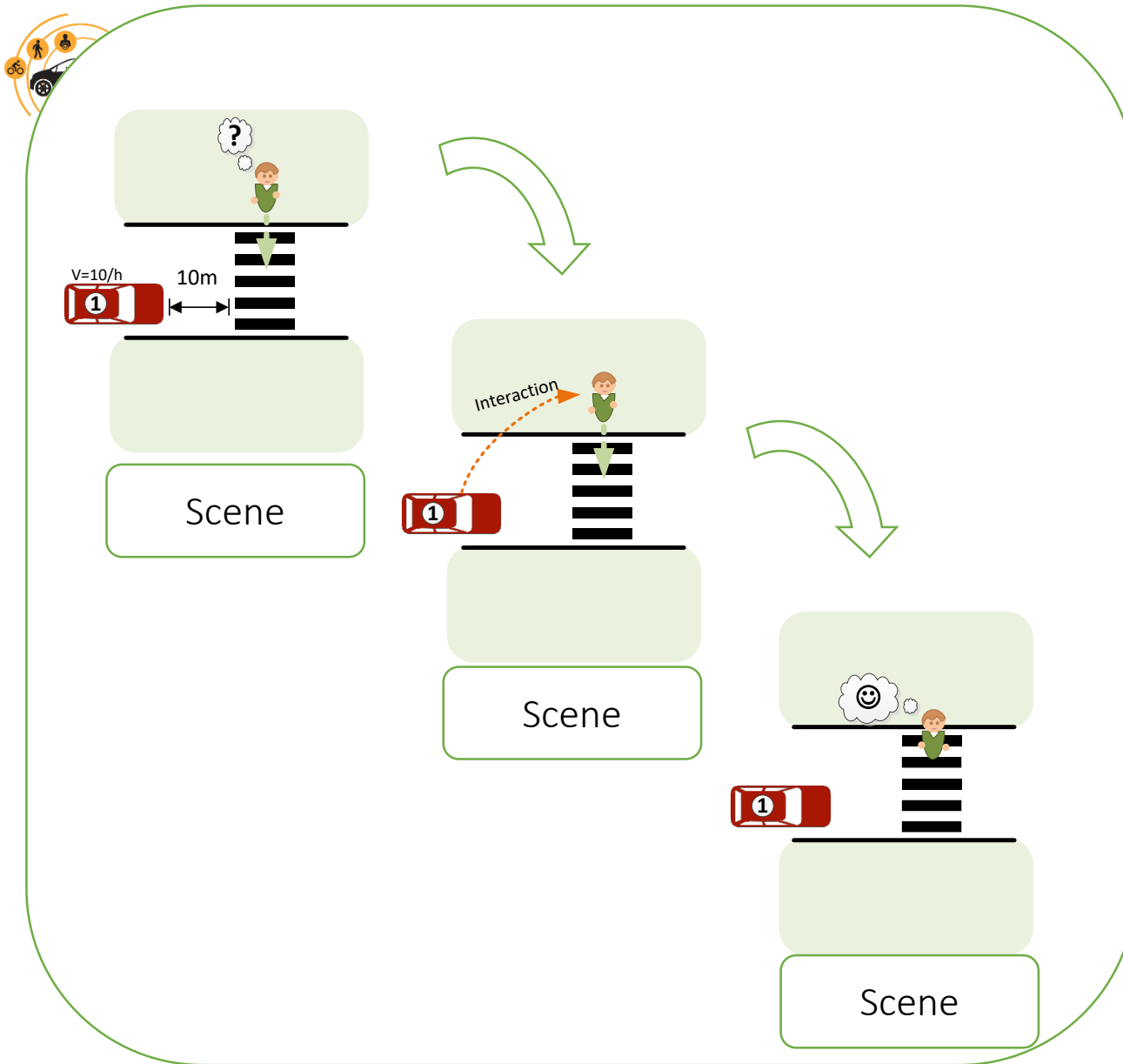
1	Taxonomy
2	interACT Scenarios and selection criteria
3	Format of standardized use case and scenario description



