CULTURAL FACTORS IN USERS' EVALUATIONS OF USER INTERFACES AND INTERACTIONS:

Exploration and representation of usage in Jordanian contexts

Fuad Ali Mustafa EL-Qirem

A thesis submitted in partial fulfilment of the requirements of the University of Sunderland for the degree of Doctor of Philosophy

February 2010

ABSTRACT

Culture shapes most human behaviour, including interaction with computers. In much Human-Computer Interaction (HCI) research, culture is assumed to impact design preferences. However, many cultural variables identified in the general literature have no clear link to design preferences. In this thesis, we develop a new model, the Diamond Model, to structure a wide range of cultural variables. This is used to organise a literature review of cultural variables and their impact in HCI, as well as to identify instances of Jordanian cultural variables, which is the focus of field studies in this thesis. The balance and range of cultural variables in the Diamond Model suggests that culture should have impact beyond design preferences, and should also influence how users react to, explain and evaluate difficulties when using computers. To investigate whether this was the case, a series of field studies was carried out to explore the balance between the impact of culture on design preferences and on reactions to usage difficulties. Each field study found Jordanian instances for cultural variables in the Diamond Model, but also added further cultural variables that had not been identified in either the general or the HCI literature. In the process, we identified more cultural variables that influenced reactions to usage difficulties in Jordan than influenced design preferences. This thesis presents the Diamond Model, applies it to existing literature on culture and HCI, and uses it to structure analysis of results from three field studies. The result is an extended Diamond Model with specific Jordanian instances of cultural variables. However, this alone may not help software developers to understand how culture impacts HCI in Jordan. To complement the Diamond Model, we developed a novel approach called “Dramatic Sketches” to communicate impact of cultural variables on HCI. We present example Dramatic sketches and conclude with guidance on developing software for Jordanian contexts.

Acknowledgments

I would like to thank God the almighty for seeing me to the end of this research process.

I would like to thank first my supervisor professor Gilbert Cockton for his support and his experience of supervision.

I would like to thank AL-Zaytoonah University of Jordan, Professor Galib AL-Rafae from Jordan and Dr. Mohamed Loutfi from UWIC, UK.

I want to express my acknowledgment to my father (Ali Mustafa EL-Qirem); without his support I would not have completed my PhD. Also I am grateful to my mother for her invaluable encouragement and psychological support. Also I would like to acknowledge my wife for her support during my study in UK.

At the end I would like to dedicate my thesis to my new born son "Muhammad" and I wish all the best for him.

Fuad Ali EL-Qirem

Table of Contents

Acknowledgements	I
Table of Contents	II
List of Tables	VIII
List of Figures	XII
Abstract	1
Chapter One: Introduction	
1.1 Culture and Human Computer Interaction	3
1.2 Investigating the Role of Culture In Computer Usage	5
1.3 Overview of PhD Research	6
1.3.1 Originality	7
1.3.2 Summary of Research Approach	8
1.4 Thesis Outline	9
Chapter Two: Literature Review and Commentary	
2.1 Culture	11
2.1.1 Culture and Individuals and Nature	15
2.2 Models of Culture	17
2.2.1 Objective and Subjective Culture	17
2.2.2 The Onion Model	18
2.2.3 Iceberg Model	19
2.2.4 Meta-Model and Computer Usage in Jordan	22
2.3 A New Meta-Model of Culture: The Diamond Model	23
2.4 Status of the Initial Diamond Model	26
2.5 Populating the Diamond Model	27
2.6 Using the Diamond Model	29
2.6.1 Material Culture	31
2.6.2 Language	31
2.6.3 Political Processes	31
2.6.4 Economics Processes	32
2.6.5 Social Structure and Interaction	32
2.6.6 Summary	32

2.7 A survey of Cultural Variables 33
2.7.1 Material Culture 33
2.7.1.1 The Arts 33
2.7.1.2 Buildings, Houses, Monuments and Manufactured Products 34
2.7.1.3 Crafts and Decorative Art 34
2.7.1.4 Food 34
2.7.1.5 Literature Arts and Media 34
2.7.2 Language 35
2.7.2.1 Nonverbal Communication 36
2.7.2.2 Familiarity With English Across Cultures 36
2.7.2.3 Text Direction 37
2.7.2.4 Contextual Information Extent in Language 37
2.7.2.5 Information Flow 38
2.7.2.6 Colour 38
2.7.3 Political Processes 38
2.7.3.1 Political Contexts 39
2.7.3.2 English Fluency And The Role Of The Educational Systems 39
2.7.4 Economic Processes 39
2.7.4.1 Cost Of Equipment 39
2.7.5 Social Structure And Interaction Segment 40
2.7.5.1 Time Of Day, Dates And Numbers 40
2.7.5.2 Patterns Of Thinking And Values 41
2.7.5.3 Concepts Of Times And Space 41
2.7.5.4 Business Etiquette 42
2.7.5.5 Long-Term Versus Short-Term Orientation 42
2.7.5.6 Attitude To The Environment 43
2.7.5.7 Individualism Versus Collectivism 43
2.7.5.8 Femininity Versus Masculinity 43
2.7.5.9 Uncertainty Avoidance 44
2.7.5.10 Neutral or Emotional 45
2.7.5.11 Structure And Achievement Versus Ascription 45
2.7.5.12 Power Distance And Authority Conception 45
2.7.6 Conclusion On General Cultural Variable 46

2.8 The Diamond Model Illustrated With Jordanian Examples 52
2.8.1 Material Culture 52
2.8.2 Language And Semiotic 52
2.8.3 Political Aspects 53
2.8.4 Economic Aspects 53
2.8.5 Social Structure Interaction 54
2.9 Culture And Human Computer Interaction (HCI) 54
2.9.1 Material Culture Variables Studied in HCI 63
2.9.2 Language Variables Studied in HCI 63
2.9.3 Political Processes Studied in HCI 64
2.9.4 Economics Processes Studied in HCI 65
2.9.5 Social Structure And Interaction Variables Studied in HCI 65
2.9.6 Culture, Design Acceptability And Use Preference 67
2.9.7 Culture And Web-Site Evaluation 72
2.10 What Is Usage Evaluation, And How Users Evaluate Their Usage? 75
2.11 Conclusions 77
Chapter Three: Research Methodology
3.1 Introduction 78
3.2 Analysis Phase 80
3.3 Studied Phase 81
3.3.1 Pilot Study 81
3.3.2 Detailed Studies 81
3.3.3 Broader Studies 82
3.4 Research Methods 82
3.4.1 Development Of Interviews 83
3.4.2 Extending The Diamond Model 85
3.4.3 Revisiting The Hypotheses 86
3.5 Design Support Phase 86
3.5.1 Develop Cultural Personas From The Diamond Model 86
3.5.2 Develop Cultural Contextual Design From The Diamond Model 87
3.5.3 Develop Cultural Scenarios From The Diamond Model 87
3.5.4 Summary for Design Support Phase 87
3.6 Expected Outcomes 87

3.7 Research Challenges 88
3.8 Summary 90
3.9 Limitation Of Research Methodology 91

Chapter Four: IT Experts Study in Jordan

4.1 Comparing a Single National Study With Selected USA And UK Literature 94
4.2 Interview Participants And Their Organisations 95
4.3 Methodology 96
4.4 Data Analysis 98
4.4.1 General Impressions Of IT Usage In Al-Zaytoonah University Of Jordan 99
4.4.2 General Impressions Of IT Usage In Umniah Mobile Company 103
4.4.3 General Impressions Of IT Usage In Jordan National Bank 103
4.4.4 Common Problems Faced by Computer User In Jordan 104
4.5 Structure For Jordanian Computer Experience 105
4.6 Summary Of User Problems: Design Or Usage? 109
4.7 Analysis Of Suggestion Solution 110
4.8 Analysis And Discussion 112
4.9 Comparing Results With Previous Studies In UK And USA 116
4.10 Conclusions 119
4.11 Limitation Of IT Expert Study In Jordan 119

Chapter Five: Frustration, Anxiety in Jordan Computer Usage

5.1 Introductions 122
5.2 A US study Of Frustration In Computer Usage 124
5.3 Repeating Lazar And Colleagues' Study In Jordan 131
5.3.1 Results For Jordanian Students 133
5.3.2 Jordanian Employee Results 138
5.3.3 Post Session Frustration Levels For Employees 140
5.3.4 Correlations For Jordanian Employees 141
5.4 An Opportunistic Question 143
5.5 Triangulation Interviews 145
5.5.1 Participants 146
5.5.2 Method For Interviews 147
5.5.3 Some Example Responses 147

5.5.4 IT Skills And Experience Relative To USA 149
5.5.5. Attitude To Work: Perceived Responsibilities 152
5.5.6. Attitudes To IT In General 153
5.5.7 Dependency On Information And Communication Technology (ICT) 155
5.5.8 Work Context: Extent Of Dependency On IT 155
5.5.9 Work Context: Overstaffing 156
5.6 Results Discussion 158
5.7 Conclusions 162
5.8 Limitation Of the Frustration, Anxiety Study In Jordan 163
Chapter Six: Computer Usage Experiences in Jordan
6.1 Introduction 164
6.2 Method and Participants 165
6.3 Results 167
6.3.1 Employees Data 168
6.3.1.1 Usage Purposes 168
6.3.1.2 Design and Usage Preferences 169
6.3.1.3 Usage Difficulties 169
6.3.1.4 Suggested Solutions 170
6.3.2 Students Data 171
6.3.2.1 Usage Purposes 171
6.3.2.2 Usage Preferences 171
6.3.2.3 Usage Difficulties 172
6.3.2.4 Suggested Solutions 172
6.4 Affinity Diagram 173
6.5 Extending The Diamond Model 184
6.5.1 English Language 185
6.5.2 Femininity vs. Masculinity 186
6.5.3 Access to, And Experience With, Technology 187
6.5.4 Identifying With Software 189
6.6 The Evolution Of The Diamond Model 190
6.7 Summary 192
6.8 Conclusions 203

6.9 Limitation Of Computer Usage Experiences In Jordan 204

Chapter Seven: Communicating the Diamond Model

7.1 Introduction 205

7.2 Develop Cultural Personas From The Diamond Model 207

7.2.1 Complementing The Diamond Model With Personas 208

7.3 Develop Of Cultural Contextual Design From The Diamond Model 210

7.3.1 The Flow Model 211

7.3.2 The Sequence Model 212

7.3.3 The Artifact Model 214

7.3.4 The Cultural Model 214

7.3.5 The Physical Model 216

7.3.6 Summary: Contextual Design And The Diamond Model 217

7.4 Scenarios, Vignettes Or Something Else? 217

7.4.1 Dramatic Sketches Of Jordanian Computer Usage 225

7.4.2 Micro Sketches Of Jordanian Computer Usage 235

7.4.3 Coverage Of Jordanian Instances For The Diamond Model 236

7.5 Conclusion 239

7.6 Limitations Of Communicating The Diamond Model 241

Chapter Eight: Conclusion and Future Work

8.1 Introduction 243

8.2 What Do Jordanian Computer Users and Organisations Need? 246

8.3 Employers And Government Responsibilities 250

8.4 Using The Diamond Model 251

8.5 Contributions Of Thesis 251

8.6 Limitation Of Thesis 252

8.7 Future Work 253

8.8 Conclusions: The Relationship Between Culture and HCI 254

References 255

Appendices

Appendix A: Arabic and English Interviews of the First Pilot Study for Chapter Four. 263

Appendix B: Lazar and Colleagues Study Forms (US) And Arabic Forms (Jordanian) 266
Appendix C: Arabic and English Interviews (Using the Computer in Jordan) for Chapter Four Study. 276
Appendix D: The Follow-up Interviews Questions for Chapter Five English and Arabic Interviews Question. 281
Appendix E: Photos of Jordanian and UK Employees' Desks. 287
Appendix F: The Correlation Coefficient of Jordanian Students and Employees Computer Users for Chapter Five Study. 293
Appendix G: The Jordanian Instances Covered in the Dramatic Sketches and Micro-Sketches. 296
Appendix H: Paper Published in IWIPS 2007. 304
Appendix I: First Structure of the Diamond Model. 313

List of Tables

#	Page number	Table
1	47	Table 2.1 Cultural variables that impact computer usage and design preferences.
2	63	Table 2.2 Material Culture variables studied in HCI.
3	63	Table 2.3 Language variables studied in HCI.
4	64	Table 2.4 Political Influences variables studied in HCI
5	65	Table 2.5 Economics variables studied in HCI
6	65-66	Table 2.6 Social Structure and Interaction variables studied in HCI
7	69-70	Table 2.7 Eleven attributes related to four cultural dimensions.
8	101-102	Table 4.1 The problems and the suggestions solution.
9	107-108	Table 4.2 Affinity diagram of the results.

#	Page number	Table
10	113-114	Table 4.3 Cultural variables and Jordanian instances
	115	Table 4.4 Affinity diagram of the suggestion solution.
11	118	Table 4.5 Users computer problems in Jordan, UK, and USA.
12	125	Table 5.1 US Student user feelings after a frustrating experience
13	126	Table 5.2 Post-session factors for student users
14	127	Table 5.3 Frustration Scores and Correlates for US Student Users
15	129	Table 5.4 USA Post-Frustrating Experience Feeling for Employee Users
16	129	Table 5.5 Post-session factors for USA employee users
17	131	Table 5.6 Frustration Scores and Correlates for US Employee Users
18	134	Table 5.7 Self Reported Computer Experience Levels
19	135	Table 5.8 Self Reported frustration level
20	135	Table 5.9 Jordanian and US student user feelings after frustrating experiences
21	136	Table 5.10 Post-session factors for Jordanian student users
22	137	Table 5.11 Frustration correlations for Jordanian student users
23	140	Table 5.12 Employee user feelings after a frustrating experience
24	141	Table 5.13 Post-session factors for employee users
25	142	Table 5.14 Frustration correlates for employee users
26	143	Table 5.15 Student and employee show if the can or can't be able to work on something else until solving the problem.
27	144	Table 5.16 Confounds, Triangulation Tactics and Sample Factor
28	148	Table 5.17 Informants and Explanatory Factors

#	Page number	Table
29	178-179	Table 6.1: The affinity diagram of the Green group: English language, and pink group: Some of the users don't understand the English language
30	180	Table 6.2: The affinity diagram of the Green group: Femininity vs. masculinity, and the pink group: Men and women experience.
31	180	Table 6.3.a: The affinity diagram of the Green group: Using technology, and the pink group: The availability of the technology.
32	181	Table 6.3.b: The affinity diagram of the Green group: Using technology, and the pink group: Training.
33	181	Table 6.3.c: The affinity diagram of the Green group: Using technology, and the pink group: Trusting.
34	181	Table 6.4.a: The affinity diagram of the Green group: Time, and the pink group: Time of using the computer.
34	182	Table 6.4.b: The affinity diagram of the Green group: Time, and the pink group: Experience of using the computer.
36	182-183	Table 6.5.a: The affinity diagram of the Green group: Identifying with software , and the pink group: Suitability for users.
37	183	Table 6.5.b: The affinity diagram of the Green group: Identifying with software , and the pink group: Suitability for users.
38	184	Table 6.6 The relation between Green groups in the affinity diagram and the culture variables group.
39	194	Table 6.7 Material Culture segment, sub-segments, groups, variables and instances of the Diamond model
40	195-196	Table 6.8 Language and Semiotics segments, sub-segments, groups, variables and instances of the Diamond model.

#	Page number	Table
41	197-198	Table 6.9 Political Processes segment, sub-segments, groups, variables and instances of the Diamond model.
42	199	Table 6.10 Economics segments, sub-segments, groups, variables and instances of the Diamond model.
43	200-202	Table 6.11 Social Structure and Interaction segment, sub-segments, groups, variables and instances of the Diamond model.

List of Figures

#	Page number	Figure
1	12	Figure 2.1 Pakistani trucks decoration
2	13	Figure 2.2: The Stabilizing of Culture Patterns. (Hofstede 1980) page; 27
3	14	Figure 2.3: Triandis definition of culture.
4	14	Figure 2.4: Kluckhohn is Definition of Culture.
5	14	Figure 2.5: Kroeber and Parsons Definition of culture.
6	15	Figure 2.6: Hofstede's Pyramid model from (Del Galdo and Nielsen 1996, page 47)
7	18	Figure 2.7: the onion model from (Del Galdo and Nielsen 1996) page 48
8	20	Figure 2.8: Iceberg model from (Del Galdo and Nielsen 1996) page 45
9	21	Figure 2.9: Jordanian employees' desks.
10	22	Figure 2.10: UK employees' desk.
11	24	Figure 2.11: Diamond model
12	25	Figure 2.12: Objectives vs. subjective as a diamond
13	25	Figure 2.13: Onion model culture as a diamond model
14	25	Figure 2.14: Iceberg model as a diamond

#	Page number	Figure
15	30	Figure 2.15: The diamond model of the five cultural variables
16	35	Figure 2.16: The semiotic triangle model (Ogden and Richards 1923).
17	36	Figure 2.17: The semiotics triangle related to the Diamond Model.
18	50-51	Figure 2.18: Tree diagram of five Culture Segments.
19	61	Figure 2.19 The two relations between culture and HCI.
20	79	Figure 3.1 Research Structure
21	83	Figure 3.2 Affinity Diagram model
22	86	Figure 3.3 Extending the Diamond model through our study.
24	133	Figure 5.1 Perceived computer experience for student in Jordan.
25	134	Figure 5.2 Incident frustration levels of Jordanian students
26	139	Figure 5.3 Perceived computer experience for Jordanian employee
27	139	Figure 5.4 Incident frustration level
28	174	Figure 6.1 First green group: card number (1) English language, and (6) Some of the users don't understand the English language
29	175	Figure 6.2 Second green group: card number (2) Femininity vs. Masculinity, and (7) Men and women experience
30	176	Figure 6.3 Third green group: card number (3) Using technology, the card number (8) The availability of the technology, (9) Training, and (10) Trusting.
31	177	Figure 6.4 Fourth green group: card number (4) Time, card number (11) Time of using the computer, and (12) Experience of using the computer.

#	Page number	Figure
32	177	Figure 6.5 fifth green group: card number (5) Identifying with software, and (13) Suitability for users.
33	179	Figure 6.6 Example of encoded Arabic website, Arabic words but appear in code and can't be read.
34	216	Figure 7.1 Cultural models in a product development organization (Beyer and Holtzblatt 1998); page 113.
35	221	Figure 7.2 Worth Delivery Scenario for Good Plan UX, by Cockton (2009) page 21.
36	247	Figure 8.1 Suggested Arabic tool tips in Microsoft word.
37	248	Figure 8.2: Example of reversed Arabic word.
38	248	Figure 8.3: Example of Google translator that translates the sentence from English to Arabic in wrong way.

Chapter One

Introduction

"As computer use becomes more widespread, an increasing number of researchers specialized in studying the interaction between people and computers, concerning themselves with the physical, psychological and theoretical aspects of this process." *Dix, et al (2004) page 3*

The thesis will study the relation between Human-Computer Interaction (HCI) and culture. But before we start, we will give a short summary of HCI and culture.

Human computer interaction (HCI) is "the study and the practice of usability. It is about understanding and creating software and other technology that people will want to use, will be able to use, and will find effective when used" (Carroll 2002).

Hofstede (1980) defines Culture as the "collective programming of the mind". The word is reserved for describing entire societies; for groups within societies, "subculture" is used (Hofstede 1980).

Kroeber & Kluckhohn (1952) define culture as “consisting of patterns, explicit and implicit, of and for behaviour acquired and transmitted by symbols, constituting the distinctive achievements of human groups, including their embodiments in artefacts; the essential core of culture consists of traditional ideas and especially their attached values; culture systems may, on the one hand, be considered as products of action, and on the other as conditioning elements of further action."

1.1 Culture and Human Computer Interaction

Most human behaviour is affected by culture, directly or indirectly. With the growth of using computers worldwide, it has become increasingly important to understand the cultural factors that influence successful use.

Computers are now everywhere. Every accountant, author, secretary, scientist, business person and engineer has to have one. The computer now performs many jobs that humans did before, such as mathematical calculations, which previously used pencil and paper, but now just by clicking on the computer, all the results will appear, faster than human calculation and with many fewer errors. The computer makes life for humans easier, faster and better organized (Landauer 1999), but the title of Landauer’s book, *The Trouble with Computers*, covers many reasons why computers were not living up to their promise.

A story of computer problems from Landauer (1999) illustrates an interaction of culture and computer usage. Landauer went to a department store to buy a watch, but the sales staff couldn’t find the stock number in the system or in paper documentation. As a result, the sales staff tried to sell Landauer another watch that they did have the stock number for! Landauer wanted the one he had chosen, and finally he left the store without any watch. In this case Landauer wasted his time and the store lost a client, but was this really “trouble with computers” or trouble with work practices?

In the author’s view, if we had the same scenario in Jordan, the store would definitely sell the watch even at the ‘wrong’ price. They would not lose a sale

because of a computer problem. This observation suggests that Jordanian users will have difficulties with computers, but the impact of these difficulties is not always the same as it would be in the UK or the USA. This thesis explores how similar usage difficulties have different consequences in different cultures.

As well as this personal observation above, research studies have found that ingrained cultural values influence human computer interaction. For example Choi et al. (2005) studied the differences between Korean, Japanese and Finnish mobile phone users, relating these to four culture dimensions identified by Hofstede (1980): uncertainty avoidance, individualism vs. collectivism, context and time perception. This and other studies are reviewed in more detail in Chapter two.

Most studies of the relation between culture and computer focus on interface preferences such as colour, typefaces, icons, style and the layout of the design. However, we should ask whether there are any other relations between culture and computer usage? And if yes, could cultural differences affect the usage of computers as well as initial aesthetic and symbolic preferences?

These two potential impacts of culture are important and need to be distinguished. By *cultural design preferences and acceptability*, we mean a user's culturally influenced responses to interface features, which can be either predicted (as preferences) or evaluated (as acceptability). Design preferences indicate user needs. Satisfying them and makes designs acceptable for use. Most HCI research on culture focuses on design preferences and acceptability. However, HCI in general has looked more at usage than preference and acceptability, and there is clearly scope to investigate how culture can influence the way that users react to, explain and evaluate usage difficulties. By *cultural usage evaluation*, we mean evaluative activities by users that express their attitudes towards specific usage difficulties. Such attitudes combine beliefs, feelings and inclinations that are revealed in users' explanations of, evaluations of, and reactions to usage

difficulties. We are not focused here on actual usage, but on how users evaluate this usage. The latter is the main focus of this thesis, in contrast to most HCI research on the impact of culture.

1.2 Investigating the Impact of Culture on Computer Usage Evaluation

This thesis reports the results of field studies in Jordan that explored the relation between culture and Human Computer Interaction (HCI) and how culture differences could impact users and usage.

There could be much cultural impact beyond preferences for user interface features, for example: the motivation of users and how they deal with computers, their trust of computers and other attitudes towards information and communication technology. These are examples of how culture could affect HCI that go beyond preferences for design features.

Some studies have focused on usage variables that relate to culture differences. A study by El Said et al. (2005) surveyed 370 computer users in Egypt, focusing on two companies selling books online. The first company was Amazon, which is an international online company and the second was E-Kotob, which was a local online company. In this study Egyptian consumers trusted Amazon more than e-kotob, because they trust international websites more than local websites. (El Said et al. 2005)

Nakakoji and Ito (1996) studied differences in usage of computer systems between the United Sates and Japan. Their anecdotal differences emphasize differences between the two cultures, which need to be understood when designing a system to be used in different cultures. They focused on three characteristics, collectivism, synthesis, and human relationships, which are examples of cultural variables, and could impact computer usage.

The research in this thesis builds on a broader view of the impact national culture on HCI in such existing research, through a series of field studies. A focus on a national culture is based on the belief that some national cultural differences could affect usage of computers, such as media, history, religion,

education or workforce development. We chose Jordan because the researcher is Jordanian, easing access and communication.

Culture is a very challenging and highly complex research area for HCI, with little agreement on definitions and uncertainty about relevant theory (Kamppuri et al. 2006). However, when we investigate usage and design preferences in non-Western countries, especially developing ones like Jordan, we do see differences that are real and relevant to design. To some extent, it does not matter whether the differences are due to national, sub-national (e.g., family, organisation, locality, or regions within nations), or international causes (e.g., geographic regions of several similar countries, common languages, common religions, globalisation). As long as differences are real and well documented, they require a design response. Thus although the research in this thesis has a national focus, it is recognised that discovered instances of cultural differences may not be common across all Jordanians, and/or may extend to other Arab or Islamic countries.

We can only study culture via artefacts or the behaviours of individuals, and this cannot wholly isolate culture from other factors. We must thus be cautious, but at the same time we need to try to identify the impact of culture, not only to provide better support for design in developing countries, but also to highlight cultural assumptions in existing HCI research that have not currently been recognised as such.

1.3 Overview of PhD Research

The aims of the research reported in this thesis are:

1. To identify cultural differences relevant to HCI, through literature reviews, field studies and related methods.
2. To identify and assess the relative role of design features and usage factors in the impact of cultural differences on interaction.
3. To assess the suitability of existing HCI methods such as personas for communicating cultural factors of relevance when designing for Jordanian interaction.

These aims suggest the following research questions:

1) Where do we see most impact from cultural differences: in design acceptability? or in users' evaluation of interaction? Cultural differences in usage have been less studied in HCI than cultural differences in interface acceptability. Culture and usage has not been studied in HCI as much as culture and design preferences. How can we improve the balance between usage and design in cultural HCI?

2) Which major cultural differences are relevant to the usage of interactive computer systems? What are the common causes of usage difficulties and design acceptability in specific cultures? How does cultural influence self-evaluation of user difficulties? How does culture influence users' explanations of difficulties and their responses?

3) How can we represent cultural differences between Jordan (and more generally, Arab countries) and Western Countries, with the aim of providing support and guidance for software developers.

1.3.1 Originality

1) This thesis presents the first broad study of the role of cultural factors in usage evaluation for a non-western country. A general overview of cultural variables in usage provides a framework for how Jordanian users evaluate their usage experiences.

2) This PhD is the first general HCI study in any Arab country, in this case Jordan. The only other Arab HCI study is El Said et al (2005) "The Effect of Uncertainty Avoidance on Online Trust for the Egyptian Internet Users" and El Said's (2005) related PhD thesis. In relation to the first point above, El Said's research is focused and specific, but this thesis takes a more open and general approach.

3) In addition, the reported research is the first attempt to balance consideration of users' usage evaluations and explanations alongside interface preferences when researching cultural differences and HCI. This balance is supported by a new comprehensive meta-model of culture, the *Diamond Model*, which organises a wide range of cultural variables into five major segments and their substructures.

4) The research explores ways of communicating cultural differences to interaction designers. Existing HCI approaches such as personas and scenarios are reviewed, and a new approach, Dramatic Sketches, is developed and illustrated as a.

As a result of this original research, the following claims are made:

1. A new Diamond Model integrates existing meta-models into a single model. The Diamond Model covers cultural variables that discovered through a literature review and our field studies.
2. An Instantiated Diamond model with Jordanian examples of cultural variables that affect computer usage in Jordan.
3. Cultural variables impact usage-related phenomena such as difficulties, reactions and explanations more than they do design preferences and feature acceptability, which is reflected in our Diamond Model with Jordanian instances.
4. A novel Dramatic Sketches approaches that communicates the impact of cultural differences on both design preferences and usage evaluation.

1.3.2 Summary of Research Approach

This PhD research has progressed through three stages:

- Identifying cultural variables from non-HCI and HCI sources, and integrating these into a model of cultural differences. This is developed in chapter two of the thesis.

- Investigating which variables in this model are important in Jordan and in other Arab countries. This will be reported in chapters four to six.
- Representing important variables relevant to HCI by adapting personas, contextual design, or scenarios to explore how important cultural variables can be communicated to software designers.

1.4 Thesis Outline

Chapter One: Introduction, gives an overview of the motivation of the research, and gives the research aims and objectives.

Chapter Two: Literature Review and Commentary, reviews definitions of culture and surveys a wide range of cultural variables. Also, we discuss three meta-models of cultures, and then we derive a new meta-model of culture. The chapter ends by reviewing culture in HCI design and evaluation.

Chapter Three: Methodology, explains the main structure of work to address the research goal, providing information on the techniques and methods used in this thesis**.**

Chapter Four: IT Experts Study in Jordan, reports a pilot study with IT experts in Jordan, interviewing IT support staff in education, communication and banking sectors, to reveal common computer problems facing users in Jordan.

Chapter Five: Frustration, Anxiety in Jordan Computer Usage, explores differences between users in Jordan and users in western country (USA) investigating frustration levels of Jordanian computer users for comparison with US users. We repeated a US study of frustration (Lazar et al. 2006). Then we carried out follow up interviews to discuss the main causes of differences and how cultural differences could influence usage differences, their evaluation and their explanation.

Chapter Six: Computer Usage Experiences in Jordan, reports a more general study of Jordanian computer users' experiences. Interviews explored

what users in Jordan need from their computers and what they prefer for design of the user interface.

Chapter Seven: Communicating the Diamond Model, tries to answer the following questions that arise from the previous studies: How can we best cover the Jordanian instances of cultural variables? How can we best express the Jordanian instances of cultural variables? And how can we readily author these representations? To answer these questions, we explore three alternative representations of cultural differences, to compare them as forms of design support. We introduce a novel representation, the Dramatic Sketch, to overcome limitations of existing HCI approaches for communicating cultural variables.

Chapter Eight: Conclusion and Future Work, gives an overview of the thesis results and outlines potential future work. Some guidance on design and use of software in Jordan is provided.

Chapter Two

Literature Review and Commentary

"There is no denying that culture influences human-product interaction."
Del Galdo and Nielsen (1996) page 41

In this chapter we will discuss culture, how can we define culture, its different aspects, and what meta-models are available to us. We develop a new meta-model of culture, the Diamond Model, which we use as a framework to organise a wide set of variables from the general literature on culture. This structure is then used to organise a survey of Jordanian culture.

The chapter closes with a survey of the use of specific cultural variables in HCI. The overall aim is to take a broad view of culture to ensure that we can explain a wide range of usage behaviours in Jordan. This is in contrast to the narrow view of culture taken in much HCI research (Kamppuri et al. 2006)

2.1 Culture

There are some distinct sources of cultural differences which are very clear and could be seen by anyone. For example, the way that Pakistanis decorate their trucks, to make them more colourful and different to other trucks, by

adding some personal-cultural touch. Figure 2.1 show how Pakistanis decorate their trucks.

Figure 2.1 Pakistani truck decorations.
(http://www.pakcomments.com/57/pakistani-trucks-marveling-the-extrodinary/)

Cultural patterns are rooted in decade's value systems of major groups of the population and are stable over long period in history. Culture has been defined in many ways. Kluckhohn (1951) detected a consensus within anthropological definitions of culture:

> A Culture consists in patterned ways of thinking, feeling and reacting, acquired and transmitted mainly by symbols, constituting the distinctive achievements of human groups, including their embodiments in artefacts; the essential core of culture consists of traditional ideas and especially their attached values.

Kroeber and Parsons (1958) arrive at a cross-disciplinary definition of culture as a "transmitter and created content and patterns of values, ideas, and other

symbolic meaningful systems as factors in the shaping of human behaviour and the artefacts produced through behaviour".

Hofstede (1980) defines culture as "collective programming of the mind". The word is reserved for describing entire societies; for groups within societies, "subculture" is used. Figure 2.2 outlines how cultural patterns are rooted in value systems of major groups of the population, and how they are stabilized over long periods of history.

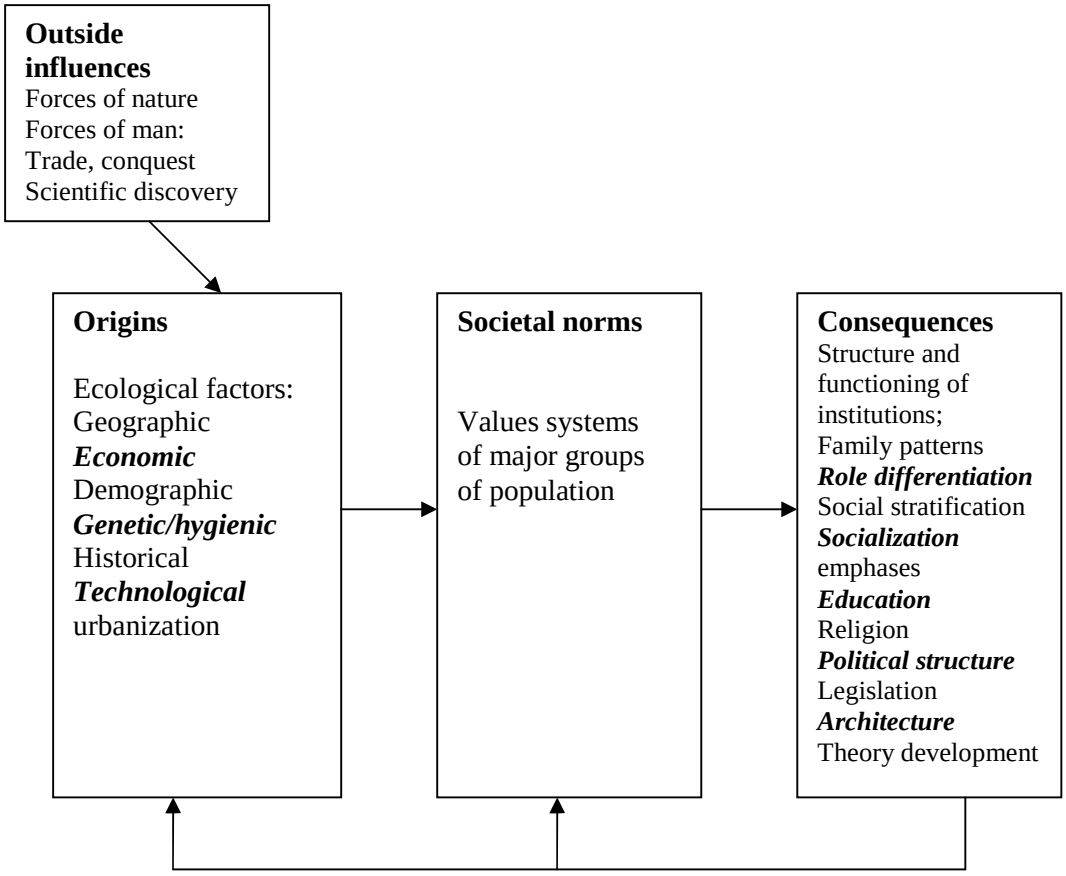

Figure 2.2: The Stabilizing of Culture Patterns. (Hofstede 1980, page 27)

Culture has been defined in many ways. Triandis (1972) distinguishes "subjective" culture from its expression in "objective" artefacts and defines the former as "a cultural group's characteristic way of perceiving the man-made part of its environment". Figure 2.3 shows the relation between subjective and objective according to (Triandis 1972); almost all approaches to culture rely on a fundamental distinction between the observable (objective)

and inferable (subjective) aspects. They also see culture as involving two processes, from the subjective to objective, and vice versa.

