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

EMERGING

Navigation
Traffic information
Mobile office
Tolling

FUTURE

ACC
Collision warning
Vision enhancement
Driver status
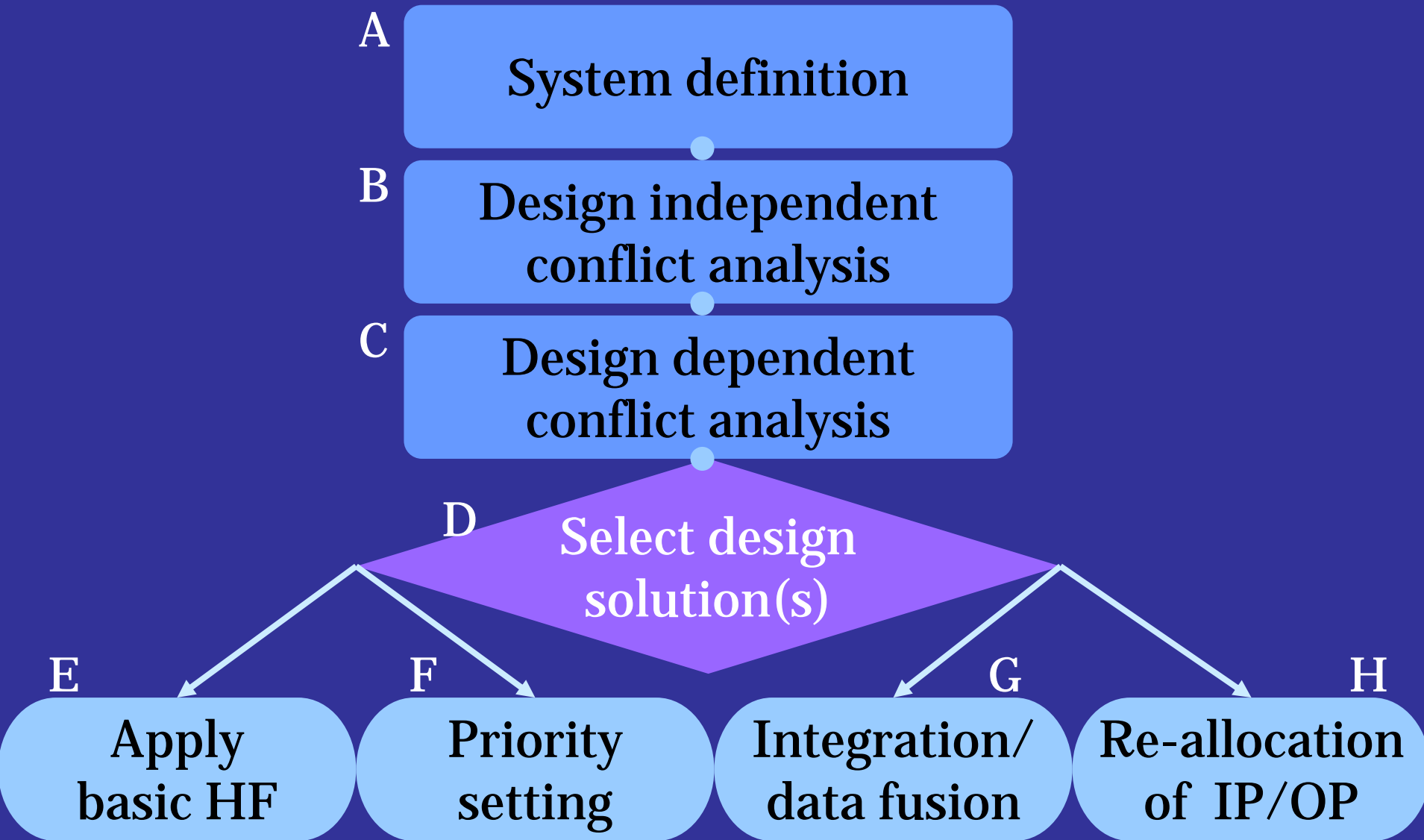
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Implications for the driver

Potential for:

- Reduced performance with individual systems

- Negative effects on primary driving task

- Increased driver stress, frustration etc.