- Persists only several seconds
- Snapshot of the environment including
 - Scenery (Lane network, stationary elements, traffic lights, obstacles)
 - Dynamic elements (cars, road users)
 - All included agents

Ulbrich, S., Menzel, T., Reschka, A., Schuldt, F., Maurer, M. (2015): Defining and Substantiating the Terms Scene, Situation and Scenario for Automated Driving. IEEE International Annual Conference on Intelligent Transportation Systems (ITSC), Las Palmas, Spanien, pp. 982-988

Scenario

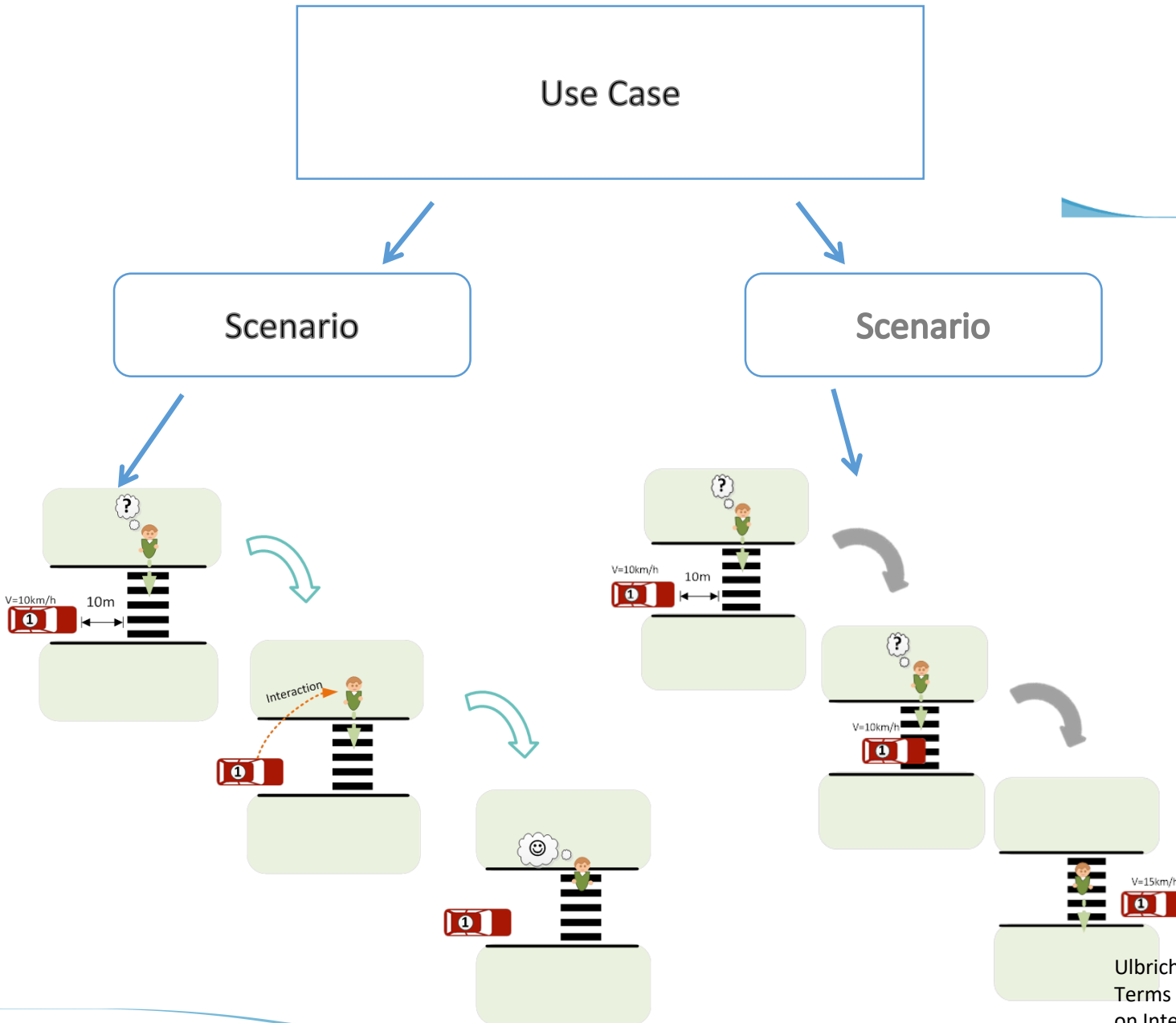


- Temporal development between several scenes
- A sequence of scenes connected by actions & events
- Includes goals of the agents
- Spans a certain amount of time

