Culturally Appropriate Interfaces

Introduction

I'm sure you are familiar with computer-based user interfaces – think about how you interact with the apps on your phone, the word processor on your computer, and the applications that run in our web browsers. These interfaces probably feel natural to you – as this is "the right way to do it". If so, you might be surprised to learn that people from different cultures may prefer different user interfaces. For example, even color preferences vary by culture. Some cultures prefer more colorful interfaces than others, like Mexicans and South Koreans. Others, like Americans, prefer a simpler, monotoned interface (Reinecke & Bernstein, 2011). Besides saturation preferences, colors can have different connotations across the world (Russo & Boor, 1993). For example, in the USA and Japan, the color red typically means danger and anger, but in China, it usually means happiness. Additionally, Egypt perceives red as death whereas India perceives it as life and creativity.

If something as simple as color is influenced by national culture, what about all the other aspects of software engineering? Many researchers have used a set of cultural dimensions defined in a study conducted by Geert Hofstede to measure cultural preferences and necessities relating to user interfaces and other software development topics. This case study briefly summarizes Hofstede's cultural dimensions and how researchers have used them to make their software more culturally inclusive.

Background

Hofstede's dimensions have been used in many different contexts, including the area of cultural inclusivity in the software development process. Geert Hofstede conducted a well-known study on culture in the workplace with a large survey database from IBM. In his study, Hofstede came up with six cultural dimensions that help explain a culture's tendencies, values, and preferences. These six dimensions are, power distance, uncertainty avoidance, individualism/collectivism, masculinity/femininity, long/short term orientation, and indulgence/restraint (Hofstede, 2011). Each dimension is described with two opposing groups of characteristics. Some cultures fall at the extremes in one or more dimensions, but most cultures fall somewhere in between.

Table 1 summarizes the characteristics and indicates the current measurements of these dimensions aggregated over the American and Chinese societies ("Country Comparison", 2020). As shown in the table, China and the United States differ the most greatly in their score of individualism. The Unites States is a very individualistic country, where even within the family each member is to look out for themselves. Chinese on the other hand, act in consideration of a group of people such as their family. Additionally, the USA scores very low in the dimension of long-term orientation whereas China scores very high. Americans make many of their decisions considering the consequences in the short run as they value more the past and present times. Chinese on the other hand, tend to value the future, so they make decisions based on the predicted long-term consequences. Remember, these are *aggregations* – they can be helpful for predicting average cultural preferences and behaviors, but may not apply to any individual member of that culture.

Table 1

Hofstede's Six Cultural Dimensions and the USA and China's Placement

Hofstede Dimension	Description	USA Score	China Score
Power Distance (PDI)	A high score indicates that unequal treatment of those of lower power is common/acceptable.	40 (Low)	80 (High)
Uncertainty Avoidance (UAI)	A high score indicates a society that highly prepares for the future/uncertain circumstances.	46 (Low)	30 (Low)
Individualism (IDV)	A high score indicates a society that acts and thinks as individuals rather than as a group/the people look out for themselves.	91 (Very High)	20 (Low)
Masculinity (MAS)	A high score indicates a society values masculine values such as competition and achievement.	61 (High)	66 (High)
Long-Term Orientation (LTO)	A high score indicates a society that makes decisions based on predicted long-term/future results, instead of short-term/present results.	26 (Low)	87 (Very High)
Indulgence (ING)	A high score indicates a society that makes decisions based on impulses.	68 (High)	24 (Low)

Hofstede's cultural dimensions have been applied in many studies that investigate the role of culture in software engineering. Some researchers have used this theoretical framework to interpret their observations. For example, Borchers (2003) and MacGregor et al. (2005) used Hofstede's dimensions to analyze common issues in multicultural software developing teams. Others have used these measures of culture to design experiments, by predicting an effect on software engineering practice and then formulating and testing hypotheses. For example, Guzman et al. (2018) conducted research on the idea that user feedback could be affected by culture, therefore programs that automatically analyze user feedback could be culturally biased. The study mostly used Hofstede's power distance, indulgence and individualism dimensions of culture to create their hypothesis. Similarly, Reinecke and Bernstein (2013) used Hofstede's dimensions to predict a user's graphical interface preferences based on the countries he/she had lived in with a program they named Modeling Culture for Cultural Adaptivity (MOCCA).

