

# Action Name

# Related Task/s

Designing Cooperative Interaction of Automated Vehicles with Other Road Users in Mixed Traffic Environment: Development of HMI solutions and evaluation criteria

Technology-related

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Why is this action important? 	Key uncertainties 	Action description 	Possible impacts 																					
<p> <ul style="list-style-type: none"> <li>As AVs are likely to be deployed in mixed traffic, they need to interact safely and efficiently with other road users, including manually driven vehicles, cyclists and pedestrians.</li> <li>Currently, there is a lack of understanding of how these driverless vehicles should communicate their intentions to other road users, which could potentially reduce their appeal and value to the user.</li> <li>To ensure intuitive and cooperative interaction between the AV and others, and a smooth flow of all traffic, it is essential that there is a good means of communication between all actors.</li> <li>New communication solutions are required to facilitate these interactions.</li> <li>In addition, new evaluation criteria and measurement techniques are required to understand what effective interactions look like.</li> </ul> <p><b>Further arguments?</b></p> </p>	<p> <ul style="list-style-type: none"> <li>The impact of Human Machine Interface (HMI) solutions on road users' interactions.</li> <li>How do we measure this impact on an individual level? (e.g. trust, perceived safety, acceptance, comprehension etc.)</li> <li>How do we measure this impact on an societal level? (e.g. overall safety, traffic flow, infrastructure requirement etc.)</li> <li>What knowledge would key stakeholder groups like to have? (e.g. policy makers, OEMs, road authorities etc.)</li> </ul> <p><b>Further key uncertainties?</b></p> <p style="text-align: center;"><b>Cause-effect or working mechanism</b> </p> <p> <ul style="list-style-type: none"> <li><b>Cause:</b> Our understanding of AV interactions with other road users is still at an early stage</li> <li><b>Effect:</b> Need more detailed understanding of how road users respond to AV communication solutions</li> <li><b>Working mechanism:</b> Standardised evaluation criteria at an individual and societal level</li> </ul> <p><b>Questions/ Feedback?</b></p> </p></p>	<p>Numerous external HMI (eHMI) and internal HMI (iHMI) solutions have been suggested in the research literature.</p> <p>These solutions are being evaluated using computer based tests, real world studies, test tracks studies, pedestrian and driver simulator studies, and distributed simulator studies.</p> <p>Measurement tools include questionnaires, measures of pedestrian and driver attitude to AV communication, measures of pedestrian crossing behaviour, and measures of drivers understanding of right of way.</p> <p>An evaluation of the information obtained through each of these tools will facilitate the development of a standardized set of evaluation criteria, and provide insight to the effectiveness of HMI solutions in facilitating interactions at an individual and societal level.</p> <ul style="list-style-type: none"> <li><b>What needs do be done from your perspective?</b></li> <li><b>What information would you like to get out of this process?</b></li> </ul>	<p> <ul style="list-style-type: none"> <li>HMI solutions for automated vehicles may facilitate the expectation conforming interaction of these vehicles in a mixed traffic environment.</li> <li>The development of a standardised evaluation methodology for assessing the effect of the new interaction strategies on AV-human interactions. This will enable a comparison across studies, aiding the development of design recommendations.</li> <li>An understanding of the individual and societal impact of AV interaction solutions.</li> </ul> <p><b>Further possible impacts?</b></p> <p style="text-align: center;"><b>Stakeholders</b> </p> <table border="1"> <thead> <tr> <th>Actor</th> <th>Task</th> <th>Role</th> </tr> </thead> <tbody> <tr> <td>EU</td> <td>Define common approach towards the evaluation of external vehicle communication</td> <td>Policy, information and implementation</td> </tr> <tr> <td>NHTSA</td> <td>AVintent is an interACT twinning partner; it is a project funded by NHTSA and conducted by Westat</td> <td>Collaborator</td> </tr> <tr> <td>OEMs</td> <td>Bring in industrial expertise and relevance</td> <td>HMI design</td> </tr> <tr> <td>UNECE</td> <td>UNECE guidelines followed in HMI designs</td> <td>Type approval</td> </tr> <tr> <td>Road authorities / traffic authorities</td> <td>Test and operate solutions</td> <td>Road operator</td> </tr> <tr> <td>ISO/TC 22/SC 39/WG 8 Task force on external vehicle communication</td> <td>Provision of a document on external vehicle communication solutions</td> <td>Standardization</td> </tr> </tbody> </table> <p><b>Further stakeholders?</b></p> </p>	Actor	Task	Role	EU	Define common approach towards the evaluation of external vehicle communication	Policy, information and implementation	NHTSA	AVintent is an interACT twinning partner; it is a project funded by NHTSA and conducted by Westat	Collaborator	OEMs	Bring in industrial expertise and relevance	HMI design	UNECE	UNECE guidelines followed in HMI designs	Type approval	Road authorities / traffic authorities	Test and operate solutions	Road operator	ISO/TC 22/SC 39/WG 8 Task force on external vehicle communication	Provision of a document on external vehicle communication solutions	Standardization
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<p> <ul style="list-style-type: none"> <li>Individual level criteria include acceptance, perceived safety, comfort, evaluations of HMI, crossing decisions etc.</li> <li>Societal level criteria include traffic flow, road safety, infrastructure requirements, cross-cultural patterns etc.</li> </ul> <p><b>Further evaluation criteria?</b></p> </p>		<p> <ul style="list-style-type: none"> <li>interACT project Deliverables to date: <a href="https://www.interact-roadautomation.eu/projects-deliverables/">https://www.interact-roadautomation.eu/projects-deliverables/</a></li> </ul> <p><b>Further key references?</b></p> </p>																						