



Cross-Regional HMI Design Considerations for In-Vehicle Infotainment Systems

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Project Aims and Objectives

1. Determine whether there are regional differences in IVIS design needs and preferences between the target regional groups (Australia and China) and to determine the impact of any differences for IVIS HMI design
2. Identify if automotive HMI design and development work conducted in one region can be applied to other regions
3. Identify if automotive HMI research conducted in one region can be applied to other regions
4. Provide global and specific recommendations regarding the design of IVIS HMI for both target regions



Method

- **Multi-method approach used:**
 - On-line Questionnaire (surface-level aspects of HMI)
 - Interaction Clinics (interaction-level aspects of HMI)
- **Data collected in:**
 - Melbourne, Australia (MUARC)
 - Shanghai, China (B.Thinking (Ipsos) Market Research)



Method – Questionnaire

Questionnaire Content:

Part 1: Demographics:

- Group characteristics – age, gender, education, occupation, etc
- Experiences in other cultures
- Length of time living in other countries

Part 2: Vehicle ownership and Driving patterns:

- Vehicle characteristics
- Travel hours and patterns



Method – Questionnaire

Part 3: Cultural Values:

- Values Survey Module (VSM 08): Hofstede's 5 dimensions
 - Individualism-Collectivism
 - Power Distance
 - Masculinity-Femininity
 - Uncertainty Avoidance
 - Long-Term Orientation
- Polychronic Attitude Index (PAI): Perception of time
- Locus of control (surrogate measure of perception of the environment)



Method – Questionnaire

Part 4: User design preferences and comprehension

4.1 Function-Matching

- To assess user comprehension of interface functions and objects, labels & displays
- The task had right and wrong answers, allowing comparison of group performance
- Range of item types (word, symbol, abbreviation) and functions (simple and complex)
- Two IVIS (Aust and Chinese) used


a. Changes to CD player source	<input type="text"/>	Select... ▾	b. Fast forward through CD audio track	<input type="text"/>	Select... ▾
c. Removes CD from CD player	<input type="text"/>	Select... ▾	d. Pause CD audio track	<input type="text"/>	Select... ▾
e. Sets the radio seek sensitivity to local or distant stations	<input type="text"/>	Select... ▾	f. Automatically searches for and stores 6 strongest radio stations	<input type="text"/>	Select... ▾
g. Mutes audio system	<input type="text"/>	Select... ▾	h. Select a radio station preset	<input type="text"/>	Select... ▾
i. Activates air conditioner	<input type="text"/>	Select... ▾	j. Adjusts the clock display	<input type="text"/>	Select... ▾



Method – Questionnaire

4.2 Labelling

- To assess user preferences for label types
 - Symbol, full word, abbreviation/acronym, Chinese character (Chinese group only)
- 8 items, each rated on 3 factors
 - Representativeness
 - Aesthetical appeal
 - Recognisability
- Used ISO symbols for clear, culture-free design
- Label types rated on 11-point scale: 0% - 100%


			COMPACT DISC	CD	光盘
4.2.5a	How well do you think the label represents a <i>compact disc</i> function?	Please select... ▼	Please select... ▼	Please select... ▼	Please select... ▼
4.2.5b	How aesthetically appealing do you think the label is?	Please select... ▼	Please select... ▼	Please select... ▼	Please select... ▼
4.2.5c	How easy do you think it would be to recognise the label while driving?	Please select... ▼	Please select... ▼	Please select... ▼	Please select... ▼



Method – Questionnaire

4.3 Input Controls

- To assess user preferences for input control types
- Different fan speed control types used as stimuli
- 8 items, each rated on 3 factors:
 - Ease of use first time
 - Ease of use once familiar
 - Aesthetic appeal
- Control types rated on 11-point scale: 0% - 100%

		
4.3.1a	How easy do you think it would be to manipulate this while driving the <u>first time you used it</u> ?	<input type="text"/>
4.3.1b	How easy do you think it would be to manipulate this while driving <u>once you were familiar with it</u> ?	<input type="text"/>
4.3.1c	How aesthetically appealing do you think it is?	<input type="text"/>