Ulbrich, S., Menzel, T., Reschka, A., Schuldt, F., Maurer, M. (2015): Defining and Substantiating the Terms Scene, Situation and Scenario for Automated Driving. IEEE International Annual Conference on Intelligent Transportation Systems (ITSC), Las Palmas, Spanien, pp. 982-988



Use Case



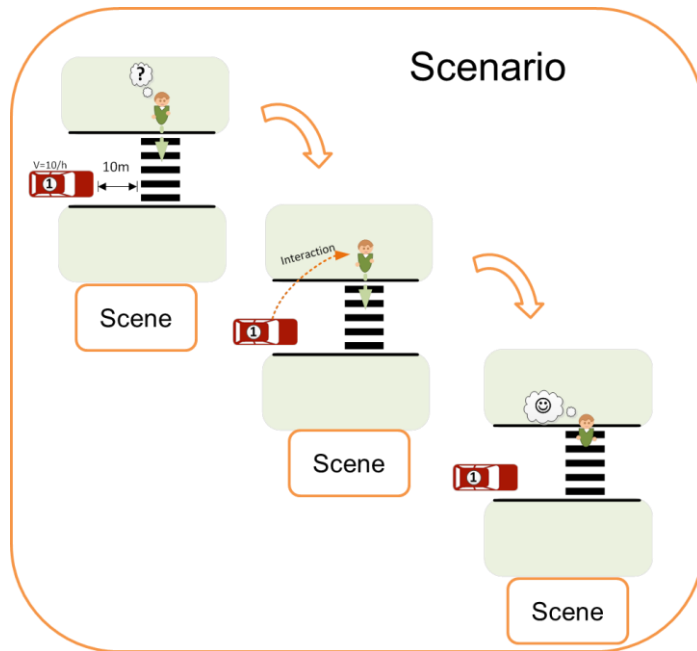
- Definition of one or several scenarios
- Description of the functional range and the desired behaviour
- Specification of system boundaries

Ulbrich, S., Menzel, T., Reschka, A., Schuldt, F., Maurer, M. (2015): Defining and Substantiating the Terms Scene, Situation and Scenario for Automated Driving. IEEE International Annual Conference on Intelligent Transportation Systems (ITSC), Las Palmas, Spanien, pp. 982-988