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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

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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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B. Design indep. conflict analysis

	Pre-trip	Urban cruise	Urban mnvr	M'way cruise	M'way mnvr	Slow mnvr
Destination entry	📄×3	⧖	⧖	⧖	⧖	⧖
Turn by turn instruction	⧖	📄×2	📄×3	📄×2	📄×2	⧖
Phone	📄×2	📄×2	📄×2	📄×2	📄×2	📄×2
Travel information	📄×2	📄×2	📄×2	📄×2	📄×2	📄×1
Advanced cruise control	⧖	📄×1	⧖	📄×3	📄×3	⧖
Forward collision warning	⧖	📄×2	📄×1	📄×1	📄×1	⧖
Lateral collision warning	⧖	📄×1	📄×2	📄×1	📄×3	📄×1
Reverse parking aid	⧖	⧖	⧖	⧖	⧖	📄×3

F. Priority setting

Priority rating (vertical axis) vs Time (horizontal axis), showing curves for Collision warning, Route guidance instructions, and Black ice on road.
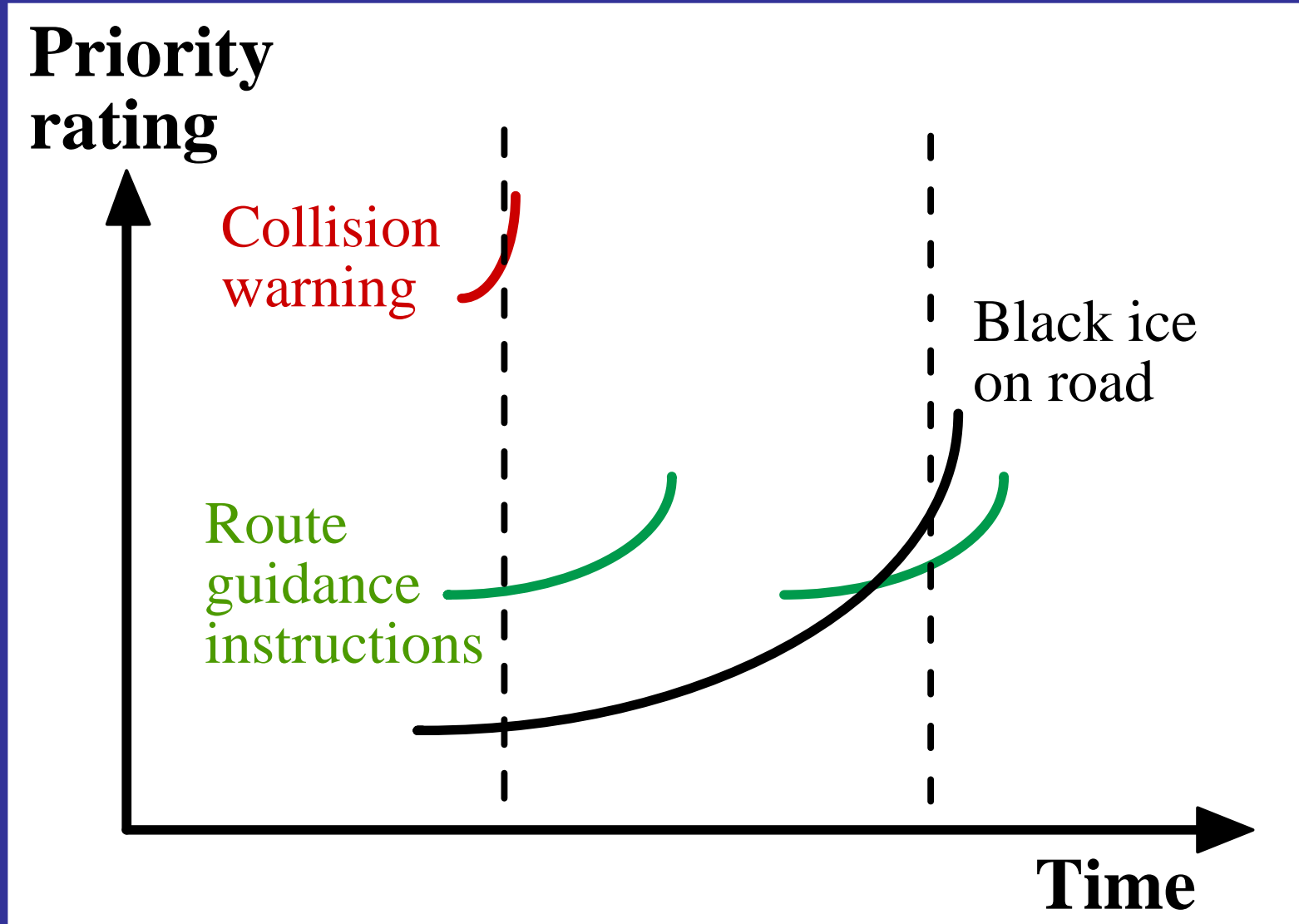
Exploitation of output