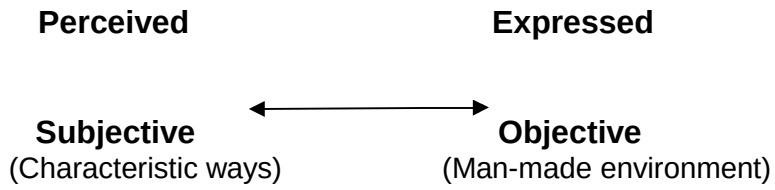

Figure 2.3: Triandis definition of culture.

Similarly, Figure 2.4 diagrams this relation between subjective and objective aspects of culture in terms of Kluckhohn's definition.

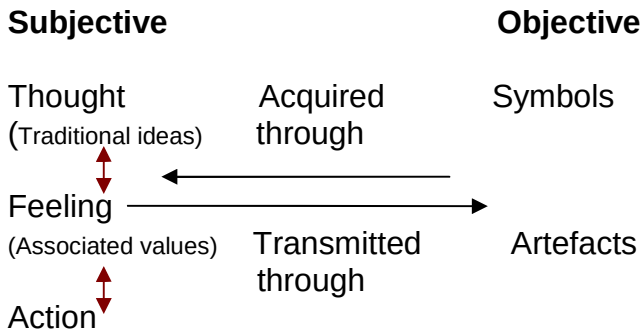

Figure 2.4: Kluckhohn is Definition of Culture.

From the figure above we can conclude that thought, feeling and action form patterns within subjective culture, which means that the culture is a structure, and not just an aggregate without form.

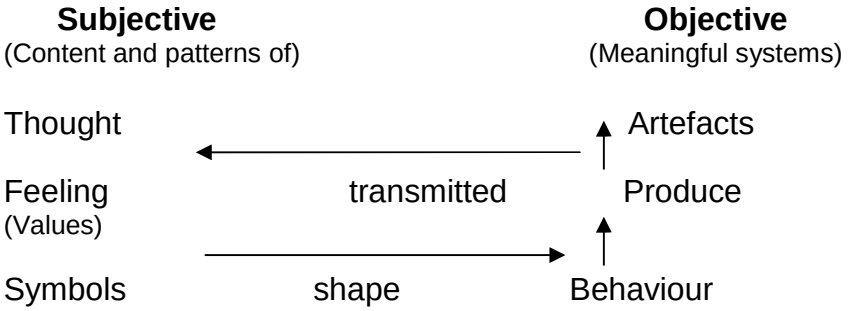

Figure 2.5: Kroeber and Parsons' Definition of Culture.

Lastly, Figure 2.5 shows the relation between subjective and objective according to Kroeber and Parsons (1958). Note again that culture consists of

patterns and systems that are structured. Unlike Kluckhohn's definition, Kroeber and Parsons (1958) behaviour also see as part of objective culture.

2.1.1 Culture, Individuals and Nature

Culture is to a human collective what personality is to an individual. Personality has been defined by Guilford (1959) as "the interactive aggregate of personal characteristics that influence the individual's response to the environment". Culture could be defined as the interactive aggregate of common characteristics that influence a human group's response to its environment, but terms such as 'structure', 'system' and 'pattern' are preferable to "aggregate". There are common relationships between aspects of cultures. For example, there is a direct relation between polices and religion in Muslim country such as the regulation in courts which are part based on religion. Culture is thus more than an aggregate.

The pyramid model of culture (Figure 2.6) introduced by Hofstede (1980) is not strictly a model of culture. Rather it relates individuals to their culture and human biology, and thus sketches out a scope for each.

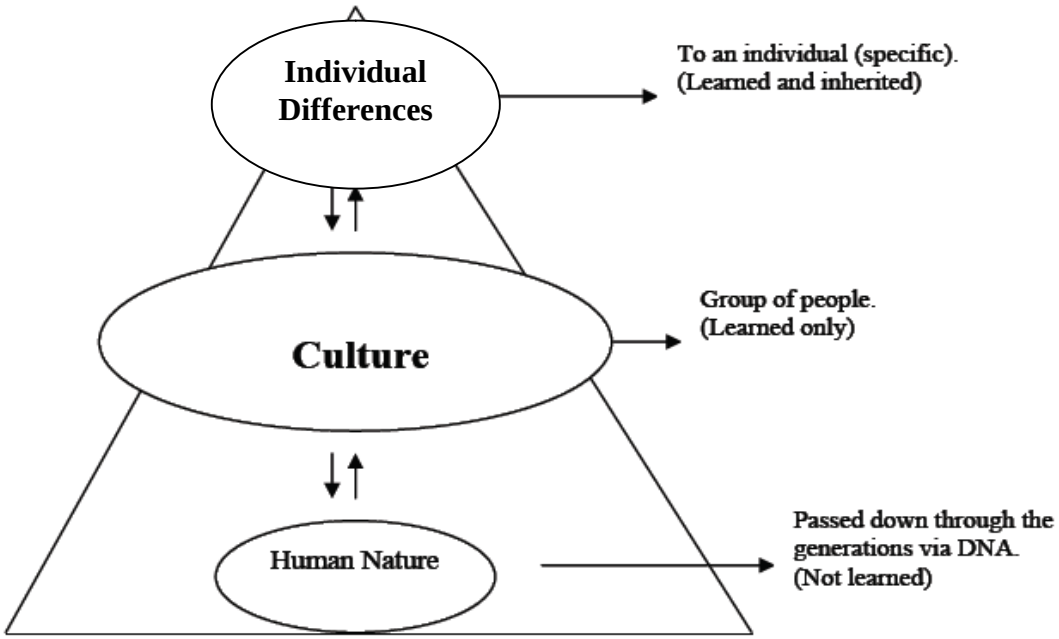

Figure 2.6: Hofstede's Pyramid model (Del Galdo and Nielsen 1996, p.47)

Hofstede (1980) makes the following distinctions:

- **Individual Differences** are specific to an individual and are both learned and inherited. An example from Jordan of individual differences is the ways that people think, talk, and live. For example: two brothers with different hobbies, such as one brother playing football, and the other playing basketball.

- **Culture**: is specific to a group or category of people. It is learned and not inherited. Examples for Jordanian culture include: strong obligations between people to find a job for their friends and family, familiarity with English language (from the British mandate 1919-1946), typical educational levels, types of building, and the typical income of people in Jordan.

- **Human nature**: is what is common to all human beings. Examples: include biological aspects, such as sleeping, eating etc.

There are collective and not just individual variables that influence people and cause differences between cultures. Each of these “cultural variables” shapes human culture, but some of affect some people more than others, and is more influential in some cultures relative to others.

Cultural variables can be organized into different categories such as Art, speech, language, knowledge, religion, family and social life, and government. For example, there are some cultural variables that influence Jordanian culture more others, such as religion and family life. The family ties of people in Jordan are very strong.

There are different reasons that could make computers hard to use. Some of these reasons are the power and complexity of computers, which could lead to disastrous errors regardless of cultural differences.
Also, the ability of users and the experience they have of using computers could be a cross cultural influence. For example; the age of users can affect

performance in any culture because old people learn more slowly, but younger people can find computer systems easy to learn (Landuaer 1999).

2.2 Models of Culture

Del Galdo and Nielsen (1996) surveyed four models of culture, these models are: objective and subjective, pyramid model Figure (2.6), iceberg model and onion model. If fact, we can call them meta-models because they are very general, not specific. A question arises as to whether these meta-models help us to understand relationships between culture, interaction and design. Research could be guided by all, some, or none of these meta-models, or by a synthesis of them.

2.2.1 Objective and Subjective Culture

The advantage of using this meta-model is that it makes it easy to compare cultures, as claimed by Del Galdo and Nielsen (1996). It highlights the differences between objective and subjective cultural variables. Objective variables are easy to identify and it will be on surface of culture, whereas subjective cultural variables will be deep and hard to reach from the surface. It may be more helpful to think in terms of manifest (obvious) culture and implicit (unarticulated) culture.

Some cultural variables in Jordan are slow to change, such as social customs, political structures and processes, which people are accustomed to. These variables could be objective, and very clear for people to identify. Instances of objective variables in Jordan include the Arabic language, especially the dialect accent in Jordan (different to other Arabic accents which make its easy to recognize).

Objective culture is learned and it is consciously shared as what human beings make, and what they consciously transmit from generation to generation. It ranges from formal systems of information, music and art, to everyday objects. A focus on the outer layer of culture without going inside will understand users inadequately. This provides weak and shallow support for

design, and could result in inappropriate user interface features, or design for inappropriate usage values.

Subjective features of culture include assumptions, values, and patterns of thinking. These variables are difficult to examine because they can operate outside of consciousness. The impact of subjective culture is hard to anticipate. For example, in Jordan using an e-card for special events is not acceptable for some people (chapter six), because they prefer visiting (or being visited) to sending (receiving) e-card. Also in Arab countries when meeting someone, you should stop and talk and ask about him and his family, which is part of respecting this person.

The objective and subjective model (figure 2.3) distinguishes between cultural variables that present different research challenges, due to challenges in identifying subjective variables and their instances.

2.2.2 The Onion Model

The Onion Model (Figure 2.7) was introduced by Trompenaars (1993). The model includes three layers of culture, the first outer layer is the artefacts of culture and then the second layer is the middle layer, which contains the norms and values of culture. The third layer is the core expresses how people adapt to their environments.

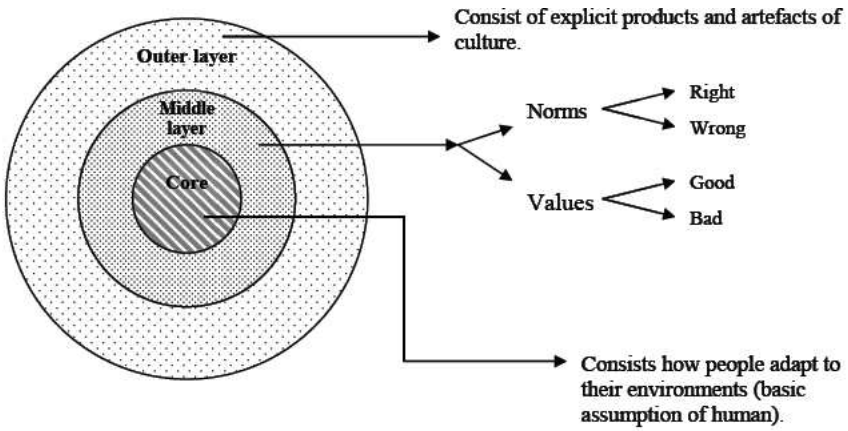

Figure 2.7: The Onion Model (from Del Galdo and Nielsen 1996, page 48)

o Outer layer: the outer layer consists of explicit products and artefacts of culture. The outer layer consists of the first things we encounter at a cultural level. For example in Jordan, the outer layer includes the observable reality of the Arabic language, buildings in Jordan and types of food. An example of how this could be relevant to HCI are the visual design preferences uncovered by Choi, et al. (2005) by studying the differences between Korean, Japanese and Finnish mobile phone users.

o Middle layer: the middle layer of culture defines norms and values. Norms are principles of right and wrong that are shared among a group of people. For example in Jordan, these norms include government law, and companies' rules. Norms make things right or wrong. Values define what is good and bad, desirable and undesirable, among a group of people. An example of how it could be relevant to HCI in Jordan concerns a cultural impact on using the internet, an internet company called *SAMA telecommunication* (http://www.sama.jo/) in Jordan provides a parental controlled internet, which blocks all websites that parents don't want their children to surf.

o Core: the core of culture is implicit and consists of how people adapt to their environments. It is hard to identify, because it's part of human nature. (Del Galdo and Nielsen 1996). For example in Jordan in the summer, when temperatures are very high, people stay at home and don't go outside, but in another culture people enjoy the sun and go outdoors.

2.2.3 Iceberg Model

The Iceberg Model (Figure 2.8) is the most popular cultural model and is applied more than others, according to Del Galdo and Nielsen (1996). This model was introduced by Victor (1992). It has three components:

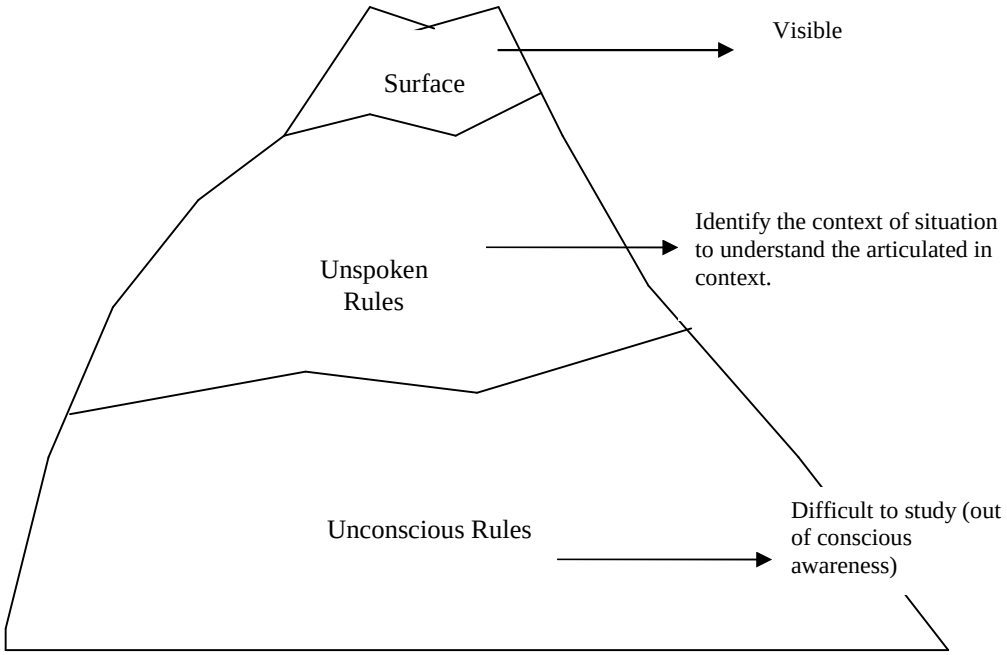

Figure 2.8: Iceberg model from (Del Galdo and Nielsen 1996) page 45

o Surface: the culture characteristics at this level are visible and obvious, and easy to research. They include currency and language in Jordan. The surface layer is the easiest layer to identify and design for, because variables in this layer can be readily identified and often quantified. For example employees' desks in Jordan are organized, clean and don't have any personal photos, but in the UK, desks are less organized and we can see personal photos and souvenirs at the desks. Figures 2.9 and 2.10 illustrate this.

o Unspoken rules: this layer includes cultural variables such as business etiquette and protocols. Evidence of this layer is indirect, but variables can be inferred via straightforward research instruments such as interviews and observation. For example, use of the internet by children is a concern for some Jordanian people, because of fears that their children adopt other culture's habits, which could contradict the learned behaviour from their parents. Such rules are routinely unspoken, but not unspeakable. When asked to reflect, people can describe and motivate these rules.

Figure 2.9: Jordanian employees' desks.

Figure 2.10: A UK employee desk.

o Unconscious rules: this layer includes cultural variables such as preferred physical distances between people and nonverbal communication. We cannot know this layer exactly. Evidence can be very indirect, and can rarely be reliably accessed via straightforward research instruments. Such assumed variables are difficult to examine, because they operate outside of conscious awareness. Also, unconscious rules could reflect individual differences to (Pyramid Mode). We need to identify the context of a situation first in order to understand what such variables may be (Stewart and Bennett 1991).

2.2.4 Meta-Models and Computer Usage in Jordan

In Jordan, some cultural variables are very hard to change such as social customs, political structures and processes. This could affect different design or usage preferences. Some variables could be clear and some not. An example of a clear variable in Jordan is the spoken Arabic dialect, which is clear to identify. It is easy to recognize the Jordanian accent as different from other Arabic accents. Similarity, the Arabic language and decorative arts are culturally distinct. A typical HCI response would be change the design or layout of the user interface to make it more Arabic and Jordanian.

The hardest variables to design for are hidden and hard to recognize, especially if you don't know about a culture. For example in Jordan, using the e-card for special events is not acceptable for some people in Jordan, because they preferring visiting. The beliefs of people in Jordan are that an e-card from a person who could come and visit is not acceptable, and could cause trouble for the sender. On other hand, in a western country, an e-card is more acceptable and the person who received it will respect the e-card.

The faith of people in Jordan could affect usage of computers sometimes. For example in Jordan; the cultural impact of internet use by children exposes them to other beliefs, but at the same time, parents think that it is important to use the internet for children to learn.

There are some common conditions in Jordan that affect people, but there are different responses from different Jordanian users. Some conditions affect Jordanian users in a direct or indirect way, such as the economic situation and the ministries of religious affairs. All this is part of Jordanian culture and common between people in Jordan. Thus, for many abstract cultural variables, it is easy to recognise specific Jordanian instances. To understand the relation between culture and HCI, we need to identify and relate a broad range of cultural variables within a comprehensive meta-model of culture. In preparation for such a review, we derive a single new meta-model for culture.

2.3 A New Meta-Model of Culture: The Diamond Model

A diamond metaphor can integrate existing meta-models, which allows us to classify culture into major segments, then objective and subjective sub-segments, then refined segments, each corresponding to groups of specific cultural variables.

The three meta-models and three definitions of culture reviewed above all employ a common distinction between objective and subjective culture, but have different structures and elements relating to this. Therefore we keep the objective and subjective distinction, but find another way to organize relations between them, based on trends in the literature on culture. Our new *Diamond*

Meta-Model responds to what we need to capture how objective and subjective variables interact in complex ways. A diamond reflects light, even from its bottom, whereas the metaphors of iceberg and onion hide the subjective beneath or inside the objective. In a diamond, light from subjective variables visibly reaches the objective crown, although its origins and path within the lower diamond are not clear.

The Diamond Model contains main segments. Each segment contains subjective and objective sub-segments, which each contain groups of specific variables. The Diamond Model thus has two main areas, the first located on the top (called the *crown*), which visible, and the second located on the bottom (called the *pavilion*), which is not directly visible. Each segment spans its two sub-segments in the crown and pavilion (Figure 2.11).

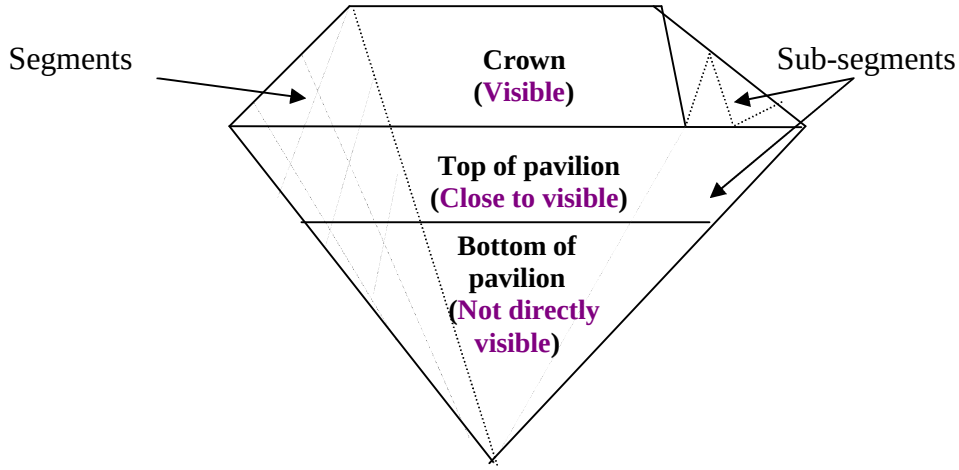

Figure 2.11: The Diamond Model

Figures 2.12, 2.13, and 2.14 show how we can represent the three existing cultural meta-models (Objective and Subjective, Onion Model, Iceberg Model) as diamonds.

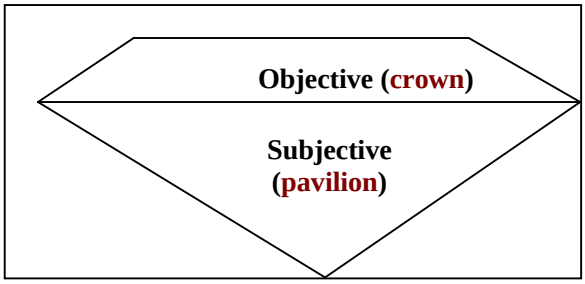

Figure 2.12 Objectives vs. Subjective as a Diamond Model

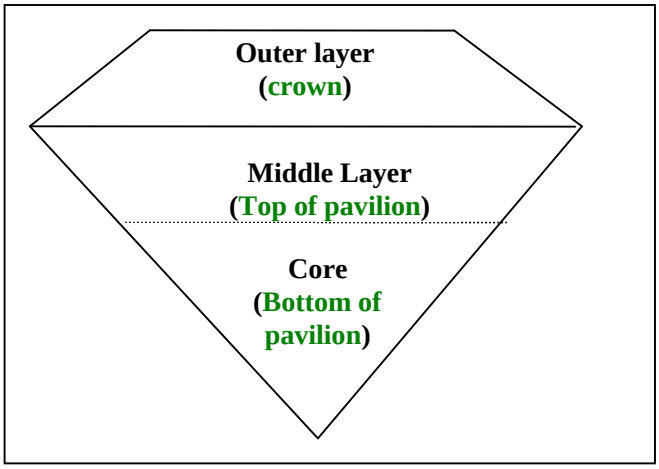

Figure 2.13 Onion Model culture as a Diamond Model

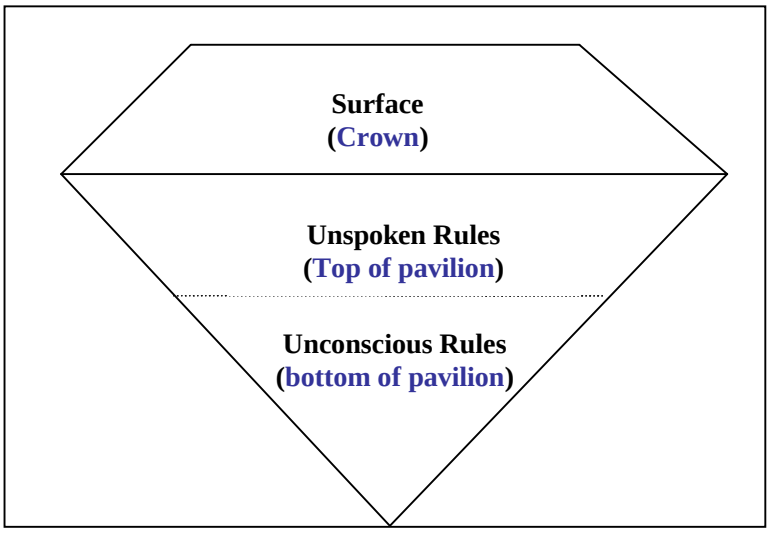

Figure 2.14 Iceberg Model as a Diamond Model

In our Diamond Model, we will group cultural variables into objective and subjective sub-segments. Then we will refine each sub-segment. We can

conclude from the figures above that the three meta-models can each be translated into a diamond model with three basic layers: the crown, which is visible, the top pavilion which is close to visible; and the bottom of pavilion which is not directly visible.

From the literature on cultural variables, there are many variables. These can be structured into a hierarchy that decomposes into segments, sub-segments and then groups, each containing progressively smaller sets of variables with common aspects. There appear to be five major segments of culture, which can span some, or all; of the crown, top and bottom pavilion. Reflection on a range of cultural research has indicated that we could distinguish between segments comprising:

1) Language and Semiotics.
2) Material culture.
3) Social structure and interaction.
4) Political processes.
5) Economics processes.

These categories emerged during iterative analysis of the literature research. The five categories above have been distilled from a series of alternative structures. The current version is the most compact and coherent, and makes good use of the diamond analogy, as the categories can each correspond to a segment.

A broad view of culture is taken, as the aim of this research is to support design and usage of interactive system, and not to draw boundaries between academic disciplines.

2.4 Status of the Initial Diamond Model

The Diamond Model have be developed through many stages, starting from a literature review to find a meta-model of culture such as subjective and objective model, onion model, and iceberg model that we can work with. There were several issues with these old models (*objective and subjective*

model, onion model, and iceberg model) such as a lack of interaction between cultural variables, and also a lack of reflection as to how much all the layers are separated. The literature showed that culture variables could interact with each other even if they belonged to different layers or segments of a meta-model.
Therefore, we developed a new model that can cover most of cultural variables and through this new model we can show how variables could interact with other variables within the same or different segments.

The Diamond Model started by finding the main high level cultural segments. We first identified two main groups (material culture and semantics), then we added other groups later through discovering the literature survey that studied the cultural variables, revising these as Jordanian variables and instances were added in the field studies. Segments were divided into objective and subjective groups (obvious or subtle).

There some limitations on the initial Diamond Model, because it had not yet been tested, by usage studies or expert review. We expected other cultural variables to be added to the Diamond Model as a result of field studies, and for the structure of the model to change as a result.

2.5 Populating the Diamond Model

We now have a structure for our Diamond Model and we need to populate it with variables such as Hofstede's (1980) five cultural dimensions; Power Distance, Individualism vs. Collectivism, Masculinity versus Femininity, Uncertainty Avoidance, and Long-Term versus Short-Term Orientation. Many HCI studies use Hofstede's five cultural dimensions to compare different cultures. Before doing this, we note that some cultural variables in the literature are controversial.

A study by Oshlyansky et al. (2006) re-tested Hofstede's Value Survey Module (VSM) in eleven countries. The aim of their study was to collect VSM data from students in eleven countries, and then replicate Hofstede's work

with a younger different demographic to the IBM employees originally used in Hofstede's study. The VSM dimensions have been widely used as a framework to provide design guidelines, for instance for cross-cultural website development (Marcus and Gould 2000). The authors noted that Hofstede's work has been criticised for its lack of insight into the richness and depth of culture, and for focusing on national cultures.

Oshlyansky et al. used Hofstede's VSM94 (Values Survey Module) which they translated into six languages. 1428 questionnaires were distributed to university students in the Czech Republic, France, Greece, India, Malaysia, Netherlands, New Zealand, Saudi Arabia, South Africa, the United Kingdom and the United States. Using factor analysis, the authors were unable to replicate any of Hofstede's original dimensional distinctions, with the possible exception of individuality, i.e., Hofstede's dimensions of individualism vs. collectivisms.

There were insufficient responses received from France and the Netherlands, leaving nine countries: Czech Republic, Greece, India, Malaysia, New Zealand, Saudi Arabia, South Africa, the United Kingdom and the United States. The highest number of questionnaires was returned from Malaysia (168) and the lowest from Saudi Arabia (91). The final sample consisted of 519 men and 489 women. 72 respondents did not give their gender.

Oshlyansky et al. found it difficult to say why the VSM dimensions did not emerge in their dataset. One possible explanation, such as translation can be ruled out, since the English-language only samples do not show any better factor loadings than the mixed language set. Also age does influence some VSM dimensions, and education level could also contribute.

The authors' analysis suggested that VSM dimensions had very little explanatory power in explaining the structure of the large study dataset. The authors' say that further research is needed to determine which cultural factors are relevant to good interaction design, and which would support HCI research in general, but they found that it is not enough to observe the

difference in interactions and interfaces from one culture to the next and to explain these observations in the light of Hofstede's cultural dimensions. However, other cultural variables may be more robust and influential.

Oshlyansky et al. conclude by questioning the validity of the VSM model, both in itself and as a tool for understanding the design of user interfaces for different cultures, and also if it still provides a useful shared language for discussion. Oshlyansky et al. state that the VSM was measuring something, but what it was measuring was unclear. However, this is primarily a criticism of the VSM, and there many still are some validity in the dimensions themselves. This is especially true for Individual vs. Collectivism, which did emerge from their factor analysis. Even so, we need to go beyond Hofstede's cultural variables to populate all five segments of the Diamond Model.

2.6 Using the Diamond Model

A diamond model has been used to structure five segments of cultural variables, and to split segments into objective and subjective sub-segments. Figure 2.15 shows the relation between variables and their objective and subjective sub-segments. There are five large segments of culture. Each sub-segment contains groups, and each group contains specific variables, for which actual instances will vary across cultures. The large segments organise specific cultural variables from the literature. Each large segment could impact both design preference and usage evaluation. Some example groups are labelled in Figure 2.15. For example; semiotics and language in Jordan reflect the Arabic language and its Jordanian dialect. Arrows show light paths through the diamond, e.g. from thought and feelings to social interaction, or via semiotics to language.

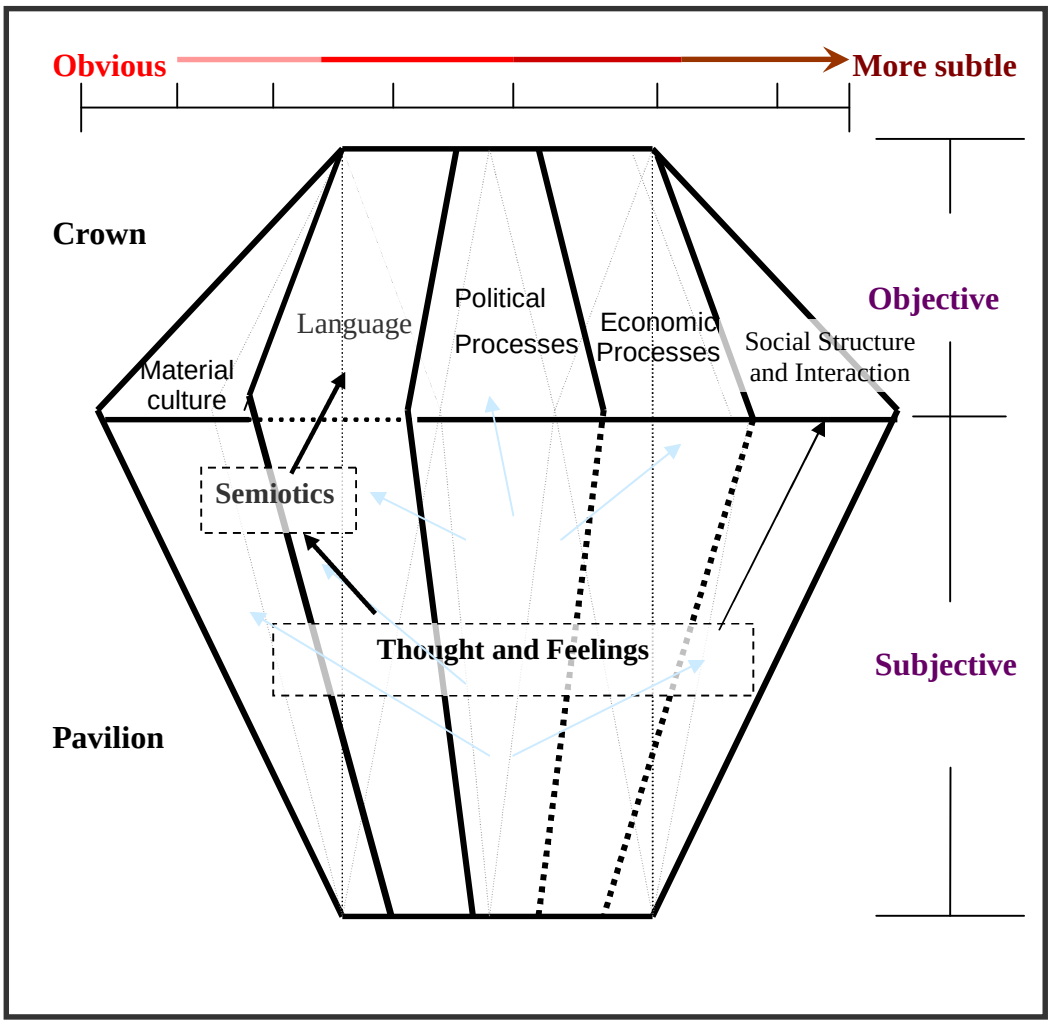

Figure 2.15: The diamond model of the five cultural variables

In Figure 2.15, the top (crown) of the diamond contains objective variables which are visible and the bottom (pavilion) contains subjective variables which become deeper and hard to reach directly. In the diamond model, segments on the left will be more obvious, then, moving from the left to the right, the variables will be more subtle. It may help here to think of the light coming from the left, and thus more strongly illuminating the more obvious segments, which are more obvious due to the nature and extent of their objective sub-segment, e.g., material culture is explicit and obvious to any visitor, as is language. Politics, economics and social behaviours are generally less obvious. A visitor may not even notice a social behaviour, still less be able to understand the underlying thought and feelings.