1	Taxonomy
2	interACT Scenarios and selection criteria
3	Format of standardized use case and scenario description

Common definition of use case and Scenario



Workshops to identify relevant use cases



Rating and agreement of addressed use cases

relevance for safety

frequency of occurrence

relevance for traffic flow

need for interaction with human road user

Realisation in demo vehicles

Realisation in driving simulator

Must have use cases in interACT

www.interact-roadautomation.eu

1

React to crossing non-motorised TP at crossings without traffic lights

2

React to an ambiguous situation at an unsignalised intersection

3

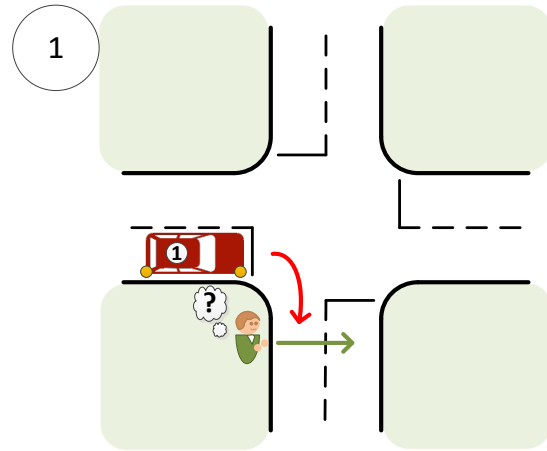
React to non-motorised TP at a parking space

4

React to vehicles at a parking space

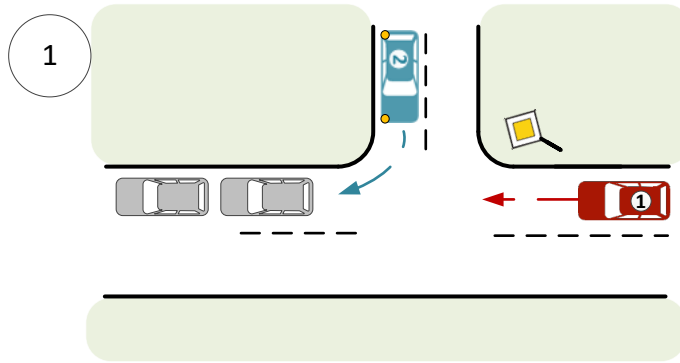
1

React to crossing non-motorised TP at crossings without traffic lights



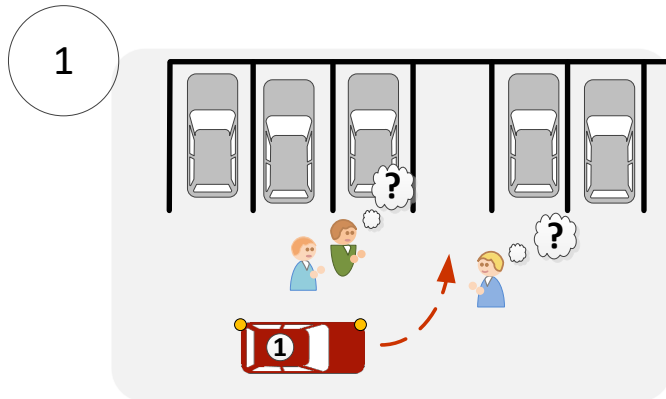
2

React to an ambiguous situation at an unsignalised intersection



3

React to non-motorised TP at a parking space



4


React to vehicles at a parking space



- 1 Taxonomy
- 2 interACT Scenarios and selection criteria
- 3 Format of standardized use case and scenario description

- Addressed interaction partner(s)
- Right of way
- Driving direction AV
- Possible perspectives of the interaction (from the perspective of the AV)