Example implementations or embodiments

The MOCCA, was a system that automatically adapted its user interface to a culture's typical preferences based on Hofstede's six cultural dimensions (Reinecke & Bernstein, 2013). The MOCCA program first provided the user with a survey that collected information on the user's current and past countries of residence. Then, the program generated a customized user interface based on Hofstede's dimensions. The MOCCA program could generate three different versions of eight interface aspects: information density, navigation, accessibility of functions, guidance, structure, colorfulness, saturation, and support. For example, if a user came from a country with low uncertainty avoidance, the interface would provide an abundance of help/guidance tools. On the other hand, if a user came from a country with high uncertainty

avoidance, the program would generate an interface with a visibly adaptive wizard. Reinecke & Bernstein (2013) formulated these interface aspects based on Hofstede's scores by summarizing their findings from other researchers who studied similar topics. The MOCCA was fairly successful in predicting user interface preferences. With random user interface generation, only thirty-three percent of users were content with the interface. On the other hand, sixty-one percent of users were content with the interface generated by MOCCA.

Figures 1-4 (Reinecke & Bernstein, 2011) illustrate some of the interfaces MOCCA generated based on the users' answers to the survey. Figure 1 displays an interface with bright colors as the user was from a fairly masculine country (Mexico, MAS: 69). Figure 2 shows an interface with medium structure density as it contains no borders, but the sections are still color coded. MOCCA generated the second interface for someone who had lived in India, a country with a neutral score in individualism (48). An interface for a user coming from a weak individualistic country on the other hand, would have a lot of structure. The information would be grouped in color-coated sections and confined with borders like in Figure 1. Figure 3 demonstrates an interface with minimal information density for those from countries with low power distance scores. The interface in Figure 3 was created for a user who had lived in Poland (UAI: 38). Lastly, Figure 4 shows an interface generated for a user from a fairly feminine country. Therefore, the interface's colors are more pastel unlike the bright colors in Figure 1. The MOCCA generated the interface in Figure 4 for someone who had lived in Romania (MAS: 42), Russia (MAS: 36), and Switzerland (MAS: 70).

