

CHAPTER 7

CONCLUSIONS

7.1 Introduction

Two research problems were identified for this research. The primary (and second) objective of this research was to design a conceptual model of usability that can be used to effectively research the relationship between subjective culture and usability. This objective arose as a result of the initial problem identified for this research, which was to establish empirical evidence that subjective culture affects usability. An experiment that was designed to measure the effects of Hofstede's [2001] cultural dimensions on accuracy, speed and satisfaction, was conducted. The experiment results were inconclusive, which led to the identification of variables that were proposed to have influenced the results of the experiment. It therefore became evident that it was necessary first to identify the variables that influence usability so that these variables can be controlled for when conducting an experiment of this nature. These variables were then synthesized into a conceptual model of usability in order to meet the primary research objective.

We begin this chapter by presenting a summary of the work completed (section 7.2). Contributions to the existing body of knowledge are then identified (section 7.3), followed by a discussion of the future research resulting from the research (section 7.4).

7.2 Summary of work completed

We began our research by reviewing the existing body of knowledge surrounding the effects of subjective culture on usability (Chapter 2). We reviewed the discipline of human computer interaction, the concepts of performance, usability and culture, and the arguments for and against the importance of culture in human computer interaction. We argued that culture influences communication, and as an interactive system is dependent on communication, culture is important in the development of such systems' interfaces. We then reviewed two approaches to culturalisation, and proposed a metamodel for the incorporation of both subjective and objective culture into the design of interfaces. In attempting to identify the most appropriate cultural models to be used as a basis for subjective cultural design guidelines, it was shown that subjective culture, and in particular, Hofstede's model of culture, influences usability from the perspectives of reducing the cognitive load, user acceptance, objective

usability and context of use. These findings provided further theoretical evidence that subjective culture influences usability.

We then conducted an experiment in order to obtain conclusive empirical evidence of the effects of subjective culture on usability. A review of research practices led us to the conclusion that the experiment should take the form of a usability test (Chapter 3). The inconclusive results of the experiment led us to identify variables that could have influenced the results (Chapter 4).

The validity of the variables proposed in Chapter 4 was then investigated. The investigation resulted in our accepting the variables relating to user acceptance, speed of performance, objective culture and performance determinants (Chapter 5). Of the four variables identified relating to the interface, only two were accepted. The other two interface variables, and the four variables relating to subjective culture could not be empirically established as valid, but there was sufficient theoretical evidence not to reject them either. The impact of the variables on experimental design, and on the results of prior research, was also discussed.

Finally, all the variables identified in the different parts of this dissertation were synthesized into a conceptual model of usability (Chapter 6). Where possible, strategies for controlling for the variables when conducting experimental research were also proposed.

7.3 Contribution to Knowledge

The products of a successful dissertation must make a contribution to the existing body of knowledge surrounding an important problem. The importance and timeliness of the problem of cultural diversity in human-computer interaction was established in Chapter 2.

This research contributes to the existing body of knowledge in many ways. First, the identified but unsolved problem of cultural diversity in user interface design was highlighted. The problem was discussed from the user-centred design perspective that interfaces should be compatible to users and their tasks. This discussion contributes to research by providing a detailed problem statement.

Secondly, we presented evidence that subjective culture influences usability from the perspectives of user acceptance, objective usability and the context of use. This evidence contributes to the debates surrounding the accommodation of subjective culture into user interface design.

Thirdly, strong theoretical evidence was presented that Hofstede's cultural dimensions influence

usability. It is hoped that this evidence will help to counteract the criticisms against the use of Hofstede's [2001] cultural dimensions model as a basis for researching the effects of subjective culture on usability.

Fourthly, by synthesizing the results of numerous other works in this field of study, this research provides a more comprehensive understanding of the variables that are known to influence usability. In addition, the validity of these variables on prior studies raised some concerns regarding the results reported by these studies. This further confirms that the cultural influences on usability and performance remain confused, necessitating further research.

These variables were incorporated into a conceptual model of usability (Chapter 6) that includes all the variables found to be valid as a result of this research. The major contributions of this dissertation stem from the proposed conceptual model of usability, discussed in chapter 6. These are unique and significant. The conceptual model of usability is seen to be useful to both academics and practitioners in the field of human-computer interaction.