Some Jordanian examples can further illustrate the role of different segments in the Diamond Model. When you arrive in Jordan for the first time, you will see the airport building (Material culture), then you will hear people talking Arabic (Language) then you may notice some of the written rules, e.g., about drinking in public (Political processes). Next you take a taxi to you hotel, paying the fare in Jordanian currency (Economic processes, perhaps converting it into UK currency). As you stay in Jordan, you may recognise some Jordanian social behaviours (this could be hard) such as the way they talk to each other and the value and the meaning of these behaviours (Social structure and interaction). Further elaborations of each Diamond Model segment follow.

2.6.1 Material Culture

Material culture creates the most obvious objective variables. In the crown of the diamond, they are instantly recognizable and easy to reach. Material culture also includes media such as newspaper and television, as well as digital artefacts. Its subjective sub-segment is largely concerned with symbolism for example; the culturally accepted meaning of artefacts. Much of this overlaps with the semiotics of spoken and written language, hence the semiotics group of subjective cultural variables span two sub-segments.

2.6.2 Language

Language gives rise to objective variables such as vocabulary, grammar, dialect and accent, visible and clear in the crown of the diamond, but semiotics are subjective variables in the pavilion and as such are deeper and harder to reach, and not visible to everyone.

2.6.3 Political Processes

Some political variables are objective and thus easy to describe, such as political institutions and public authorities. The subjective sub-segment covers political attitudes, for example, to democracy, authority and the use of violence.

2.6.4 Economic Processes

Economic variables include wealth and material resources, which are objective and thus in the crown sub-segment. Subjective variables in the pavilion include conceptions of worth, value and affordability. These reflect consumer choices, and extend to free goods and services such as e-cards. As such, economic processes overlap with social interaction and political processes via the broadest subjective variable group of thoughts and feelings.

2.6.5 Social Structure and Interaction

Social interactions give rise to objective cultural variables that include observable behaviours in religion, social communication and family customs. All these variables will be in the crown of the diamond, and thus easily recognizable. Thought and feelings are common to all subjective sub-segments, but they are most frequently associated with social structure and interaction in the literature on culture. We thus associate the social sub-segment of 'thought and feelings' with social structure and interaction but recognise that all subjective sub-segments overlap extensively.

2.6.6 Summary

From the Diamond Model, we can structure culture as spanning objective and subjective sub-segments. Each sub-segment contains one or more groups of variables with common aspects. Each group contains specific variables. Some further examples of specific variables for Jordan follow.

Material culture: the food prepared for at most special events in Jordan is called Mansa'f, a very traditional food made only in Jordan. It has a subjective meaning that makes wedding and other events special.
Language: the English language is the second common language in Jordan, because of the history of Jordan (British mandate from League of Nations).
Political Processes: the Jordanian government is committed to international standards in education (subjective values) and its secondary education certificates exams are accepted in world-class universities (objective reality).
Economic aspects: Jordan is a small country with limited natural resources and the Gross Domestic Product per capita is very low (objective reality)

which shapes the perceived affordability of information technology (subjective judgements).

Social structure and interaction: Most of the population in Jordan are Muslim: Islam is the biggest religion in Jordan (objective reality). This strongly influences many social values (subjective) in Jordan.

2.7 A Survey of Cultural Variables

From the diamond model, there are five large segments of culture. Their sub-segments contain groups, and each group contains specific variables. The key question is which of these large segments will impact most on either *design* or *usage*? The impact on design would primarily be via users' preferences and the acceptability of user interfaces. The impact on usage will primarily be via users' evaluations and explanations of usage, and how users react to usage. After this survey, we will be in a better position to start to address our key research question.

2.7.1 Material Culture

Material culture comprises artefacts that are mostly physical; but we can regard digital artefacts as part of material culture, as they require physical devices for interaction. Interpretation of artefacts changes over time and place, and they vary according to the position of the viewer within a society. Material cultures produce objective surface variables that are easy to recognize, but interpretations of objects are subjective variables. Material culture can impact HCI, providing the basic cultural markers that can be used as user interface elements to meet culturally specific design preferences (Barber & Badre 1998). However, such cultural markers depend on subjective variable groups such as semiotics and thought and feeling that span more than one segment. Thus Hoft (1995) notes that business etiquette can provide insights into proper and improper examples of graphics for international technical communication.

2.7.1.1 The Arts

Stewart and Bennett (1991) define The Arts as the background of cultural history, through which we recognize the achievements of a culture.

Art includes artefacts from the distant past and new modern arts which could be 'imported' from other culture.

2.7.1.2 Buildings, houses, monuments and manufactured products

The shape and structure of the buildings will be different from culture to culture, and different according to the materials used. Therefore sometimes, from building shape and materials used, we can guess the culture of that made it (Trompenaars 1993). For example:

- Monuments: From Monuments we can learn about a culture's history.
- Houses: We can see cultural differences according to materials used to build houses, their design and colour.

For example, in Jordan the lifestyle has changed for women who now work who need to prepare food before going to work and therefore need to have big fridges to keep prepared food in.

2.7.1.3 Crafts and Decorative Arts

Stewart and Bennett (1991) classify craft as a cultural variable. Crafts involve skill in doing or making something. For example, people in different places began to make different things according to the environment that they live in. People have daily contact with Decorative Arts which could thus influence design preferences for visual interface elements.

2.7.1.4 Food

Internationally all people eat food, but differ how they prepare and cook this food, what they add to the food, and also the equipment used in cooking. Therefore we can recognize a culture according to its food. (Trompenaars 1993)

2.7.1.5 Literature, arts and media

Barros (2004) defines literature as what accredited scholars and researchers have written on a topic. This is too narrow a definition. A broader definition

includes any material form that uses language to communicate, i.e. print, broadcast, display and recorded media. Cultural conventions here could shape design preferences and acceptability.

2.7.2 Language

Language is easy to recognize and visible in written forms. Language is a communication tool between people and differs between cultures. Hoft (1995) notes that degrees of fluency, accents, and regional dialects affect business communication.

Semiotic theory explains the process by which meaning arises from data, and this connects objective to subjective aspects of language. The semiotic triangle (Figure 2.16) includes three elements (Ogden and Richards 1923):

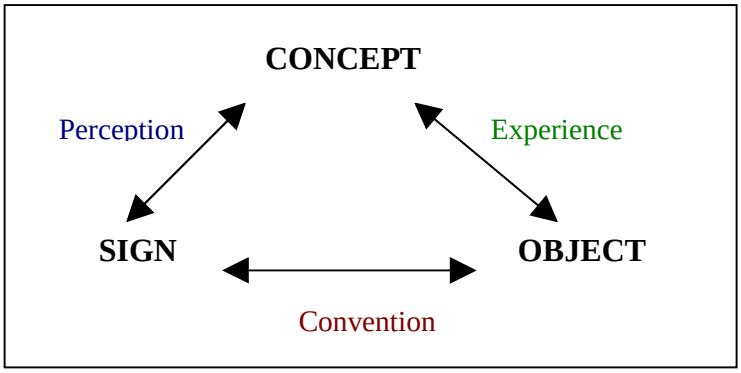

Figure 2.16: The semiotic triangle model (Ogden and Richards 1923).

- The sign is a perception of something that exists in the physical world.
- The object is what the perception is said to refer to.
- The concept is a thought or image that is formed in the mind as a result of the perception, which relates it to the object.

The semiotic triangle can be related to the diamond model. A concept would be in the pavilion, whereas the sign would be on the surface in the crown, as would the object. The result will be as in Figure 2.17.

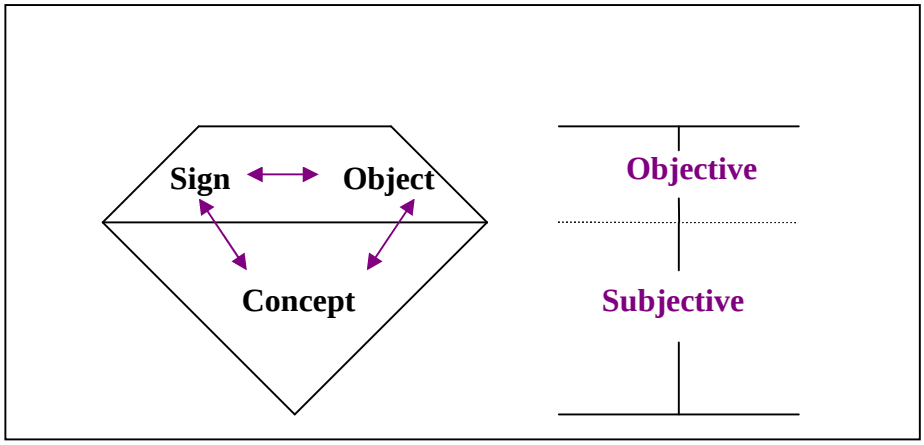

Figure 2.17: The semiotic triangle related to the Diamond Model.

Objective variable groups

Objective language variables include three important groups as follows

2.7.2.1 Nonverbal communication

Nonverbal communication means communication without the use of written or spoken language. Nonverbal communication includes gestures, facial expressions, and body positions (known collectively as “body language”), as well as unspoken understandings and presuppositions, and cultural and environmental conditions that may affect any encounter between people (Mifflin 2005). Nonverbal communication is difficult to study, because its not part of conscious awareness, but it may not impact usage with established interactive technologies (Hoft 1995). However, HCI research is attempting to detect and respond to non-verbal communication such as the facial expression of emotions. This could require cultural sensitivity for correct interpretation.

2.7.2.2 Familiarity with English across cultures

“All major programming languages today use keywords derived from English and this can impose a significant burden on non-native speakers unfamiliar with the highly irregular spelling of English words. Mistyping or misspelling a single character of such a keyword will invariably trigger an error message,

and determining the cause of such an error is often time consuming for non-native speakers of English" (Del Galdo and Nielsen 1996, page 97).

As the international language of business (Globalization language), English can help people in communication, especially if they use the same language without needing to translate, because sometimes translations will not be accurate and change the meaning. For example, international conferences or business fora will use the English language to help people to understand and communicate with each other. Familiarity with English will influence the acceptability of English language interfaces.

Subjective specific variables

2.7.2.3 Text direction

Del Galdo and Nielsen (1996) Chapter 3 (Developing a Culture Model), and Chapter 6 (Impact of Culture on User Interface Design) define the text direction as the direction of writing words. Some cultures start writing the word from left to right and another start from right to left. For example, in English we start printing the word from left to right, in Arabic we start printing from right to left, which could impact user interface design preferences.

2.7.2.4 Contextual information extent in language

Context offers technical communicators a way to assess the amount and kind of detail they should include in an information product for maximum effectiveness. The need for different extents of context will affect usage. Hall and Hall (1990) define two kinds of context:

- *High context* requires extensive information in a given communication as a function of the context in which it occurs. Jordan is a high context culture according to (Hall and Hall 1990). In high context cultures, people give lots of information when someone asks any question, and explain in detail.

- *Low context* means requires limited explicit information. In low context cultures, people give less information and the answer will be direct, without any details because people from low context cultures expect to be understood from limited information.

2.7.2.5 Information flow

Hoft (1995) define this as the measure of how long it takes for a message intended to produce an action to travel from one part of an organization to another and for that message to release the desired response. Hall states that in high context cultures, which value relationships and information more than schedules, the information flow tends to be very fast and free. Knowing the right people is highly valued. In low context cultures, where everything tends to be compartmentalized and where bureaucracies flourish, information flow tends to be slow. Careful following of procedures is highly valued in bureaucracies. (Hoft 1995)

2.7.2.6 Colour

Although colour is a physical characteristic of systems, it is the meaning of colour that is a cultural variable. If a word is written in red in the West, this word could refer to something important. This will affect how user interface elements are interpreted, and design preferences are formed.

Colours take on different meanings according to cultural differences. For example; in China medical electronic equipment key colours are different than England. In China a red key means start, and a green key means stop on the other hand in England, a red key means stop and a green key means start (Hölscher, et al. 2005).

2.7.3 Political Processes

Political science is the academic subject centring on the relations between governments and other governments, and between governments and peoples (About Economics 2005). As our research interest is focused on differences in usage and preferences in the national context of Jordan, and the reasons for these differences, we need to take as broad a view as possible of cultural

variables. Education systems, media policies and religion policies are all political phenomena, and all could influence computer usage, especially via the internet. For example, in Jordan there is a Ministry of Awqaf and Islamic Affairs, this ministry source of all religion decisions and it is very effective in Jordanian life because they will follow the ministry policy when it comes to religion and any things impact the religion.

2.7.3.1 Political contexts

Stewart and Bennett (1991) define political contexts as objective cultural variables. Political contexts impact computer design. For example, in some countries, the government restricts users' access to some specific websites, for political or religion reasons.

Political beliefs differ all over the world. It is important to understand at least some simple details of a country's political tradition, because it will help us to understand how people respond to authority. The response to authority can make a big difference in how can you present training material (Hoft 1995).

2.7.3.2 English fluency and the role of the educational systems

English is the most common language in user interfaces, therefore most software development focused on using English language (Del Galdo and Nielsen 1996). Government can directly influence familiarity with English via their education and language policies.

2.7.4 Economic Processes

Economic is the social science that studies the production, distribution, and consumption of goods and services: how they are distributed for selling to the public and how the public responds to buying products (Noah et al 2000).

2.7.4.1 Cost of equipment

Low incomes will affect usage of computers, and could decrease the number of users because of the cost of internet and computer equipment. In poor countries, internet costs and the price of computers will impact the usage of computers, restricting many users to work usage only.

2.7.5 Social Structure and Interaction Segment

Social interaction covers behaviour in many forms: eating, viewing, working and dancing. Social behaviour is how people behave in their environment and society, creating and reproducing the social life of a culture (Stewart and Bennett 1991).

Social behaviour is influenced by attitudes, emotions, values, ethics, authority, persuasion, and coercion. Social interaction is guided by how people think and feel. Thought and feelings will be different from person to person. Del Galdo and Nielsen (1996) thus define behaviour as a variable from person to person, and we can not completely generalize this variable across a culture. How people in different societies will think and feel in the same situation can differ according to his/her personality. Hoft (1995) however, notes that there will also be commonalities within a culture.. Even so, social behaviour is an objective phenomenon where it is hard to separate the roles of personality and culture. Unlike the other segments of the Diamond Model, it is also harder to isolate national instances of cultural variables, which could often be also interpreted as local to a geographic region (smaller or larger than a country), or to a language or religion that spans many countries.

Hall and Hall (1990) define action chains as a sequence of events that lead to the accomplishment of a goal. Action chains are central to computer usage. Some examples of action chains are: tasks, procedures and methods for performance. All planning must take into account the elaborate hierarchy of action chains, which are constrained and guided by cultural expectations on appropriate behaviour. Action chains can be thought of as specific structures for social behaviours.

Objective Sub-Segment

2.7.5.1 Time of day, dates and numbers

Nancy Hoft (1995) defines these variables as an important and complex variable in Hall's model of culture, and they feature in other models of culture as well. For examples, the Saudi Arabian calendar is different than UK. In Saudi Arabia, they use the Islamic calendar (Hijri calendar), which different in

months and year's names and number. For example if the day/month/year in the UK is 23/December/2008, it will be in Saudi Arabia 25/Thw al-Hijjah/ 1429 A.H.

Subjective groups

2.7.5.2 Patterns of thinking and values

Stewart and Bennett (1991) identify patterns of thinking as cultural. They are difficult to examine because they operate outside of conscious awareness. Patterns of thinking are unspoken rules.

Stewart and Bennett (1991) also identify values systems as cultural. Values define what is good and bad, desirable and undesirable, among a group of people. Patterns of thinking and values will affect both usage of computers and preferences for user interface design (Del Galdo and Nielsen 1996).

2.7.5.3 Concepts of times and space

Del Galdo and Nielsen (1996) define this cultural variable as a complex international variable. Hall's model of culture distinguishes two instances of a specific cultural variable:

- *Polychromic time (P-time)* is characterized as simultaneous and concurrent. 'Many things at once' is the phrase that Hall uses to polychromic time.
- *Monochromic time (M-time)*: is characterized as being sequential and linear. 'One thing at a time' is the phrase that Hall uses to define monochromic time. (Hoft 1995)

For example; when users of mobile data services perform a task that involves a given time delay, polychromic users (perform many things at once) will likely be more resilient to the delay than monochromic users (carry out only one task at a time) (Choi, et al 2005), as they may find other things to do during delays.

2.7.5.4 Business etiquette

Hoft (1995) identifies business etiquette as helping to facilitate interaction within an international team. Protocol means the roles and policies of the countries or companies or any group of people (Hoft 1995). Business etiquette could impact the usage of computers. For example, in some cultures people prefer face to face business deals because they are more trusted and respected.

Subjective specific variables

2.7.5.5 Long-term versus short-term orientation

Hofstede (1980) defines long and short term orientation as a measure of the concern about the past/future in society. Hofstede found long-term and short-term cultural differences as a result of a long process of "weeding out what he discovered to be cultural bias inherent in the original surveys; that is, the IBM surveys had a western bias. The surveys did not consider non-western values, particularly those of China and relating to the teaching of Confucius" (Del Galdo & Nielsen 1996 page 61).

The long and short term orientation variable could impact usage evaluations. Different orientations could result in different reactions to computer usage. There a specific differences between long and short term orientation. For long-term orientation, its characteristics are (Chuang Tzu 2005):

- Persistence (perseverance.)
- Ordering relationships by status.
- Thrift.
- Having a sense of shame.

For short-term orientation, the characteristics are:

- Personal steadiness and stability.
- Protecting your face.
- Respect for tradition.

- Reciprocation of greetings, favours, and gifts.

2.7.5.6 Attitude to the environment

Trompenaars (1993) defines an attitude to the environment as a measure of people's beliefs in their ability to control the environment. The attitude to the environment could impact usage evaluation, since users many differ across cultures in their reactions to difficulties, depending on whether they believe they are in control.

2.7.5.7 Individualism versus collectivism

Trompenaars (1993) defines individualism versus collectivism as relating to self-perception: do people perceive themselves primarily as individuals or as members of group? This value orientation pair also relates to a sense of responsibility (Del Galdo & Nielsen 1996).

Individualism represents a preference for a loosely-knit social framework where people are expected to take care of themselves and their own interests, whereas collectivism indicates an inclination toward a tightly-knit social framework where people expect their companions to look out for their welfare and where personal goals are subordinated to those of the group, which will impact the usage evaluation. For example Choi et al. (2005) found that users from a culture with individualistic tendencies select services based on their own personal preferences alone. It can be inferred that these users will opt for mobile data services that are more personalized. On other hand, users with a collectivist inclination may tend to use services that enable them to feel more connected to other people.

2.7.5.8 Femininity versus Masculinity

Femininity versus masculinity covers implications of gender for social roles (Hofstede 1980). For example, using Hofstede's scales Japan is the world's most masculine society, with a rating of 95/100, while Sweden is the most feminine society, with a rating of 5/100. Other "masculine" cultures include the USA, the German-speaking world, Ireland, United Kingdom, Mexico and Italy.

“Feminine" cultures include the Netherlands, Spain, Thailand, Korea and Portugal.

Characteristics of a masculine culture

- A tendency to admire achievement and wealth.
- In politics, conflicts are solved by aggression.
- The belief that it's more important for men than women to have a professional career.
- A low number of women represented in politics
- Professionals often "live to work"

Characteristics of a feminine culture

- Admiration of nurturance and environmental protection.
- Conflicts solved by negotiation, with aggression as a last resort.
- The belief that women are as entitled to a profession the same way men are.
- A high number of women in politics.
- Professionals "work to live".

This cultural variable thus addresses the acceptability of ‘masculine’ and ‘feminine’ characteristics in different cultures, primarily for male behaviours. Thus males in a more ‘feminine’ culture can be valued for their feminine characteristics. Overall, gender roles are more blurred in feminine cultures.

2.7.5.9 Uncertainty avoidance

Hofstede (1980) defines uncertainty avoidance as a measure of how uncertainty about the future is perceived as threatening. This subjective cultural variable focuses on the extent to which people feel threatened by uncertain or unknown situations. Hofstede’s contrasts:

- *Strong Uncertainty Avoidance*: indicates that a culture tends to perceive unknown situations as threatening and that people, therefore, tend to avoid these situations.

- *Weak Uncertainty Avoidance*: indicates that a culture is less threatened by unknown situations.

Uncertainty avoidance as a variable affecting the users' decision and thinking, therefore it could also impact the usage of computer, by deciding how to reach to usage difficulties in the face of uncertainty.

2.7.5.10 Neutral or emotional

Trompenaars (1993) proposed Neutral to emotional measure of the range of emotions that people express when dealing with others in a business context (Del Galdo & Nielsen 1996). Displays of frustration in the face of usage difficulties could be influenced by this variable.

2.7.5.11 Structure and Achievement versus Ascription

Social structure determines the "standing", i.e., the honour or prestige attached to one's position in society. Note that social status is influenced by social position, but one can have several social positions, but only one social status.

The *Achievement versus Ascription* value orientation measures how status is accorded. In achievement orientated cultures, status is accorded based on individual achievements. Examples of countries where this is the case include Norway, the United States and UK. In ascription oriented cultures, status is accorded based on birth, kinship, gender, age, your connections and your past educational record; examples of countries include Russia, Japan, China, Jordan and France (Trompenaars 1993). This cultural variable could impact computer usage through differences in motivation to achieve. Achievement is less important for ascription social status.

2.7.5.12 Power Distance and Authority Conception

Hofstede (1980) defines *Power Distance* as a measure of the interpersonal power in society as perceived by the less powerful. Power distance measures how subordinates (employees, staff members) respond to power and authority (leaders, managers). Power distance is an objective variable which impacts

usage evaluation such as a manager forcing their employees to use specific software, even if the employees do not have experience to use software.

Del Galdo & Nielsen (1996, page 57) define *Authority Conception* as an "international variable that considers differences and similarities in power, authority, and leadership; how they are perceived differently in cultures, and how this perception affects business communication". This is very similar to power distance, and could impact reactions to usage difficulties by determining whether users feel they are allowed to resolve problem without permission.

2.7.6 Conclusion on General Cultural Variables

The full version of the Diamond Model in this chapter shows the much of structure of the final version. After each study in chapter 4, 5, and 6 we will add a new variables and instances of Jordanian users. At the end of each study, we may restructure the Diamond Model according to the results; also some of the variables will be moved from segment to other.

Each updating step took us closer to the final full version of our Diamond Model as we will see in chapter 6. However, the initial Diamond Model actually had six main segments 1) thought and feeling, 2) language and semiotics, 3) material cultures, 4) social, 5) political, and 6) economic. (See Appendix I for this version). However some of these segments were merged to reach the five main segments above. To simplify reading of this thesis, the version above is a substructure of the final model. Structural revisions made after each field study have been omitted. However, it is important to understand that the Diamond Model was not 'right first time', and may never be 'right'. Instead, it has evolved in use through a combination of simplification and extension. Its validity is always relative to the literature reviewed (initial structure above) and the findings from each field study.

The initial Diamond Model thus started to be populated with Jordanian instances from the first study in chapter four, where new variables were added under existing groups such as *Government Support for IT Training* (3.3),

Availability of International Products and Services (4.2), and *Affordability of IT Access* (4.3).

After each study we will revisit the Diamond Model and update the variables, by adding new variables, and where necessary we simplified the model by restructuring.

The general cultural research literature covers many variables. Some appear to be more relevant to HCI than others. We can thus prioritise the final Diamond Model segments according to their likely impact on design preferences or usage evaluation. For usage evaluation, the ranking will be (descending, most important first):

1. Social Structure and Interaction
2. Language and Semiotics
3. Economic Processes
4. Political Processes
5. Material Culture

The order above is based on the frequency in the above literature review of possible influences of cultural variables on users' reactions to usage difficulties, and how they are explained and evaluated.

In contrast for design preferences, the ranking will be (descending, most important first):

1. Material Culture
2. Language and Semiotics
3. Social Structure and Interaction
4. Political Processes
5. Economic Processes

The order above is again based on frequency of possible influences in the above survey.

From above, we conclude that some major groupings of culture variables (Diamond Model segments) may impact design preferences, some may impact computer usage, some both, and some perhaps neither. The following table identifies those (groups of) variables most likely to impact computer usage or impact design preferences.

From Table 2.1 we conclude that more cultural variables are likely to impact usage evaluation than design preferences, but both are still important and could impact HCI in different ways. Not only are there more variables with relevance to usage that for design preferences, these 'variables' have much great scope, often corresponding to complete segments of the Diamond Model. However, the likely balance of impact is not well reflected in the literature on culture and HCI, as we will see in Section 2.8. Before reviewing this literature, we will summarise the state of the Diamond Model after the general literature survey and then ground it via some Jordanian examples. Figure 2.18 presents tree diagrams of each Diamond Model Segments.

	#	Segments Groups of Cultural variables
Computer usage reactions to difficulties, and their explanation and evaluation	1	Information Flow (2.6.2.5)
	2	Patterns of thinking and values (2.6.5.2)
	3	Business etiquette (2.6.5.4)
	4	Long-term versus short-term orientation (2.6.5.5)
	5	Individualism versus collectivism (2.6.5.7)
	6	Femininity versus masculinity (2.6.5.8)
	7	Structure and achievement versus Ascription (2.6.5.11)
	8	Power distance and Authority conception (2.6.5.12)
	9	Economic processes (2.6.4)
	10	High and Low context (2.6.2.4)
Design preferences and feature acceptability	1	Familiarity with English across cultures (2.6.2.2)
	2	Text direction (2.6.2.3)
	3	Colour (2.6.2.6)
	4	Time of day, dates and numbers (2.6.5.1)
	5	English fluency and the role of the educational systems (2.6.3.2)
	6	Femininity versus masculinity (2.6.5.8)
Both Usage and Design	1	Patterns of thinking and values (2.6.5.2)
	2	High and Low context (2.6.2.4)

Table 2.1 Cultural variables that impact computer usage and design preferences.

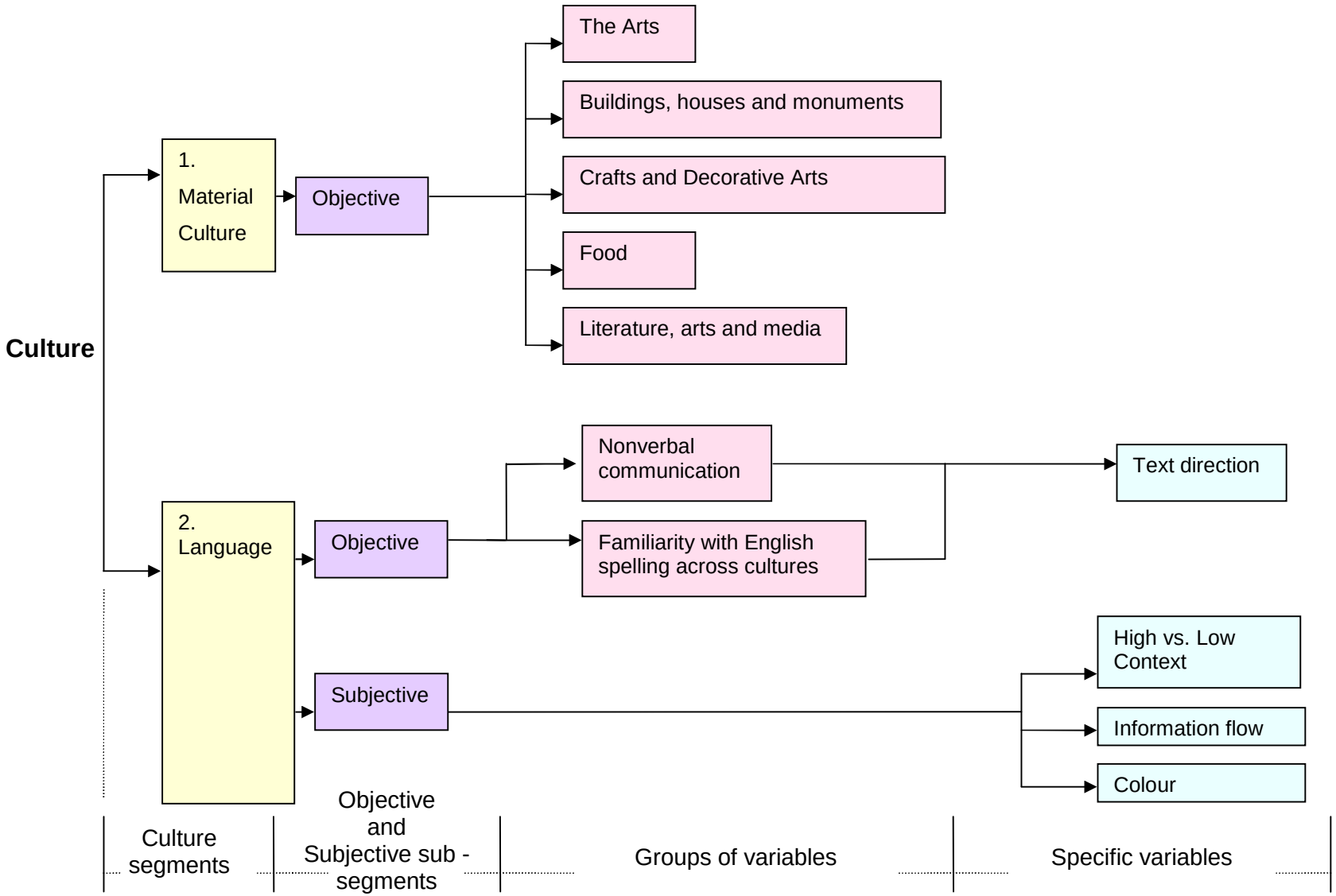

Figure 2.18a: General Cultural Variables by Diamond Model Segment

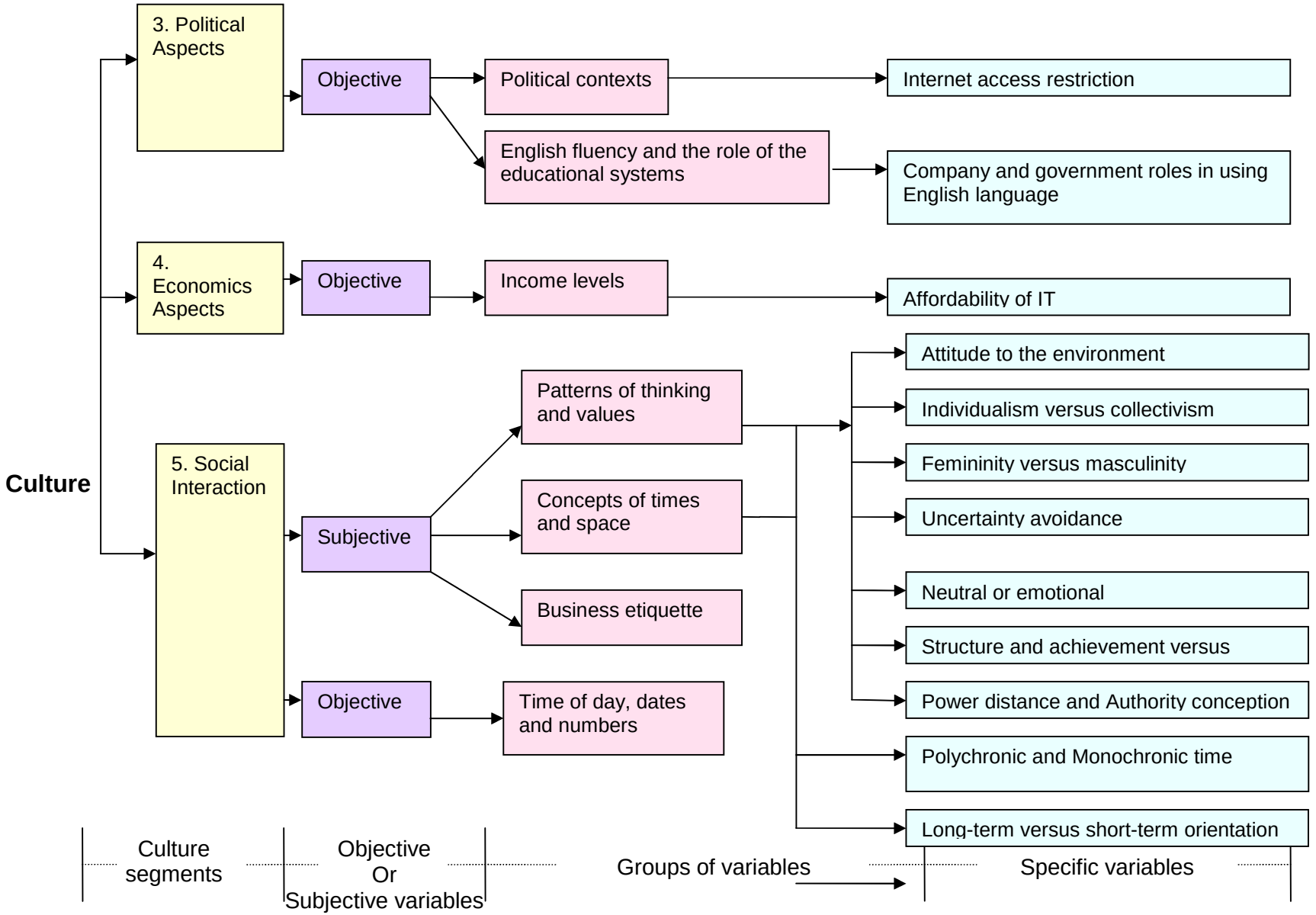

Figure 2.18b: General Cultural Variables by Diamond Model Segment

2.8 The Diamond Model illustrated with Jordanian examples

In the new millennium computers are more widespread especially after the internet. This makes the world a small village, from where we can find information and explore. In Jordan, computers have entered into most public and private sector work, which can cause some difficulties for people when they start using them.