Use Case description

Name of the use case	Use Case	Need to crossing non-motorised TM at crossings without traffic lights									
Environment of use case	Use Case Priority	<input checked="" type="checkbox"/> Low <input type="checkbox"/> Medium <input type="checkbox"/> High	Priority of use case								
Graphical example of the use case	Use Case Environment	<input checked="" type="checkbox"/> Intersection <input type="checkbox"/> Parking space									
	Graphical example										
Verbal description of use case	Verbal description	The AV wants to turn right at an intersection and approaches a non-motorised TM who wants to cross the road at a crossing without traffic lights. The non-motorised TM has right of way and the AV has to react to the traffic situation. Main goal is to handle the situation safely by using a clear and understandable communication of the AV's intention other than the AV should continue driving (e.g. AV wants to yield for the non-motorised TM. The AV expresses its intention to the non-motorised TM and waits for him to cross the road).									
Importance description of the use case	Importance of the use case	<p>Accident data</p> <p>AVI: pedestrians killed or road accidents in the EU: 22 % of all killed on EU roads are pedestrians. Highest risk in urban areas (BfV). Children and elderly are particularly at risk (European Commission, 2016).</p> <p>Consensus opinion</p> <p>The use case is important from a safety perspective and occurs often in residential areas. The use case has only a low influence on traffic flow but interaction between TM is needed and has a great impact on experience for AVs. Further it is possible to realise the use case in the demo vehicles using video, V2X, Radar and video camera for TM detection and in a pedestrian simulator.</p>									
Taxonomy used to describe use case	Taxonomy	<table border="1"> <tr> <td>Addressed interaction partner</td> <td><input type="checkbox"/> Vehicle driver <input checked="" type="checkbox"/> Cyclist <input checked="" type="checkbox"/> Pedestrian</td> </tr> <tr> <td>Right of way</td> <td><input checked="" type="checkbox"/> AV <input checked="" type="checkbox"/> Non-motorised TM <input type="checkbox"/> Undefined</td> </tr> <tr> <td>Driving direction AV</td> <td><input checked="" type="checkbox"/> Driving forward <input type="checkbox"/> Reverse</td> </tr> <tr> <td>Possible Perspectives from the perspective of the AV</td> <td><input checked="" type="checkbox"/> ahead <input checked="" type="checkbox"/> side/rear - diagonal <input type="checkbox"/> back/rear</td> </tr> </table>	Addressed interaction partner	<input type="checkbox"/> Vehicle driver <input checked="" type="checkbox"/> Cyclist <input checked="" type="checkbox"/> Pedestrian	Right of way	<input checked="" type="checkbox"/> AV <input checked="" type="checkbox"/> Non-motorised TM <input type="checkbox"/> Undefined	Driving direction AV	<input checked="" type="checkbox"/> Driving forward <input type="checkbox"/> Reverse	Possible Perspectives from the perspective of the AV	<input checked="" type="checkbox"/> ahead <input checked="" type="checkbox"/> side/rear - diagonal <input type="checkbox"/> back/rear	Information about importance of use case
Addressed interaction partner	<input type="checkbox"/> Vehicle driver <input checked="" type="checkbox"/> Cyclist <input checked="" type="checkbox"/> Pedestrian										
Right of way	<input checked="" type="checkbox"/> AV <input checked="" type="checkbox"/> Non-motorised TM <input type="checkbox"/> Undefined										
Driving direction AV	<input checked="" type="checkbox"/> Driving forward <input type="checkbox"/> Reverse										
Possible Perspectives from the perspective of the AV	<input checked="" type="checkbox"/> ahead <input checked="" type="checkbox"/> side/rear - diagonal <input type="checkbox"/> back/rear										

Scenario description

Name of scenario →
 Name of scenario
 Author
 Environment of use case
 Graphical representation of the scenario
 Verbal description of the scenario

Scenario	Need to a single pedestrian crossing at a distance from 30m-50m from right to left at a crossing without traffic lights	
Name related use case	Need to crossing from motorised TP at crossings without traffic lights	
Author	Name (Surname)	
Use case priority	<input checked="" type="checkbox"/> High <input type="checkbox"/> Medium <input type="checkbox"/> Low	Priority of use case
Use case environment	<input checked="" type="checkbox"/> Intersection <input type="checkbox"/> Priority road	
Graphical representation		
Verbal description	The car approaches a pedestrian who wants to cross the road at a crossing without traffic lights. The car has right of way, but wants to yield for the pedestrian. The car stops at the pedestrian. The car starts to move when the pedestrian has crossed the road. The car continues to drive.	
Traffic & Environment	Right of way <input checked="" type="checkbox"/> car <input type="checkbox"/> other TP <input type="checkbox"/> undefined	Description of the traffic and environment
Longitudinal distance (meters)	<input type="checkbox"/> < 5m <input checked="" type="checkbox"/> 5-10m <input type="checkbox"/> > 10m	
Lateral distance	<input type="checkbox"/> 0m <input checked="" type="checkbox"/> 5-10m <input type="checkbox"/> > 10m	
Speed car	<input type="checkbox"/> 0 km/h <input checked="" type="checkbox"/> 30 km/h <input type="checkbox"/> 50 km/h	
Speed other TP	<input type="checkbox"/> 0 km/h dependent <input type="checkbox"/> 0-5 km/h (pedestrian) <input type="checkbox"/> 10-15 km/h (cyclist) <input type="checkbox"/> 30 km/h <input type="checkbox"/> 50 km/h	
Time of day	<input checked="" type="checkbox"/> Day <input type="checkbox"/> Night	
Lighting conditions	<input checked="" type="checkbox"/> Pedestrian lights <input type="checkbox"/> Pedestrian lights <input type="checkbox"/> Pedestrian lights	
Investigator in country	Belgium	