From the practitioner perspective, the model provides designers with a better understanding of the design and user experience goals that should be incorporated into user interfaces. In particular, the model can be used to establish design goals appropriate to the specific context of use of a particular product. Furthermore, this research contributes a more cost-effective approach to designing global software products. It has been shown that the validity of the variables that influence acceptance is dependent on the subjective cultural context of the users. Furthermore, it has been shown that the validity of usability principles, heuristics and guidelines as design goals is dependent on the subjective cultural context of the intended users. As the subjective cultural context of users neutralizes the effects of selected user acceptance variables, and usability principles and heuristics, the complexity of accommodating for cultural diversity in the context of subjective culture is reduced.

From an academic perspective, the model provides a more holistic view of the issues that influence usability, which can be used as a basis for structuring tertiary coursework in the human-computer interaction field of study.

Finally, the conceptual model of usability contributes to the existing body of knowledge by providing a stepping stone in the long-term effort of fully defining the effects of cultural diversity on human-computer interaction. Although this research contributes to the problem of cultural diversity in human-computer interaction, it does not provide a complete solution, and also raises issues that require further research. This further research requires an effective conceptual model of usability that will help to ensure valid and reliable results. The conceptual model of usability provides researchers (both academics and practitioners) with a more effective tool for

continued research into the complex issue of usability, and in particular, into the issue of cultural diversity in human-computer interaction. Thus, the conceptual model of usability is seen as the main contribution of this dissertation to the existing body of knowledge in this area.

7.4 Future Research

The uncovered complexity of the problem of cultural diversity in human-computer interaction implies that there is a vast amount of work that must be done before a final solution will be available. These additional efforts are outlined here and left as future research.

There are two categories of future work: (1) further validation of the proposed variables presented in this dissertation; (2) validation and adaptation of the proposed conceptual model of usability. These are discussed below.

7.4.1 Further Validation of the Proposed Variables

The validity of six of the variables has been supported from a theoretical perspective only, and therefore empirical evidence is still required before their validity can be accepted. The validity of some of the variables has been established empirically from the literature; however, the full extent of the influence of these variables is still to be determined. The variables relating to these two categories of further research are discussed below.

7.4.1.1 Variables with Theoretical Evidence Only

The variables that were accepted as valid based only on theoretical support provided by the literature, and consequently require further research to establish their validity empirically are discussed below. In addition, further research is required in some instances to establish the full extent of the influence of these variables on usability.

- Cultural dimension strengths: the strength levels at which each dimension begins to significantly influence usability needs to be determined (see section 5.2.1).
- Cultural dimension interplays: the effect that cultural dimensions have on each other and therefore on usability needs to be fully defined (see section 5.2.2).
- The relative impact of cultural dimensions on usability: although subjective cultural dimensions have been shown to influence usability, it is necessary to identify which of them have significant and lesser impacts on usability (see section 5.2.3).
- Other subjective cultural dimensions: theoretically, all subjective cultural dimensions potentially impact on usability. However, empirical evidence of the specific dimensions need to be determined, including their strength levels, any interplays between them and the relative impact of these dimensions on usability (see section 5.2.4). It will also be

necessary to establish guidelines for the assessment of users and interfaces, as well as guidelines to incorporate the valid dimensions into the design of the interfaces.

- Relative impact of components: the degree to which the different components of a user interface influence usability needs to be defined (see section 5.3.3).
- Nature of the cultural dimensions: further research is required to determine whether the inherent characteristics of a particular side of some of the cultural dimensions will naturally result in higher usability (section 5.3.4).

7.4.1.2 Variables Requiring Definition of Extent of Impact

Although the variables listed below were accepted as valid based on the existing body of knowledge, further research is required to fully define the extent of their influence on usability:

- Usability principles and guidelines: The guidelines and principles that are relevant and valid within specific cultural, other user and task contexts need to be established (see section 5.3.2).
- User acceptance variables: not all of the variables influencing user acceptance have been identified. In addition, the dependencies between the user acceptance variables and the cultural (objective and subjective) and task contexts needs to be fully defined (see section 5.4).
- User preferences: the specific design preferences relevant to each nationality and ethnicity group needs to be defined (see section 5.6.2).
- Cognitive abilities: the effects of American and Chinese nationality and ethnicity have on cognitive abilities have been established. However, the effects of other nationalities and ethnicities still need to be defined (see section 5.6.3).
- The relative importance of usability measures for each nationality and each of the many types of tasks needs to be established (see section 5.8.1).