The Hashemite Kingdom of Jordan is located in the Middle East, with a total land area of 92,300 sq km. The population of Jordan was 6,053,193 in July 2007 (Central Intelligence Agency 2008). The effects on computer usage of the instances of cultural variables within five Diamond model segments in Jordan often differ from other countries.

2.8.1 Material Culture

In Jordan, the style of buildings and the materials used to build houses, make them look distinctive. For example, the face of the building built from stones. Also, there are special types of food that can be found only in Jordan such as Mansaf'. Hand crafts are very popular in Jordan, such as dresses for woman that are made only for special events, which will be in different colour and shapes according to the situation of this event. For example, the traditional dress in the day before the wedding will be hand made with pink colours.

2.8.2 Language and Semiotics

Arabic is the official language of Jordan. English is widely understood by many Jordanians, although this varies with educational level and social status. Middle and upper class citizens consider English as their second language.

A large part of the labour force in Jordan is educated and bilingual, speaking Arabic and English. That gives Jordan an advantage in the IT sector, covering the Arabic market, and English speaking market such as North America, Europe, and Asia. (Jordan National Competitiveness Observatory 2007)

2.8.3 Political Processes

Jordan has given great attention to education in particular. Its educational system reaches international standards with its secondary education certificates[1]/ exams are accepted in world-class universities. It is ranked 77th in the world according to literacy rate, and is first in the Arab world (Wikipedia 2008 a). The Jordan government professes great zeal for teaching information science providing schools with computers.

Jordan spends 5.6% of GDP on education, which makes Jordan relatively one of the highest spenders in the world on education (Jordan National Competitiveness Observatory 2007). Jordan has achieved over 90% literacy and its education system. In Jordan there are 8 public universities, 12 private universities and 21 community colleges, graduating over 4,000 IT graduates every year[2].

2.8.4 Economic Processes

The Gross Domestic Product per capita was $4,700 in 2007 compared to the United States of America ($46,000) and United Kingdom ($35,300) according to the central Intelligence Agency website (The World Factbook 2007).

Jordan is a small country with limited natural resources. The country is currently exploring ways to expand its limited water supply and use its existing water resources more efficiently, including through regional cooperation. Jordan also depends on external sources for the majority of its energy requirements (The Arabic Network for Human Rights 2004).

There are 4.34 million mobile phone users in Jordan, a high proportion of the population. However, the household demand for IT services in Jordan, as measured by the use of the internet, is around 0.5% of total domestic revenue, based on statistics at 2006 (Jordan's Competitiveness Report 2007). This is due to the limited internet connectivity and low computer ownership in Jordan, due to the relatively high prices of systems. Also the internet-based e-

[1] based on 2006
[2] According to 2005 survey by ICT in Jordan

commerce market is close to non-existent for those who speak only Arabic. The internet is mostly used by the private sector for e-business, and for e-government initiatives. There were 2,500 internet hosts in 2007 and 796,900 internet users in Jordan in 2006. (Central Intelligence Agency 2008).

27% of households have a personal computer in Jordan, according to ministry of ICT in Jordan for 2006. But the number of computers per household in Jordan continues to be low, around 5.5 per 100 people, and internet connectivity stands at 11 users per 100 citizens (Jordan's Competitiveness Report 2007). Compared to United Kingdom the percentage of householder accessing the internet from home at 2007 was 61% of all householders (National Statistics of UK 2008). The average Jordanian Internet user uses the Internet between 40 and 50 hours per month; the total cost for these ranges from 15 to 20 Jordan Dinars (JOD)[1], a prohibitive amount for many, given Jordanians' economic condition. Internet use in Jordan is available only to those who can afford it (The Arabic Network for Human Rights 2004).

2.8.5 Social Structure and Interaction

The culture of Jordan, as in its spoken language, its values, and beliefs, is Arabic and Islamic. Bonds between members of an extended family will be strong. According to Hofstede[2] Jordan is slightly above average on Masculinity community, with large power distance and uncertainty avoidance.

2.9 Culture and Human Computer Interaction (HCI)

Human-Computer Interaction (HCI) is the study of how people design, implement, and use interactive computer systems, and how computers affect individuals, organizations, and society (Mischitz 2001). Interactive computers systems bring many benefits at work; they support user tasks by providing better access to information and more powerful forms of communication. HCI research also develops tools used to design, build, and test and evaluate user interfaces, and methods for designing the interface. HCI has also been defined as "the study and the practice of usability. It is about understanding

[1] Jordanian Dinar equals approximately 1.4 US Dollar
[2] http://www.geert-hofstede.com/hofstede_arab_world.shtml

and creating software and other technology that people will want to use, will be able to use, and will find effective when used" (Carroll 2002).

"Computer" means any technology ranging from the general desktop computer to a large scale computer system, a process control system or an embedded system. These systems may include non-computerized parts, including other people. When we say 'interaction', we mean any communication action by a user via a computer. (Dix, et al 2004)

In HCI there are three major issues of concern: the people, the computers and the activities that are performed. The system must support users, which gives Dix et al. (2004) a fourth focus, usability; the system will not be usable if the system forces the user to adopt unacceptable modes of action. Cultural factors can influence acceptability here.

HCI became a distinct intellectual activity the early 1980s. It has its roots in the systematic study of human performance early in the last century in factories, with an emphasis on manual tasks. The first studies of interaction between humans and machines were in the Second World War, and focused primarily on the physical characteristics of machines and systems, and how these affect user performance (Dix et al. 2004)

In 1980s, HCI involved the design, implementation and evaluation of interactive systems in the context of the user's tasks and work, with a focus on quality in use (Cockton 2004). In the 1990s, HCI focused on designing for context. A focus on context redefined HCI's design challenges. As using technology became more variable, we needed to understand more about specific uses. So a major concern in HCI become to understand the potential relationship between computation and the context in which it is embedded (Dourish 2004).

In the new millennium, HCI is seen to be entering a third wave. For Bødker (2006), second wave HCI focused on groups working with a collection of applications. Second wave theory focused on work settings and interaction

within well established communities of practice (Bødker 2006). In the third wave, usage context and application types have broadened substantially. Computers are being used in the private and public spheres. Using technology has spread from the workplace to homes and wider lives. In third wave HCI, culture, emotion and experience have become key interaction concerns. The third wave of HCI focuses at the cultural level, through aesthetics, expansion of the cognitive to the emotional, and a "cultural-historical focus on experience" (Bødker 2006). Thus while cultural differences have been a concern in HCI for over a decade (Del Galdo and Nielson 1996), culture is no longer a specialist sub-area concerned only with internationalisation and localisation.

As noted during the review of general cultural variables, there are two broad areas where cultural factors are relevant to HCI. These are design acceptability and usage evaluation. The former concerns how culture influences users' preferences for design features, and what users find acceptable in terms of user interface design. The latter concerns a different focus, not on the users interface, but on the user experience, in particular how culture influences how users react to difficulties, how they evaluate these difficulties and how they explain their reactions.

There are many studies of cultural factors in HCI, but they make different assumptions about the potential impact of cultural differences. Most assume that cultural differences will primarily impact on the acceptability of user interface features, through how design preferences vary systematically across cultures. By understanding these preferences for features, designers can create culturally appropriate user interfaces.

As a detailed example of such a study, Nakakoji and Ito (1996) reviewed user interface design and Japanese culture as compared to North America. They studied cultural effects on the user of computer systems in order to understand the important characteristics and aspects of user interface design. They used schematic models to illustrate cultural impact by dividing user-computer interactions into two modes: *listening* mode, in which people are

presented with a computer's reaction, and *speaking* mode, in which people give instructions to a computer system. In terms of the Diamond Model, they focus within the major segment of Language, also drawing on media elements of material culture.

There are three phases of *listening mode, where* users react along the timeline after a computer system presents information on the display:

1. *Perception phase*: this initial recognition relies on instincts about colour or shape. For example, a user recognizes that a list of characters is presented in red on the screen in this phase. For Nakakoji and Ito (1996) the perception phase has the least cultural impact, since the physiology of colour and the size of a shape do not depend on languages or cultural background, but on sensory monitoring by humans. In Hofstede's Pyramid model (Figure 2.6), biology would be the main determinant in this phase.

2. *Association phase*: in this phase people associate semantic meaning with what they perceived in the preceding perception phase. For example, the user understands that a list of characters is a message written in English, and associates a warning meaning with the presented message because of the red colour used. The association phase should be more culturally-sensitive. Culture-specific aspects of representations related to the association phase can mostly be dealt with by surface-level adjustment, such as languages, icons, colour and formats of numbers. The focus is on culturally-specific design preferences, since different cultures have different psychological associations for colour. For example, purple indicates dignity and nobleness in Japan, but is an icon for death and evil in ancient Greece.

3. *Reasoning phase*: after understanding the semantic association of the information or behaviour presented by a computer, users reason about the presented information. For example, the user tries to understand why the warning message is presented at this moment and how it is related to what the user has done previously. The Reasoning phase can be affected by culture, but through usage evaluation as much as through design preferences.

Although formal reasoning, such as mathematical reasoning or logical reasoning is universal, much of cognitive reasoning depends on social norms and background culture (Nakakoji and Ito 1996), which can impact how users react to usage difficulties, and how they explain their reactions.

Speaking mode is when the users want to indicate their intention to the system. This mode consists of four phases:

1. *Affordance perception* is when users identify what they can do with presentation displayed by the system. For example, the user looks around on the screen and identifies highlighted icons that seem clickable.

2. *Applicability check* is when users validate their choice of actions; that is, whether the chosen action plan will actually let users do what they intend. For example, users read the label on the icon which they viewed in the previous affordance perception phase and examine whether the label indicates their intended action.

3. *Enactment with expectations* is when users enact their selected action plan. For example, this is the phase when users physically click on the mouse button after bringing the mouse cursor onto the icon display.

4. *Confirmation*: After the enactment, users need to confirm that the enacted action has carried out what they expected of the system.

In western cultures, individuals want control over their surrounding environment, while in oriental cultures, individual try to accommodate the external environment (Section 2.6.5.7). These characteristics are reflected in the typical attitudes that Japanese users take towards the use of computer systems (Nakakoji and Ito 1996) which is related to our Diamond model (Social Structure Interaction segment, as Individualism versus Collectivism, and Power Distance).

There are differences in the initial acceptance of a newly deployed system between Japan and the United States. In Japan, people tend to have less resistance against, and want to use, new technologies. This is because in general, Japanese workers are very compliant to their senior workers or managers, which is related to the Diamond model (Social Structure and Interaction segment, Power Distance and Authority Conception variable, Section 2.6.5.12).

When a Japanese manager decides to bring change into a workplace, such as introducing a new computer system, the workers will accept the change. In these situations, technology becomes useful only if a certain percentage of group members use it. But if everyone acts in pursing their own best interest, the result gets worse, not only for the group, but also for the individuals.

A difference also lies in where users ascribe the difficulty of using a system. If Japanese users cannot use the system, it is likely that they conclude that it is their fault. If they do not understand how a command works, they are likely to blame themselves that they have not read the instruction manual carefully. Nakakoji and Ito (1996) thus argue that Japanese IT systems must be designed in the best way and that modifying the user interface according to their personal preference is an unlikely to be required.

Culture affects how people value and prioritize human relationships and technologies. Successful human computer interface design cannot be achieved without considering these issues. For example, technical support is considered to be more important than price in Japan, while the price is a driving force in choosing a system in the United States (Nakakoji and Ito 1996). This example in an instance in our Diamond model of Social structure and interaction (patterns of thinking and values subjective group).

Until the 1990s in Japan, it was quite uncommon for people to change their jobs. The average length that a person remained in the same company used to be somewhere around twenty to thirty years. In this situation, the problem of the mismatch between those who have to do the work and those who get

the benefit is less problematic. For example, successful software reuse in Japanese industry is partly due to the fact that the same group of people who built the software do not mind extra work, for future maintenance and reuse, because they are the ones who would maintain and reuse the same software later (Nakakoji and Ito 1996).

Design preferences in some cultures may be unspecific, e.g., that everyone in an organisation has the same bespoke user interface. For example Japanese users would like to work as a group, not on an individual basis. Nakakoji and Ito (1996) presented examples in support of this:

> In the course of deploying Lotus Notes, needs for companywide system customizations are much stronger than individual-based system adaptation. Japan is used to office computers for word processing and accounting jobs. These are specialized microcomputers, with software that is totally customized to individual users or companies. The market share of personal computers in Japan used to be comparatively low as compared to that of the United States (34% in Japan and 55% in the USA in 1993) because of the existence of office computers. Japanese companies were not interested in purchasing shrink wrapped software packages and installing them on personal computers because they would lose their identity as a company. Now that functionalities of packaged software surpass those of office computers software, companies have started using personal computers. Still, they need their specialized software for their own company. (Nakakoji and Ito 1996, pg. 118)

Figure 2.19 summaries how the relation between culture and HCI can take two forms. The first relates culture to design acceptability. The second direction relates culture to usage evaluation. The first has been studied in much HCI research, focusing on design features and cultural acceptability. The assumption here is that design success depends on cultural preferences

for interface features, and not cultural responses to experiences and outcomes during usage. This approach to culture and design has become normal science in HCI, resulting in an established research methodology that assumes casual relationships between culture and the acceptability and appeal of user interface features, based on the presence or absence of cultural markers. Barber and Badre (1998) thus define *cultural markers* as: "design elements found in web pages and such elements become cultural markers when they prove to be highly prevalent within a particular cultural group and less prevalent or absent in other groups".

Barber and Badre (1998) say that "Culturability, the merging of culture and usability, has implications for Web and software design. Usability must be re-defined in terms of a cultural context, as what is 'user friendly' for one culture can be vastly different for another culture. The intent is not to develop a generic Global Interface to be accepted by all cultures participating in this medium, but to suggest that cultural markers can be manipulated to facilitate international interactions". (Barber and Badre 1998)

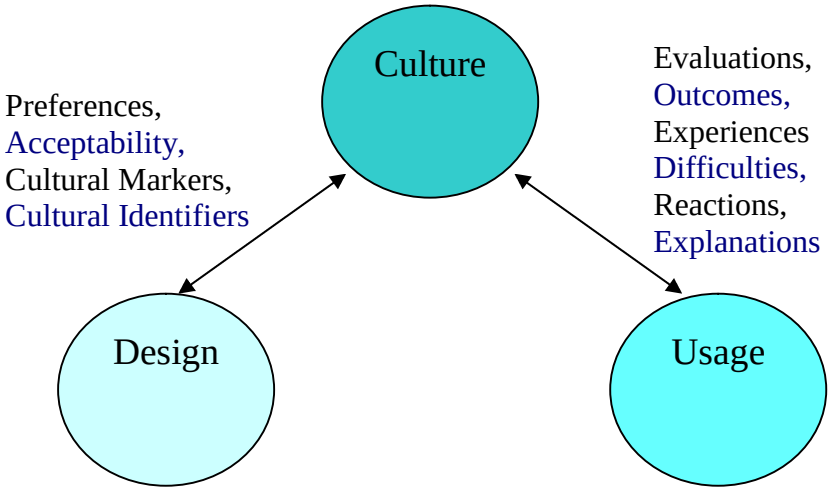

Figure 2.19 The two relations between culture and HCI

The second form of relation focuses on how culture impacts users' evaluations of their interaction usage, their reactions, and how they explain their reactions and evaluations. The important point is that different cultural values may result in different views on, and responses to, success or failure

during interactions. Users in different cultures may thus have different responses to the same interaction event or outcome on the basis of cultural differences.

Successful design meets users' needs, and the end user will be satisfied if their needs and goals are satisfied. Users have individual and cultural differences with different values and goals; therefore it is not possible to have global design that fits all users' needs and values.

Differences between users are often caused by cultural differences that impact usage. There are strong relations between culture and HCI that affect the computer user in a direct or indirect way. But the important issue is how we theorise the relation between culture and HCI.

The impact of some cultural variables has already been studied in HCI, but other culture variables have not been studied before. Tables 2.2 to 2.6 summarise how culture variables have been studied in HCI. Reference is made to previous sections where this research already has been covered (e.g. section 2.6.1 to 2.6.5) or to following subsections where it will be reviewed (e.g. 2.8.1 to 2.8.5)

2.9.1 Material Culture Variables Studied in HCI

#	Culture variable	Studied in HCI by	Refer to Section
1	Buildings, houses, monuments and manufactured products	Shen, Woolley, and Prior (2006).	2.6.1.2
2	Crafts	Shen, Woolley, and Prior (2006).	2.6.1.3

Table 2.2 Material Culture variables addressed in the HCI literature

Two cultural variables for this Diamond Model segment, *Buildings, houses, monuments and manufactured products* and *Crafts* are mentioned in Shen, et al. (2006) study, explaining the basis for icons in culture.

2.9.2 Language variables studied in HCI

#	Culture variable	Studied in HCI by	Refer to Section
1	Natural language	Hoft (1995), Zakaria, et al. (2003), Smith, et al. (2004)	2.6.2
2	Familiarity with English	Del Galdo & Nielsen (1996)	2.6.2.2
3	High/ Low context	Zakaria, et al. (2003), Choi, et al. (2005)	2.6.2.4
4	Colour	Smith, et al. (2004)	2.6.2.6
5	Nonverbal communication	Hoft (1995)	2.6.2.1

Table 2.3 Language variables addressed in the HCI literature

Zakaria, et al. (2003) study natural language by comparing USA culture with Arab culture. They found that in US culture, conveying information is a primary function of language, with an emphasis on function, and by extension, substance, meaning, and accuracy. In Arab culture, language functions as a social tool for weaving relationships. Form presides over function, affect over accuracy, and image over meaning.

Del Galdo & Nielsen (1996) address *Familiarity with English*, explaining the difficulties of Japanese when using English software.

Zakaria, et al. (2003) integrate high and low context in communication by linking them to three motivational variables: context and trust/fairness motivations; context and instrumental motivations; and context and expressive motivations. High vs. low context has also been addressed by Choi, et al. (2005) in an evaluation of mobile data service. Smith et al. (2004) address natural language and colour as *culture attractors* (similar to *cultural markers*) of interface design elements.

Hoft (1995) addressed nonverbal communication in her review of technical communication, and covered natural language as a variable that affects HCI.

2.9.3 Political Processes studied in HCI

#	Culture variable	Studied in HCI by	Refer to Section
1	Political contexts	Smith and Yetim (2004)	2.6.3.1
2	English fluency	Del Galdo & Nielsen (1996)	2.6.3.2

Table 2.4 Political Processes variables addressed in the HCI literature

Political contexts have been mentioned only in Smith and Yetim (2004) study and not been covered in any significant detail within HCI. Del Galdo & Nielsen (1996) offer an example of how the Japanese educational system emphasizes written English rather than spoken English; this at least in part accounts for the disparity between years of study and achieved oral fluency. Also Del Galdo & Nielsen (1996) explain how important is the education training for young, and how is cultural foundation needs to be broadened, starting with the very young.

2.9.4 Economics Processes studied in HCI

#	Culture variable	Studied in HCI by	Refer to Section
1	Economic Processes	Yasin (1996)	2.6.4

Table 2.5 Economics Processes addressed in the HCI literature

Yasin (1996) studied the economic growth of Arab countries in specific Jordan. This segment is more commonly covered in more recent HCI literature on HCI in developing countries, but separating it out in this way is not helpful to designers who need to consider all relevant aspects of differences in countries and related geographical units.

2.9.5 Social Structure and Interaction variables studied in HCI

#	Culture variable	Studied in HCI by	Refer to Section
1	Business etiquette	Hoft (1995)	2.6.5.4
2	Power distance	Ford and Kotze (2000), Storm (2005), Smith et al.(2004)	2.6.5.12

Table 2.6 Social Structure and Interaction variables addressed in HCI

#	Culture variable	Studied in HCI by	Refer to Section
3	Religious	Zakaria and Stanton (2003), Yasin (1996), and Smith, et al.(2004)	2.6.5.13
4	Time of day, dates and numbers	Hoft (1995) and Choi et al. (2005)	2.6.5.1
5	Long-term versus short term	Hoft (1995)	2.6.5.5
6	Individualism versus collectivism	Ford and Kotze (2000), Storm (2005), Choi et al. (2005), Yasin (1996) Smith, et al. (2004)	2.6.5.7
7	Femininity versus Masculinity	Ford and Kotze (2000) Storm (2005), Yasin (1996) and Smith et al. (2004)	2.6.5.8
8	Uncertainty avoidance	Ford and Kotze (2000) Storm (2005), Choi et al. (2005) and Smith et al. (2004)	2.6.5.9

Table 2.6 continued: Social Structure and Interaction variables addressed in HCI

Hoft (1995) notes that business etiquette can provide insights into proper and improper examples of graphics for international technical communication. A, and also Hoft (1995) mentions time of day, dates and numbers as cultural variables in relevant to HCI.

Smith et al. (2004) present a process model for developing usable cross culture website and considered Hofstede's (1980) cultural dimensions of power distance individualism versus collectivism, femininity versus masculinity, and uncertainty avoidance. Smith et al. (2004) present a process

model for developing usable cross culture website. Also Choi et al. (2005) studied also considered Individualism versus collectivism. Hoft (1995) covered Hofstede's (1980) long-term versus short term variable.

Storm (2005) studied power distance, individualism versus collectivism and femininity versus masculinity variables to identify differences in design decisions in two different cultures. Ford and Kotze (2000) studied Hofstede's (1980) four dimensions: power distance, individualism versus collectivism, uncertainty avoidance and Femininity versus Masculinity. Yasin (1996) mentions in his study cover individualism versus collectivism, femininity versus masculinity and religion as a variables affecting HCI. Smith, et al. (2004) refer to religious aspects of culture in relation to iconography.

Selected HCI references are now reviewed in detail to illustrate the balance between considerations of the impact of cultural variables on users' design preferences and impact on usage.

2.9.6 Culture, Design Acceptability and Use Preference

Choi et al. (2005) studied differences between preferences of Korean, Japanese and Finnish when downloading media for their mobile phones. Some differences were explained through four of the cultural dimensions identified by Hofstede (1980): uncertainty avoidance, individualism vs. collectivism, context, and time perception. In the Diamond Model, these are all instances of subjective social structure and interaction variables, except High/ Low Context, which is an objective language variable, as it very apparent in communications.

The study focused on what Korean, Japanese and Finnish users preferred in their mobile phones without looking at any differences in usage. The study was based on two steps, first interviewing 24 people from Korea, Japan, and Finland, then asking about their impressions after viewing video clips of mobile data services. The second step identified the relationships between these significant attributes of mobile data services and the culture to which an interview subject belonged.

The study explored the relationship between four of Hofstede's four cultural dimensions and critical design attributes of mobile data services. The focus was to show how cultural differences influence acceptability of mobile interface designs.

Choi et al. (2005) conclude that Human Computer Interaction (HCI) is influenced by cultural dimensions, specifically preferences for design attributes of mobile data services. For example: eleven attributes of using mobile phones are related to four cultural dimensions in Table 2.7.

Preferences on the first six attributes appear to be culturally dependent on Hofstede's uncertainty avoidance dimension:

1) Efficient layout or space usage
2) Larger amount of information within a screen
3) Clear menu labelling or hyperlink connotation
4) Provision of secondary information about contents
5) Variety of contents
6) Minimal steps or keystrokes

Preferences for four attributes relate to Hofstede's context dimension:

7) Variety of options for contents, which is an attribute of the individual vs. collectivism.
8) Iconic menu style.
9) Variety of font colours.
10) Variety of font sizes.

Lastly, (11) Logical ordering of menu items, relates to the time perception dimension.

Uncertainty Avoidance			
High		Low	
Korean & Japanese		Finnish	
Attribute	Prefer	Attribute	Prefer
Efficient layout of space usage	+	Provision of secondary information about contents	-
Large amounts of information within a screen	+	Variety of contents	-
Clear menu labelling or hyperlink connotation	+		
Provision of secondary information about contents	+		
Variety of contents	+		
Minimal steps or keystrokes			

Individualism vs. Collectivism			
Individualism		Collectivism	
Finnish & Japanese		Korean	
Attribute	Prefer	Attribute	Prefer
Variety of options for contents	+	Provision of secondary information about contents	+
Variety of contents	-	Variety of contents	+
Minimal steps or keystrokes			

Context			
High		Low	
Korean & Japanese		Finnish	
Attribute	Prefer	Attribute	Prefer
Iconic menu style	+	Iconic menu style	-
Variety of font colours	+	Variety of font colours	-
Variety of font sizes	+		
Minimal steps or keystrokes			

Table 2.7 Eleven attributes related to four cultural dimensions. (Choi et al. 2005, page 667)

Time Perception			
Monochromic		Polychromic	
Korean & Japanese &Finnish		None	
Attribute	Prefer	Attribute	Prefer
Iconic menu style	+	None	
Logical ordering of menu items	+		
Minimal steps or keystrokes			

Table 2.7 continued: Eleven attributes related to four cultural dimensions. (Choi et al. 2005, page 667)

Cha et al. (2005) studied differences between British and Korean mobile phone users. Two studies identified cross cultural patterns of mobile phone usage and preferences for user interface among Korean and British users. These studies focused on differences in user interface preferences in UK versus Korea for mobile phones, and considered users' values and satisfaction with mobile phone usage. Cha and colleagues' first study used a questionnaire that was designed to identify patterns of mobile phone usage between the two countries. There were 66 British and 71 Korean participants.

The second study in Cha et al (2005) was a user evaluation focusing on different values for the user interface of mobile phones. The study was based on two different simulations, which looked similar to real mobile phone interface to help the participant experience a real context of use. The first simulated a Samsung mobile phone and the second simulated a Nokia mobile phone. The results show that British participants related to the Nokia mobile phone, whereas Korean participants related to Samsung mobile phones according to their features. Cha and colleagues found different preferences between Korean and British users', British preferred different levels of menus on one screen. Koreans preferred a single menu on one screen. However, these design preferences were not related to cultural variables.

Interestingly If British users accidentally missed calls; they become frustrated with the technology if they felt they should not have missed the call. This

provides clear evidence that cultural differences influence users' evaluations of interaction, and not just preferences for design features, which can be easy to uncover but harder to explain. It is also hard to show performance improvements for user interfaces that are designed for specific cultural variables. Thus, Ford and Gelderblom (2003) sought to identify potentially relevant cultural dimensions, and tested interfaces designed to match specific cultural differences on Hofstede's cultural dimensions. Ford assessed the impact of cultural dimensions implemented as user interface design features on speed, accuracy and satisfaction (acceptability) levels achieved by test subjects. Ford and Gelderblom (2003) examined whether five of Hofstede's culture dimensions (power distance, uncertainty avoidance, masculinity vs. femininity, individual vs. collectivism and time orientation) had any impact on performance. They concluded that "the results of study did not provide sufficient evidence to conclude that any of the tested cultural dimensions affected human performance" (Ford & Gelderblom 2003). Unlike Choi et al, (2005), this study was not able to ground the impact of culturally appropriate design features in cultural variables.

Ford (2005) further researched the relation between culture and usability in her masters' thesis. She proposed a conceptual model of usability that can be used to investigate the effects of culture on usability. Her study "investigates the factors that influence usability in order to identify the variables that need to be controlled for when researching the influence of subjective culture on usability of computer based systems". Ford (2005) tested whether Hofstede five cultural dimensions affected the usability of computer based system, and tested different user interfaces that displayed characteristics appropriate to Hofstede's cultural dimensions.

Usability levels were significantly affected only when users were at an extreme of a cultural dimension. She also discovered interplay between dimensions. One cultural dimension could override the impact of others when a user displays a substantially high level for a dimension. This suggests that the relationship between cultural variables and usage could be more complex than that between cultural variables and design preferences. Ford offered

further explanations of the limited clear impact of cultural dimensions. Firstly, although several more obvious confounds were controlled for, such as age, home language and computer skills, it is possible that cultural aspects other than Hofstede's five dimensions and user characteristics could have influenced performance. Secondly, the *limited time* within the user studies could have affected the subjects' performance as it could have caused stress and anxiety. Thirdly, different exposure due to the *study design* to the various components (design elements) comprising an interface could affect usability. The results could have been affected if the test tasks did not test these components equally between the interfaces (Ford 2005).

2.9.7 Culture and Web-site Evaluation

El Said, Hone and Ali (2005) investigated cultural issues for e-commerce trust. They surveyed 370 Egyptian internet users to explore their views of two book-seller websites. The first was Amazon, an international website, and the second was e-kotob, Egyptian book seller site. They found that users preferred to use the international website (Amazon) rather than the local one, because they trusted Amazon more than local websites: "The study suggests that Egyptian internet consumers with high perceived reputation and high perceived familiarity on an e-commerce store tend to trust that store". Also, Egyptian internet consumers with high trust of an e-commerce store, tend to have a positive attitude toward it, and show willingness to by from that store.

This study did not reveal that some web site design options were more acceptable than others for Egyptian users, nor was the western design of Amazon a problem. Instead, cultural factors led to the sample preferring a western site on the basis of trust..

El Said (2005) discussed the cultural effect on electronic consumer behaviour in her PhD. Her research offers an understanding of the cultural drivers of e-commerce, contributing to building a theory of consumer's cultural trust for internet stores. Her research demonstrated the roles of trust, uncertainty avoidance, attitude and willingness to buy, perceived familiarity and reputation for Egyptian users. Cultural factors can thus be seen to influence users'

evaluation of actual or potential usage, and not just their preferences for design features.

El Said carried out three studies. The first interviewed 24 Egyptian internet users. The aim was to find out what the internet was being used for and what problems users experienced, and then trying to link these to cultural variables.

Her second study was an electronic survey of 57 respondents (33 IT respondents and 24 non-IT respondent) to collect data around Egyptian use of the internet and their perception of e-commerce. Her third study used card sorting sessions with 15 participants to examine the e-commerce interface features that are most salient to the user group and to explore how these relate to user intentions to engage in internet shopping. The card sorting used screen dumps of web pages as the material to be sorted and was able to generate criteria by which web pages could be judged along with users' willingness to make purchase decision from an e-commerce site.

This study focused on book selling e-commerce sites because books are the most purchased items by Arabs on the Internet. The chosen sites included local (Egyptian) sites, sites from other Arabic countries and international sites. Also included sites with Arabic or English language interface. El Said (2005) found that the eleven sites included different options of book categorisation, and they represented both secure and non-secure sites.

1. E-Kotob: affiliated with Amazon http://www.ekotob.com/, Location of E-Retailer: Egypt, Arabic language interface.
2. Amazon, http://www.amazon.com/. Location: USA, English language interface.
3. Barnes and Noble, http://www.barnesandnoble.com, Location of E-Retailer: USA, English language interface
4. Borders, http://www.borders.com/. Location of E-Retailer: USA, English language interface.
5. Alkitab, http://alkitab.com/originalsite/. Location: USA, English language interface.

6. Neelwafurat, http://www.neelwafurat.com/. Location of E-Retailer: Lebanon, Arabic language interface.
7. Almaktabah, http://www.almaktabah.com/BrowseSubjects.asp. Location of E-Retailer: Lebanon Arabic language interface.
8. Arabooks, http://www.arabooks.net/. Location of E-Retailer: Lebanon English language interface.
9. Boustany, http://www.boustanys.com/. Location of E-Retailer: Egypt English language interface.
10. Arabic World, http://www.arabicworld.com/books.htm, E-Retailer Location: Lebanon, Arabic language interface.
11 Al-Basheer, http://www.al-basheer.com/arabicBooks.asp E-Retailer Location: USA, Arabic language interface.

The card sort asked the participants to look at the cards and to choose a criterion by which web site home pages could be distinguished from one another. Having named the sorting criterion, they would sort the remaining cards into these categories. This procedure was repeated until the participants could think of no more criteria. Here, the choice of criteria reveals the design feature variations that are noticed by participants. Those that are chosen most frequently reveal which features are most salient.

She found that the percentage of participants' willing to buy from:

1. Amazon 13 out of 13 – 100%
2. Borders 9 out 0f 13 – 69%
3. E-Kotob 8 out of 13 – 62%
4. Barnes & Noble 7 out of 13 – 54%
5. Neelwafurat 4 out of 13 – 31%
6. Alkitab 2 out of 13 – 15%
7. Arabooks 2 out of 13 – 15%
8. Al-Basheer 2 out of 13 – 15%
9. Almaktabah 1 out of 13 – 8%
10. Boustanys 1 out of 13 – 8%
11. ArabicWorld 1 out of 13 – 8%

El Said's (2005) analysis was that participants choose the Amazon website, according to familiarity with it and having more trust for an international website than Arabic or local website. Such preferences contrast strongly with studies influenced by *cultural marker* approaches to the relationship between culture and HCI. For example, Smith et al. (2004) reported two studies. One attempted to verify the influence of four cultural dimensions, power distance, individualism vs. collectivisms, masculinity vs. femininity and uncertainty avoidance. Their aim was to discover which generic cultural issues impacted website usability and acceptability, and how information about this can be communicated to developers and the site owners. The other study explored differences between e-finance websites in India and Taiwan focusing on; colour, culturally specific symbols, linguistic, specific iconography (religious and cartoon) and trust aspects as instantiated in site branding and signification. Smith et al. (2004) conclude that India and Taiwan define their own e-culture which is mix of eastern and western visual influences.

Smith et al. (2004) also noted that we can't assume that Western methodologies, techniques for user centred design and participation can be used in other cultures, or within multicultural teams without adaptation.

2.10 What is Usage Evaluation, and how do Users Evaluate their Usage?

From the literature, there are three main approaches to studying relations between culture and design and the relation between culture and usage. Firstly, a focus on design appeal simply considers whether users like a design as it without any changes or personalization.

