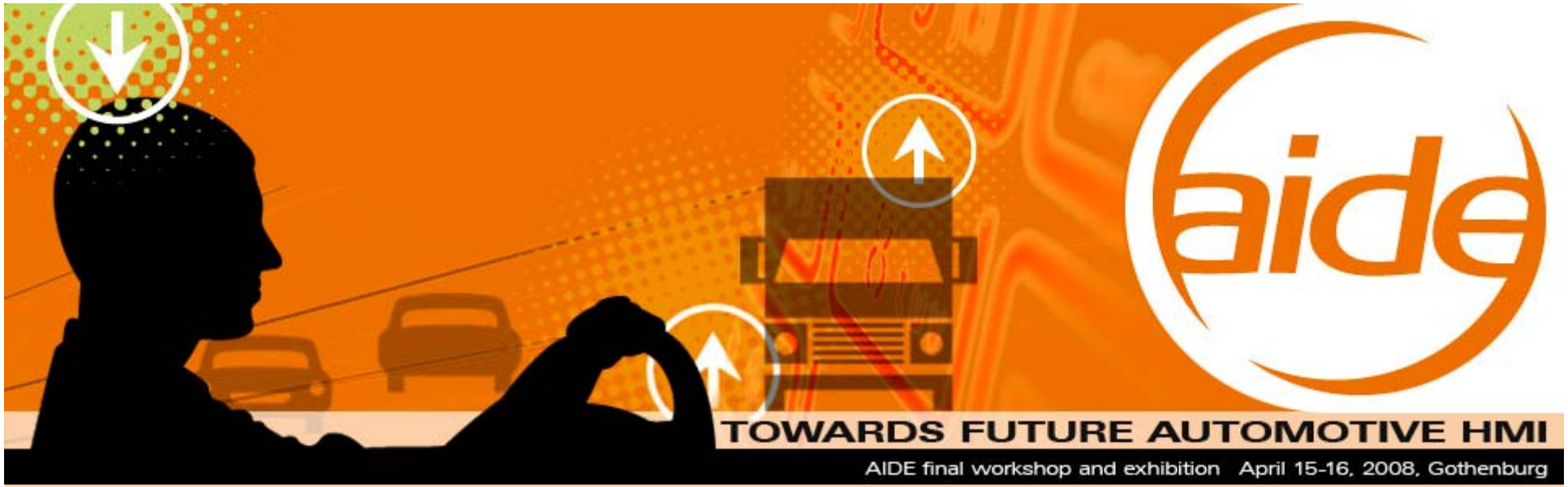


Evaluation of the AIDE CRF demonstrator

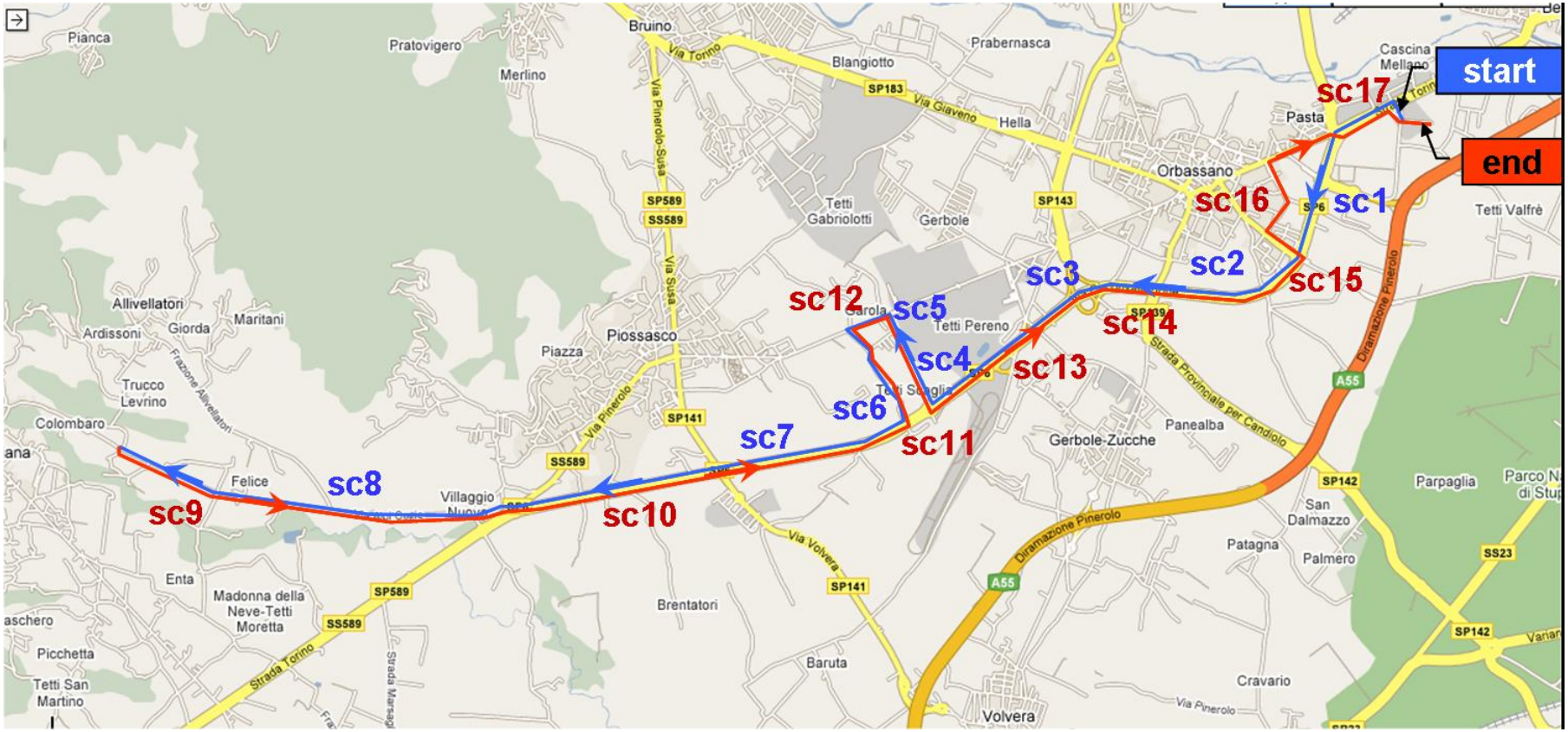
TNO/CRF/Kite

Rino Brouwer, TNO

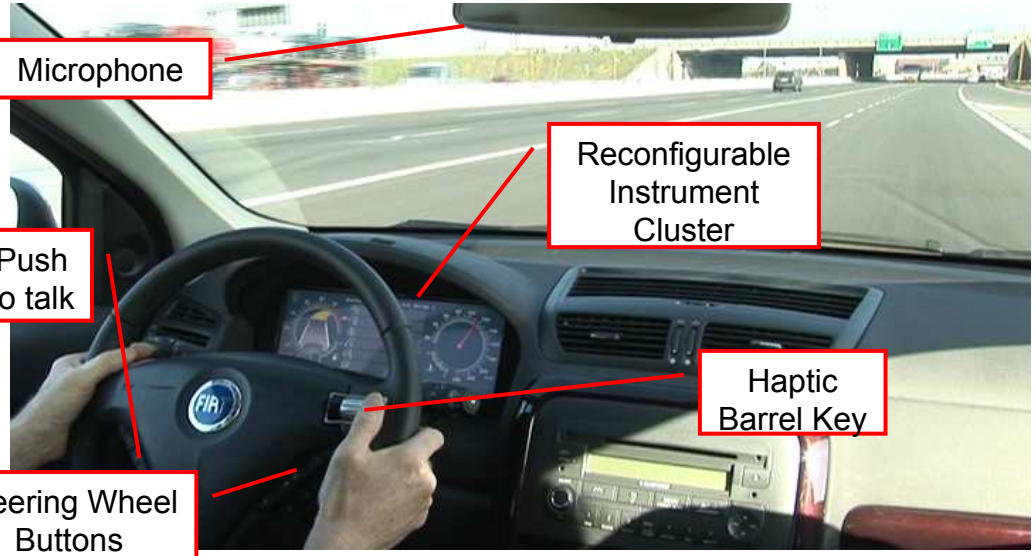
Experimental design

- 18 subjects tested
- Three driving sessions for subject (Baseline, AIDE, not AIDE) randomly balanced
- Duration : almost 1 hour per session (3 hours per subject)
- Route: main roads, secondary roads, urban streets
- Scenarios: extraurban and urban scenarios
- Use cases: 17 use cases per session