7.4.2 Testing and Adaptation of Usability Model

The conceptual model of usability provides a list of variables that are known to, and are hypothesized to influence usability, as well as recommended strategies for controlling for these variables. However, as noted in Chapter 1, the conceptual model has not been tested. Therefore the validity of both the variables and their strategies need to be demonstrated through empirical use.

The conceptual model of usability is seen to be a continuously changing tool that will need to be updated once new information comes to light. As a result of the future work proposed above, new variables may be identified, or the validity of existing variables may be negated. This will require the conceptual model of usability to be updated accordingly.

7.5 Summary

This chapter has summarized the work done for this dissertation. Contributions to the existing body of knowledge have been identified, as well as areas for further research that resulted from this research.

In conclusion, the problem of cultural diversity in HCI can be a source of amusement for many interface designers and software developers, as illustrated in Figure 7.1.

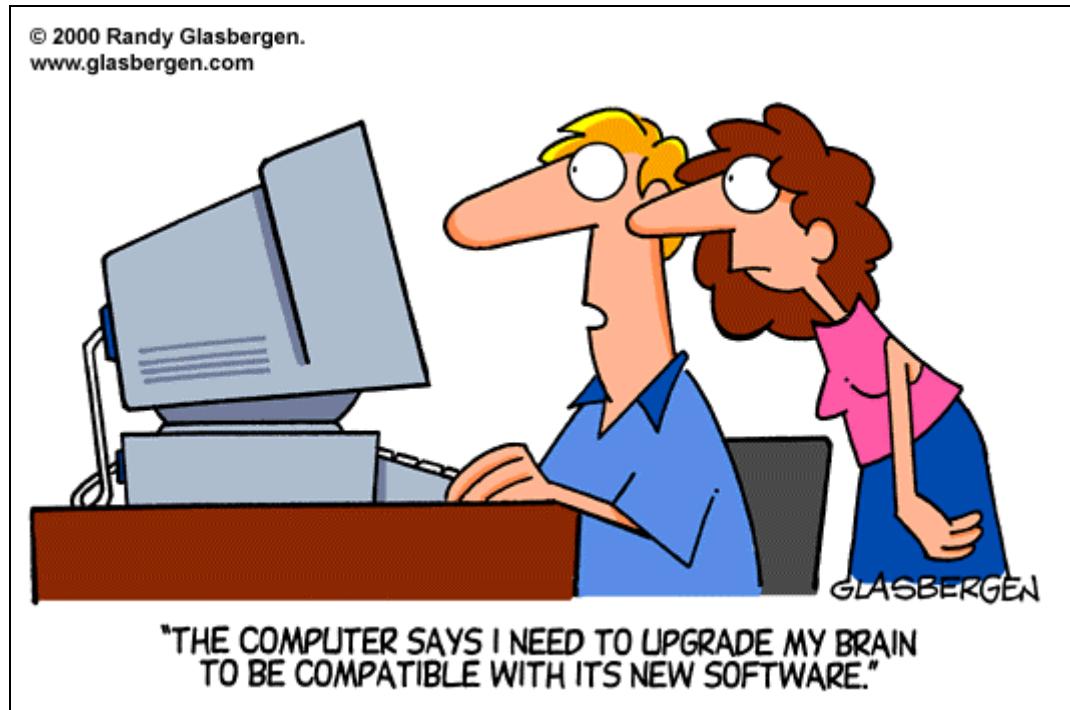


Figure 7.1: The Effects of Culture on Usability

However, not accommodating for cultural differences in user interface designs has often resulted in lowered performance and a degraded user experience, which is not so amusing to the users of such products. In addition, if the HCI community wants to be accepted as a professional discipline, then it needs to ensure that it achieves its ultimate purpose of making products easier and more enjoyable to use, by matching the product more closely to user needs and expectations.

Consequently, we believe that further research into the effects of culture on usability, and ways to combat such effects, is important and necessary to allow designers to design a positive relationship between the product and the human, rather than a negative one.