Secondly, a focus on fit to user needs, taking into account differences due to users' cultures. For example a case study by Chetty and Grinter (2007) in the area of HCI for development (HCI4D) addressed users' cultural needs and was designed for a specific rural South African usage context.

Using participatory design or related techniques, the authors designed and implemented a software prototype called *multi-model*, a telemedicine

intercommunicator that allowed a nurse at a clinic to send voice, text, and image data about patients to a hospital doctor via the wireless network using store and forward techniques between the two sites. This allowed the nurse to get the doctor's advice on whether to refer patients to the hospital. (Chetty and Grinter 2007)

From this study the authors design a software specific for the nurse in rural South Africa and meet their design goals on cultural fit through this software, an example of the relation between culture and design that seeks to fit users' cultural needs, by making suitable software for local users.

The third relationship between culture and design in HCI research occurs when an existing design is used in different way, such as having a western design in developing countries, but it is used differently. For example a study by Donner (2007)explored the practice of "beeping" or "missed calling" between mobile phone users, which is achieved by calling a number and hanging up before the mobile's owner can pick up the call. This study was carried out in a developing country, "Rwanda", Donner (2007) interviewed small business owners and university students and identified three kinds of beeps: (call-back, pre-negotiated instrumental and relational) and the norms governing their use. Donner (2007), discusses beeping's implications for increasing access to telecommunications service.

Donner (2007) discovered that users in Rwanda used mobile beeping (forced missed calls) to communicate with other people by signals, which is given specific meaning within social contexts. Beeping behaviours reflected economic circumstances and social relationships within Rwandan culture.

These three relations between HCI and culture are not exhaustive. They focus either on the appeal and acceptability of design features, which may have been designed to fit a local culture, or on cultural differences in usage practices with design features. However, there has been limited consideration of the relation between culture and usage evaluation, i.e., what users feel about usage practices and experiences. Donner (2007) does cover users' evaluations of how well beeping works for them, and specific difficulties with

beeping. However, HCI research on cultural differences has not covered usage evaluation very well. Users evaluate their usage whether or not they are using software or devices in a culturally distinct way. There are general issues of what users feel and how they evaluate their usage. For example, using any, users could give their opinions on what it's like to use and their purposes in using the software.

This relation between culture and usage evaluation hasn't been covered enough in the HCI research literature, therefore this research will focus on it and develop a better understanding of it.

2.11 Conclusions

We have taken a broad view of culture including both cultural variables that are currently studied in HCI research and cultural variables from a more general literature. These have been integrated via a new meta-model, the Diamond Mode, that classifies variables into segments, sub-segments and groups. The balance of cultural variables in this model is biased towards usage rather than design preference, with some existing HCI studies unable to explain design preferences in terms of established cultural variables. Many cultural variables appear to be relevant to usage: evaluation, user experience, attitudes and reactions towards usage difficulties. Cultural variables that could impact design preferences, acceptability and cultural markers are less prevalent in the Diamond Model, although this does not imply that they will be less influential. Even so, it is worth seeking to balance the existing HCI literature on cultural factors, with its emphasis on cultural markers and design preferences, with studies of cultural factors impacting the broader user experience. The research in this thesis thus seeks to redress the balance between design and usage to explore which may have relatively more impact in HCI.

Chapter Three

Research Methodology

3.1 Introduction

This research is exploratory, aiming to uncover not only cultural variables their influence design acceptability, but also ones that shape users' responses to interaction events and outcomes. The research will thus focus on usage evaluation, that is, how users judge their interaction and achievements. This is a relatively new research area in cultural HCI.

There were three main research phases in this PhD. The first phase was the analysis phase where we analyzed the literature on relations between cultural variables and HCI (chapter two). The outcome was that usage evaluation appears to get less attention than feature preferences, but the Diamond Model suggests that more cultural variables are relevant to usage evaluation than to design preference.

The second phase will investigate relevant cultural variables in Jordan to explore the balance of impact of feature preferences and usage evaluation. If the implications of chapter two appear to be true, then, the remainder of the research with focus on how culture shapes users' judgements about their interaction with computers, how they react to usage difficulties, and how they explain their reaction.

The third phase will briefly explore ways to support design and usage in the future for Jordanian users. Figure 3.1 shows the structure of the research.

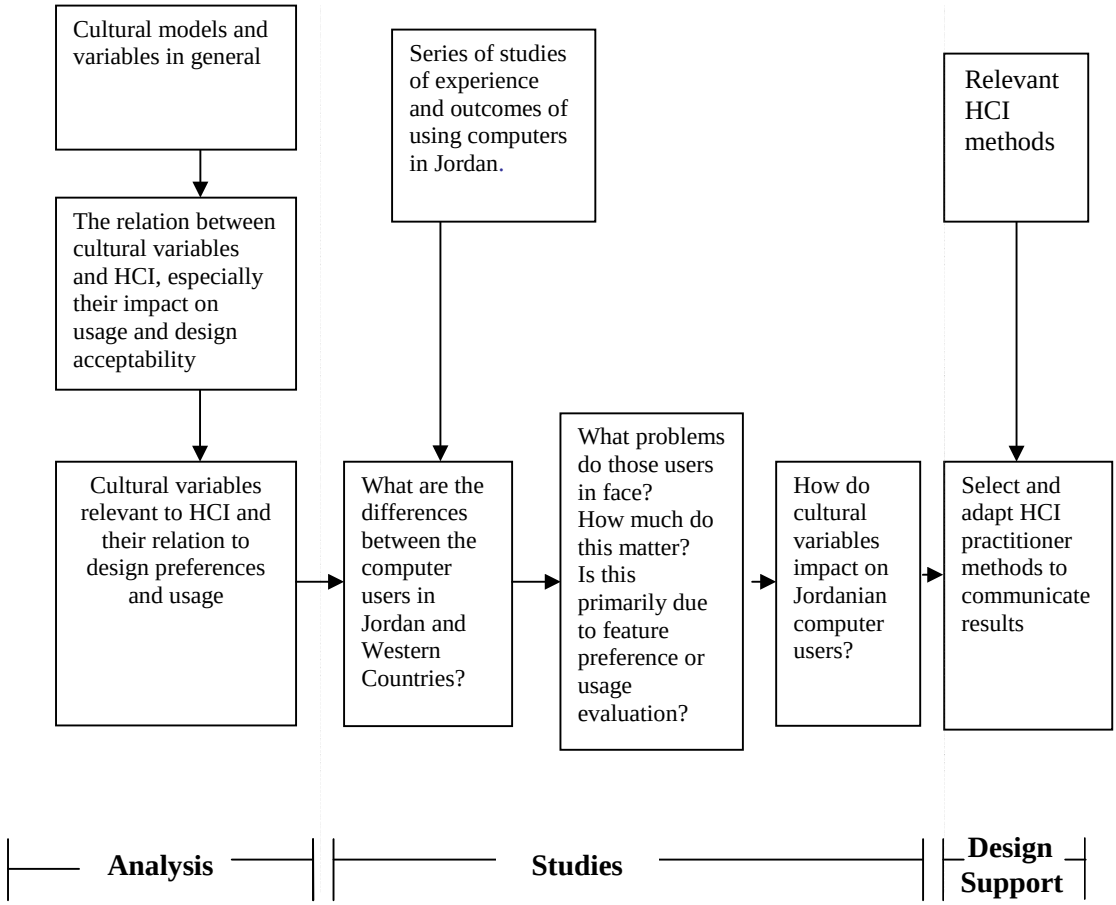

Figure 3.1 Research Structure.

At the end of each study, Jordanian examples will be identified as instances of variables in the Diamond Model. Also, new cultural variables may be identified that need to be added, with their Jordanian instances, to the Diamond Model.

The **hypotheses** guiding the planned research are:

H1: Cultural differences influence both design acceptability and usage as reactions explanations and evaluations, which can have a positive or negative impact on attitudes toward, and competence with, computer based systems.

H2: Cultural differences impact attitudes to usage as much as they do the aesthetic and cultural acceptability of user interface features.

H3: Existing HCI design approaches can be modified to communicate cultural factors relevant to interaction design and computer usage.

3.2 Analysis Phase

This was reported in chapter two of the thesis. A literature survey indicated a need for a single meta-model of culture. The Diamond Model was developed to meet this need. It was used to structure a survey of cultural variables and their consideration in HCI.

From the literature review, we exposed four distinct forms of the relation between culture and HCI. The appeal, acceptable fit, appropriative use, and usage evaluation such as how users evaluate their interaction and its consequences. Their relative influence will investigated for the first and second hypotheses. The extent of the Diamond Model indicates that culture and HCI should have more extensive interrelations than has been recognised.

Expanding the relations between culture and HCI will require study of usage and needs. The main issues are to better understand the relation between culture and computer usage, and how we can take account of this in computer

product design and general user support, which is investigated for the third hypothesis.

3.3 Studies Phase

This phase is an exploratory series of studies. As an under-explored area of HCI, cultural influences on usage are not well understood, so we cannot confidently plan a whole programme of PhD research at the outset.

To decide on the initial direction of study, we will start by interviewing IT experts in Jordan. This pilot study asked IT support staff to identify what they perceived to be the most common and severe usage problems for Jordanian computer users. However, the exploratory nature of this research means that we can rarely plan more than one step ahead. Thus, only at the end of each study can we fully plan the subsequent one: the design of each study is *contingent* on the results of the previous one.

3.3.1 Pilot study

To study the relation between culture and HCI, we will interview Jordanian IT experts, because they have broad experience of users' problems and are easy to access, so arranging interviews can be straightforward. The results of this study will inform the first and second hypotheses by assessing the extent of cultural influences on usage. The expectation was that we would encounter cultural impacts on reaction, evaluations and explanation at least as often as cultural influences on design preferences.

3.3.2 Detailed studies

Results from the pilot study, may or may not guide us to continue to study the relation between culture and usage. There could be more than one study, which could involve repeating a usage study from the west to expose differences between users from different culture. The contingent nature of this research means that the exact sequence of studies cannot be determined at the outset. The results of each study will guide choice of subsequent studies.

3.3.3 Broader studies

Broader studies will build on previous detailed studies. Once again, their scope and focus depends on previous results. For example, a study could interview Jordanian computer users on their general experiences of computer usage and their views on how computers and software could be improved.

3.4 Research Methods

In our studies, we mostly use semi-structured interviews, based on a list of questions and topics that need to be covered during a conversation, usually in a particular order. These provide a clear set of instructions for interviewers. Semi-structured interviews often contain open-ended questions allowing discussions to diverge from the interview guide to get more information and new ideas. It is generally best to record interviews and later transcribes recordings for analysis.

Semi-structured interviews can provide reliable, comparable qualitative data, which makes them a versatile technique (Cohen and Crabtee 2006). Given the exploratory nature of this research, we need such flexibility. We selected semi-structured interviews because they are more flexible for changing questions. We can also change the structure of the interviews according to participant answers.

After transcribing the recordings, data will be analysed by using affinity diagrams. The affinity diagram is a tool that organises large amounts of verbal data such as ideas, opinions, and issues into groupings based on their emergent relationships.

We can use the affinity process to sift through large volumes of data. It helps us to organize very large sets of unsorted data by organizing it into groups (Beyer & Holtzblatt 1998). Groups that emerge can be then grouped into overarching groups, and so on.

The level of a group can be coded by colour, as shown in Figure 3.2. In this hierarchical coding, green is used for the header, which is the main group

category, and then sub-headers will be pink (sub-categories of green) then blue indicates a first level group. Basic findings are yellow.

Figure 3.2 illustrates the use of colour coding for the levels of the affinity diagram.

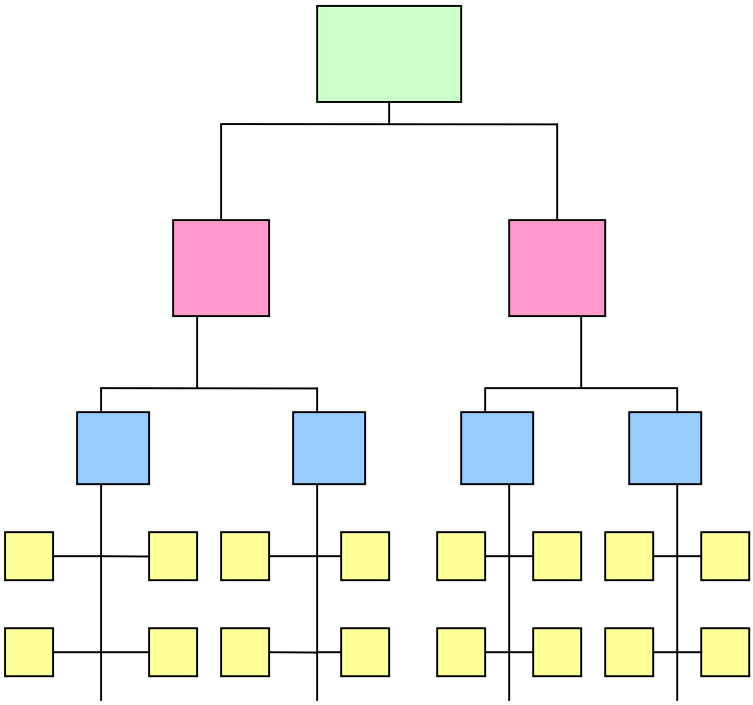

Figure 3.2 Affinity Diagram model

3.4.1 Development of Interviews

Semi-structured interviews will take place throughout the study. Some of the interviews will be a balance between questions on design and on usage of computers. This balance is important to avoid a bias towards usage evaluation, which is argued in this research to be an underexplored but valuable area for HCI research on cultural differences. The structure of the interview will depend upon the aims of each field study, and could change slightly during the interview, because sometimes participants may not understand the questions. This may involve explaining questions in more detail.

We will aim to avoid bias by choosing questions which do not direct the interviewee to an answer or area, and will use flexible and open questions. Some of the participants may not be honest in their answers and they may give additional information which does not directly relate; or their answer may will be given according to their current thoughts. In such cases we will remind them of the question and explain it in more detail. We will not include any personal questions which could encourage prestige bias such as questions relating to income, occupation or age.

People looking at the same event may understand it differently; the main aim is to try to explain as much as we can to avoid any misunderstanding of the question. When we deal with questions which focus on computer knowledge or experience, we try to elicit opinions, and use questions which avoid any bias or misunderstanding.
Semi-structured interviews help us to get to further details of the processes that users follow when dealing with usage problems; this will help us to discover the processes that they use and their feelings about their usage experiences, or the usage experiences of others (when interviewing IT experts for example, Chapter 4)

In some studies, we will give the participants information on a previous study, and ask them to comment on the results. We might, for instance ask them what they thought, and how they might explain the differences between the results of two studies in Jordan and another country. In this case, we will avoid bias by asking them first if they agree or do not agree with the results, followed by an open discussion of why they do or do not agree.

In this research, we try to focus on the quality of the interviews; rather than the quantity. Therefore the interviews are based on listening, a respect for and curiosity about what people say, and a systematic effort to really hear and understand what people say (Rubin and Rubin 1995).

In some cases we repeat studies done in west countries to make a comparison between the users in western countries and Jordan to show if

there are any differences between the users from different cultures. The sample size of repeated studies in Jordan will be mostly similar to western studies to have fair comparison between the two studies. Then a triangulation interviews will follow to collaboratively explore the differences between the two results.

Also, another comparison between the western and Jordanian users will explained, the comparison done with case studies done in Jordan at current time and previous studies published in the western countries in the 80s and 90s such as Coombs and Alty (1981) and Landauer (1999). The aim was to compare the problems that face computer users in Jordan with the problems facing computer users in western countries.

3.4.2 Extending the Diamond Model

After each study, we will revisit the Diamond Model and add any instances, variables, groups or sub-segments that have been not covered. At the end of each study, we will review the affinity diagrams and check the green, pink, blue and yellow cards to see if these correspond to variables already in the Diamond Model group or to new variables that need to be added.

Figure 3.3 illustrates this in a simplified form. An initial Diamond model contains only two groups with one variable each. After a first study, a new group with two variables is added, and an instance is found for the variable in another group. After a second study, an instance is found for one variable in a group and another variable is added to this group. A fourth group with one variable is also added. When HCI relevant variables are initially identified in Chapter 2, they do not have Jordanian instances. When any new variable is found in a study, it must be based on an actual instance, hence new variables without instances cannot be added as a result of a study.

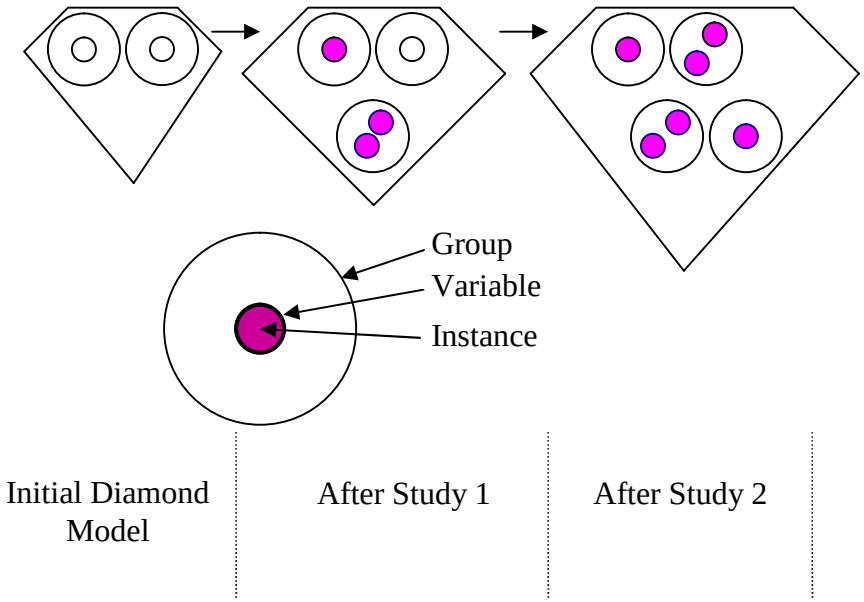

Figure 3.3 Extending the Diamond model through our studies.

3.4.3 Revisiting the Hypotheses

At the end of each study we will revisited the first and the second hypotheses to assess what the results indicate for each study.

3.5 Design Support Phase

At the end of the studies, we expect that the Diamond Model with Jordanian instances will not provide adequate support for interaction and software designer. We will thus need to explore complementary approaches to communicating cultural differences.

To complement the Diamond Model, we will try to develop cultural personas, cultural contextual models and cultural scenarios for Jordan. We will discuss these approaches in detail in chapter seven, but briefly introduce each here

3.5.1 Develop Cultural Personas from the Diamond Model

Personas are based on interviews with real people that include behaviour patterns, goals, skills, attitudes, and environments. Each persona should have three or four important goals that help to focus a design. There are three main

aspects to designing personas: users' goals, users' roles and users' segments (Goodwin 2005).

3.5.2 Develop Cultural Contextual Design from the Diamond Model

Contextual Design defines "a customer-centred process [that] supports finding out how people work, so the optimal redesign of work practice can be discovered". (Beyer and Holtzblatt 1998). Beyer and Holtzblatt (1998) classify five types of work models of contextual design, the five types of model are: Flow model, Sequence model, Artefact model, Cultural mode, and Physical model.

3.5.3 Develop Cultural Scenarios from the Diamond Model

Scenarios are usage stories that are real or imagined experiences of people; what they do and what they want (Benyon and Macaulary 2002). It may be possible to express Jordanian usage patterns through cultural scenarios.

3.5.4 Summary for Design Support Phase

After we have reviewed the three approaches in detail, we will apply them, or some modification or merger of them, as a complement to our Diamond Model. The aim here will be to communicate cultural differences to designers then ideally test the technique with the developers to see if they understand the implications of using it and what benefits there will be for designing software for users in Jordan.

3.6 Expected Outcomes

The results of the planned research should be

1. The Diamond Model of cultural variables, used to structure HCI literature on cultural impact (achieved in chapter two) extended by each study with new variables, and Jordanian instances.
2. Examples of relations between culture and design preference, and relations between culture and usage, and an assessment of the relative balance of each with HCI.

3. Design support for communicating Jordanian computer usage.

The first form of the relation between culture and HCI concerns design preferences, without focusing on the broad full range of values, goals and practices that characterise a culture. But the aim of this research is to go beyond the study of interface preferences, because culture could impact general usage more than it does design preferences.

We can extend the Diamond model after each study to update our results.
Each study can:

1) Find instances for existing variables in the Diamond Model.
2) Add new (groups of) variables, with instances.
3) Show how these variables are relevant to HCI, and the challenges that we face in isolating the impact of national culture.

3.7 Research Challenges

In this research, we will study relations between HCI and cultural differences, focusing on a national context. We will explore how cultural factors influence individual behaviours in computer usage, and to what extent these are local, national, Arab or Islamic in origin. However, it is very difficult to confront fundamental sociological problems in research, here the relationship between the individual and society. This problem may be irresolvable for general science. Related to this, we have the challenge of separating the influence of personality and subcultures from national culture.

We can be most confident about people's behaviours and material culture from the objective outside, making it difficult to separate out the relative influences of personality, subculture and national culture, as well as broader Arab regional, Islamic faith, and globalisation factors.

Even so, from the researcher's experience of Jordan and UK culture, there are clear differences, for example, between Jordanian national media and UK media. Types of programs and issues that programs focus on in the UK are

different in Jordan. However, to systematically isolate national factors in ICT usage studies, we would need multiple studies involving very large samples.

To credibly expose cultural differences, Hofstede (1980) studied differences between mangers from different cultures, but at the same company (IBM). Hofstede's cultural generalisations were thus valid for differences within IBM management. However, this PhD research does not have the resources to control studies in many countries so as to absolutely isolate national influences on behaviour. We must accept these limitations and take other approaches, for example, by comparing existing studies from the UK and USA with new data from studies in Jordan. This tactic is applied in the pilot study to help to distinguish between the impact of familiarity and expertise with computers and the impact of local culture.

A second tactic here is to repeat studies from the USA or UK in Jordan. We can *repeat*, but not *fully replicate*, as there will be multiple influences on individuals in each study that cannot be fully controlled for scientific replication, for example, differences in software applications. By repeating studies, we can look for differences in how users' reactions, evaluations and explanations are influenced by culture. However comparisons need to be able to rule out confounding factors such as:

- Different usage settings such as home, internet cafés, at work, and in schools and universities.
- Different application software and IT hardware.
- Different responsibilities, motivation and reward structures at an organizational level.

It is very hard and almost impossible to fully meet scientific standards in such studies. Therefore we need to do our best to look for differences and find an explanation for these and their origins. These could be all true of typical Jordanian settings, but also not all unique to Jordan. They could be common to Arabic, Islamic, or even international cultures.

In our case there are different between individual differences and cultural differences. Individual differences will be according to two or three or could be small groups of people which common between them. But cultural differences its common between large groups of peoples for example the sample size of repeated study in Jordan was 161 participants which mean this differences between the users are according to culture differences not individual differences because it impossible to have 161 people mention the same problem and consider it as individual differences.

3.8 Summary

This thesis is the first broad exploration of users' and stakeholders' evaluation of usage outside of North America and Europe.

Mostly we see material on culture and the behaviours of people, that is, the objective aspects of culture, not the underlying subjective aspects. We need to design studies that can access subjective cultural variables. Although our studies will be single country ones, we can compare them with existing studies from different countries. These differences may have cultural explanations. Also, we can repeat (partially replicate) existing studies in different countries. Again, we can identify differences and explore the causes of these. We need to be able to determine whether each difference is due to individual or cultural factors, and if cultural, whether these can be argued to be national, regional or global. Once cultural factors are identified, we need to find effective ways to communicate these factors to designers using Jordanian examples.

To begin our explorations of these issues, we interviewed IT support experts in Jordan, to form a rapid understanding of how they understood usage difficulties, users' reactions to their difficulties, and how they evaluate and explain these.

3.9 Limitations of the Research Methodology

The work in this chapter has some limitations. In particular at this stage we have not tested the Diamond Model and dramatic sketches. Therefore, at this stage there is a limitation of the lack of validation of the effectiveness of dramatic sketches, and a limited validation of the Diamond Model.

There are some limitations of finding more evidence for the importance of usage evaluation, and it will be hard to prove this due to the different cultural factors that affecting users. These differences are more cultural factors rather than individual differences because most of the differences are common between large groups of people with different backgrounds in the same culture.

Also there may be some limitations of the literature survey of this thesis, because it is possible that the research does not cover all papers which link HCI and culture, and not all the HCI4D (Human Computer Interaction for Development) or ICT4D (Information and Communication Technologies for Development) papers. This means that there could be some cultural variables missing from the diamond model, but the field studies will find more cultural variables, and rectify this.

In some field studies we repeat a study done in western countries and compare the results of the two studies. The advantage of this repetition is to discover if there is any difference between users from different cultures and how this difference affects the computer usage. However, there is a disadvantage of repeating a study and comparing the results because of a lack of information as to how the pervious study was exactly done, what technique they used, what equipment the participants used and the sample size of the study. This information may be missing which makes it hard to repeat and compare the results in any meaningful way.

The affinity diagrams in thesis was built by the author and after sort the affinity diagram to groups and analysis the data the results presented to author supervisors to discuss the results with them therefore, some limitation on the

results could be caused when using the affinity diagrams (Holtzbatt et. al 2004).

Chapter Four

IT Experts Study in Jordan

"Computers should make life easier and better"

By Landauer (1999)

In chapter two, we noted the relative distribution of Diamond Model variables relevant to design acceptability and usage. The indications were that cultural variables would impact usage at least as much as design acceptability.

The question is, if we study usage in a national context, will we see more cultural impact from design acceptability or usage factors?

To address this question, we based a pilot study of usage in Jordan on interviews with IT support and developers. This focus on experts could highlight the more common problems and the type of problems. We chose IT

support experts for this pilot study because they have extensive experience of problems that face Jordanian users, were easy to access, and would be able to offer a rapid overview of usage problems, suitable for an initial exploratory study. There will be issues of reliability and accuracy for at least some of the IT experts' (second-hand) reports, but the aim is to explore the balance of cultural impacts on design and usage, and we would not expect this balance to be distorted by reliance on second-hand accounts. Also, we can address issues of indirectness and scope (i.e., only work usage and not home usage) in subsequent studies. The primary aim of this pilot study was to form a rapid impression as a basic for planning subsequent studies.

4.1 Comparing a Single National Study with Selected USA and UK Literature

The aim of this pilot study is to compare interview results to two existing national studies to see whether maturity of IT experience (and similar, non-national factors) or cultural differences figured more in experts' accounts of users' difficulties.

Comparison with earlier western IT experiences will draw on US experiences from the 90s and the early 80s in the UK, because of the similarity of users' situations during new technology introduction. It could be that most of the problems that faced users in the 90s and 80s in a Western country are similar to the problems that face Jordanian users. This would prefer *non-cultural explanations* of user difficulties to cultural ones, i.e., the general extent of computer experience would better predict usage difficulties than specific cultural differences would.

For example in Coombs and Alty (1981), a study within Liverpool University during 1977 and 1978 focused on users' need for instruction and assistance. They found to increase the abilities of computer users, they should concentrate on:

1. Learning.
2. Skills.

3. Individual differences in intelligence, cognitive style and personality.

User difficulties were thus a result of limited IT knowledge and experience, which could be addressed by training that was sensitive to individual differences.

In USA, Landauer (1999) suggested that the main reasons for computer problems in 90s were:

1. High cost: the cost of the computer was high for the users.
2. Slow learning: users were too slow to learn about computers.
3. Unreliability: computers were unreliable. For example, in chapter one, we mentioned the experience of Landauer when he went to a department store to buy a watch.
4. Complexity: the computer was complex to use.

Note again, these are not culturally influenced for Landauer. While the second applies universally to all users and does not refer to any cultural differences, the others are presented as problems with computers, not people.

4.2 Interview Participants and their Organisations

The pilot study began by interviewing IT support staff to identify what they perceived to be the most common and severe usage problems for Jordanian computer users. Interviews were carried out in three work sectors to reduce institutional bias. The three sectors are the education sector (AL-Zaytoonah University of Jordan), telecommunications sector (Umniah Mobile Company) and bank sector (Jordan National Bank) to explore the most common problems to described. The pilot study interviewed a total of 19 IT experts from the university, mobile company and the bank.

The first interviews in this pilot study are with the IT support and web developer and designer at Al-Zaytoonah University of Jordan. The total number of interviewees was 15 IT experts. There are 8,000 students and 769

employees at Al-Zaytoonah University, 90% of staff and students use computers. The most common uses of computers in the university are for registration, in the library, computer lab, personal use, and academic and management use. Most financial activities and student registration are computerized.

The participants at Umniah Mobile Company were an IT infrastructure manager and an IT support expert. The computer users in Umniah mobile company fall somewhere between 250 and 500 employees. According to IT support, 95% of total number of employees that work in the company use computers.

The remaining two expert participants worked in software development and systems analysis in a bank. The computer users in Jordan National Bank ranged between 900 and 1200 employees. This wide range clearly indicates some uncertainty about the extent of computer usage.

4.3 Methodology

The pilot study used semi-structured interviews in the participants' workplaces. These interviews included open questions. The questions for the IT experts were chosen to uncover common problems that regularly face users in Jordan. The questions were designed to explore common problems, and how they deal with these problems.

As explained in Chapter 3, we chose semi-structured interviews because they are flexible, we could add to the questions during the interviews, and we could discuss and clarify questions to avoid any misunderstanding. Questions were selected to avoid anything personal or which could embarrass the participant. The interviews were in Arabic language (the participants' mother tongue) to make it easier (or possible) for the participant to answer the questions, and then we translated the responses to English. The Arabic questions are in Appendices A and C. The questions in English for the pilot study are:

Q1. What is your job exactly?

Q2. What is the range of people in your (University or Company) using the computer? and how many?

Q3. If there are any problems for users, can they fix them by themselves?

Q4. If NO, what kind of problems needs an expert to solve them? And why you can't solve it?

Q5. Which group of users have most problems with computers?

Q6. What are the most common problems that face computer users?

Q7. If there are problems, did you have any solutions?

Q8. If yes, what kind of solution do you have?

Q9. What do you think causes these problems?

Q10. Did you have any suggestion to solve these problems in future?

Q11. Do you have any comment on these questions?

The above eleven questions have been chosen to show uncover common problems that face users in Jordan. The first question gave us information of the participants job so that we knew who we were dealing with. The second question asked to know who was using the computers and how many users there were.

The third and fourth questions tested computer skills of the users. The fifth and sixth questions focused on the most common computer problems that the users faced and what type of users are they. From the above six questions we focused on both usage and features, and the answers could be in terms of appeal and acceptability, not just focusing on usage evaluation, which mean that no bias on these questions because the questions focused on both usage and features and not on usage only to find which have more impact.

The seventh, eighth, ninth and tenth questions were chosen to go deep into the problems that the users face, the causes of those problems, and the suggested solutions to solve the problems. The answers to the questions

seven to nine could be considered in terms of the four relations between culture and HCI (appeal, acceptability, appropriative usage, and usage evaluation).

4.4 Data Analysis

The analysis had three phases. The first quickly formed a descriptive overview of computer problems that face users in the university, telecommunications and banking. The second formed a list of common problems across all three sectors. The third phase constructed an affinity diagram of all the reported problems. The three phases of analysis were chosen to explore how the impact of cultural variables could be exposed and analysed.

From the first and second phases we focus on the common problems across the three organizations. At this level these problems are evidence of cultural differences at national level, or at least in the Amman area. This shows that individual differences or differences in applications used could explain the patterns in the data that we found in this two phases.

The first phase defined each organizations problem, then the second phase merged the common problems between the organizations, then the third phase was used to check the detailed data from the author transcripts, based on an affinity diagram. We undertook this stage to allow the first and second phases to proceed quickly and informally. We then double checked and refined the initial impressions in the third phase. Affinity diagrams were used to help us ground our findings in specific interviews data, and also to enable us to align our findings with the Diamond Model and to help us adding instances and new variables.

4.4.1 General Impressions of IT usage in Al-Zaytoonah University of Jordan

During the interviews, most IT support experts agreed that there are some problems that even they could not fix, and they therefore seek a combination of support from outside the university or from companies that deal with only with its products. IT support at the university is used to fix any other problems.

Overview

According to the Al-Zaytoonah University of Jordan statistics within IT support, computer users at the university with usage problems were estimated to be distributed as follows:

1) Student (50%)
2) Staff (30 %)
3) Academic staff (20%)

50% of the problems came from students, because most lack experience of using computers and they also need training to develop themselves. Even so, there are far more students (8,000) than staff (169) at the university.

Second comes staff, with 30% of problems, because they use the computer at work, leading to many opportunities for user difficulties. Also the software that they use needs some development to be more applicable. For example, some staff at the university have problems with language, complexity, skills and training.

Academic staff report 20% of computer usage problems. They should have most experience of using a computer in their work for research and special software for teaching. But, still we can say some academic staff has trouble with computers because they use computers less frequently, such as academic staff within Faculty of Law, Literature Study, English Language, Nursing, etc.

Proportionately, it seems that the students have fewer problems with computers than staff, even if students have less experience than staff. Table 4.1 summarises the main problems that face the computer users in the university, the frequency with which these problems, were reported, and the suggested solutions of IT experts to solve the problems.

#	The problems	How many times repeated by respondents	Suggested solutions from IT support to solve the problem	How many times repeated by respondents
1	Don't know how to deal with computer in right way, also not qualified for using it.	10	Need more training and more skills to know all part of computer and courses in ICDL.	4
2	English language problem for users.	4	No suggestion.	0
3	There is no development of staff skills on using equipment or software.	4	Try to fix any equipment or software problems for the computer.	2
4	Sometimes the computer and software used are too complicated for user.	4	No suggestion.	0

Table 4.1 Problems and suggested solutions.