'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

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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

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Product Introduction Process

Market Research

Concept ⟵ How do we convince management to spend on HF?

Feasibility ⟵ We have a few ideas, how can we try them out quickly?

Prototype design ⟵ Here's our chosen solution. Is it viable?

Costing

The solution is almost complete.
We just have a problem with x and y

Prototype manufacturing

Prototype test

Production design

Tooling

Production validation

Production

Earlier involvement
of T1 supplier

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Potential applications of VIVID

1. Dealing with conflicts

2. Scheduling of information

3. User understanding of systems

4. User differences & customer segmentation

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1a. Dealing with conflicts

Navigation message

Incoming phone call
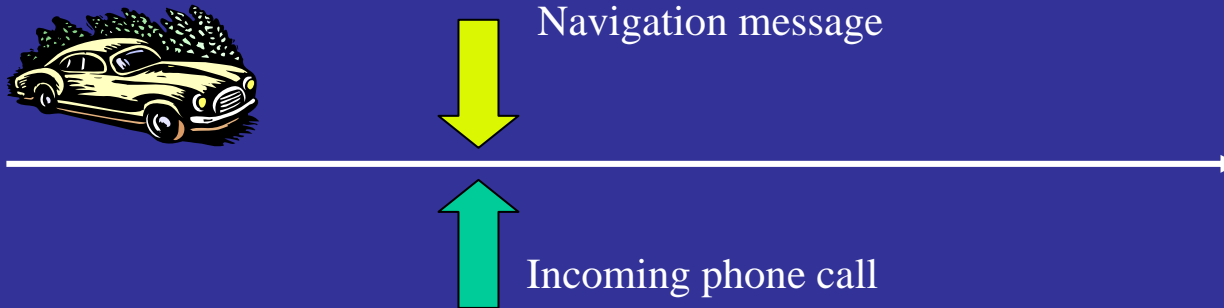
Potential solutions:

Navigation System	Phone
1. Presented	Accepted
2. Presented	Diverted
3. Not presented	Accepted
4. Visual only	Accepted

