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
System scope

STANDARD
Primary driving controls
HVAC
Vehicle status
ICE

FUTURE
ACC
Collision warning
Vision enhancement
Driver status

EMERGING
Navigation
Traffic information
Mobile office
Tolling
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

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6
### B. Design indep. conflict analysis

<table>
<thead>
<tr>
<th>Feature</th>
<th>Pre-trip cruise</th>
<th>Urban cruise</th>
<th>Urban mnvr</th>
<th>M’way cruise</th>
<th>M’way mnvr</th>
<th>Slow mnvr</th>
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<tbody>
<tr>
<td>Destination entry</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
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<td>☑</td>
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<tr>
<td>Turn by turn instruction</td>
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<td>☑</td>
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<td>☑</td>
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<tr>
<td>Phone</td>
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<td>☑</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
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<tr>
<td>Travel information</td>
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<td>☑</td>
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<tr>
<td>Advanced cruise control</td>
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<td>☑</td>
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<tr>
<td>Forward collision warning</td>
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<td>☑</td>
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<tr>
<td>Lateral collision warning</td>
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<tr>
<td>Reverse parking aid</td>
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</table>

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F. Priority setting

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

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

Earlier involvement of T1 supplier

Concept

Feasibility

Prototype design

Costing

Prototype manufacturing

Prototype test

Production design

Tooling

Production validation

Production
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

- Will drivers understand why systems may behave differently?
- Will they accept such systems?
- Driver expectations
- System design, training?

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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 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