Experimental design - route



Experimental design – the vehicle



A = instrument cluster areas
B = ADAS display area
C = navigation display area
D = menu and info area

Experimental design – Use Cases

Use case	DVE	Description	AIDE	Non-AIDE
UC 6	low	TL triggers OP2 message (low brake fluid) and immediately after that another OP2 message (excessive engine coolant fluid temperature).	The two OP2 are visualized in cycle	Incoming OP2 interrupts the current OP2
UC 17	high	An OP4 action (glow plugs failure) is initiated while another Op3 action (external light failure) is executing and while DVE1 = HIGH	• The first incoming OP3 is postponed until the DVE1 state becomes LOW. • The second OP4 is also postponed until the DVE1 state becomes LOW. • When DVE1 state becomes NO/LOW the OP3 is allowed to be visualized first in its standard modality. • The second OP4 is visualized only after the OP3 is ended.	The first OP3 is visualized immediately and the second OP4 interrupt it while DVE1 = HIGH.
UC 1	low	Driver is asked to look for Paolo in the address book and after have found it to exit from the menu. While doing so an ESP failure message (OP2) is triggered by the TL when menu is opened	• OP2 is allowed to interrupt D2 with a popup modality, D2 is suspended but not interrupted	OP2 interrupt D2 in standard modality (not popup), dialogue is aborted

Experimental design – the 16 Use Cases

So, in AIDE:

- only safety critical warnings in demanding situations / interaction with system
- multiple messages are scheduled and prioritized according to their relevance
- interaction with system is not aborted

Experimental design – annotation

Experimental design – annotation

Variables

- Steering Wheel Reversal Rate (3 degrees, LP 0.6 Hz)
- Speed (Mean, Max, Sd)
- RSME
- Self-rated driving performance (ten-point scale)
- CRF questionnaire

Results per Use Case

Use case	Variable	A – NA	A – B	NA – B	difference	DVE	more then one message
UC 6	RSME	x	x		A > NA	low	yes
UC 9	RSME Rating	x x	x x		A > NA A < NA	low	yes
UC 7	SRR RSME Rating		x x	x		low	yes
UC 17						high	yes
UC 16	RSME Rating	x	x x		A > NA	high	yes
UC 15	SSR			x		high	yes
UC 2	RSME Rating		x	x x			no
UC 4	RSME Rating	x	x	x x	NA > A		no
UC 3	Std speed RSME Rating		x x	x x x			no