Method – Interaction Clinics

- **Purpose:** extend questionnaire findings to examine interaction-level aspects of HMI design preferences across regional groups
 - Combination of photo clinic and focus group methods
 - 8 IVIS photos shown
 - Set questions and group discussion about each photo
- **8 interaction clinics in each region (16 in total):**
 - 2 x Light vehicle owners
 - 2 x Small vehicle owners
 - 2 x Mid-size vehicle owners
 - 2 x Large/Luxury vehicle owners



Method – Participants

- Questionnaire:**

Region	n	Mean (SD) age	Gender
Australia	320	30.6 (11.2)	171 M 149 F
China	300	33.8 (6.4)	210 M 90 F

- Interaction clinics:**

Region	n	Mean (SD) age	Gender
Australia	57	35.9 (14.3)	31 M 26 F
China	64	32.8 (5.1)	46 M 18 F



Results – Key Regional Differences

- The Chinese prefer ISO symbols and Chinese characters over words or abbreviations, particularly in terms of recognisability.
- The Chinese appear less successful (compared to Australians) at comprehending abbreviations, particularly when the abbreviations are associated with complex IVIS functions.
- Australians are more comfortable with full English word labels than the Chinese and prefer this label type over symbols for labelling complex functions.
- The Chinese prefer symbol-based labels more so than Australians, but tend to find Chinese characters more recognisable for more complex IVIS functions. These findings are of particular significance given that many of the local and foreign IVIS interfaces designed for the Chinese market use English labelling almost exclusively.



Results – Key Regional Differences

- The Chinese tend to focus more than Australians on the aesthetic aspects of the IVIS rather than its functionality and usability. They want the interface to look modern and sophisticated and one that denotes a sense of high status.
- Australians appear more concerned than the Chinese with the safety (distraction) and usability issues associated with IVIS design, particularly display size and location, reach, control size and ease of use



Region-Specific Design Recommendations

China:

- Abbreviation labels should not be used unless the abbreviation is very commonly used (e.g. A/C and CD). Where possible, ISO symbols or Chinese characters should be used.
- For complex functions, such as automatic search and outside air quality, Chinese characters should be used over symbols unless the symbol directly and concretely relates to its associated function and is commonly used in China.
- Particular attention should be given to the aesthetic aspects of the interface, to make the IVIS look modern, sophisticated and uncluttered.
- Communication functions are viewed by the Chinese as a useful and expected part of an IVIS. Vehicle marketing in China could highlight the communication and connectivity features of IVIS.
- Careful consideration should be given to the use of colours, e.g., Red should be confirmed as an appropriate colour to convey warning or alert messages as it is often associated with good luck or happiness.
- During the IVIS design process, a Chinese culture consultant should confirm that the interface does not contain images, symbols or information that is culturally sensitive, likely to cause offence or be interpreted inaccurately by Chinese users, e.g., the numbers 4 and 7 and images of clocks, all of which are associated with death.



Region-Specific Design Recommendations

Australia:

- For complex functions, full English words should be used over symbols, unless the symbol directly relates to the function and is commonly used.
- There was strong preference from the Australian group for the radio/CD system to be placed above the HVAC controls.
- The IVIS display should be located as high on the dash as possible and in close proximity to related system controls.
- To the extent that it does not compromise safety, the IVIS should allow for some level of configurability or personalisation, e.g. ability to change the background and foreground colours and type of information on the screen (e.g. whether the time, date, outside temperature is displayed on the home screen).
- Marketing materials for vehicles designed for Australia should emphasise the safety and usability aspects of the IVIS design, including the research and development effort behind the design.



- Young, K.L., Rudin-Brown, C.M., Lenné, M.G., & Williamson, A. (In Press). The implications of Cross-Regional Differences for the design of In-Vehicle Information Systems: A Comparison of Australian and Chinese Drivers. *Applied Ergonomics*.

Thank You