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A Cross-Cultural Comparison of UI Components Preference between Chinese and Czech Users

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Abstract. Thanks to the intensification of globalization through communication technology, we are faced more and more with UIs coming from different cultural backgrounds. In order to fit the user's cultural expectations as closely as possible, designers need to combine usability knowledge with cultural insights. By defining a usable set of UI design guidelines for a target culture, designers could market their products with lower costs than with cross-cultural testing. To promote this line of research, we carried a pilot study targeted at the habits, mental models and UI preferences of Chinese and Czech users. Our findings show there is a strong influence of globalization on the cultural markers mainly through the use of common software platforms. However, we found many important culture-specific differences as well in both groups. We present our results as guidelines that could be used to enhance the user's acceptance of the UI in a specific culture.

Keywords: Cross-cultural research, Cultural markers, Methodology, Design, Guidelines, User-interface, HCI, Semiotics.

1 Introduction

Thanks to the intensification of globalization through communication technology, we are faced more and more with UIs coming from different cultural backgrounds. There is also a growing need to design UIs that are usable and well accepted in a targeted culture. In order to match the user's cultural expectations as closely as possible, designers need to combine usability knowledge with cultural insights. Cross-cultural testing of UIs is the most comprehensive way to meet this goal, but it is also the most financially demanding. Therefore, by defining a usable set of UI design guidelines for

a target culture, designers could market their products with lower costs and with better acceptance. In the field of cross-cultural comparison [3], we can build upon a body of previous research [7, 10, 11]. In our view, however, only limited work has been done in creating usable guidelines for cross-cultural UI design.

To promote this line of research and, to acquire the necessary insights, we carried a pilot study targeted at the habits, mental models and UI preferences of Chinese and Czech users. For this purpose, we chose to work from the semiotic perspective which helps us uncover the sense-making processes of the users. We used semiotic methods to build a common framework to gather and analyze cross-cultural data. From our perspective, the UI is an example of complex language. Consequently, in our research we focused on different components of the UI language such as: discrete elements, interaction sentences, narration, rhetorical tropes, and patterns. [2] Discrete elements are the smallest elements to have a meaning. The interaction sentence is a meaningful unit describing a task in the user's interaction. The narrative in UI is made both by the designer's meta-communication and the temporal and/or sequential aspects of perceiving UI elements. Rhetorical tropes are devices of persuasion and emphasis, such as metaphors. Patterns are typical configurations of UI language components in different settings. Focusing on these UI language components allowed us to focus the scope of our research.

2 Research Methods

In order to find the prevalent and preferred UI components or cultural markers [1], we focused our study on the five following areas: personal information (demographics, exposure to other cultures and technologies), layout (discrete elements, patterns, interaction sentences and narration), color (discrete elements, rhetorical tropes), symbol (rhetorical tropes) and look and feel (interaction sentences, narration, patterns, and rhetorical tropes). There were few overlaps due to the broad scope we focused on in this pilot study.

For the pilot study, we gathered 45 hypotheses about the specifics of Chinese users. The hypotheses were drawn from the conclusions of previous research in usability testing, psychological studies, visual semiotics and linguistics. For the information value of UI components's spatial organization we worked with the oppositions of Given/New, Ideal/Real, and Center/Margin proposed by Kress and van Leeuwen [5]. In this context Given is a taken-for-granted information and New information is being introduced only after. Similarly, Ideal presents what might be, and Real what is, *e.g.*, a specific or practical information. All of these oppositions can be combined with Center, a nucleus of information (or the most important information), and Margin, containing other dependent information.

Some of the conclusions were directly included in the hypotheses (*e.g.*, favorite colors for the background: blue, purple, cyan, gray), some were modified according to our assumptions (*e.g.*, because Given information in the West is expected on the left of a screen, we expected the information to work better on the right in China), some were constructed from our direct experience with the Chinese culture (*e.g.*, red color

with yellow text is used for special occasions), while some tested our more general assumptions (*e.g.*, there is a close similarity between the sequential information structure in language and the horizontal structure in visual composition).

Our qualitative method was based on one-to-one and one-to-many interviews supported by note taking and filling in questionnaires. In order to test the different hypotheses, we created at least one question for each hypothesis. The questions were clustered according their areas, *i.e.*, personal information, layout, color, symbol and look & feel. When appropriate, we used closed questions. However, because we carried an exploratory pilot study, we did not want to constrain our respondents and offered mostly open questions. The questionnaire was supported by examples of UI components.