#	The problems	How many times repeated by the participant	The suggestion solution from the IT support to solve the problem	How many times repeated by the participant
5	Viruses	3	Need more practise to use the computer and how to use the internet to search to be sure that the user knows about file downloads, also decreasing users' authority to use computer facilities, in some cases to minimize damage to the computer.	2
6	Problems in software that they use.	3	Design software that is more helpful for users in Jordan.	3
7	Social problem that some times users will be afraid to be honest about problems that they have with their computer.	2	No suggestion.	0

Table 4.1 (continued): Problems and suggested solutions.

Table 4.1 summarises common problems that computer users in the university face and the suggested solutions from IT support to solve these

problems. The first column describes the problems; the second column shows the frequency of these problems during interviews. The third column describes the suggested solution, and the fourth column how many times this solution was repeated.

4.4.2 General Impressions of IT usage in Umniah Mobile Company

User difficulties were encountered across the company in:

1. Shops.
2. The call centre.
3. Administrative use.

Staffs use computers most of the time. When most of their work (e.g., in shops) depends on computers, there are more problems rather than those who use computers less frequently (typical user in the company). The most common problems that face the computer user according to the IT experts are:

1) User problems: 60% of the problem comes from users because they do not understand the problem and its causes
2) Hardware problem 20%.
3) Software problem 20%.

4.4.3 General Impressions of IT usage in Jordan National Bank

Some difficulties can be communicated via the bank's use of a system called *Quantum*. This system is used in treasury department in the bank and the finance department.

The company producing this software is *Sun Guard* from England. All banks in the world using a standard accounting system called Palel 2. This is system is the same in all over the world, but terms and the way that they calculate finances differ. The default layout and colour of the systems are the same.

Jordanian users prefer to change it to several colours, rather than one colour for all the system.

The bank contacted *Sun Guard* to make some changes to the software to be more applicable to Jordan for example: all the currency is in dollars ($) They want to change it to Jordan Dinar (JD), therefore they add to the software a final process to change all the currency from dollar ($) to Dinar (JD). Also in some Jordan banks there is no money interest calculation, because In Islamic banks (only Islamic banks) there is no money interest; therefore they need to make some other changes to the system.

After redesign, the bank tested the system three times before finalizing it. This process took a year and a half from first interview with the supplier until finishing the system, which cost the bank more money than expected and more time too.

These changes in the systems make it easier for the company in future to redesign the system for any bank in the Middle East, especially in Jordan and the Gulf. Jordan national bank is the first bank in Middle East to use Quantum.

From the above story we can conclude that there are differences between user needs in Jordan and the West, according to religious influence on financial practices and currency differences.

The challenge is to create software that meets users' needs across the bank, such as layout and appearance (colour and font), and local currency. Thus, while Jordanian organizations understand localisation needs, the cost of changes (time and money) can be considerable.

4.4.4 Common Problems Faced by Computer User in Jordan

The above descriptive overviews were combined and analysed to create a list of problems commonly faced by computer users in Jordan, as reported by IT support specialists.

The first and second phase of data analysis were informal, with the aim of seeing quickly if there were computer problems facing the users and which of problems are common to the three organizations.
This list of problems is as follows:

1. *Cultural problems when using computers*. (Age, language, Table 4.2, 1.1 and 1.2.2).
2. *Education problems*: Education levels will affect users (Table 4.2, 3.3.)
3. *Complexity*: When program difficulty increases, computer problems will increase (Table 4.2, 1.1.1).
4. *Technology issues*. (Table 4.2, 1.1.1).
5. *Infrastructure of computer networks and equipment problems*. (Table 4.2, 2.1.2)
6. *Education policy* (Table 4.2, 3.3.1)
7. *The cost of the equipment*. When the cost of good computer equipment is high, the quality of affordable equipment will be poor (Table 4.2, 3.2.1).
8. *Software problems* (Table 4.2, 2.2.1).

Such lists of issues or problems are often the final analyses in HCI field work. However, they do not correspond very well to the structure of the Diamond Model, and thus a third analysis was carried out to create a hierarchical structure that could identify instances of (groups of) cultural variables in the Diamond Model as presented in chapter two. Also, this analysis may identify new (groups of) cultural variables that can extend the Diamond Model. The numbers in the list above refer forward to Table 4.2, which summarises the hierarchical structure created in the third analysis.

4.5 A Structure for Jordanian Computer Experience

A common structure for frequent design and usage experiences in Jordan was formed by creating an affinity diagram. This process began by forming a set of basic issues from respondents' information. These provided the yellow

elements in the affinity diagram. These were then grouped to identify blue elements. Higher level pink and finally green label groups were formed, resulting in the affinity diagram in Table 4.2.

Green	Pink	Blue	Yellow
1. Users' problems	1.1 Dealing with computers	1.1.1 Experience of using computer	a. Don't know how to deal with computer in the right way, also not qualified for using it. (U) b. Need more training and more skills to know all parts of computer through courses such as ICDL. (U) c. There is no experience of dealing with computer in some university department (U) d. Need more practice and more skills of the users to know the main equipment of the computer and how to solve any little problem that they face. (M) e. The problem comes from the user because the user doesn't understand the problem and the causes of this problem. (M) f. There is no development of staff skills on using equipment or software. (U) g. There is no deep study of the product before using it. (B)
		1.1.2 User's authority	a. Sometimes to minimize the problems in use, we need to limit the user's authority to modify the computer. (M)
	1.2 Interaction between the application and user	1.2.1 Self supporting	a. Sometimes users know only computer basics and if they face any little problem they are stuck and don't know what to do. Example: an academic called IT support saying the computer does not work she turned on the computer but it was not working, when the IT support arrive he found only that the screen is turned off, so she thought the computer does not work. (U) b. Try to fix any equipment or software problems at the computer by themselves. (U)
		1.2.2 Language	a. English language problems. (U and M)

Table 4.2: Affinity diagram for third analysis

(U) University participants (M) Mobile company participants and **(B) Bank participants**

Green	Pink	Blue	Yellow
2. Software and equipment problems	2.1 Accessing the computer	2.1.1 Software problems, including localisation	a. Windows problems. (U) b. Not adapted to our work flow (B) c. Sometimes the software they use is not applicable for the user we need more development to meet Jordanian user needs. (U and B) For example, Jordan national bank purchase of international software that needed localisation d. Modify software to be more applicable for the users, but this often takes several attempts to get right, e.g, bank changes took more time and cost money than expected.
		2.1.2 Problems with IT equipment	a. More complex applications create more difficulties. (B) b. Viruses (B), (U) and (M) c. Internal network problems (U) and (M)
3. Political, Social and Economic Issues	3.1. Social Factors	3.1.1 Social and Organisational Behaviours	a. Women are more honest to admitting to problems with computers than men. (U) b. Sometimes, older people in Jordan don't accept people younger than them teaching them how to use computers (U) c. Hiding problems or avoiding usage. (U and B) d. Some departments don't use computers, which causes some delay in work. (B)
		3.1.2 Religion	e. No money interest in Islamic banks. (B)
	3.2 Economic situation	3.2.1 Cost	a. We have to buy cheapest, but they are of poor quality and less easy to use. (B)
		3.2.2 Currency differences	a. There are different financial practices such as currency. (B)
	3.3 Political Factors	3.3.1Education policy	a. The education level impacts users (B) b. More educated users have more knowledge of computers (U and B) c. Younger users seem to have more experience with computers. (U)

Table 4.2 (continued): Affinity diagram for third analysis

(U) University participants (M) Mobile company participants and **(B) Bank participants**

From the above affinity diagram, the first and third green groups largely concern difficulties of usage, such as lack of training and English language problems. Only the second group covers design acceptability, but issues here are mostly to do with the underlying technology,

4.6 Summary of User Problems: Design or Usage?

From Table 4.2, the balance of issues is more towards usage difficulties than design preferences. While most issues for "user problems" (First Green element) would have been familiar in the UK and USA in the 1980s and 1990s, some elements in the affinity diagram such as 1.2.2 Language was rarely mentioned in the HCI literature then. This also the case for the third green group of Political, Social and Economic issues, although Landauer did mention the cost of computers. Coombs and Alty's focus on training was not at the level of educational policy for schools. Some problems that arise in Jordan may also arise in some but not other cultures. For example in some Arab countries, they have common cultural variables such as language and religion, and thus could have similar, or even worse problems with English language (due to the British Mandate in Transjordan from 1920-1948, knowledge of English is better in Jordan than in other Arab countries).

We can extend the Diamond Model by adding new variables that cause problems for users in Jordan: *age differences*, *beliefs about interest* (religion group). These new cultural variables will be located in the social structure and interaction segments as subjective variables. A new variable,: *currency differences*, will be added to the economic processes segment.

In chapter two, we prioritised Diamond Model segments of culture variables in order of their variables potential relevance within HCI. There was two lists relative impact on usage and design. From this study, the relative influence of variables is be more similar to the usage than the design list. The ordering of

segments according to frequency of problems that connect to cultural variables is (descending, most important first):

1) Social Structure and Interaction
2) Language and semiotics
3) Political Processes
4) Economic Processes
5) Material Culture

Note that political processes now appear to be more influential than economic ones. This list indicates that we expect culture to have at least as much impact on usage evaluation as it does on design preferences for Jordanian users, i.e., Jordanian users' interpretations of, and responses to, usage difficulties will be no less culturally influenced than their design preferences. At this point, we can refer to first and second thesis hypotheses that cultural differences influence both design acceptability and usage, and cultural differences impact attitudes to usage as much as user interface features. The current study supports both hypotheses, although as a pilot study it cannot prove either of them.

4.7 Analysis of Suggested Solutions

As well as discussing common design and usage issues, the IT experts were also asked to explain how they do or would address these problems. Their suggestions were:

Suggestion from IT experts in the University

1) Developing users by training and teaching them IT principles.
2) Sometimes users should try to solve them problem by themselves to know next time how to solve the problem.
3) The government should teach about computers in all primary school education.

4) Free centres in small towns and villages to teaching the principles of computers.
5) Simplifying web applications for users, especially in e-government.
6) Create software that doesn't need many workers to correct errors.
7) Design software that does more processing without needing much user intervention, to minimize the human error.

Suggestion from IT experts in telecommunications

1) Experience and Training: Need more practice and more skills of the users to know the main equipment of the computer and how to solve any little problems that they face.
2) Electronic support in the small mobile phone shops throughout Jordan, by adding new technology to the shops and updating software.
3) Minimize user authority.
4) Anti-virus software.
5) Try to help themselves before calling the IT support. Before calling the IT support they suggest trying to solve this problem if they can, because sometimes the problem will be very easy and they can solve it by themselves, but they don't try to.

Suggestion from IT experts in banking

1. Modify software to be more applicable for users.
2. Replace old hardware with new.
3. Provide a call centre in the bank. To connect the users directly with the IT expert. Employees at the bank would be connected with the IT experts when they face technical problems.
4. Help desk. To contact the IT expert to solve the problem as soon as possible. For example if the customers have any problems the help desk will try to connect the customers to the IT expert.

4.8 Analysis and Discussion

Software problems were reported in all three sectors, which suggests national problems for users in Jordan. The cost of computer equipment will affect usage and cause problems, which will be a national, because of Jordan's economic situation.

Table 4.4 presents an affinity diagram for the suggested solutions, which reveal the influenced some further cultural variables for proposed solution beyond those associated with identified problems. Note that there is less emphasis on individual problem solving than on collective solutions, e.g., revising software to reduce the number of people needed to solve a problem, but also providing support and education so that users are not left to solve problems on their own, although they are expected to become more capable by solving some problems on their own. These responses could well be related to cultural differences associated with individualism vs., collectivism (3.5 in the Diamond Model). The balance here is not absolutely towards collectivism, but this reflects the nature of cultural variables, which span a range of values rather than being just opposite extremes.

There are new cultural variables and instances add in this chapter, the new variables are, with instances in brackets:

1. Age Differences (reluctance to accept training from younger instructors),
2. Religion: beliefs about interest (*no money interest calculation in Islamic banks.*),
3. Personal experience/knowledge,
4. Currency differences (Using Jordanian Dinar)
5. IT Education in Schools
6. Access to, and Experience with, Technology (There is no experience of dealing with computer).

Table 4.3 shows the Jordanian instances for variables that were already in the Diamond Model

Cultural Segments/ variables	Jordanian Instances
Economic Processes segment	
Currency Different	Using Jordanian Dinar
Cost of Equipment	We have to buy cheapest, but they are of poor quality and less easy to use.
Political Processes segment	
IT Education in Schools	The education level impacts users. More educated users have more knowledge of computers
IT Training Centres in Communities	Free centre in small town and village to teaching the principles of computers
Social Structure and Interaction segment	
Individualism versus collectivism	User contacts the IT support to solve the problems.

Table 4.3 Cultural variables and Jordanian instances.

Cultural Segments/ variables	Jordanian Instances
Social Structure and Interaction segment	
Femininity versus masculinity	Women are more honest to admitting to problems with computers than men.
Personal experience/knowledge	There is no experience of dealing with computer in some university department. Need more practice and more skills of the users to know the main equipment of the computer and how to solve any little problem that they face.
Access to, and Experience with, Technology.	More complex applications create more difficulties. Computer viruses problems. Internal network problems.
Religion	No money interest in Islamic banks
Age differences	Difficulty of training.

Table 4.3 (continued): Cultural variables and Jordanian instances

Green	Pink	Blue	Yellow
1.Training	1.1 Developing users	1.1.1 Supporting users	a. Sometimes users should try to solve the problem by themselves to know next time how to solve problem. b. Call centre in the bank. To connect the users directly with the IT expert c. Help desk. To contact the IT expert to solve the problem as soon as possible.
		1.1.2 Education	a. Need more practice and more skills of the users to know the main equipment of the computer and how to solve any little problem they face. b. Free centre in small town and village to teaching the principles of computers c. The government should teach the computer in all primary school education.
		1.1.3 User autonomy	a. Before calling IT support they suggest to try to solve this problem if they can, because sometimes the problem will be very easy and they can solve it by themselves, but they don't try to solve it.
2.Technology	2.1 Design issues	2.1.1 User interface	a. Create software that doesn't need many workers to correct errors. b. Simplifying web applications for users, especially in e-government c. Modify software to be more applicable to users
		2.2.1 Software problems	a. Design software to carry out most processes without needing many workers to operate it, to minimize the human error. b. Use anti-virus software
	2.2 Technology issues	2.2.2 Hardware problems	a. Replace old hardware with new
3.Language	3.2 Language issues	3.2.1 English problems	a. Users need more practise in English language for using English software

Table 4.4: Affinity diagram for suggested solutions

4.9 Comparing Results with Previous Studies in UK and USA

The focus for this thesis is how we judge whether design or usage issues are culturally influenced, and to what extent. Many of the issues and solutions reported by Jordanian IT experts were common in Western IT literature in the 1980s and 1990s. They could thus be due to more general, culturally independent causes.

This study is similar to a repeated study, but in this case we can't repeat Landauer (1999) and Coombs and Alty (1981) because such as the limitation of information of the previous studies, different equipment and technology, and different environment.

The main focus was to compare our findings with Landauer and Coombs and Alty finding to discover if there were similar, where there were different, and whether these differences concerned usage evaluation rather than appropriative usage or appeal or acceptability of design features.

To explore this further, we will compare the problems that face computer users in Jordan with the problems facing computer users in UK from Coombs and Alty (1981) study. Coombs and Alty (1981) studied staff and students at Liverpool University during 1977 and 1978, focusing on the user's need for instruction and assistance, and they found to increase the abilities of computer users, they should concentrate on:

1. Learning.
2. Skills.
3. Individual differences in intelligence, cognitive style and personality.

Two of the three suggestions of Coombs and Alty (1981) to reduce usage difficulties with computers in the UK in the '80s were also suggested by Jordanian IT experts. But the third suggestion *Individual differences in intelligence, cognitive style and personality* were not suggested by Jordanian IT experts, because mostly there was no focus on individual differences and

specific styles preferred by users. Jordanian IT experts focused on general learning and skills to develop usage of computer for new users. Cultural differences could explain these differences in priorities. e.g., Jordanians are more collective than individual.

Similarly, we can also compare the problems that face computer users in Jordan with ones that faced computer users in USA as reported in Landauer's (1999) account of the trouble with computers in the 1990s.

There are both commonalities and differences between reported computer problems, their likely causes and possible solutions in Jordan today, the US in the 1990s and the UK in the 1980s. Table 4.5 summarises these. The presence of a problem is shown by a **×.** A **+** indicates issues where there is insufficient information in Coombs and Alty (1981) or Landauer (1999) to make a cultural comparison.

Code in Table 4.2	Problems	Jordan 2000s	UK 1980s	USA 1990s
3.3.1 c	Age difference	×		
1.1.1	IT experience	×	×	×
	Slow learning			×
1.2.2	English language	×		
3.2.1	High Cost	×		×
3.3.1	Education level	×	+	
3.1.1c	Unreliability		+	×
2.1.2 a	Complexity	×		×
2.1.1e and 2.1.1c	Individual differences and personality		×	
1.1.2 a	Users' authority	×		
1.2.1 d	Self supporting	×		

Table 4.5 Computer usage in contemporary Jordan, 1980s UK, and 1990s USA.

We can conclude from this pilot study that there may be some problems associated with usage of computers in Jordan that were not widely reported in the USA in the 1990s or the UK in the 1980s. On some issues, there is not enough information to judge, but overall it is safe to conclude that difficulties with computers in Jordan have a mix of causes, some universal that influenced experiences in the West in the 1980s and the 1990s, and others

different to the West, which could be specific to Jordan or apply more widely across Arab or Islamic countries.

4.10 Conclusions

Referring to this thesis' *first hypothesis* (chapter three*)*, it does appear that cultural differences influence both design acceptability and usage as reactions explanations and evaluations, which can have a positive or negative impact on attitudes toward, and competence with, computer based systems. Throughout this chapter we have confirmed that cultural differences influence both design acceptability and usage.

For the *second hypothesis*, cultural differences impact attitudes to usage as much as they do the aesthetic and cultural acceptability of user interface features, from this chapter we discovered that cultural variables influence causes of and reactions to usage difficulties, when compared to design preferences. However, several problems are similar to those experienced in the USA and UK during the spread of computer usage, and are thus examples of globalization, with people using similar software and IT equipment all over the world. The interaction between culture, design and interaction is thus complex, but we need to find ways to focus on the interaction between culture and usage, since this has not been a major focus to date in HCI research.

In the following chapter we repeat a US study in Jordan to find out if there are further differences between usage evaluation in Jordan and USA, and if so, what causes these differences.

4.11 Limitation of IT expert study in Jordan

In this study there are some limitations of the indirect sample of this study because we chose the participants randomly from education, telecommunication and banking sectors. Form this study results we are confident of the IT experts interviews results and what they said about the

problems that face computer users, because IT experts have more experience of the problems that face the users.

From the comparison between western users in Landauer (1999) and Coombs and Alty (1981) studies in the 80s and 90s with the Jordanian users in the current time we are confident of the results that there are common and different computer problems between western and Jordanian users according to users culture.

Also the study shows that usage evaluation can be culturally dependent, and some of the problems that face the users are related to national differences more than global differences.

Chapter Five

Frustration, Anxiety in Jordan Computer Usage

In chapter four, IT experts reported the most common problems that face users in Jordan. Some problems in Jordan were similar to those experienced in previous decades in western countries, but others were not. There are many possible causes of these differences: these could be linguistic, social (e.g., age differences), economic or political (e.g., education levels). Some could be national Jordanian factors, but others could be due to regional and Arab cultural factors. For example, English language problems, age differences and the cost of computer equipment affected usage. These are at least national factors, because of the economic situation of the country, and social aspects and values that cause embarrassment to older people when learning about computers. They may however also be factors in other Arab countries with similar economies and age hierarchies, or even more generally in similar developing countries. All our data however was collected in Jordan, so we cannot confidently generalise beyond it.

5.1 Introduction

From the previous pilot study, we found that the relation between culture and HCI was not just about design features and their acceptability. Commonly reported usage difficulties and reactions did not involve specific unattractive design features, but instead suggested interactions between culture and usage, and not just between culture and design. Design features such as language, colour, layout and icons did not dominate IT experts' responses on usage difficulties. Given this, further studies in Jordan for this research will concentrate on usage problems and users' evaluations and reactions to these difficulties, and how they explain these.

In comparing usage in Jordan and western countries, we must ask whether problems that face the users are national or international, and could thus face users in the west. We discussed in chapter two Landauer's (1999) *The Trouble with Computers* and the problems that faced computer users in 1990s USA. But in Jordan, from IT experts' reports in chapter four, it appears that usage difficulties are not 'trouble' for Jordanian users, but are often more problems to share with others. There were no reports of frustrated or angry users, but instead ones about users who seek help from others when they

have a problem. IT experts focused on the collective costs of having to fix the aftermath of a user's problem. Requiring help from several sources was seen as a problem for IT support, but there was no evidence that users saw such difficulties as problems. Although IT support wished for more individual responsibility, capability and initiative, there was no evidence that users wanted this. In more collectivist cultures such as Jordan, we can expect users in difficulty to seek help from others, whereas in a more individualistic culture, we can expect users to try for some time to resolve a problem on their own before seeking help. In the latter case, frustration and anger may well result, but this may be less common in collectivist cultures where help is sought earlier.

We need to focus on how users in Jordan evaluate and react to usage problems, and explain their behaviours. To make such a focus possible, we decided to repeat Lazar and colleagues' (2006) US study in Jordan, and compare their results with results from Jordan to identify differences between the two countries. By repeating this study, we could explore if frustration levels were really different (as expected) and, if so, we could then explore reasons for these differences. Lazar and colleagues (2006) study was published when the pilot study in chapter four had just completed, and it was seen as providing a good opportunity to explore reactions to computer usage in Jordan, since Lazar and colleagues' reports appeared to be very different to the situations reported in our pilot study.

The repeated study was a *probe* in the sense that we expected to find major differences in anger and frustration between US and Jordanian users, but that this would not be conclusive without further investigation. The aim was thus not just to show that we would get a different set of numbers to Lazar and colleagues, but to use differences here as a basis for exploring whether Jordanian users believed the revealed differences, how they evaluated these differences, and most importantly, how they *explained* them. This would hopefully give us more focused insights into Jordanian usage than the second-hand reports of chapter four, which lacked the depth needed to confidently associate issues with specific cultural variables.

5.2 A US Study of Frustration in Computer Usage

Lazar and colleagues (2006) studied the severity and impact of computer user frustration in educational and workplace settings in the USA. Participants were asked to record frustrating incidents during an hour of computer usage. Before this hour, participants were asked to complete a pre-session survey, which collected demographic information, computer experience and attitudes, level of computer anxiety, and mood. This was in part motivated by previous research that showed that levels of computer experience or perception of computer self-efficacy can affect subsequent user behaviour, which would be a culturally-independent explanation of frustration and anger. Participants then filled in a form for each frustrating episode during an hour of computer usage. Most questions used Likert scales, but others used check box lists or open questions (see Appendix B for the two surveys and the incident report form in English).

Each episode report form recorded an incident, and tracked data related to the causes of any frustration and the individual's responses to it. Incident factors included time lost, time to fix, and importance of the task. Individual factors examined included demographic factors, computer experience, computer anxiety, computer self-efficacy, and mood.

At the end of the hour, participants filled in a post session survey, which assessed mood and overall frustration, how frustrations affected the rest of the day, and the frequency and typicality of the frustrating experiences. Lazar and colleagues' study could thus examine the influence of pre-session factors on frustrating incidents, and the influence of the latter on post session mood. They also calculated frequencies for users' feelings about frustrating experiences.

Lazar and colleagues' study investigated general computer incidents, with no attempt to classify problems into usability or other classes (although data on the application being used was recorded, this would still not distinguish, for example, a network problem from an application one). While HCI specialists may want to distinguish between interaction difficulties with specific

applications and difficulties experienced with operating systems, networks and computer hardware, to users a usage difficulty is a usage difficulty. The technical origins are irrelevant. The focus is on what users' experience, and not on the human or technical origins of a problem. For the purposes of this research, usage difficulty and usability problem are synonyms.

Lazar and colleagues (2006) found that student self-reported computer experience in USA averaged 6.88 on a scale of 1 (less experience) to 9 (high experience). The average incident frustration level of the student was 6.74 on the same scale. Table 5.1 summarises the feelings of US student after 370 reported frustrating experiences using the forms provided. The first column from the left shows the feeling of a student after facing a problem, the second column shows how many times this feeling was repeated across students, and the third column shows the percentage of the total reports for each feeling.

Feelings: N=370	Frequency	Percentage
Angry at the Computer	155	41.9
Angry at Yourself	15	4.0
Determined to Fix it	84	22.7
Helpless/Resigned	45	12.2
Other	71	19.2
Total:	370	100.0

Table 5.1 USA student feelings after a frustrating experience

Table 5.2 shows the mean and standard deviations for post-session student scores. Data on mood before the session began was collected in the pre-session form The mean for overall post-session reported frustration of 5.87 for US students was lower than the 6.74 mean for the incident frustration reports, indicating that frustration tended to decrease after an incident.

	Overall Frustration (N=107)	Effect on Day	Pre Mood	Post Mood	More or Less Frustrated
Mean	5.87	3.87	6.10	5.67	4.55
Standard Deviation	1.90	1.96	1.45	1.59	1.84

Table 5.2 Post-Session Variables for Student Users

Table 5.3 shows Pearson's R correlations between pre-session student ratings and incident data with incident frustration and post-session variables (session frustration, post-mood affect on day). Significant correlations are shown with a * or ** as indicated above the table caption. Most rows in Table 5.3 correspond to variables from the pre-session survey: years of computer experience, usage hours per week, anxiety and comfort with computers self-rated experience, perceived ability to fix, self-reported tendency to keep thinking about unresolved problems, life satisfaction, mood prior to session, and frequency towards getting upset. The remaining rows are variables from the incident form with summations and an average: per incident and total time lost per individual, per incident and total time to fix per individual, importance of current task per incident, and per individual average and per incident importance of the current task at time of reporting. Correlations were calculated between these row variables and column variables, of which were variables from the post-session survey, except incident frustration, which came from the incident report form.

The blank cells in the top of the table means there is no relation between variables, for example in first row there is no relation between incident time and post session values. Further significant correlations can be read from the table. When making comparisons from the repeat of the study in Jordan, we need to be cautious about over-interpretation, since we only have the magnitude of R values and their significance from Lazar et al. (2006). There are 72 different tests in the Table 5.3, and thus a Bonferroni adjustment should set the significance threshold to $p<0.0007$ (.05/72). Also, comparisons based on r values alone are inadequate, and some error metric is also required (e.g., confidence intervals). However, Lazar et al. (2006) presents no

such error terms, further limiting the comparisons than can be confidently made by comparing the results from repeating their study in Jordan.

	(N=372), Incident frustration	R Values for Post Session (N=107)		
		Session frustration	Post-mood	Effect on day
Time	R value			
Time lost (incident)	**.293			
Time to fix (incident)	**.233			
Computer years	-.041	*-.195		*-.243
Hours per week	*-.124	-.176		-.096
Time to fix (Total)		.124	-.015	-.167
Time Lost (Total)		.062	-.014	.152
Computer anxiety				
Anxiety	.032	-.103	**.346	-.163
Comfort	.095	.007	**.273	-.190
Computer self-efficacy				
Self-Rated Experience	-.023	-.155	**.314	**-.257
Perceived ability to fix	-.021	-.163	**.286	**-.308
Think about unresolved	-.059	-.010	.121	.040
Stick with problems	**-.138	**-.326	**.439	*-.240
Mood				
Life satisfaction	-.099	-.183	.184	-.185
Pre-mood	-.027	.005	**.337	-.007
Upset often	.115	.145	-.062	.140
Mood swing	-.085	**-.324		**-.252
Importance				
Importance	**.237			
Avg. importance		.099	.114	.169

* Correlation is significant at the 0.05 level (2-tailed)

** Correlation is significant at the 0.01 level (2-tailed)

Table 5.3 Frustration Scores and Correlates for US Student Users

Due to the lack of Bonferroni adjustments, it may be unwise to regard any of correlations highlighted by Lazar and colleagues (2006) as significant. We should certainly ignore individual correlations significant at the 0.05 level. It may however be useful to consider significant positive correlations at the 0.01 level between per incident frustration and: the per incident amount of time it took to fix the problem; the per incident amount of time lost due to the problem; and the importance of the task at the time of reporting. However, none of these account for more than 9% of the variance (i.e., $R^2 < 0.1$ for all three).

There was an equally significant but slightly stronger correlation between post session mood (1 = very unhappy, 9 = very happy) and comfort with computers (1 = very uncomfortable, 9 = very comfortable, $R^2 = 0.12$), but a weaker significant correlation with reported anxiety over computer problems (1 = anxious, 9 = relaxed/indifferent, $R^2 < 0.08$). This indicates a relationship between individual differences and the impact of frustrating experiences.

There were further significant correlations at the 0.01 level between post session mood and individual differences in self-rated experience, perceived ability to fix the problem, and self-rated tendency to stick with problems. Along with the correlations for anxiety and comfort, these together would account for over 50% of the variance here if the variables were independent, indicating a strong relationship between individual differences and the impact of frustrating experiences. There were also significant negative correlations between the expected effect on the day and self-rated experience, perceived ability to fix, and tendency to stick at problems, i.e., advantaged individuals here expected less of an effect on their day. There were also significant negative correlations at the 0.01 level between both post-session reported frustration, expected effect on the day and to the reported change in mood from before to after the one hour session.

Also, there is negative correlation at the 0.01 level between incident frustration and tendency to stick with problems.

109 US employees completed the same pre- and post-session surveys and incident forms as the students, except that they used an on-line version. Table 5.4 shows their frequency of feelings for 149 USA incident reports. Unlike Table 5.1 there is no percentage due to multiple reports of feelings because of a difference between online and paper forms (161 feelings were reported for 149 incidents).

(N=149)	Frequency
Angry at the Computer	58
Angry at Yourself	15
Determined to Fix it	27
Helpless/Resigned	34
Other	38

Table 5.4 USA Post-Frustrating Experience Feeling for Employees

Most employees in the USA felt angry at the computer, with 58 reports here. For a much smaller number (15) of frustrating experiences, users felt angry at themselves, with 34 feeling helpless or resigned.

Table 5.5 shows that the overall post-session frustration was lower than the average for incident frustration (5.89 as opposed to 7.1 on 9 point score), again showing a trend towards lower frustration when reflecting for the post-session survey. There was a slight drop in mood ratings from 7.14 to 6.27.

	Overall Frustration (N=107)	Effect on Day	Pre Mood	Post Mood	More or Less Frustrations
Mean	5.89	4.53	7.14	6.27	4.51
Standard Deviation	2.16	2.48	1.34	1.70	1.84

Table 5.5 Post-Session Variables for US Employee Users

Table 5.6 reports the same correlations for US employees as Table 5.3 does for US students (Lazar et al 2006). Significance differences are marked * or ** as shown in Table 5.3. No significant correlations were found between individual differences and the frustration/mood of students show up for

employees. The only significant positive correlations at the 0.01 level are between per incident frustration and: the per incident amount of time it took to fix the problem; the per incident amount of time lost due to the problem; and the importance of the task at the time of reporting. The first two each account for less than 8% of the variance (less if they are inter-dependent), but the importance of the task accounts for just over 20% of the variance on reported incident frustration. There were thus significant tasks and time correlations for both US students and employees, but only significant correlations for individual differences for students, suggesting that national cultural factors did not have a role here.

In the Lazar et al (2006) study the sample size was 50 employees and 107 students; which a large sample size. There was little mention of Bonferroni adjustments, which could cause some limitations. There was no record of motivational differences between the users.

There were fails on the motivational differences and limitations on the role of individual differences, but form the sample size there are a fair indication of US patterns in users' evaluation of their usage. Therefore we will ignore the motivational differences and the individual differences and repeat the study as a probe, then focusing on triangulation interviews to be more specific on this study.

	(N=149) Incident frustration	R Values for Post Session (N=50)		
		Session frustration	Post-mood	Affect day
Time	R value			
Time lost (incident)	**.270			
Time to fix (incident)	**.263			
Computer years	-.051	.020		-.154
Hours per week	.161	-.035		.169
Time to fix (Total)		.106	.106	*.315
Time Lost (Total)		.188	.149	*.314
Computer anxiety				
Anxiety	.014	*-.368	.255	-.247
Comfort	.002	-.152	.085	-.228
Computer self-efficacy				
Self-Rated Experience	.048	-.114	.051	-.103
Perceived ability to fix	-.056	-.220	.162	-.079
Think about unresolved	.052	.070	-.003	.155
Stick with problems	.031	-.129	.096	-.083
Mood				
Life satisfaction	-.052	-.157	.281	.139
Pre-mood	-.075	-.261	*.315	.006
Upset often	.091	.255	-.249	.029
Mood swing	-.056	-.288		-.255
Importance				
Importance	**.456			
Avg. importance		*.302	-.014	.209

Table 5.6 Frustration Scores and Correlates for US Employee Users

5.3 Repeating Lazar and Colleagues' Study in Jordan

We repeated the method used by Lazar and colleagues (2006), using the same study design. Pre- and post-session questionnaires were translated into Arabic, as was the incident report form. By using identical formats, we

could compare US and Jordanian samples. We repeated the same statistical analyses. Appendix B shows Lazar and colleagues (2006) English form and translated Arabic form.

Data will be reported separately for students and employees, as above. Interim results for an incomplete sample (around 56% of the final sample) were reported in Qirem et al. (2007).