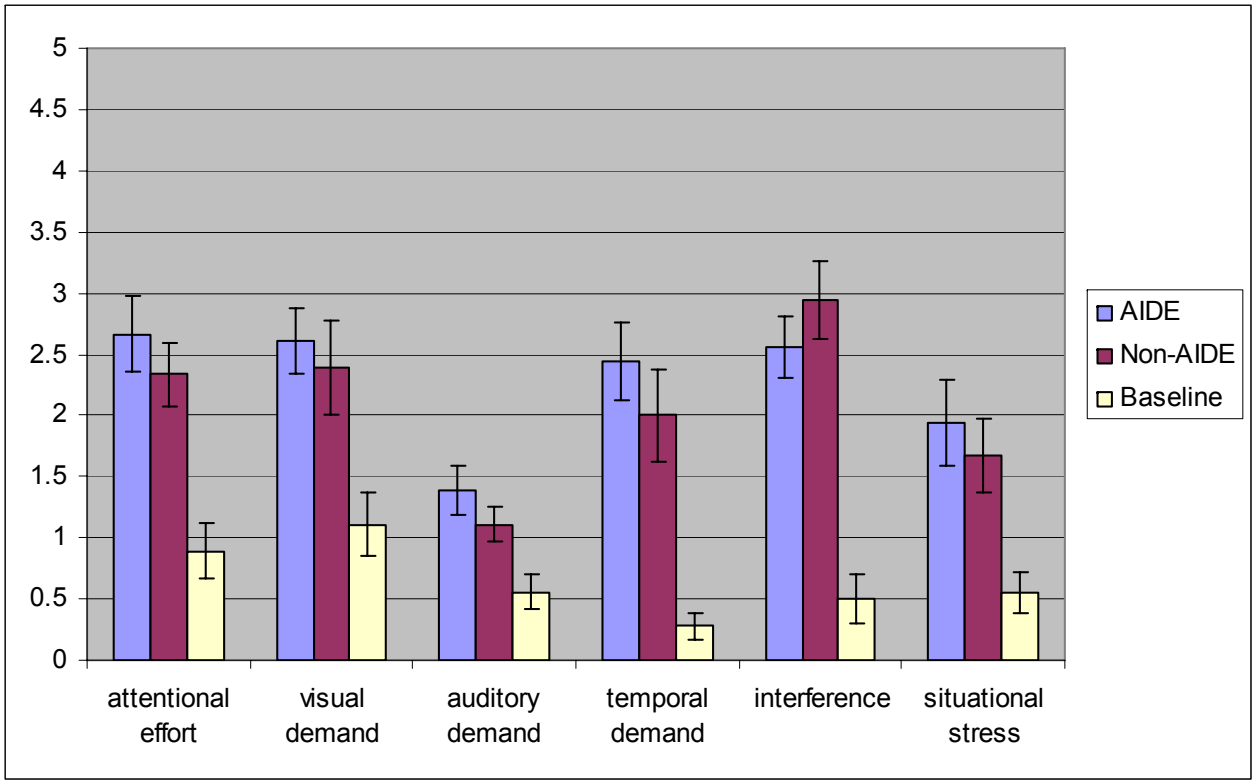
Results per Use Case

Use case	Variable	A – NA	A – B	NA – B	difference	DVE	more then one message
UC 1	SRR RSME Rating		x x x	x x x			no
UC 10						high	no
UC 14						high	yes
UC 5	RSME Rating	x	x	x x	NA < A		no
UC 8	Std speed Rating	x x			NA > A NA < A		yes
UC 12	RSME		x	x		high	no
UC 13	RSME Rating		x	x x		high	no
UC 11	RSME Rating		x x	x		high	no

Summary per Use Case

- No effect for driving related measures
- Effects for workload and self-rated driving performance
  - Generally B is better than A/NA
  - Differences between A/NA and B are about equally divided
  - Differences between A and NA are about equally divided. However,…..
  - …..all messages in A were perceived which was not the case in NA. Nevertheless this did not always result in higher workload in A
  - Levels of workload were generally quite low in A and NA (highest average indicated ‘rather much effort’)

Over all Use Cases (DALI)



