HMI integration for driver systems: INTEGRATE and VIVID

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HMI Integration for Driver Systems
INTEGRATE and VIVID

TTEC: Tailoring Transport Technology to People

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What was INTEGRATE?

- 2 year project, 1997 - 1999, EPSRC IMI Programme
- HUSAT, MIRA, Coventry Univ. KBE Centre
- HMI design advice for integrated in-vehicle systems
- ‘Whole Vehicle’ approach:
  - Future-proof / flexible / modular integration
Implications for the driver

Potential for:

- Reduced performance with individual systems
- Negative effects on primary driving task
- Increased driver stress, frustration etc.
Industry Requirements

• Ford, Jaguar, Rover, Honda, Nissan
• TRW Automotive, Alpine, Visteon
• Human Factors staff and Engineers

• Aimed at HF expert
• Procedural
• Early input
• Future-proof
Overview of the INTEGRATE Process

A
- System definition

B
- Design independent conflict analysis

C
- Design dependent conflict analysis

D
- Select design solution(s)

E
- Apply basic HF

F
- Priority setting

G
- Integration/data fusion

H
- Re-allocation of IP/OP
## B. Design indep. conflict analysis

<table>
<thead>
<tr>
<th></th>
<th>Pre-trip</th>
<th>Urban cruise</th>
<th>Urban mnvr</th>
<th>M’way cruise</th>
<th>M’way mnvr</th>
<th>Slow mnvr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Destination entry</td>
<td>![Diagram]</td>
<td>![Diagram]</td>
<td>![Diagram]</td>
<td>![Diagram]</td>
<td>![Diagram]</td>
<td>![Diagram]</td>
</tr>
<tr>
<td>Turn by turn instruction</td>
<td>![Diagram]</td>
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<td>![Diagram]</td>
<td>![Diagram]</td>
<td>![Diagram]</td>
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<tr>
<td>Phone</td>
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<td>![Diagram]</td>
<td>![Diagram]</td>
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<tr>
<td>Travel information</td>
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<td>![Diagram]</td>
<td>![Diagram]</td>
<td>![Diagram]</td>
<td>![Diagram]</td>
</tr>
<tr>
<td>Advanced cruise control</td>
<td>![Diagram]</td>
<td>![Diagram]</td>
<td>![Diagram]</td>
<td>![Diagram]</td>
<td>![Diagram]</td>
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<tr>
<td>Forward collision warning</td>
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<td>![Diagram]</td>
<td>![Diagram]</td>
<td>![Diagram]</td>
<td>![Diagram]</td>
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<tr>
<td>Lateral collision warning</td>
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<td>![Diagram]</td>
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</tr>
<tr>
<td>Reverse parking aid</td>
<td>![Diagram]</td>
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<td>![Diagram]</td>
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<td>![Diagram]</td>
<td>![Diagram]</td>
</tr>
</tbody>
</table>
F. Priority setting

<table>
<thead>
<tr>
<th>Time</th>
<th>Priority rating</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Collision warning</td>
</tr>
<tr>
<td></td>
<td>Black ice on road</td>
</tr>
<tr>
<td></td>
<td>Route guidance instructions</td>
</tr>
</tbody>
</table>
Exploitation of output

‘VIVID’ Virtual In-vehicle Information Displays
- UK Foresight Vehicle LINK project
- Oct 2000 - Sep 2002
- PERA, TTEC, Thales Optronics, OCF

A Simulation Tool to:
- Rapidly simulate voice/display options
- Develop ‘typical’ driving scenarios
- Test prioritisation/timing algorithms
VIVID Tool

Information management and presentation

• Priority rules
• Message exclusion zones

• Visual characteristics of HUDs
• Location of displays

• Adaptable HMIs
• Other events on the road
• Real time driver behaviour
Product Introduction Process

- Market Research
- Concept
- Feasibility
- Prototype design
- Costing
- Prototype manufacturing
- Prototype test
- Production design
- Tooling
- Production validation
- Production

Earlier involvement of T1 supplier

How do we convince management to spend on HF?
We have a few ideas, how can we try them out quickly?

Here’s our chosen solution. Is it viable?
The solution is almost complete. We just have a problem with x and y
Potential applications of VIVID

1. Dealing with conflicts
2. Scheduling of information
3. User understanding of systems
4. User differences & customer segmentation
1a. Dealing with conflicts

Potential solutions:

<table>
<thead>
<tr>
<th>Navigation System</th>
<th>Phone</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Presented</td>
<td>Accepted</td>
</tr>
<tr>
<td>2. Presented</td>
<td>Diverted</td>
</tr>
<tr>
<td>3. Not presented</td>
<td>Accepted</td>
</tr>
<tr>
<td>4. Visual only</td>
<td>Accepted</td>
</tr>
</tbody>
</table>
1b. Conflicts: types of navigation messages

- Will solution vary depending on point of conflict?
- Solution may depend on:
  - Importance of next manoeuvre
  - What driver has already received
  - Complexity of manoeuvre

Incoming phone call
2. Scheduling

- What should the time windows be?
- What should they depend on?
### 3. User understanding: inconsistent HMI

<table>
<thead>
<tr>
<th></th>
<th>Navigation Preview 1</th>
<th>Navigation Preview 2</th>
<th>Navigation Final</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A+V</td>
<td>A+V</td>
<td>A+V</td>
</tr>
<tr>
<td>2</td>
<td>A+V</td>
<td>A+V</td>
<td>V only + phone</td>
</tr>
</tbody>
</table>

- Will drivers understand why systems may behave differently?
- Will they accept such systems?
- Driver expectations
- System design, training?
4. User differences, segmentation

- Designing for novice customers
- Designing for 3rd generation customers
- Gradual evolution of ‘intelligence’
- ‘Taking away’ information or features seen as retrograde step by step by customers
Exploitation of VIVID Tool

- For researchers to generate new knowledge in appropriate dialogue management methods
- For vehicle or system manufacturers to investigate options for integration
- For experts to test already proposed algorithms
- An illustrative tool
- Plus potential for evaluation