While we repeated Lazar and colleagues' study, we could not replicate it, as this would require having the same equipment and software. We could not control both situations and have the same software and equipment in both countries, especially as the US study does not report on types of software or equipment, and therefore it would be impossible to replicate the study. Note also that Lazar and colleagues had no control over such factors either, so to some extent results in both their study and the repeat study here cannot be shown to be due to the impact of specific applications or hardware platforms. Instead, the sample sizes let us make reasonable conclusions about the extent and impact of frustrating incidents from computer usage in the US and Jordan.

We chose to repeat the study in Jordan as a *probe*, that is, to find the response of users when facing any computer problem and how this could affect their day. Given the inability to replicate, we have to be careful in drawing conclusions from differences between US and Jordanian data. Therefore we need to understand the differences between US and Jordanian data. To reduce reliance on quantitative comparisons, we also gathered qualitative data on completion of our repeat study. Discussions during distribution and collection of questionnaires and reports had already indicated that much work did not depend on a computer, and that there were other ways of achieving goals other than immediate success in a computer-based context. We clearly needed to investigate how work and judgements of performance were constructed in Jordanian contexts. We believed that influential factors could include the role of explanation in social settings (accountability), negotiation (social construction) and individual autonomy on

task execution (institutionalization). Such social concepts are relevant to understanding computer-based work performance. We thus used follow-up interviews to explore how work-based factors may explain differences between US and Jordanian users, but did not prime for any of the social constructs that we thought may be at work. The aim of the follow up interviews with IT experts, students and employees was to thus simply to discuss differences between the Jordanian results and those of Lazar and colleagues (2006). We were particularly interested in responses to the findings, which were already clearly different for Jordan and the US at an interim point in data collection and analysis. The interviews were thus a further probe, using the data from the repeated study to collaboratively explore the cultural factors that influence users' attitudes and behaviours in response to usage difficulties.

5.3.1 Results for Jordanian Students

A total of 109 frustrating experiences were reported by 27 females and 82 males. 88 students were 23 years old or under, the remaining 21 were above 23 yeas old. Jordanian students reported a high level of self-reported perceived computer experience (Figure 5.1, N=109, mean=6.35, SD= 3) which is scale from 1 (less computer experience) to 9 (high computer experience).

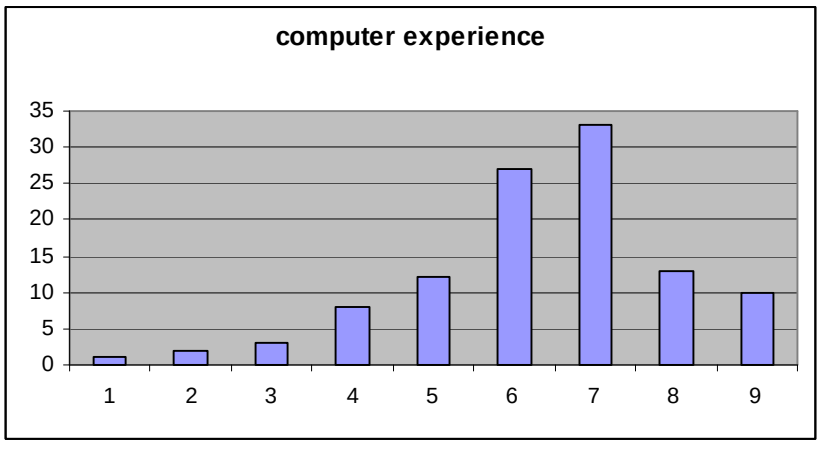

Figure 5.1 Perceived computer experience for student in Jordan.

The US student average for self-reported computer experience was 6.88 on a scale of (1=low experience) to (9=high experience) (Table 5.7), which means

that Jordanian student reported themselves as only having slightly less computer experience on average than US students. Thus self rating of computer experience will not explain any cultural differences between US and Jordanian students,

	Students		
	N	Mean	Standard deviation
Jordan	109	6.35	3
USA	107	6.88	1.88

Table 5.7 Self Reported Computer Experience Levels

Incident frustration was self-reported on a scale of 1 (not very frustrating) to 9 (very frustrating) for each incident (N= 109, mean= 4.5, std. deviation=2.56). Figure 5.2 shows frustration levels from 109 reported frustrating experiences. The mean incident frustration level of Jordanian students was 4.5 on a 9 point scale, compared to 6.74 for US students. There is a marked difference in these means (Table 5.8).

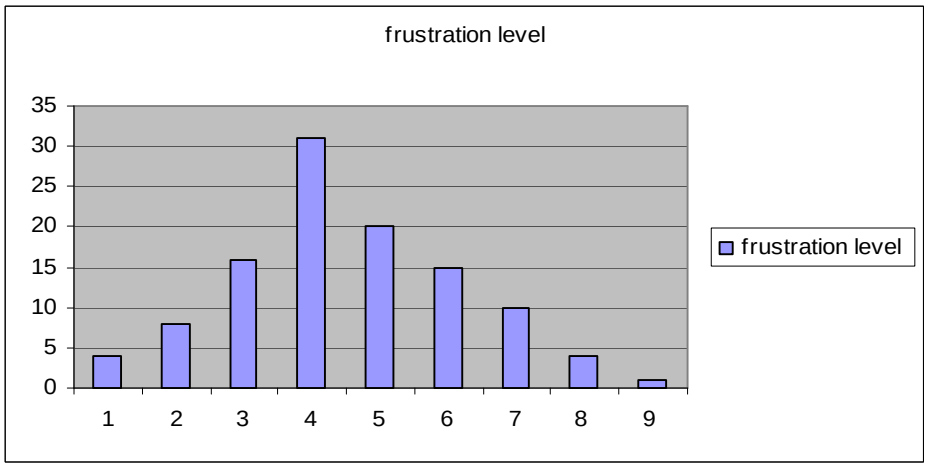

Figure 5.2 Incident frustration levels of Jordanian students.

	Students		
	N	Mean	Standard deviation
Jordan	109	4.5	2.56
USA	372	6.74	2.13

Table 5.8 Self Reported frustration levels

	Jordanian Students (N=109)		US Student Reports (N=370)	
Reported Feeling	*Frequency*	*Percentage*	*Frequency*	*Percentage*
Angry at computer	6	6	155	41.9
Angry with yourself	19	20	15	4.0
Determined to fix it	25	25.8	84	22.7
Helpless/resigned	9	9.2	45	12.2
Neutral	30	31	71	19.2
other	8	8		
Not answered	12	—		
Total	109	100	370	100.0

Table 5.9 Jordanian and US student user feelings after frustrating experiences

Table 5.9 shows the distribution of feelings reported by Jordanian students in response to frustrating incidents. 12 participants did not answer this question; therefore there were 97 relevant reports. In Jordan, students most often felt neutral (30=31%) or angry with themselves (19=20%). Only 6 students (6%) were angry at the computer and (8%) selected other, without mentioning any specific. In contrast, the feelings of US students after a frustrating experience are different. 155 (41.9%) felt angry at the computer, and only 15 were angry with themselves (4%). There were even more marked differences here than for other results, although some responses remained similar, i.e., in the US 84 students (22.7%) were determined to fix the problem, and 25 (25.8%) in Jordan.

The post-session survey collected data on overall frustration about the session, how it affected their day, and their mood after the session were all measured (on a scale of 1–9), as well whether they experienced more or less frustrating incidents in the study, as compared to a typical day (see Table

5.10). Table 5.10 also includes data on the mood before the session began, which was collected in the pre-session form.

	Overall frustration (N=109)	Effect on day	Pre-mood	Post-mood	More or less frustrations
Mean	3.29	4.28	5.86	5.72	2.89
Standard deviation	2.21	2.63	2.63	2.66	2.11

Table 5.10 Post-session factors for Jordanian student users

Overall, it does not appear that the one hour session as a whole had much of an overall affect on the Jordanian students. It would appear that the frustrating incidents encountered were about average for these users. The mean rating as to whether they encountered more or less frustrating experiences in an average day was 2.89, so on balance the day was somewhat more favourable than others. However, the mean for US students here was 4.55, so they too were not having a bad day on average, relatively speaking. The Jordanian mean for overall frustration (3.29) was lower than the mean for incident frustration (4.25), indicating that, as with US students (overall 5.87; 6.74 for incident reports), reported frustration drops between incident reporting and post-session reflection, but the mean ratings are lower.

The average Jordanian student rating for whether or not the incidents taken together affected the rest of their day was 4.28, similar to the US mean of 4.55. Mood scores went down slightly on average after the session, from 5.86 to 5.7 (compared to 7.14 down to 6.27 for US students).

	(N=161) Incident frustration,	Session R, values (N=109)		
		Session frustration	Post-mood	Effect on day
Time	R value			
Time lost (incident)	.142	.093	-.056	.121
Time to fix (incident)	.118	.114	.141	.136
Computer anxiety				
Anxiety	-.078	.062	.008	.158
Comfort	-.156	-.338**	.093	-.263*
Computer self-efficacy				
Self-rated experience	-.181	-.122	.110	-.043
Perceived ability to fix	-.062	-.193	.267*	-.289*
Think about unresolved	.240*	-.018	.182	-.081
Stick with problems	.200	.022	.239*	.123
Mood				
Life satisfaction	-.062	-.137	.530**	0.72
Pre-mood	-.006	-.108	.771**	-.036
Upset often	.103	-.025	.041	-.203
Mood swing	-.101	-.133		-.111
Importance				
Importance	.153			
Avg. importance		.225	.232	-.014

* Correlation is significant at the 0.05 level (2-tailed)

** Correlation is significant at the 0.01 level (2-tailed)

Table 5.11 Frustration correlations for Jordanian student users

In table 5.11 there is a missing row (computer years) because not all of the Jordanian participants provided a response to this question.

To explore which factors influence both incident specific frustration and the overall effects of frustration in computer use for Jordanian students, we calculated Pearson's R correlations (Table 5.11) for the same pairs of variables as Lazar et. al (2006). There is no overlap at all in the significant correlations at the 0.01 level for Jordanian and US students.

Firstly, there are no significant correlations between time and importance factors and incident frustration for Jordanian students. This suggests that short term time factors are not important for Jordanian students and don't cause any frustration when losing time, but time may matter if this leads to a loss of marks or missing a deadline. Student responses on this point in the triangulation interviews may provide further information on this.

Secondly, there are no significant correlations between computer anxiety factors and post session mood for Jordanian students (unlike for US Students). However, there was a significant negative correlation at the 0.01 between comfort with the computer and session frustration, i.e., those who were more uncomfortable (1 = very uncomfortable) reported lower session frustration.

Thirdly, there were significant correlations between two mood factors and post session mood for Jordanian students, which account for almost 30% (life satisfaction) and 60% (mood before reported session) of the variance. This suggests that students' post session moods are mostly affected by their reported mood before session and generally how they satisfied they are with their life, i.e., the reported session itself has very little impact, further indicating that Jordanian students are not frustrated by usage difficulties in the way that US students are.

5.3.2 Jordanian Employee Results

There were 52 employee participants, 16 females and 36 males. Respondents reported a high level of self-reported perceived computer experience (see Figure 5.3, N=52, mean= 6.4, SD=2.33). 54.5% had used a computer between 6 to 10 years, and 39.4% used a computer more than 10 years.

.

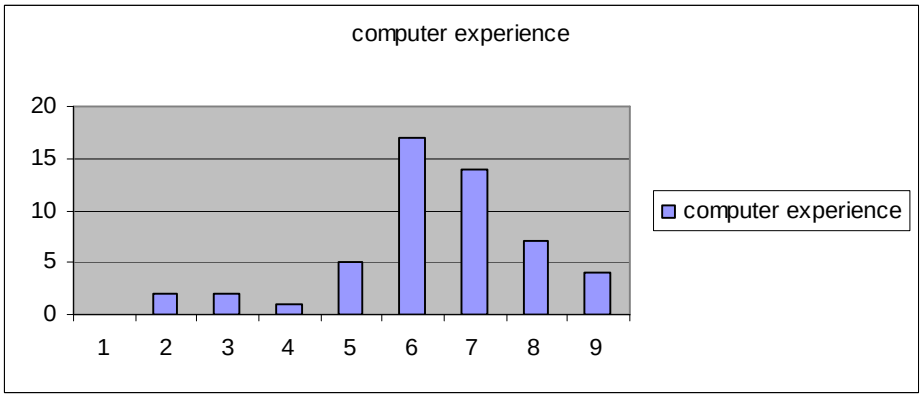

Figure 5.3 Perceived computer experience for Jordanian employees

Figure 5.4 displays Jordanian employees' data on incident frustration levels, (N=52, mean=3.55, SD=2.83).

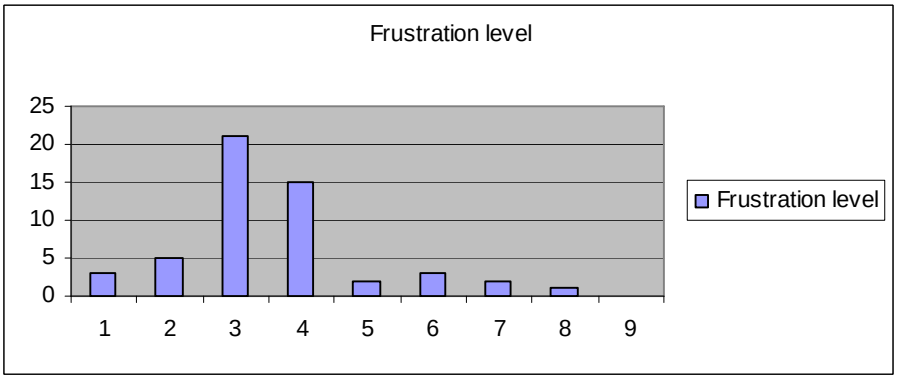

Figure 5.4 Incident frustration level

The mean incident frustration level of 3.55 for employees in Jordan is much lower than the US employee mean of 7.10, a big difference. Jordanian employees appear to be less frustrated when facing computer problems during work than American employees, and we need to be able to explain these differences. However, Jordanian employees also reported lower average per incident frustration than Jordanian students. The frustration level of Jordanian student was (4.5) and for Jordanian employees was (3.55) out of (9). The Jordanian employees appear to experience less frustration than Jordanian students, maybe because Jordanian employees rate themselves as having more experience with IT than Jordanian students.

Feelings: N=52	Frequency	Percentage
Angry at the computer	2	3.5
Angry with yourself	2	3.5
Determined to fix it	8	14
Helpless/resigned	7	13.6
Neutral	24	62
other	1	3.4
Not answered	8	–
total	52	100

Table 5.12 Jordanian employee user feelings after a frustrating experience

Jordanian employees' feelings after a frustrating experience were different to US employees. In Jordan most employees feel neutral (24) with 8 determined to fix the problem and only 2 angry with themselves and 2 angry at the computer. 7 users reported feeling helpless or resigned. 8 participants did not answer this question; therefore the total numbers of participants who answered questions was 44.

For US employees, 58 users reported feeling angry at the computer, 34 helpless/resigned, 15 angry at themselves. No US employee felt neutral.

It seems that Jordanian employees feel less frustration when facing problems and most of them feel neutral, but in the USA most employees reported anger at the computer, but in Jordan was only 2 employees did.

5.3.3 Post Session Frustration Levels for Employees

Table 5.13 shows average frustration and standard deviations for the session, how it affected employee's day, and their mood after the session were all measured (on a scale of 1–9), as well as a question on whether they experienced more or less frustrating incidents in the study, as compared to a

typical day (see Table 5.17). The mean mood dropped from 5.94 at the beginning of the session to 5.67 at the end of the session.

	Overall frustration (N=52)	Affected day	Pre-mood	Post-mood	More or less frustrations
Mean	3.94	3.88	5.94	5.67	3.44
Standard deviation	2.13	2.35	1.66	1.57	2.09

Table 5.13 Post-session factors for employee users

The overall mood for the employee in USA dropped from (7.14 of 9 point score) to (6.27 of 9 point score) from the beginning to the end of the session.

5.3.4 Correlations for Jordanian Employees

To explore which factors influence both incident specific frustration and the overall effects of frustration in computer use for Jordanian employees, we calculated Pearson's R correlations (Table 5.14) for the same pairs of variables as Lazar et. al (2006).

As with Jordanian and US students, there is no overlap in significant correlations at the 0.01 level between Jordanian and US employees. However, as with US employees, individual differences have not resulted in any significant correlations (of which there was only one for Jordanian students, which was a negative one between comfort with computers and session frustration). There are only two significant correlations at the 0.01 level, between two mood factors and post session mood for Jordanian students, which account for almost 20% (life satisfaction) and 76% (mood before reported session) of the variance, although these will not be independent and thus together do not account for almost all of the variance here. Even so, for Jordanian employees, there were three significant correlation at the 0.01 level, between two mood factors and post session

mood, which account for almost 25% (life satisfaction) and 49.7% (mood before reported session) of the variance. The third significant correlation was between tendencies to stick with problems and reported post session mood for Jordanian employee, which accounts for almost 25.7 % (stick with problems) of the variance. However, there are mostly probably interactions here, with the three correlations reflecting common underlying factors and thus not together accounting for almost all of the variance for reported post session mood.

	Incident frustration (N=161)	(N=52) R Values for Session		
		Session frustration	Post-mood	Effect on day
Time	R value			
Time lost (incident)	.269	-.111	.143	-.119
Time to fix (incident)	.447	. .056	.095	-.056
Computer anxiety				
Anxiety	-.066	.397*	-.190	.100
Comfort	.012	-.340*	.306	.154
Computer self-efficacy				
Self-rated experience	.076	.035	.404*	.174
Perceived ability to fix	-.106	-.083	.401*	.134
Think about unresolved	. .161	-.144	.351*	.149
Stick with problems	.096	-.071	.453**	.037
Mood				
Life satisfaction	.004	.001	.442**	-.013
Pre-mood	-.136	-.123	.871**	.135
Upset often	-.103	-.255	.186	-.232
Mood swing	-.111	-.121	1	.113
Importance				
Importance	-.018			
Avg. importance		-.039	.252	-.080

* Correlation is significant at the 0.05 level (2-tailed)

** Correlation is significant at the 0.01 level (2-tailed)

Table 5.14 Frustration correlates for employee users

In table 5.14 there is a missing row (computer years) because not all of the Jordanian participants provided a response to this question.

5.4 An Opportunistic Question

After collecting forms and surveys from just over half (56%) of our participants, we analysed the interim results (Qirem et al. 2007), which already showed clear differences in US and Jordanian reactions to usage difficulties, revealed not only in differences between significant correlations, but also clear differences in the frequency of specific responses (e.g., angry at computer, helpless/resigned). Conversations with participants during form collection revealed one possible explanation, which was that Jordanians had less negative reactions to computer usage difficulties than Americans because they could shift their attention to other work until their computer problem was resolved. This could explain the lack of significant correlations with the loss of time to computer problems and with the importance of the current task. Table 5.18 below shows how many of the remaining 73 participants were or were not able to work on something else.

Participants	YES	NO
Student	29	22
employee	12	8
Total	43	30

Table 5.15 Student and employee ability to work on something else until a computer problem is solved.

The percentage of students who could work on something else was 54.7% and for employees, it was 60.0%. This may explain some of the differences between Jordanian and US responses to usage difficulties. This is consistent with the contrasts between shopping in the US and Jordan. In Jordan, a problem with a computerized sales system would not obstruct a sale, even if they don't know the price exactly, because they still want to sell the product. As mentioned in chapter one, when Landauer (1999) wanted to buy a watch,

the shop would not sell the watch that he wanted due to a computer problem. However, we needed to explore further than this, and thus we followed through with triangulation interviews with selected participants and most of the IT experts interviewed in chapter four.

Apparent Result	Possible confounds	Triangulation
Frustration levels in Jordan are lower than in USA.	Different computers, different software. Random in US and random in Jordan.	Users' explanations of and comments on the results (Triangulation Interviews).
Most US users become angry at the computer, but very few Jordanians do.	Computer usage in USA is more developed, so users understand and expect more.	As above, triangulation may confirm this confound, or reveal other reasons

Table 5.16 Confounds and Triangulation Tactics

Triangulation interviews were needed for a range of reasons. Firstly, we could not regard our study as a replication due to an inability to control potential confounds in both Lazar et al. (2006) and our own study, which were both naturalistic because incident reports were based on the computers and software applications in use for the tasks current during the hour of incident reporting. Secondly, samples could not be matched, although we had a larger sample and could in principle have selected some random subsamples of identical size to Lazar et al.'s sample. Thirdly, Lazar et al. (2006) did not report their statistical results in enough detail (and also did not make any Bonferroni adjustments) to allow confident comparisons. However, these were mostly well enough understood before repeating Lazar et al.'s study in Jordan for us to see the need to combine triangulation interviews with study results. This made the results of the repeated study a probe, i.e., a set of response materials to which participants and IT experts could respond. Table 5.16 relates some possible confounds to triangulation interview tactics.

Even so, some differences in descriptive statistics were so striking that they were a basis for reliable comparisons. For example, the mean self-reported frustration levels were higher for US students (6.74) and employees (7) than in Jordan (students 4.5, employees 3.55). That means in our case the users in USA are more frustrated when they face a computer problem more that Jordanian users. Similarly, the frequency of reactions to frustrating incidents was markedly different in the US and Jordan. Far fewer Jordanian students and employees reported getting angry at the computer than US students and employees. Students in Jordan reported getting angry with themselfe more than US students. More US students and employees reported feeling helpless than Jordanian students and employee. In the USA, no students or employees reported feeling neutral after frustration experience, but a moderate proportion of students (around 31%) and a high percentage of employees (62%) in Jordan reported neutral reactions. However, students in Jordan and the USA appear to be equally determined to fix the problem.

5.5 Triangulation Interviews

The aim of the interviews with IT experts, and some student and employee participants was to collaboratively explore the differences our results and Lazar and colleagues (2006). Some were a form of *participant triangulation* (Falloon 2004). Where results are reported back to (some) participants to investigate their reactions. Participant triangulation lets detailed qualitative data be related to more shallow quantitative data from questionnaires. As we could only repeat, and not replicate, Lazar and colleagues' study, participant triangulation let us reduce some of the concerns about the lack of control within and between the two studies through returning to participants and IT experts to discuss whether our results were credible, and whether this credibility could be backed up by credible explanations of differences in frustrations between Jordan and the USA.

Triangulation interviews can strength the results of repeating Lazar's study because will help understand the users problems more and have more possible explanations of this differences between our study and Lazar study.

The results from repeating the study and these follow up interviews will guide us when extending the Diamond Model and adding Jordanian instances. The results could extend our understanding of cultural differences. In particular, we may be able to add further specific variables relating to users' evaluations of their interaction.

5.5.1 Participants

There were 25 participants: 15 IT experts, 6 students and 4 employees.

Then we asked the participant three main questions, the first question asked them what they thought about the results, which we showed them at the start of the interview. Participants were asked to comment on the results. The second question was about their own feelings before, during, after their study session. IT experts were not asked this question, as they had not participated in the repeated study (it does thus not appear in Appendix D). The third question asked participants to explain our results, assuming that they agreed with them. Responses would hopefully provide Jordanian instances and perhaps new cultural variables for the Diamond Model.

The sample size of translation interviews was 25 participants the number was according to how many interviews we need to start having similar answer and when we having similar answer in this case we will stop, we start with first participant then we stopped at the 25 participant when we start having similar answer and not add any new results for our interviews results. We chose the students and employees as a participant in this triangulation interviews because they was our participant in the repeated study, which help us to ask and communicate the results with the same or maybe different participants and having the feedback from them. We choose the IT expert because there are expert of the computer problems and what problems face the users and they could have more possible explanation of the differences between the Jordanian and US users. In this case this will string the triangulation by having different explanation from different sources.

5.5.2 Method of Interviews

Most of the interviews focused on how and why there were different frustration levels between Jordanian and US users. The type of the interview was semi-structured. We designed the interviews to focus on the results of the repeated Lazar study in Jordan. These results thus provided a probe for use in the triangulation interviews. Hence the first question asked them what they thought about the results, after they had been shown the tables. The second question probed for any individual circumstances that may have influenced their feelings at the time of the study (this did not apply to the IT experts). The third question was designed to extend the Diamond Model by revealing new instances of existing variables, or by revealing new variables for adding to the model. The aim here was to expose the 'unspoken rules' that can operate in a culture, and thus expose instances of cultural variables,

The interviews started by giving general information and the data that we found from repeating the Lazar study in Jordan such as, total numbers of students and employees in both Jordan and the USA, self-rating of computer experience, and reported frustration levels for Jordan and the USA. As stated in Chapter 3, we used semi-structured interviews because of their flexibility in adding and discussing questions. This reduced the potential bias caused by misunderstanding questions (and here also the repeat study results), and also opened up possibilities for exploring issues beyond those closely associated with the main research questions for the study.

5.5.3 Some Example Responses

One employee commented that:

> The frustration level of employees in Jordan should be less than in the US, because employees here don't feel anything when facing a computer problem.

This is consistent with the high percentage (62%) of Jordanian employees who reported neutral reactions to usage difficulties.

One student responded:

> I feel that we have less experience than US students because they learn computers from long time ago, but we have just learned computers in the past 4 or 5 years only, therefore our experience should be less than US students.

Responses such as the above were coded based on an emergent category structure of five plausible sources of cultural differences in interviewees' responses to the study results. These were:

1. IT skills and experience relative to the USA.
2. Attitude to work (perceived responsibilities)
3. Attitudes to IT in general.
4. Work Context: Extent of dependency on IT
5. Work Context: Overstaffing.

Table 5.21 will relates these to respondent categories (IT experts, employees, and student) and groups them by skills, attitudes and context. Not surprisingly, the IT experts had more to say than the students and employees, confirming their value as respondents in chapter four. More interestingly, there was limited overlap in the comments of IT experts and the other respondents, as shown in Table 5.21, so they are clearly not without bias.

		Experts	Employees	Students
Skills		*		
Attitudes	To work		*	*
	To IT	*		
Context	Dependency on IT	*	*	
	Overstaffing		*	

Table 5.21 Informants and Explanatory Factors

5.5.4 IT Skills and Experience Relative to USA

Employees in Jordan most probably have less experience than in the USA, but they think that once they know the basics of computers that they have enough experience. Jordanians may not have rated their experience on the same scale as US users, where more have used computers for longer. Differences in calibration were regarded as a fact by IT experts, who were adamant that Jordanian users could not have had the same level of experience as US users.

> *The student experience in Jordan should be also less than that, because computers are more available in USA users' homes than in Jordanian users' homes. Therefore the personal experience in Jordan will be less. Also there are extra technology services available in the USA, more than in Jordan, and for a longer time, such as the internet service. In some Jordanian houses, no computer is available, and if there is a computer, it will be the only one and the number of users will be 6 to 7, therefore they don't have enough time using the computer and learning how to use it.*

This difference was offered as an explanation of the different responses of US and Jordanian users to usage difficulties:

> *There is no way that the computer users in Jordan when they face any problem will blame the computer for this problem or the software that they use, because: 1) the users don't have enough experience and enough training as in the USA; 2) The user doesn't have the self-confidence to solve the problem by themselves, and even if they try to solve it, they will try without knowing how to solve it, and all this is because of inexperience.*

The availability of, and access to, technology such as computers is important to skills development. The IT experts doubted whether Jordanian users would have had enough access to computers at work and home to develop comparable skills and experience to US users. Also, opportunities for

informal training at work were limited by avoidance of team work (see Section 5.5.9), which minimizes employees learning from each other. While Jordanian culture does have strong collectivist values, this may be overridden by stronger working preferences.

As a result of these multiple obstacles to IT skills development, users may not fully realize what is happening with their computer or an application:

> *Users in Jordan, when they face a problem, they can't recognize where the problem is and what is the type of this problem. Also the users don't read the help messages that pop up on the screen, they don't care about the message even if the solution is included in this message, but they ignore it and don't read it and maybe because they can't read it because it's in English language and they can't understand what it includes.*

Clearly, Jordanian users face additional difficulties to US users when error messages appear in English. As a result, usage experience will not translate into skills as often as it does in the US, since poorly understood English will impede skills development. In such contexts, Jordanian users may be less able to learn from their mistakes than US users. Such 'help' messages here may not be particularly helpful. Users will often ignore these messages or not understand completely them due to their grasp of English.

Actual competence, combined with further factors discussed below, appears to limit Jordanian's users' motivation to try to resolve computer problems on their own. This need for, and expectation of, support from others, may well reduce the incidence of individual anger, frustration and negative impact on their mood. Conversely, US users may suffer from expectations of mastery, control and responsibility when resolving usage problems.

Additionally, more extensive IT experience and competence in the USA means that when users face a problem, they may be able to locate the origin of the problem (software application vs. or computer hardware) and further analyze it. A virtuous (although frustrating) circle may result, with US users trying their best to solve a problem and getting knowledge and experience if

they do solve it. Jordanians appear to be less motivated or empowered to resolve usage problems and are less likely to try to fix problems on their own.

We found from the results above that employees in Jordan probably do have less IT experience than in the USA, because much work does not depend on computers, and even if they have other work without using the computer they still don't do it. Also they don't care about the time taken and whether a task is completed on time or not.

Users in USA have more experience, and when they face a problem they know that sometimes that the problem is from the software or the computer itself. That means they have more competence in USA. In the USA, users try their best to solve a problem and at the same time get experience when they solve it. Also, there is limited team working between Jordanian employees (see below) which reduces the experience for learning from each other.

Computers have only entered Jordanian primary schools in the past few years, giving Jordanian users less experience, but perhaps also less frustration, because they don't use computers very much. As some work does not depend on computers, this too may make frustration levels low.

Discussions with the IT experts suggested relations between relative inexperience and the following Diamond Model variables:

A. *Familiarity with English*. Users may not understand help messages on the screen because they are in English (Language segment).
B. *Individualism versus collectivism.* The user doesn't have the self-confidence to solve the problem by themselves therefore they call IT support. (Social Structure and Interaction segment)

However, it also would be helpful to add a new variable to the Diamond Model:

C. *Access to, and Experience with, Technology* (Social Structure and Interaction segment). Users don't have enough experience and enough training as in the USA. One student said “I feel that we have less experience than US students because they learn computers from long time ago”.

This is an objective group of variables in the Social Structure and Interaction segment, which is linked via light paths to other (groups of) variables such as computer teaching in primary schools and familiarity with the English language. While the impact of computer usage on experience can be regarded as a culturally-independent factor, in that experience develops expertise in any culture, the relationship between experience and expertise is not constant worldwide. In Jordan, several factors, such as familiarity with the English language, slow down the rate at which experience translates into improved expertise. In this sense, the much reported need for more computer training in Jordan may reflect the extent of obstacles to more passive learning on the job.

5.5.5. Attitude to Work: Perceived Responsibilities

Jordanians are often not relaxed, and given this, frustration levels could be higher than in the USA, because Jordanians can live quite stressful lives. They do not hold back on displays of anger, and yet this was hardly ever reported as a response to usage difficulties, unlike in the USA. A second possible explanation of differences between US and Jordanian employees lies in their attitudes to work:

1) Some employees, if they face any problem and their computer stops will be happy because they can have a rest and enjoy a break from work.

2) Sometimes users use their computers for games during work or surf the internet.

3) Some people, if they have a problem, do not try to fix it, but stop working for a while.

4) Users do not care about their work, perhaps because they want higher salaries. They have limited loyalty to their job, and do not feel under pressure when they face any problem.

One employee response expressed much of the above:

> *Employees don't care about the work very much and most of the time don't like to work and prefer to get some rest, maybe because of the financial or social situation, which means they need more income to work better. At the end of the day, the employee will take the salary and this is the important thing for him, not the work.*

In contrast to workers, students could suffer significant adverse consequences of computer usage difficulties:

> *if we have a homework to do or a project to submit in the next day, and the computer that we work on has been damaged at night and we can't do any things to solve this problem, in this case we will be very frustrated because we will losing marks and maybe we will fail and then we will repeat it, which costs us more money.*

There is a relation between attitudes to work and time as cultural variables. Workers in Jordan often do care about how much time is spent on a task, and sometimes work is delayed for days. This provides good triangulation for the lack of significant correlations between Jordanian's frustration and mood on the one hand, and loss of time and the importance of the task on the other.

5.5.6. Attitudes to IT in General

Attitudes to work interact with attitudes to IT, which only IT experts saw as different in Jordan compared to the USA:

> *One bank in Jordan provides a service for bank users to pay all their bills online by using the computer, by taking the amount directly from*

your bank account. But still it is a new technology for Jordanian and it's underused.

Another significant set of attitudes in Jordan concerns the higher relative value of IT equipment relative to developed countries. Jordanians will not try to fix a valuable 'damaged' computer themselves. They seek expert help quickly and avoid interfering with a potential 'crime scene'. They want to avoid blame for damage. Language use here is very revealing. US computers *don't work* and users must find work around. Jordanian computers *are damaged* and must be repaired by the IT experts.

IT skills and attitudes to IT are clearly interrelated, and not only in the minds of Jordan IT experts. Effective IT skills can lead to positive attitudes, whereas negative attitudes will slowdown skills development. In the US, positive attitudes towards IT will make users want to master it, and as a consequence, experience more frustration when they don't succeed. In contrast, users in countries like Jordan who do not value IT as in the USA will be less motivated to exploit IT, and less concerned when they fail to benefit from usage. Frustration is clearly related to expectations, and lower expectations will translate into less frustration.

If everything in Jordan were computerized, the people could still not accept all this technology for many reasons, for example the economic situation and trusting technology for paying through the internet. For example one of the employees says:

I found it difficult to pay something through the internet because I heard some story of my friend who pays through the internet from a local company then his credit card number was stolen.

In future, perhaps Jordanian will continue to not trust technology, because they will not enter their credit card number online.