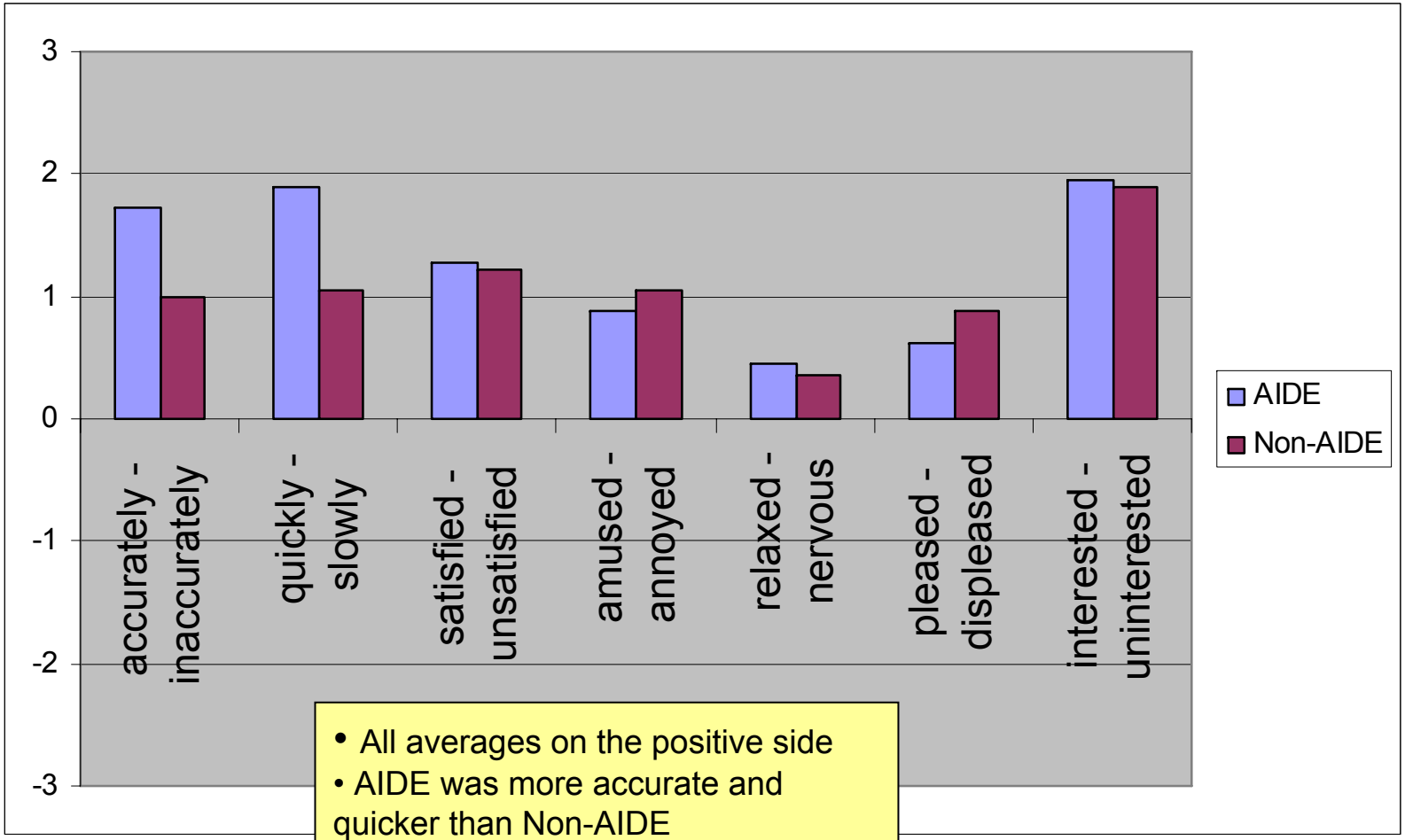
Auditory demand: A > NA

All scales: A & NA > B

Rating driving performance

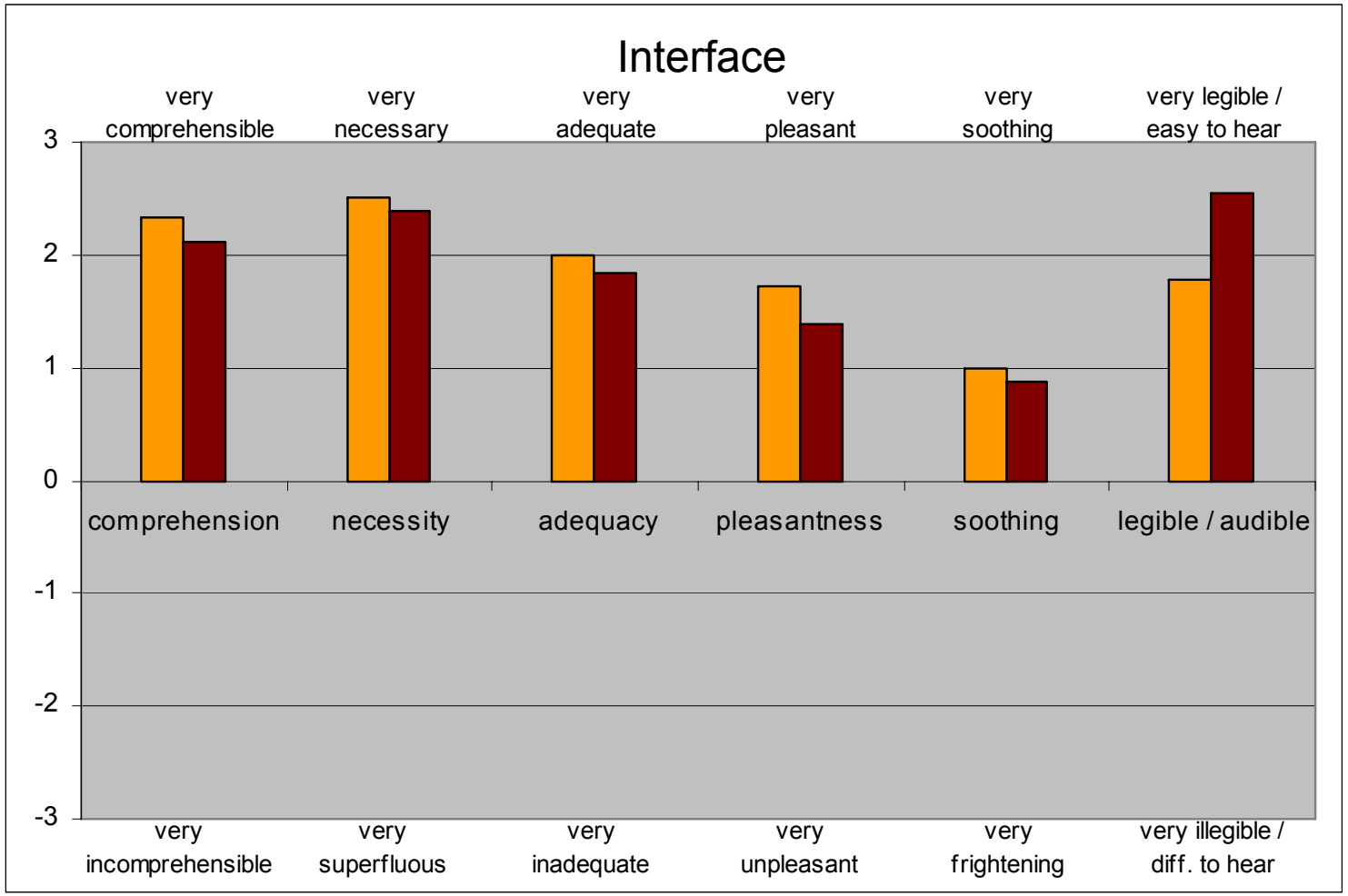
- Four questions were asked with relation to driving performance
  - General driving performance (Very well – Very bad)
    - A lower than B (< 0.1)
  - Feeling of safety – (Very safe – Very unsafe)
    - B safer than A / NA (< 0.1; < 0.05)
    - A safer than NA (< 0.1)
  - Least driving errors (e.g., missed traffic sign) in B; A and NA about equally often

Perceived utility



- All averages on the positive side
- AIDE was more accurate and quicker than Non-AIDE

Adequacy of interfaces



VISUAL

ACOUSTIC

Comparative questions

	A	NA	No difference
Felt Safer	4	8	6
I drove worse	5	7	6
More amused	4	4	10
More scared	2	2	14
More bored	1	3	14
More annoyed	4	1	13
Closer to my usual driving style	6	6	6
Made more driving errors	5	6	7
More difficulties in driving	5	4	9
More errors during task accomplishment	5	2	11
Session preferred	4	5	9

Summary of results

- Objective data
  - No results with respect to driving behaviour data
- Subjective data
  - RSME – no clear difference between A and NA. However,……
  - DALI – one difference for auditory demand (A > NA)
  - CRF – Driving performance – A felt safer than NA
  - CRF – Utility – not many differences but if so then favouring A
  - CRF – Interfaces were judged positively
  - CRF – Final comparison – not conclusive