INTELLIGENT TRANSPORT SYSTEMS TODAY: A EUROPEAN PERSPECTIVE

Dr. Ioanna Spyropoulou, Dr. Matthew Karlaftis, Prof. John Golias, Dr. George Yannis, Merja Penttinen
Outline

- General issues
- European studies on ITS impact
- Delphi study principles
- Questionnaire design
- Participant characteristics
- Questionnaire results
- Summary and Next steps
General (1/2)

- **Activity Framework**

  HUMANIST NoE → [www.noehumanist.org](http://www.noehumanist.org)
  Task Force B “Evaluation of Potential ITS Benefits”

- **Objective**

  Identify certain issues related to impact of ITS mainly on Road Safety

- **Tool**

  Conduction of a Delphi Study - not to find the truth but the opinion of the people responsible for research, design, application and use of the systems
Intelligent Transport Systems - Definition

Application of advanced sensor, computer electronics, and communication technologies and management strategies - in an integrated manner - in order to increase the safety and efficiency parameters of the transportation system

Why ITS?

Anticipate positive impact on:

- Road Safety
- Network Conditions
- Environmental Conditions
- User comfort
- User integration
Studies on ITS impact (1/3)

- **ITS development**
  
  IDEA → PROTOTYPE → ASSESSMENT → MARKET INTRODUCTION

- Assessment methods
- Assessment measures
- Results...

- Are intelligent transport systems a promising means to the future?
Studies on ITS impact (2/3)

- Impact of Intelligent Speed Adaptation (Várhelyi et. al., 2002)
  - Using a wide range of assessment methods
  - Included elements (interaction) of non-users
  - Effort to link system impact with accident data

- Behavioural effects of Lane Departure Warning Systems (Alkim and Korse, 2003)
  - Real network study
  - No behavioural change (no of warnings over time)
  - Impact on road safety could not be identified - system compensation
Studies on ITS impact (3/3)

- Prediction of driver drowsiness for fatigue warning systems (Muzet et. al., 2004)
  - Use of driver simulator
  - Steering grip sensor signals - obj. and subj. sleepiness score
  - Significant correlations BUT differences from participant characteristics → incorporation of individual characteristics into simulation programs is still an issue

- Impact of Adaptive Cruise Control and Intelligent Speed Adaptation systems (Yannis et. al., 2002)
  - Use of traffic simulation programs (3 different ones)
  - Results of impact on road safety related to: simulation program, simulation scenario and variables used as assessment measures
Design of the Delphi Study (1/2)

- **General elements of a Delphi study**
  - Expert opinions recorded through structured and specific way
  - Main objective to reach consensus amongst participants
  - Conducted in the form of questionnaires
    - **Step 1** Participants receive questionnaires
    - **Step 2** Answers are analysed and comments are taken into account
    - **Step 3** Participants receive updated questionnaires along with their previous answers and the average answers
    - **Step 4** Steps 2 and 3 are repeated until reaching consensus or stability of respondents answers
General principles of design

- Questionnaire
  - Should not be long
  - Should be clear, structured and comprehensive

- Expert characteristics
  - Attention on the type of experts
  - High drop-out rate between rounds
Questionnaire design (1/2)

❖ Objectives → design

• Specific → Choice of IT systems investigated
  → Anticipation of impact on road safety
  → Systems for which there is no sufficient evidence but close to the market BUT ALSO “baseline” systems which are already widely used
  → Different systems in terms of their operation
  → ISA, ABS, Intersection Warning, Enhanced Navigation, Lateral Control
Questionnaire design (2/2)

- **Road Safety Impact → Questions mainly involve road safety & few general ones**
  
  First Part General questions on the systems
  Second Part Questions on impact elements
  Third Part General conclusive questions and comments
  Fourth Part Questions on participant characteristics

- **Clarification on issues → Questions for which there is a variety of answers**

- **Input on issues → Questions for which not sufficient research has been conducted**

- **Convenience in receiving and filling-in the questionnaire →**
  Questionnaire at: [http://www.noehumanist.org/DelphiStudy](http://www.noehumanist.org/DelphiStudy)
Participants characteristics (1/3)

- Number of participants → 33 (56)
- Variability → Country of work
  → Profession
  → Scientific Background
### Participants characteristics (2/3)

#### Expertise and experience

<table>
<thead>
<tr>
<th>Experience/Systems</th>
<th>ISA</th>
<th>ABS</th>
<th>Intersection Warning</th>
<th>Enhanced Navigation</th>
<th>Lateral Warning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specialist/Expert</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Knowledge Resulting from minor research</td>
<td>8</td>
<td>8</td>
<td>6</td>
<td>15</td>
<td>8</td>
</tr>
<tr>
<td>Knowledge Resulting from reading technical literature</td>
<td>24</td>
<td>19</td>
<td>18</td>
<td>18</td>
<td>21</td>
</tr>
<tr>
<td>No knowledge</td>
<td>1</td>
<td>5</td>
<td>5</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Personal experience (system user)</td>
<td>6</td>
<td>21</td>
<td>2</td>
<td>14</td>
<td>2</td>
</tr>
<tr>
<td>Laboratory experience (use it only in tests)</td>
<td>9</td>
<td>5</td>
<td>9</td>
<td>11</td>
<td>10</td>
</tr>
<tr>
<td>No experience</td>
<td>19</td>
<td>9</td>
<td>21</td>
<td>9</td>
<td>20</td>
</tr>
</tbody>
</table>