1b. Conflicts: types of navigation messages

Nav Pr 1   Nav Pr 2   Nav Final

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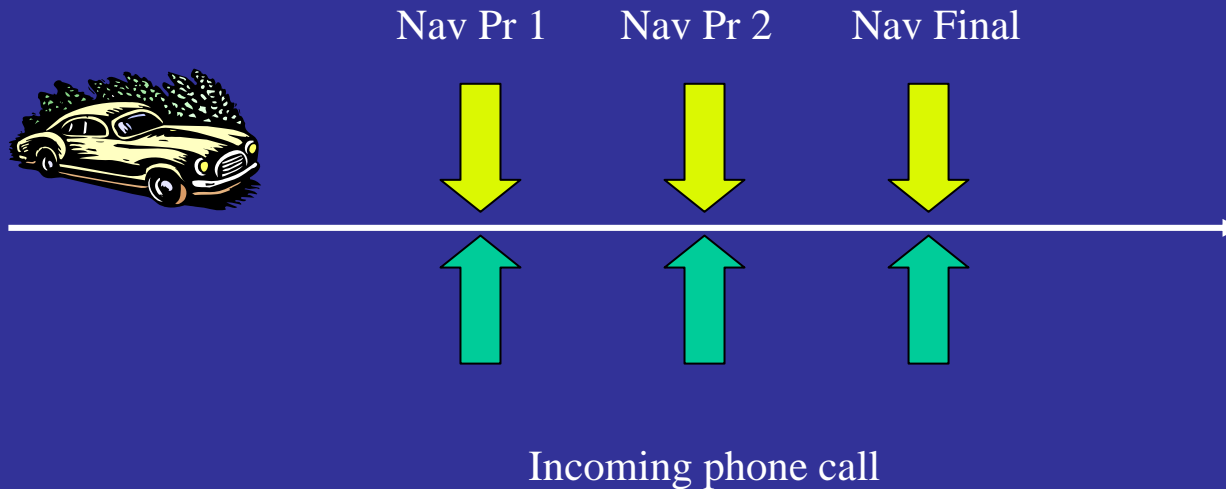
- Will solution vary depending on point of conflict?
- Solution may depend on:
    - Importance of next manoeuvre
    - What driver has already received
    - Complexity of manoeuvre

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2. Scheduling

Nav Final

Travel and Traffic Info

Complex manoeuvre
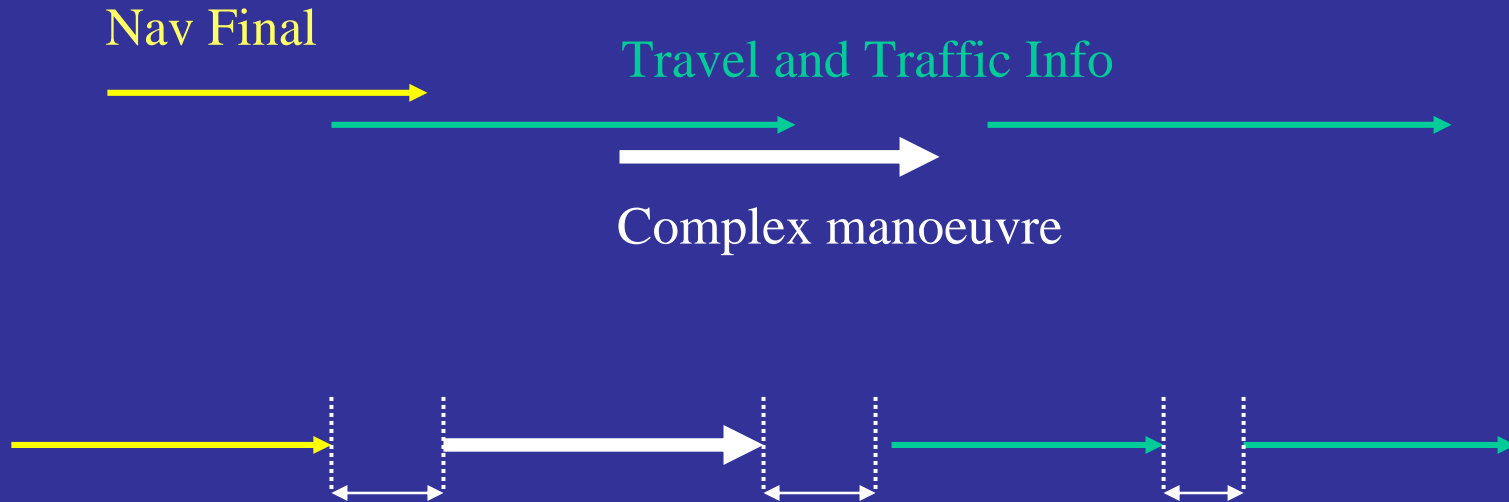
- What should the time windows be?
- What should they depend on?