To get data as reliable as possible, we wanted to limit the respondent's adaptation to a foreign culture. For that reason, we worked with students who were enrolled at a local university (Dalian Maritime University in China and Charles University in Prague, the Czech Republic) and were born and lived in the target cultures of our study. Also, the moderator of the interviews was a native speaker at both the locations. For each of the interviewed groups we chose a sample consisting of 20 respondents, evenly split between females and males. The Chinese respondents had a mean age of 23 years, while the Czechs had a mean age of 26 years. For this kind and depth of research, 20 respondents make for an adequate saturated sample size [4, 6, 8]. The results were analyzed both qualitatively and quantitatively with regard to the threshold of significance. The threshold of significance was set to 10 %. Only results of more than 10 % from one another were taken as different. This level is based on Sauro [9], where there is an 8 % margin of error for results from 20 respondents. We took into account only results greater than or equal to 60 %. The open questions were then analyzed with content analysis and contextual analysis across multiple questions where appropriate.

3 Results

Our findings show there is a strong influence of globalization on the cultural markers, mainly through the use of common software platforms. In spite of that, we found still many important culture-specific differences in both groups which are related to: spatial organization of information [5], shapes, direction of reading, motion, color, color combinations, semantic organization of content, use of icons and metaphors, user's preferences for different types of media, preference for culture-specific content and for cartoon imagery, trustworthiness of the content, navigation tools, visible and interaction grammar of menus and commands. Almost half (22) of our hypotheses were fully supported by the results from individual questions, 17 were partly supported (*e.g.* the result came second with a small difference in percentage after the first answer). 14 hypotheses were not supported, although useful information could be extracted. 2 hypotheses were impossible to verify due to lack of data. In the following sub-sections, we provide a summary of the hypotheses that were supported by the

data, those that were not, as well as other interesting insights and comments. The summary is divided by the main themes of our research.

3.1 Layout

For testing the UI composition we used a matrix with 3 rows and 3 columns. The hypotheses that were supported in relation to the spatial organization of the UI, shapes, direction of reading and motion are:

- Given information is expected on the right of the screen.
- A central composition is regarded more aesthetically pleasing than triptych composition.
- An even number of elements is more preferred than odd number. Ideal is 8.
- Images placed symmetrically in the middle look better than on the left/right of the screen.
- Free-flow layout is easier to use than grid-based layout.
- Users tend to read from top-left towards the center of the screen.
- Left-to-right lines of text are easier to read than top-to-bottom and right-to-left.
- There is a close similarity between the sequential information structure in language and the horizontal structure in visual composition.
- Curves stand for softness (and would be better perceived), while straight lines for hardness.
- Rounded corners (curvilinear patterns) are better perceived than square corners (geometrical patterns).
- Copied UI elements are better perceived than original elements. This applies both on computer icons and design patterns.
- Icons presenting objects with a description are more understandable than those without a description.

The unsupported hypotheses, on the other hand, disclosed interesting details:

- Real information is expected on the bottom of the screen. The majority of Chinese respondents put real information in the middle level of the screen (middle row in the matrix), overlaying it thus partly on the new and ideal information.
- A square and double-square layout would be more preferred because it is widely used in Asia (a symbol of Earth, Japanese buildings, *etc.*). Instead, respondents preferred a golden-section layout, such as 16:9 or 4:3.

3.2 Color

For testing colors we used a 16 color palette [12]. The supported hypotheses regarding colors and color combinations were:

- Users would prefer lighter (pastel) colors and a white background.
- Personal websites would use a wider color palette than websites for other purposes.

Unsupported hypotheses were the following:

- UIs with the white and yellow colors in the foreground tend to be regarded as more aesthetic.
- Background color is more important than foreground color. Interestingly, the Czech sample results supported our hypothesis and valued the background very high.
- UIs with the following background/foreground color combination are most appealing: white on blue, white on gray blue, white on purple. The background color preference was shared among the groups, except for lime, which was chosen by the Chinese. For foreground, blue was a favorite for the Chinese, while red and silver for the Czechs. From the shared color combinations, black on white stood for clearness and naturalness for the Chinese, while for the Czechs it was for contrast and simplicity.

