InMotion

Light-based communication between automated vehicles and other road users
1) Wizard-of-Oz study, passing pedestrians

- **Aim:** effects of light signals on naive pedestrians (3 modes + no signal, color turquoise)
- **Setting:** parking area on the campus of Chemnitz University of Technology
- **Wizard of Oz-technique** (driver hidden by seat suit); between-subjects-design
- **Applied methods:** questionnaires, interviews, video recording

<table>
<thead>
<tr>
<th>Drivers’ visibility</th>
<th>No signal</th>
<th>Automated mode</th>
<th>Crossing mode</th>
<th>Starting mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driver visible (no seat suit)</td>
<td>Questionnaires, Interview data, video data</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Driver invisible (seat suit)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Interview data (all conditions)

Open question: What do you think was indicated by the signal?

- Communication to other drivers
- Communication in general
- Warning/caution
- Giving right of way
- Priority/precedence/privilege
- Driverless vehicle
- Police
- Security transport
- Topographical survey
- Indicating risks and hazards
- Spectrometers as driver assistance systems
- Spectrometers in general
- Illumination
- Detection and tracing of obstacles and obstructions
- Ambulance
- No idea
- Emergency/rescue vehicle in general
- Communication to pedestrians
- No meaning

Qualitative data analyzed over all conditions, N = 138

Type of vehicle
- No information
- Communication partner
- Communication message
- Vehicle functions
- Light bar functions

Matthias Beggiato, Isabel Neumann, Ann-Christin Hensch
2) Field study, invited participants

• Aim: Evaluation of visibility and meaning of light signals for VRU

• 3 modes (automated, crossing, starting) and 3 colors (WHITE, TURQUOISE, PURPLE)

• Setting: field study (Elsasser Straße, Chemnitz), realistic environment, controlled conditions

• Experimental setup; within-subjects-design

• Applied methods: questionnaires, interviews, evaluation of visibility
Method & procedure field study

1. Welcome and socio-demographics
2. Visibility of colors (distance measurement; 470m condition)
3. Visibility of colors (100m, 50m, 20m and 5m distance)
4. Assumed meaning of light signals (uninformed)
5. Evaluation of light signals; appropriateness of colors (informed)
6. Closure and goodbye

Laboratory (uninformed)
Test site (informed)
Test site (uninformed)
## Summary and overview of results

<table>
<thead>
<tr>
<th></th>
<th>Wizard of Oz study</th>
<th>Field study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visibility of colors</td>
<td></td>
<td>Clear ranking: purple &gt; turquoise &gt; white</td>
</tr>
<tr>
<td>Acceptance</td>
<td></td>
<td>Good acceptance of signals</td>
</tr>
<tr>
<td>Trust in presented signals</td>
<td>No agreement regarding trust in signals</td>
<td>Rather high agreement regarding trust in signals</td>
</tr>
<tr>
<td>Meaningfulness (presented</td>
<td>Partly agreement, significant differences between signals</td>
<td>Rather useful, no differences between signals</td>
</tr>
<tr>
<td>signals)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Importance of visual signals</td>
<td>Agreement that visual signals are generally useful for automated vehicles</td>
<td></td>
</tr>
<tr>
<td>(in general)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comprehensibility of presented</td>
<td></td>
<td></td>
</tr>
<tr>
<td>signals (uninformed)</td>
<td>Without information, the meaning of the signals is unclear</td>
<td></td>
</tr>
<tr>
<td>Comprehensibility of presented</td>
<td></td>
<td></td>
</tr>
<tr>
<td>signals (after explanation)</td>
<td>No agreement that presented signals are comprehensible</td>
<td>Rather high agreement that presented signals are comprehensible</td>
</tr>
</tbody>
</table>
InMotion

Light-based communication between automated vehicles and other road users

Coordinator:

Dr. Matthias Beggiato
Chemnitz University of Technology
Department of Psychology - Cognitive and Engineering Psychology
Wilhelm-Raabe-Straße 43
D-09120 Chemnitz, Germany
Phone: +49 371 531-38654
Email: matthias.beggiato@psychologie.tu-chemnitz.de