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3. User understanding: inconsistent HMI

	Navigation Preview 1	Navigation Preview 2	Navigation Final	
1	→ A+V	→ A+V	→ A+V	
2	→ A+V	→ A+V	→ V only + phone	? 😐
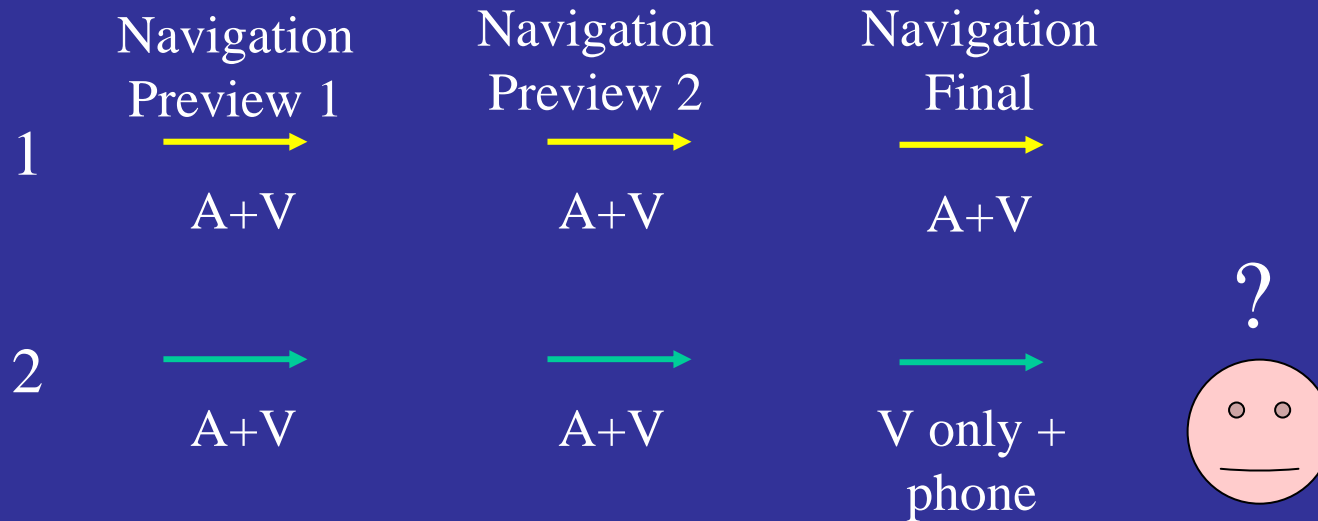
- Will drivers understand why systems may behave differently?
- Will they accept such systems?
- Driver expectations
- System design, training?

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4. User differences, segmentation
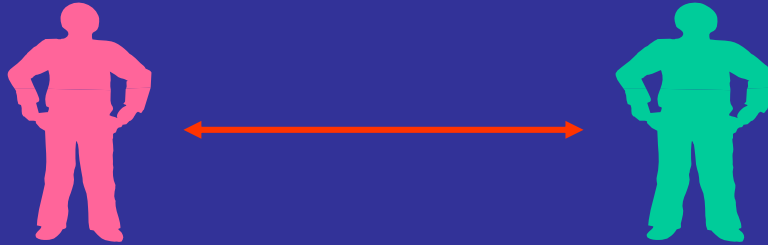
- Designing for novice customers

- Designing for 3rd generation customers

- Gradual evolution of 'intelligence'

- 'Taking away' information or features seen as retrograde step by by customers

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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

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