Moreover, some interesting insights into the perception of colors emerged:

- Black: The largest group of semantic items pertained to night and death, followed by solemn and elegant, and ink and information device.
- Navy: The largest shared groups contained painting and writing, sky, navy and sea.
- Green: The largest shared groups were related to grass and plants, spring and summer and a commonality was also found in environmental activism.
- Teal: The Chinese respondents connected this color to ink and paint, whereas the Czech respondents with water and swimming as well as relaxation. No shared meaning was found.
- Silver: Metal and machine was the most common shared group of items, followed by fashion and luxury. The Chinese respondents mentioned also cold and rain, while the Czech respondents Christmas decorations and snow.
- Blue: The most common shared meaning was related to the sky and ocean, followed by happy and fun. The Chinese group mentioned clean and relaxing while the Czech group regarded blue as neutral and cold.
- Lime: Spring, life, and vigor was the largest and single shared meaning of this color. For the Chinese, it was also a color of comfort and relaxation while for the Czechs it was connected with food and eating.
- Aqua: Sky and water was the most common meaning shared between the two groups, the second was positive and energy. For the Chinese group, it was a bright color while for the Czech respondents it was connected with angels and innocence.
- Maroon: Passion and blood was the commonest shared meaning. The Chinese respondents also answer hair and chestnuts, while the Czech respondents said women's apparel.
- Purple: Dress, luxury, and attractiveness was the largest and single shared meaning. For the Chinese group, the color was connected also with flowers while the Czech group named sweets and candy floss.
- Olive: No directly shared meaning was found. The Chinese respondents regarded the color as military or soil while the Czech respondents connected with it wood, food, and dirt.

- Gray: The single shared meaning was gloomy and unpleasant, mostly cited by the Chinese respondents. For them, it was also connected with rain and dust while for the Czech group the color pertained to neutral, city, and office.
- Red: Together with maroon, the largest shared group revolved around passion, blood, and energy. Alarm and warning came second, followed by happiness and fun. For the Chinese respondents, it was a color of the national flag, warmth, and lipstick while for the Czech group it was connected with berries and flowers.
- Fuchsia: The single largest shared group was connected with girlish fashion and apparel. For the Chinese group, it was also a color of flowers and beauty.
- Yellow: The single largest shared group orbited around brightness, warmth, good mood and activity. For the Czech respondents, it was a color of attention and highlighting while for the Chinese group it was for childhood and freshness.
- White: The largest shared group was related to cleanness, followed by hospitals. For the Czech group, it was connected with neutrality, potential and contemplation. The Chinese related the color to simplicity and holiness, snow, but also weddings (together with red).

3.3 Symbol

For testing symbols we used various examples of computer icons found in different applications, or we created the examples by ourselves. The supported hypotheses regarding user's preferences for different types of media, preference for culture-specific content and trustworthiness of the content were:

- Icons presenting situations are more intuitive than those containing objects. The Czech sample preferred image icons to those presenting situations, in contrast with the Chinese results.
- There is a close similarity between sequential information structure in language and the horizontal structure in visual composition. Verb (a pointer icon) and adverb (a "+" sign) would mimic their position in sentence (*i.e.*, the verb comes before the adverb).
- Users can recognize visual patterns occurring in the UI.
- Copied UI elements are better perceived than original elements. This applies both on computer icons and design patterns.
- The sequence of input in a faceted search follows the sequence of natural language. The Subject comes first (relating to the user's gender, or size), followed by an implied Verb and adverb (purpose) and finally the Object (price, color, rating *etc.*). In contrast to the Chinese results, the Czech respondents would put size after gender (instead of purpose), purpose instead of price and price as the last, thus omitting color and rating.
- The use of Chinese calligraphy is very praised by the users.

The unsupported hypotheses:

- Icons presenting images are more intelligible than those containing characters
- There is a close similarity between sequential information structure in language and horizontal structure in visual composition. Noun (folder) and adjective (star at-

tribute) would mimic their position in sentence (*i.e.*, the attribute precedes the subject).

- Long textual pages are considered more useful than texts on more screens because the former contain all the information in one place (show more context)
- Icons with symbols coming from users' own cultural background are better perceived and understood than those from a foreign culture.
- Given that most of the websites contain mostly text, text would be regarded the most useful media. In the Chinese sample, pictorial media (images, videos) had the highest acceptance and credibility. In contrast, the Czech respondents preferred images and texts to videos and sound, both in terms of the efficiency of information transmission and trustworthiness.
- A localized UI would be better accepted than non-localized UI. The respondents were used to use foreign, non-localized applications, so localization was their least concern. On the other hand, speed and usability was the major concern among users. Also, originality and aesthetics was highly praised. The Czech results, on the whole, and in contrast to the Chinese results, showed a preference for features instead of color.