- Right of way
- Longitudinal/ Lateral Distances
- Speed of AV
- Speed of other TP
- Time of Day
- Lighting conditions



Scenario description

Name of scenario →

Name of scenario Author →

Environment of use case →

Graphical representation of the scenario →

Verbal description of the scenario →

Name related use case →

AV related information →

TP related information →

Sequence diagram →

AV related attributes	Driving direction: <input type="radio"/> Forward <input type="radio"/> Reverse
Perspective from the perspective of the AV	<input type="radio"/> Street <input type="radio"/> Intersection - Integrated <input type="radio"/> Roadside
AV's intention regarding right of way	<input type="radio"/> Let other TP go first <input type="radio"/> Go first
Attention on-board user	<input type="radio"/> Yes <input type="radio"/> No
Interaction partner (other TP observed)	<input type="radio"/> Vehicle driver <input type="radio"/> Cyclist <input type="radio"/> Pedestrian
Number of traffic participants	J_1, N J_2, N (non-observed TP) J_3, N (vehicle)
Other TP's intention regarding right of way	<input type="radio"/> Let AV go first <input type="radio"/> Go first
Age of TP	<input type="radio"/> Not in focus <input type="radio"/> 0-17 years <input type="radio"/> 18-60 years <input type="radio"/> > 61 years
Impairment of the TP's perception	<input type="radio"/> No impairment <input type="radio"/> Vision <input type="radio"/> Hearing <input type="radio"/> Both vision and hearing
Attention other TP	<input type="radio"/> Yes <input type="radio"/> No
Sequence diagram	

- Driving Direction of AV
- AV's intention regarding right of way
- Attention on-board user towards traffic situation
- Interaction partner (type)
- Number of Traffic participants
- Attention other TP towards AV




Deliverable D1.1 – Definition of interACT use cases and scenarios

<https://www.interact-roadautomation.eu/projects-deliverables/>



Designing cooperative interaction of automated vehicles with
other road users in mixed traffic environments

interACT D1.1 Definition of interACT use cases and scenarios

Work package	WP1: Scenarios, Requirements and interACT System Architecture
Task	Task 1.1: Scenario definition
Authors	Wilbrink, Marc (DLR) , Schieben, Anna (DLR), Markowski, Robert (DLR), Weber, Florian (BMW), Gehb, Tina (BMW), Ruenz, Johannes (BOSCH), Tango, Fabio (CRF), Kaup, Marc (HELLA), Willrodt, Jan-Henning (HELLA), Portouli, Villy (ICCS), Merat, Natasha (ITS LEEDS), Madigan, Ruth (ITS LEEDS), Markkula, Gustav (ITS LEEDS), Romano, Richard (ITS LEEDS), Fox, Charles (ITS LEEDS), Althoff, Matthias (TUM), Söntges, Sebastian (TUM), Dietrich, André (TUM)
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Thank you!

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Marc Wilbrink,
Marc.wilbrink@dlr.de



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