3-5 October 2005  
ETC, Strasbourg
Participants characteristics (2/3)

• Expertise
  → Majority of respondents’ expertise from technical literature
  → Enhanced navigation significant number resulting from minor research (probably on navigation functions)
  → Few respondents have no knowledge on systems

• Experience
  → Majority of respondents users of ABS
  → Around 30% of respondents lab experience on all systems except ABS
  → Significant amount of respondents no experience on ISA and Lateral Warning
Questionnaire Results –
System importance (1/4)

Impact parameters
• Road safety
• Traffic conditions
• Environmental conditions
• Driver Comfort
• User Integration

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Questionnaire Results - System importance (3/4)

❖ Results
  • All five systems are expected to contribute positively to road safety (intersection warning only positive impact)
  • ABS and ISA most promising
  • Systems score differently in different categories
  • Negative impact anticipated on driver comfort by ISA

❖ Systems rating
  • Road safety
  • Acceptability Issues
### Questionnaire Results -
**System importance (4/4)**

#### Systems application

<table>
<thead>
<tr>
<th>Development/Systems</th>
<th>ISA</th>
<th>ABS</th>
<th>Intersection Warning</th>
<th>Enhanced Navigation</th>
<th>Lateral Warning</th>
</tr>
</thead>
<tbody>
<tr>
<td>In their current level of development</td>
<td>6</td>
<td>32</td>
<td>1</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>Following a few more impact studies</td>
<td>11</td>
<td>1</td>
<td>7</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>With some further development</td>
<td>9</td>
<td>1</td>
<td>24</td>
<td>9</td>
<td>18</td>
</tr>
</tbody>
</table>

- 20% (7) of experts that ISA should not be part of standard vehicle equipment, 3% (1) for intersection warning, 6% (2) enhanced navigation
- 2 respondents believe that more research is needed on ABS
Questionnaire Results -
Gaps in knowledge (1/3)

Amount of evidence available from the most appropriate types of studies

ISA

<table>
<thead>
<tr>
<th>Test track</th>
<th>Real traffic</th>
</tr>
</thead>
<tbody>
<tr>
<td>no evidence</td>
<td>16,7%</td>
</tr>
<tr>
<td>little evidence</td>
<td>33,3%</td>
</tr>
<tr>
<td>evidence</td>
<td>38,9%</td>
</tr>
<tr>
<td>sufficient evidence</td>
<td>11,1%</td>
</tr>
</tbody>
</table>

ABS

<table>
<thead>
<tr>
<th>Test track</th>
<th>Real traffic</th>
</tr>
</thead>
<tbody>
<tr>
<td>no evidence</td>
<td>11,8%</td>
</tr>
<tr>
<td>little evidence</td>
<td>52,9%</td>
</tr>
<tr>
<td>evidence</td>
<td>35,3%</td>
</tr>
</tbody>
</table>

Intersection Warning

<table>
<thead>
<tr>
<th>Simulator</th>
<th>Test track</th>
<th>Real traffic</th>
</tr>
</thead>
<tbody>
<tr>
<td>no evidence</td>
<td>11,8%</td>
<td>20,0%</td>
</tr>
<tr>
<td>little evidence</td>
<td>35,3%</td>
<td>26,7%</td>
</tr>
<tr>
<td>evidence</td>
<td>41,2%</td>
<td>26,7%</td>
</tr>
<tr>
<td>sufficient evidence</td>
<td>11,8%</td>
<td>26,7%</td>
</tr>
</tbody>
</table>

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Questionnaire Results -
Gaps in knowledge (2/3)

Available Evidence

ABS → sufficient amount
ISA → good amount
Intersection warning → Further research needed
Enhanced navigation → Further research needed
Lateral Warning → Further research needed
Questionnaire Results -
Gaps in knowledge (3/3)

❖ “No opinion” answers

- Relationship between penetration rates and impact
- System side effects
+ Appropriate types of studies for each system (except ABS)
Summary and Next steps

✓ Preliminary results of Delphi study
✓ Diversity between answers
✓ Some general trends appear
✓ Gaps in knowledge are evident from the 1st Round

❖ Further analysis

→ Link answers with expertise and participant characteristics
→ Link system importance with willingness to pay
→ Link answers with results from studies on the impact of ITS
→ Conduct Round 2 of the Delphi Study
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