Figure 1 : Bright colors for high MAS

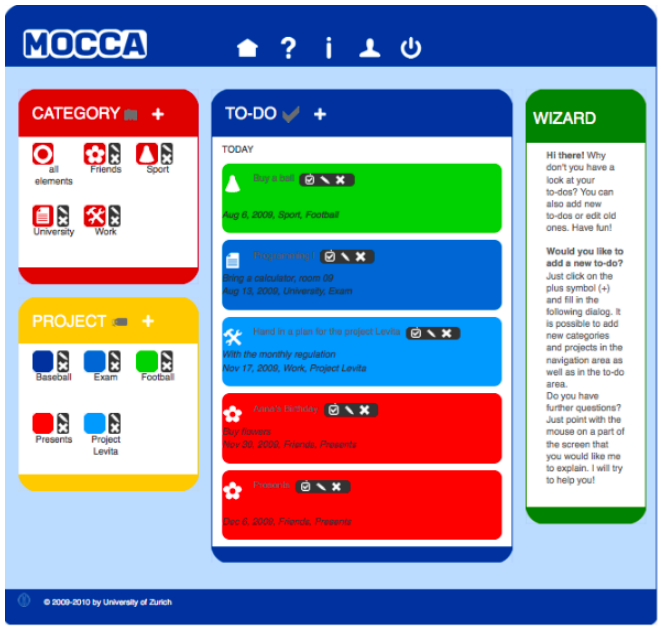

Figure 2: Medium structure definition for medium IDV

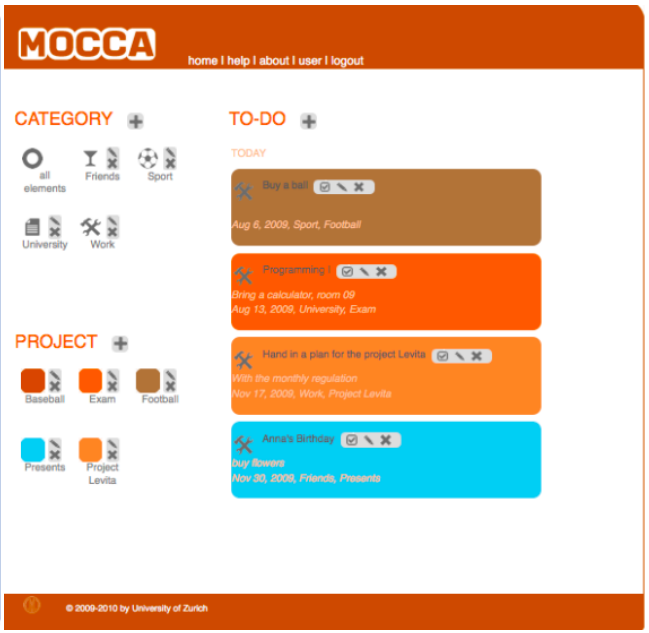

Figure 3: Minimal information density for low LTO

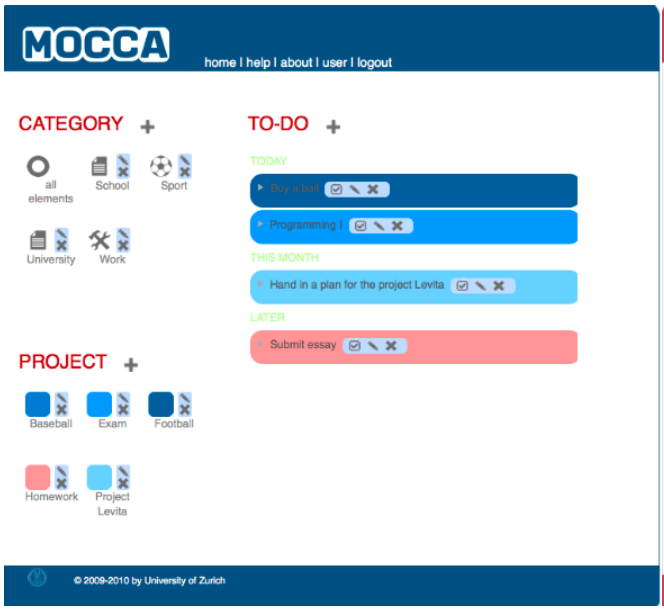

Figure 4: Pastel colors for low MAS

Discussion Questions

1. The MOCCA requires each user to fill out a form before entering the website to get an idea of user's cultural background. This restriction affects its accessibility (users might not be willing to share the information) and usability (users want to access the website, not fill out a survey!). How might a computer system's user interface *infer* and *dynamically update* to match a user's preferences?
2. Guzman et al. mentioned in their study, that the MOCCA did not succeed in satisfying the participants from Rwanda. The study suggests this could have been because Hofstede's dimensions generalize east Africans and therefore do not capture the typical preferences of Rwandan culture. Why do you think such a gap existed in Hofstede's data, and what would you do to fill it?
3. How might Hofstede's dimensions be used beyond user interfaces and usability? For example, are there applications in machine learning or in privacy policies?
4. Just as with culture, people of different genders tend to prefer different interfaces as they think and problem solve differently. [1] In your own culture, how do you think user interfaces be developed to include the preferences and requirements of other genders? Collect your thoughts and then discuss them with a classmate of a different gender.

[1] For further reading on this topic, look at *Finding Gender-Inclusiveness Software Issues with GenderMag: A Field Investigation.* Burnett, M., Peters, A. Hill, C., Elarief, N. (2016). https://doi.org/10.1145/2858036.2858274

References

Guzman, E., Oliveira, L., Steiner, Y., Wagner, L., & Glinz, M. (2018). User feedback in the app store: a cross-cultural study [Proceeding]. *International Conference on Software Engineering (ICSE-SEIS)*, 13–22. https://doi.org/10.1145/3183428.3183436

Hofstede, G. (2011). Dimensionalizing Cultures: The Hofstede Model in Context. *Online Readings in Psychology and Culture*, *2*(1), 1–26. https://doi.org/10.9707/2307-0919.1014

Reinecke, K., & Bernstein, A. (2013). Knowing What a User Likes: A Design Science Approach to Interfaces That Automatically Adapt to Culture. *Journal of Chemical Information and Modeling*, *37*, 1–28. https://www.jstor.org/stable/43825917

Reinecke, K., & Bernstein, A. (2011). Improving performance, perceived usability, and aesthetics with culturally adaptive user interfaces. *ACM Transactions on Computer-Human Interaction*, *18*(2), 1–29. https://doi.org/10.1145/1970378.1970382

Russo, P., & Boor, S. (1993). How fluent is your interface? Designing for international users. *Conference on Human Factors in Computing Systems (CHI)*, 342–347.