3.4 Look & Feel

For testing the look and feel we used various examples found in different applications, or we created the examples by ourselves. The supported hypotheses in this section regarding user's preference for cartoon imagery, navigation tools, visible and interaction grammar of menus and commands were:

- Menus starting with a verb are considered more natural than those starting with nouns. Although a noun and verb menu was regarded as easy to understand, a verb-driven menu was preferred in that it showed a clear purpose to the user. In contrast, the Czech sample expressed a strong preference towards nouns as these were the most intelligible.
- Cartoon imagery (*e.g.* little animals) plays an important role in communication. The cartoons improve users' mood and help recall different applications better than characters.

Unsupported hypotheses were:

- Menus progressively disclosing a narrative (*e.g.* starting with "I want to...") are considered more natural.
- Theme-driven menus (*e.g.* starting with "I want to...") or role-driven menus (*e.g.* starting with "I am...") are more logical than menus driven by attributes or concepts.
- The proposed interaction is best understood when starting from a concrete situation (a use-case, *e.g.* "I want to...") rather than user-role (*e.g.* "I am...").

4 Proposed Guidelines for Chinese UI Design

To help cross-cultural UI designers utilize our findings, we present our results in the form of guidelines that could also be used to enhance the user's acceptance of the UI in a specific culture:

1. Important information should appear in the top-left corner or in the middle-center of the screen.
2. New (or problematic) information should appear in the middle-center or top-center of the screen.
3. Given (or familiar) information should appear in the bottom-right or middle-right of the screen.
4. Ideal (or general) information should appear in the middle-left or top-left of the screen.
5. Real (or detailed) information should appear in the middle-center or middle-left of the screen.
6. Images should be placed in the middle-left or top-right corner of the screen.
7. Put information meant to be easily noticed in the middle-center or top-left corner of the screen.
8. Carefully choose the images: they start the visual narration on the screen, followed by titles.
9. The layout should allow for a central composition (1-column, 3-column, central layout).
10. The layout should follow the golden ratio (4: 3, or 16: 9).
11. Design the layout to be read from left to right. New information should come from the right.
12. Layout dividers should be straight, windows should have rounded corners and icons should be rounded.
13. UIs should use common patterns so that users can transfer their knowledge from other UIs.
14. Use blue, purple, aqua (cyan), and gray (silver) for background color.
15. Use light pastel colors on a white background.
16. Use black, blue, and lime for foreground color.
17. Put more important information on the foreground.
18. For commercial websites, use the combination of white, silver and black. For personal websites white, blue, black and aqua. Lime and fuchsia would also be well received. For educational websites use white, blue and black. For governmental websites use white, red and black.
19. Do not put yellow text on red background.
20. Use silver on black, blue on lime, black on white.
21. Use icons containing characters and images.
22. Place icon attributes on the right from the icon.
23. Create shorter pages with fewer contexts.
24. Search facets should follow the order of the natural language (Subject, verb, object).

25. For the highest acceptance and credibility, use pictorial media (images, videos).
26. Above all, the UI should be fast (responsive) and usable as well as aesthetic.
27. When suitable, use Chinese calligraphy elements (readable is better).
28. Form menus from verbs, submenus from nouns. Alternatively, use a combination of verbs and nouns.
29. To improve users' mood and recall use, cartoon imagery in the UI.

5 Discussion

In our paper we tried to show what interesting and workable differences between user groups, if any, we can gather from cross-cultural research. Both the groups were exposed to similar computing environments which lead to similar preferences for the UI structure in general. However, we found a few cultural markers that were different and were related mostly to layout and color. The impact of the native language grammar on the spatial and logical UI organization was not so profound as we expected. More differences came from habits and cultural background.

Given the large scope of the initial research focus, we were not able to run more tests on topics where the results did not support previous research results or were not clear enough or promised more interesting data. In a future study, we would like to focus more on those questions.

We hope our results and proposed design guidelines will help the international HCI design community and they will contribute to a discussion on how to improve cross-cultural research.

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