Computers are not as important in the Jordanian user's life as is in the USA. US employees who has mastered software may know who problems are from software, not from them. US users facing a problem thus angry with the computer (Table 5.1).

5.5.7 Dependency on Information and Communication Technology (ICT)

Employees reported that much work in Jordan does not depend on computers, limiting usage of computers (Table 5.18). Unlike Jordanian students, who needed to finish work on time and could not afford to waste time, employees often lacked a career orientation, and/or did not like their job. One thus commented:

> *We don't have the spirit of work and don't enjoy our work; the only important things are how we can get our salary and when. Also we don't care if the work is done today or tomorrow or any time later. If the computer or the software for the salary system has been damaged, at this time all the workers will be anxious to solve this problem to have their salary, but if something is damaged in any another system they will not care about it so much.*

As much in Jordan does not depend on computers, when employees have any problem with a computer, they can do something else (but they don't like to work generally).

5.5.8 Work Context: Extent of Dependency on IT

Jordanian users can switch to other tasks when they encounter usage difficulties, but they tend to prefer to rest instead. One IT expert reported that:

> *If the computer that the users are using has been damaged, the work will be delayed. In this case they have other work that does not depend on the computer, but still they don't do that work and enjoying their time by sitting and having a rest until someone comes and fixes the computer, and if the manager asks them why you don't finish this job, they simply say that their computer has been damaged and they are waiting to have this solved. The work*

in Jordan does not depend 100% on the computer and even if the computer stops working there is other work that can be done manually.

Less work has been computerised in Jordan than in the US, and there is still much work that can be performed manually. Another consequence of lower relative computer usage in Jordan than the US is thus that there are fewer opportunities for usage difficulties to cause frustration.

Lower relative dependencies on computers at work in Jordan are compounded by lower relative dependencies on the work of specific individuals.

5.5.9 Work Context: Overstaffing

Some companies in Jordan have many employees working at the same job, therefore when they have something delay them, they can do it next day because employees are not busy all week. But the USA, there may be more pressure to finish their work in the same day, and perhaps no available time or help to continue next day.

A strong cultural influence in Jordanian work contexts is to find a job for friends and family, therefore sometimes employ unnecessary employees. (Nepotism). There is a relation between overstaffing and the following cultural variables:

A. Family obligation, which is not currently included in the diamond model.
B. Attitude to time, when many employees are given the same job that makes them leave work for each other. Attitude to time is a new cultural variable in that it is not currently included in the Diamond Model.

Overstaffing is common. It results from employing more people than the actual work really needs, often due to employment being a means of meeting obligations to relatives and friends. The differences with US work are clear. Efficiency is an easier focus in meritocratic cultures. Where appointment depends less on aptitude, and continuing employment does not depend on

sustained good performance, there are fewer incentives to use IT to introduce more efficient work processes within cost cutting strategies. One employee thus noted that the:

> *Number of employees in the same department is more than what we need, for example, if the number of employees in some job are 7, and sufficient employees for this job are 3, therefore 4 employees are more than what we should have, and in this case if we face any problem we can keep it and stop working and continue our work later because there is another employee who can do it, because if any employee is free they will become occupied in the new work, and this is not what the employees really want. Therefore everyone delays his work to not have any extra work. Because in the end, there are many employees and most of the time they are free and can take my work if I ask them. The main reason for overstaffing is because of the relation between people: friends and relatives are employed in jobs without looking if they really want this employee or not.*

Note how employees manage their shared job roles by avoiding finishing their share too quickly. In this sense, Jordanians do not work as a team because ambiguities over individual responsibilities make this difficult. Overstaffing thus reduces the impact of usage difficulties on individual workers, who in the US may simply not be able to afford the additional time required to resolve a computer problem. Also, overstaffing in Jordan is associated with a lack of individual responsibility as several people can be given the 'same' job. The cost of making up time lost due to computer difficulties will thus not clearly fall on the worker who experienced the problem, Note that this is not the collective responsibility reported by Nakoji and Ito (1996) for Japanese workers towards their employers. Collective responsibilities in the Jordanian workplace operate differently. Lastly, cultural differences over how time is valued are reinforced in work settings where other staff can take on extra work resulting from computer problems.

Del Galdo and Nielsen (1996) contrasted Polychromic time and Monochromic time as a cultural variable, but differences here on multi-tasking do not appear to explain what we have discovered, that is, Jordanian users' lesser concern (relative to US) for time as something that can be wasted. Their attitudes to time are different.

5.6 Results Discussion

We need to re-think how to interpret and respond to user difficulties across national cultures. Much of the overt frustration recorded in western studies may be much less evident elsewhere. We should not assume that what is a usability problem in the USA will be one in Jordan, not only in its severity, but also whether it is viewed as a problem at all. Our views on the value of usability in the West are much based on the negative emotional impact of poor usability, yet in other cultures these associations may not hold as much, even at all. Effective localisation guided by software quality needs to take this into account. It is not just that the same feature may be judged differently by the same quality criterion, but that quality criteria themselves may be radically different.

We are averse to over interpreting what is a linked pair of studies intended to confirm or reject a conjecture from initial field work. Having confirmed that Jordanian users report different patterns of frustration to US users, we need further qualitative and quantitative studies to test the provisional explanations above. With this, we will be better placed to advice on how to plan and interpret user testing, especially field studies in countries similar to Jordan. We assume here that self-reporting was an accurate instrument and triangulation interviews did appear to confirm self-rating. Even so, it might be interesting to replicate studies that have suggested that physiological measures of stress are more reliable (e.g., Mandryk 2005).

The social life and economical situation affect computer users in Jordan, because users trust western technology more than local or Arabic technology. This thinking is hard to change, even if the local technology becomes better than the western technology.

From our study we found that:

1) In Jordan, users don't get angry with their computers, even if they have experience of using IT. If they face any problem, they often do not know if the problem comes from the computer or from them. Therefore the last things that users may think are that the problem is from computer itself. If this is so, then they will not be angry with their computer.

2) Some expert users in Jordan using the new technology of buying from the internet and paying their bills online, but still very few people do this.

3) Sometimes when the users face a problem they stop and don't think how they can fix it by themselves, but wait for IT support to solve it even if it is a small problem that would be easy to fix.

4) There is no group or team works support the company and its work. For example, if the system for employee salaries is damaged, all employees will care about it, but if that happened on any another system they don't care about it, and maybe avoid fixing it. This can be a problem with some people, but not all, employees in Jordan.

Alternative interpretations could come from theories of frustration, as in Lazar and colleagues (2006) study, which base explanations on inhibiting conditions that interfere with, or stop, realization of goals. However, Lazar and colleagues' study only provides evidence for this for US students, indicating that individual differences do not play a strong role here, and that contextual factors, especially cultural ones, are more important..

We can conclude from the above study there are (groups of) cultural variables that can be argued to affect computer usage in Jordan. Some are already included in the Diamond Model, and some need to be added:

1. Familiarity with English, already in the Diamond Model (in the language segment).
2. Individualism versus collectivism, already in the Diamond Model, social structure and interaction segment.
3. Access to, and Experience with, Technology. A new variable not currently included in the Diamond Model.
4. Economic contexts, already in the Diamond Model as the economic processes.
5. Family obligations (Nepotism) are not clearly covered in the current Diamond Model, A specific variable, nepotism in the workplace, needs to be added. As an instance of this family obligations variable, an employee said: *There are many employees and most of the time they are free and can take my work if I ask them.*
6. Attitude to Time, a new variable needs to be added to the Diamond Model. As an instance of this variable, an IT expert said: *If the computer that the users are using has been damaged, the work will be delayed. In this case they have other work that does not depend on the computer, but still they don't do that work and enjoying their time by sitting and having a rest until someone comes and fixes the computer*
7. Power distance and authority is already a variable in the Diamond Model (Social structure and interaction segment). For example, when a computer is damaged, an employee will not try to fix it because he or she will be worried by their manager's reaction if they damage it more.

Three new variables thus need to be added to the Diamond Model: Family Obligations; Access to, and Experience with, Technology; and Attitude to Time. Family obligation (Nepotism) is added in the social structure and interaction segment as a subjective variable. Attitude to Time is also added to the social structure and interaction segment, covering differences in how users evaluate their use of time at work.

Therefore the updated Diamond Model will be:

1. Material Culture
   - 1.1 The Arts
   - 1.2 Buildings, houses and monuments
   - 1.3 Crafts and Decorative Art
   - 1.4 Foods
   - 1.5 Literature arts and media

2. Language
   - 2.1 Nonverbal communication
   - 2.2 Familiarity with English spelling across cultures
   - 2.3 Text direction
   - 2.4 High vs. Low Context
   - 2.5 Information flow
   - 2.6 Colour

3. Political Processes
   - 3.1 Political contexts.
   - 3.2 English fluency and the role of educational systems and colonialism.
   - 3.3 Government Support for IT Training. (added in chapter four)
     - **3.3.1 IT Education in Schools** (new variable added in chapter four)
     - **3.3.2 IT Training Centres in Communities** (new variable added in chapter four)

4. Economics Processes
   - 4.1 Cost of equipment.
   - 4.2 Availability of International Products and Services. (added in chapter four)

5. Social Structure and Interaction segment

5.1 Time of day, dates and numbers

5.2 Patterns of thinking and values

5.3 Long-term versus short-term orientation

5.4 Attitude to the environment

5.5 Individualism versus collectivism

5.5.1 Individual responsibilities towards computers

5.6 Femininity versus masculinity

5.7 Uncertainty avoidance

5.8 Concepts of times and space

5.9 Business etiquette

5.10 Neutral or emotional

5.11 Structure and achievement versus Ascription

5.12 Power distance and Authority conception

5.13 Age differences (added at chapter four)

5.14 Personal experience/knowledge. (added at chapter four)

5.15 Attitude to Work. (added at chapter four)

5.16 Religion (added at chapter four)

5.17 Access to, and Experience with, Technology **(new variable added in this chapter)**

5.18 Attitude to Time. **(new variable added in this chapter)**

5.19 Family obligation and relationships **(new variable added in this chapter)**

5.19.1 Nepotism in the Workplace. **(new variable added in this chapter)**

5.7 Conclusions

This chapter cover the first two hypothesis of this thesis, the first hypothesis is: Cultural differences influence both design acceptability and usage as reactions explanations and evaluations, which can have a positive or negative impact on attitudes toward, and competence with, computer based systems. This chapter has shown that cultural factors influence usage evaluations in ways that not been investigated in HCI before.

The second hypothesis is: cultural differences impact attitudes to usage as much as they do the aesthetic and cultural acceptability of user interface features. T study in this chapter allows us to conclude that cultural differences impact usage as much as design, directly affecting in the computer usage as a result of users' reactions and evaluations. The study has revealed cultural variables that do not figure in existing HCI research, for example family obligations, which operate in Jordan in ways that are less prevalent in western countries, especially outside of family owned businesses.

To build on these results, the next chapter will extend interviews to include broader issues of computer usage in Jordan.

5.8 Limitation of the Frustration, Anxiety study in Jordan

The repeated study was a probe study to find major differences in anger and frustration between US and Jordanian users, and it could be some limitation in this study such as Bonferroni adjustments and role of individual differences between users, but the main aim was to discover if the frustration level will be different between the US and Jordanian users and why, and through this study we reach this point and found that the possible causes of frustration in US will be different in Jordan.

Also, there is some possible limitation of the sample size of the triangulation interviews if we continue the interviews we could seek more problems but in our case we stopped because the recorded problems have been repeated through the interviews.

Chapter Six

Computer Usage Experiences in Jordan

6.1 Introduction

Two studies in Jordan have added instances and new (groups of) variables to the Diamond Model as initially formed from chapter two's literature survey. The cultural variables that affect computers usage in Jordan could be organisational, national, Arab or Islamic in origin. However, they were clearly present in our Jordanian studies, but there were also differences and similarities with previous (1981/1999) reports of usage in Western countries. In this chapter we take a more open approach to computer usage in Jordan to add further instances of cultural variables and perhaps new variables too. A key difference between this chapter and chapters four and five is a move from a tight focus on usage difficulties. A broad approach will be taken that lets both design preferences and usage patterns be explored, both positive and negative ones,

6.2 Method and Participants

Semi-structured interviews in the work place with participants included open questions. The interviews had three parts: the first part was about the current programs that they use and the main purpose of using the computer at work, home and in public places such as internet café's.

The first question was to discover the aim of using computer and in which place they using it, this will help us to understand the individual differences of computer usage, and what make it more usage within different places. Also identify individual differences which different than cultural factors.
The second part explored what participants thought their future computer should be and what they need from it. What type of changes do users need?
The second question is a projective technique that gets people's unmet and latent needs. The question will guide to understand the users needs and if it's different than the current one, and how we can develop it in the future to improve the usage.

The third part asked for suggestions as to what motivates them to use computers. For example, what could make computers easier for use? Participants were asked to explain the causes of computer problems in Jordan. The aim of third part of interviews is to motivate the usage of computer in Jordan. Also the third question will help us to expose new instances and variables through the answers by given some possible causes of usage difficulties that part of culture and referred these cultural difficulties as new instances and variables if not existed in the Diamond Model.

Then we took photos of employees' computer workplaces (see Figures 2.8 and 2.9, chapter two and Appendix (E). The photos will help to understand the differences between users from different culture such as the differences between the work place areas, computers, desk organization which could explain the difference of usage. These photos are part of open study of cultural differences between work place areas. The Jordanian photos had

been taken for Al-Zaytoonah university employees' desks and the UK photos taken for Sunderland university employees' desk independently to show the differences between work places.

The interviews were based on open questions to avoid any directed or guided answers from the participants. The questions based on basic concepts of computer usage.

There were 24 participants from Al-Zaytoonah university of Jordan, all computer users. There were 10 male students and 14 employees (6 IT support and software developers, 8 male non-IT people). One software developer was female. It was not easy to recruit female participants, who were reluctant to be interviewed. The one female employee who did participate asked not to have her voice recorded, but to just write what she said. Most of the IT employees were male only two female, which affecting the balance of the participants gender because most the participants male and the instances that relevant to gender could be more than that.

The sample size was good enough to discover new Jordanian instances new (groups of) variables and added to the Diamond Model, bigger sample size could increase number of instance and variables but in this case the aim was to discover the cultural variables that affect computers usage in Jordan could be organisational, national, Arab or Islamic in origin.

The interviews started with six IT support and software developers because of their experience. It was believed that they can provide us with most problems that help us to find more instances. Then we interviewed eight more non-IT people who were easy to access in the same university to discover more instance and variables from normal users. Then we interviewed students to find more instances or variables because student usage is different than employees and IT experts, there were 10 students. These students were male; most female student did not wish to be interviewed.

All of our studies were carried out in Amman, the capital of Jordan, where most of government and company offices are located. Amman is the centre for all business and related work, most Jordanians around Amman commute to Amman for work. Given this, the sample is not unrepresentative of Jordanian computer users overall.

Analysis of the data from interviews began by rapidly and informally exploring the data to identify the main themes. Then an affinity diagram was drawn up through a more detailed analysis of the data to support identification of instances of cultural variables, as well as variables that need to be added to the Diamond Model.

6.3 Results

It seems that young people have more experience using computers than older people because they are a new technology in Jordan.

The interview results have been classified in four main themes which are:

1. Usage purpose, covered in the first interview question.
2. Design and usage preferences, covered in the second interview question.
3. Usage difficulties also covered in the second interview question.
4. Suggested solution and improvement, covered in third interview question.

6.3.1 Employee data

The four overall themes of employees in Jordan are reported below:

6.3.1.1 Usage purposes

Employees in our study used computers for their work, but also for reading books (E-book), surfing the internet, learning, studying and for entertainment purposes. They use computers for learning new courses or software.

For some employees, the computer is a communication tool, using it to meet new friends or send an e-card for a special event. Further reports of usage purpose from IT support and developers included:

> "I use the computer for learning and reading e-books through the internet"

> "I use the computer at home for entertainment such as watching movies; listening to music, chat, etc."

> "I need some information on programs or instructions on software that I use at work, therefore I use Google search to find it."

> "Most of my work at the computer is to control the network in the university and monitoring the network if there any failure in the network."

One IT developer with experience of software design was very adventurous in his computer usage:

> "I have created software called *intelligent house* that can control the house by computer. It works by voice command, and it needs 2 hours to reset the computer to recognize you voice. It's an easy way to control your home, but I think people in Jordan prefer the simple and easy way,

for example they will not spend 2 hours to reset the computer for their voice and also it will be hard for them."

6.3.1.2 Design and Usage Preferences

Employees reported a preference for simple and easy to find tool bars. The female participant preferred interfaces to be colourful with lots of pictures. Users prefer programs that let them re-design to meet their needs, even if only to personalize a small thing such as MSN messenger by making special icons with Arabic words. The female IT support expert reported:

"I like to have MSN with Arabic icons, pictures and voices to send to my friends when we chat, because sometimes there is some impression we like to send but don't find the right one on the regular MSN"

Similarly, an accounting employee at the university said

"Sometimes I prefer to change the layout of the windows to make it easier for me such as, the order of the icons, the shape, the way of display icons and files and changes in the colours too"

Preferences for input devices were also reported by one IT developer:

"My grandfather is having some problems using the mouse; he prefers the touch screen because it's easier for him."

We discover a new cultural variable "Colour Preferences" which assume that some Jordanian users preferring polychromic.

6.3.1.3 Usage Difficulties

Most software that large companies use is in English, as reported by two IT support experts

> "I use the English software, because all our work is in English and even the books we read are in English, and the big companies use the English version, therefore we should learn the English software. And after all this time using the English version, it will be hard for us to convert from the English version to the Arabic version."

> "If we buy a new computer for work, we install the English software not Arabic."

The problem that users commonly face is the English language, because some find it hard to read or write in English, therefore they prefer an Arabic version if one is available. But sometimes there is a problem in Arabic software. Difficulties of use here were mentioned in chapter four. For example an employee at the financial and registration department at the university said:

> "I know basic English language but I am not fluent because it's not my first language, and sometimes when I face problems in the computer, a message appears in my screen to help me fix the problem, but unfortunately most of the words in the message I cannot understand, because most of the words are hard for me to understand. I suggest having a simple sketch that shows me how to solve the problem rather than a written solution."

Lack of training is often due to cost problems, because some users' cannot buy a specific training program, or their company doesn't train them because of the cost.

Also trusting technologies is a problem for users that cannot trust the internet for buy or sell products, which reduces e-commerce usage.

6.3.1.4 Suggested Solutions

An IT support expert focused on training problems:

"The people need to concentrate computer training and how they can use the computer to minimize the problems."

6.3.2 Student Data

The results of interviews of student could be related to the same four themes as follows:

6.3.2.1 Usage Purposes

One student reported:

"I use the computer for studying, but at home I use the computer for entertainment, movies, chat, etc."

Another student said

"I use the Royal Jordanian Airline website for buying an e-ticket, because I know that the ticket will be cheaper than paying it from the travel agent's office. "

6.3.2.2 Usage Preferences

Most students agreed that interface design should be simple and easy to use, without big icons in different shapes. And they like colours and different backgrounds in the interface. Students liked simple design that makes the user interface clear and easy, for example:

"We prefer the simple interface design that makes the screen clear for read."

Students preferred English language software:

"I use the English version because I've used it from long time back, and it's hard for me to convert to Arabic version"

"We use the English version to learned more English words and improve our English language"

"I don't prefer the Arabic version, even if it had the same quality as the English version, because we believe that English versions are more developed"

"We think the English software will be better because the western how create the computer therefore they will develop it better."

6.3.2.3 Usage Difficulties

Another problem that faces users is the cost of the technology such as computers, software, and internet provision and computer courses. Users can't get all these because of the high cost of these technologies. The economic situation of people in Jordan affects the computer usage, for example, one student said:

"The cost of a computer and original software are high and hard to buy sometimes."

The time that users can spend on the computer is limited because of reasons that include:

1) Many people using the same computer at home.
2) The social lives of people minimize the number of hours that they can use the computer at home.

6.3.2.4 Suggested Solutions

One student suggested having both Arabic and English in the same software by having the meaning of an English word in Arabic appear when the mouse is over it:

"I suggest if we have English version but at the same time having a translation of the word in Arabic at the same time"

However, students had few ideas about possible improvements:

> "We aren't looking for any changes to the current computer because the current computer is good for us"

6.4 Affinity Diagram

Having reviewed the data against emergent themes related to the interview questions, we needed to structure it further via an affinity diagram to align the results with the existing diamond model. As we explained before in chapter three, we started by sorting yellow cards containing interview data into groups under blue cards, then grouped blue cards under pink cards, and then grouped pink cards into the main green groups. This colour coding of levels for a group is shown in Figure 6.1. In this hierarchical coding, green is used for the header, which is the main group category, and then sub-headers will be pink (sub-categories of green) then blue indicates a first level group. Basic findings are yellow.

Figure 6.1 to 6.5 present the affinity diagrams and caption keys. Tables 6.1 to 6.5 then re-present the affinity diagrams as structured tables, with the fourth column indicating which participant reported the instance, i.e., woman employee (WE), male employee (E), IT support (IT), or student (S).

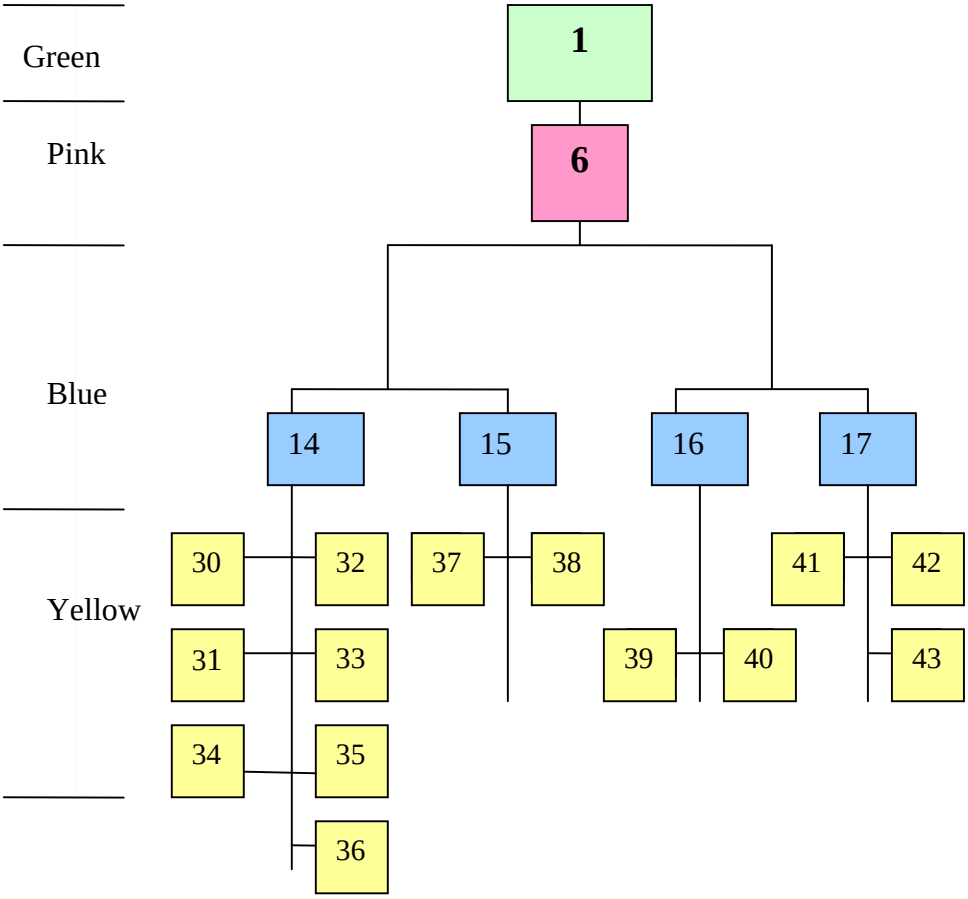

Figure 6.1 First green group: card number (1) English language, and (6) Some of the users don't understand the English language, for blue and yellow card number see table 6.1

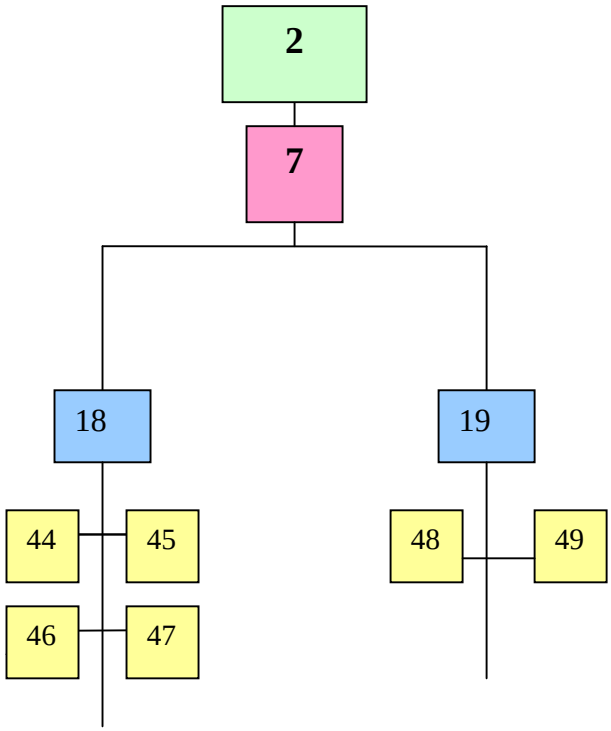

Figure 6.2 Second green group: card number (2) Femininity vs. Masculinity, and (7) Men and women experience, for blue and yellow card number see table 6.2

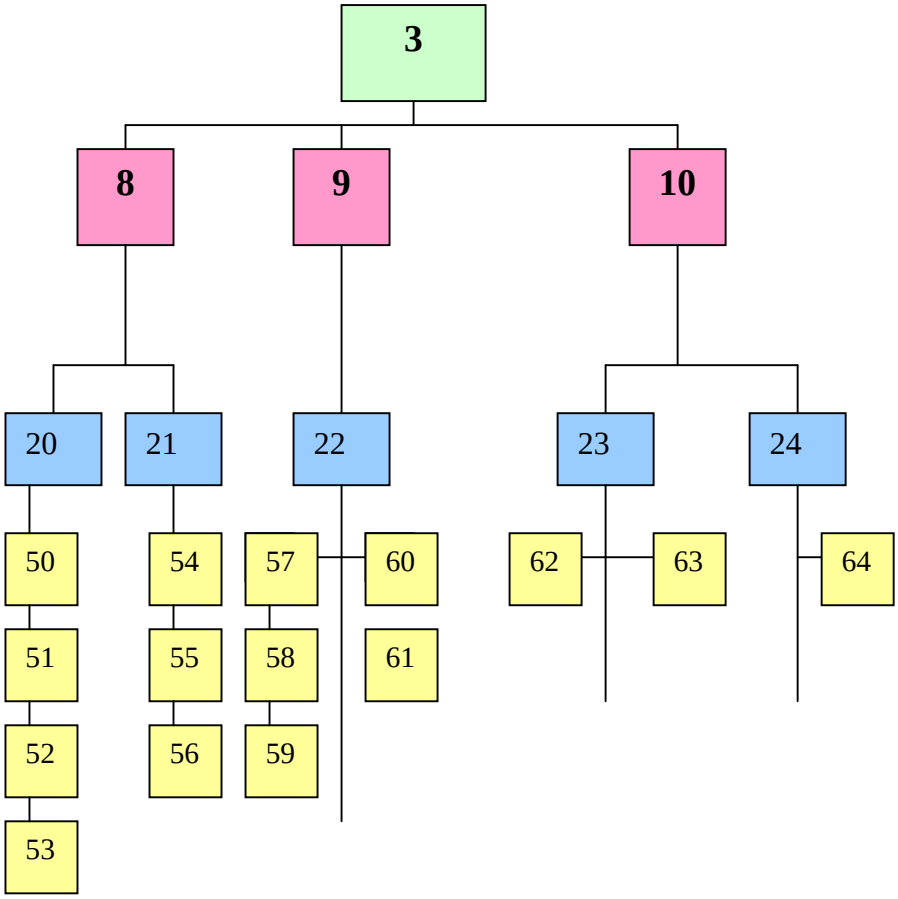

Figure 6.3 Third green group: card number (3) Using technology, the card number (8) The availability of the technology, (9) Training, and (10) Trusting, for blue and yellow card number see table 6.3

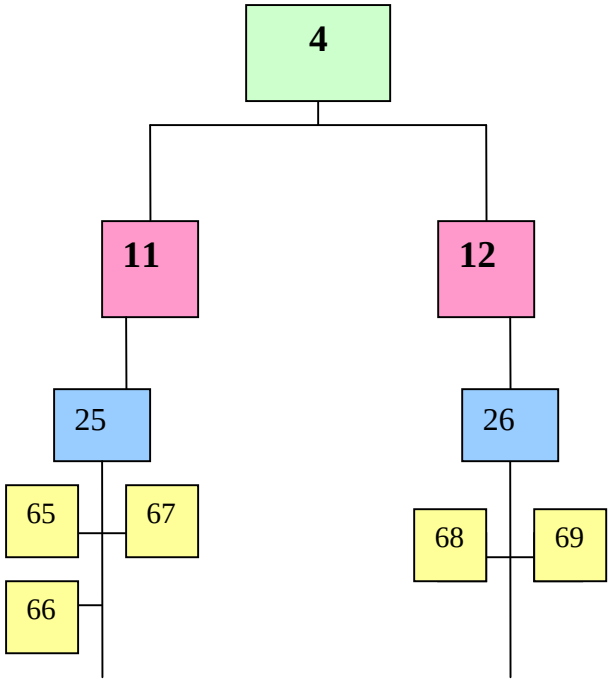

Figure 6.4 Fourth green group: card number (4) Time, card number (11) Time of using the computer, and (12) Experience of using the computer, for blue and yellow card number see table 6.4

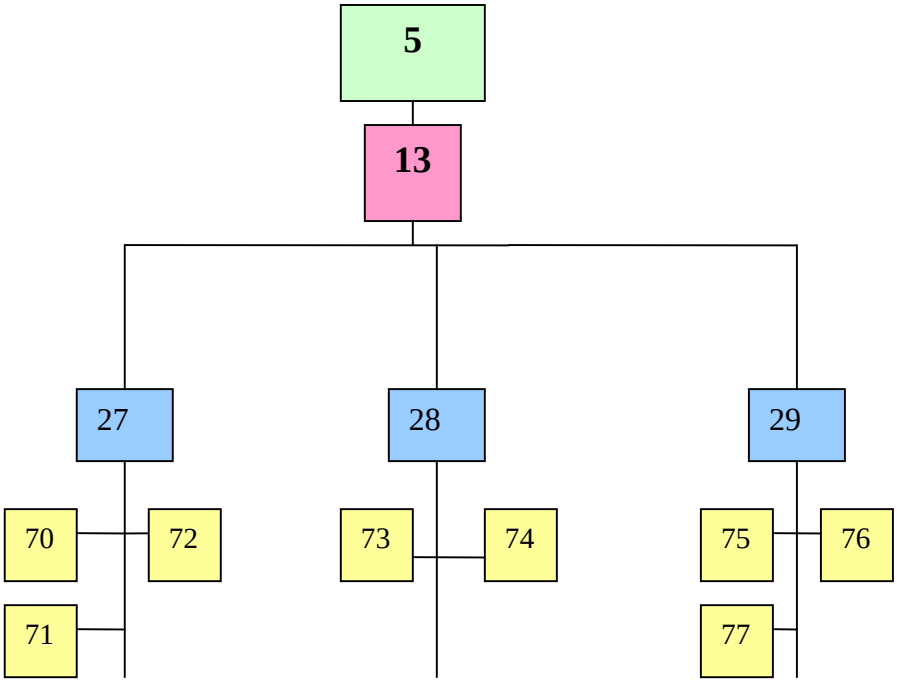

Figure 6.5 fifth green group: card number (5) Identifying with software, and (13) Suitability for users, for blue and yellow card number see table 6.5

Blue	code	Yellow	P
(14) The Arabic software is not as good as the English software	1.1.a	(30) In some Arabic programs, the help on the toolbar in English.	E
	1.1.b	(31) Some users prefer English software because there are lots of problems in Arabic version.	E IT
	1.1.c	(32) We should develop the Arabic software market.	IT
	1.1.d	(33) We should encourage the Arabic software by using it if it is good enough.	E
	1.1.e	(34) In some Arabic countries such as Syria they use Arabic software all the time and they don't have any problem when they using it because all the software and products are in Arabic not in English.	E
	1.1.f	(35) The direct translation make us more confused and some time the word will be reversed, because the text direction in Arabic is from right to left which opposite of English text direction.	E, S
	1.1.g	(36) When we use internet explorer to try to open an Arabic website or document in the Arabic language, all the Arabic words will be encoded and hard to read, which causes much confusion for me. Encoded mean that all the word will not be in Arabic or English it will be coded and can't be read. See figure 6.6.	E, S

Table 6.1: The affinity diagram of the Green group: (1) English language and pink group: (6) Some users don't understand the English language.

Blue	code	Yellow	P
(15) Most of the software we need is in English	1.2.a	(37) The availability of Arabic software is very limited	E, S
	1.2.b	(38) What is important is for user is to be comfortable using the software even if it is in Arabic or English.	E
(16) We should improve our English language	1.3.a	(39) Focusing in primary and secondary education on English	S
	1.3.b	(40) Free English courses for employees.	E
(17) Using the English version to improve their English language.	1.4.a	(41) English language is important for our careers.	S
	1.4.b	(42) Most big companies use English software communicates with the rest of world.	E
	1.4.c	(43) We learn English when we use the English software.	S

Table 6.1: The affinity diagram of the Green group: (1) English language and pink group: (6) Some users don't understand the English language.

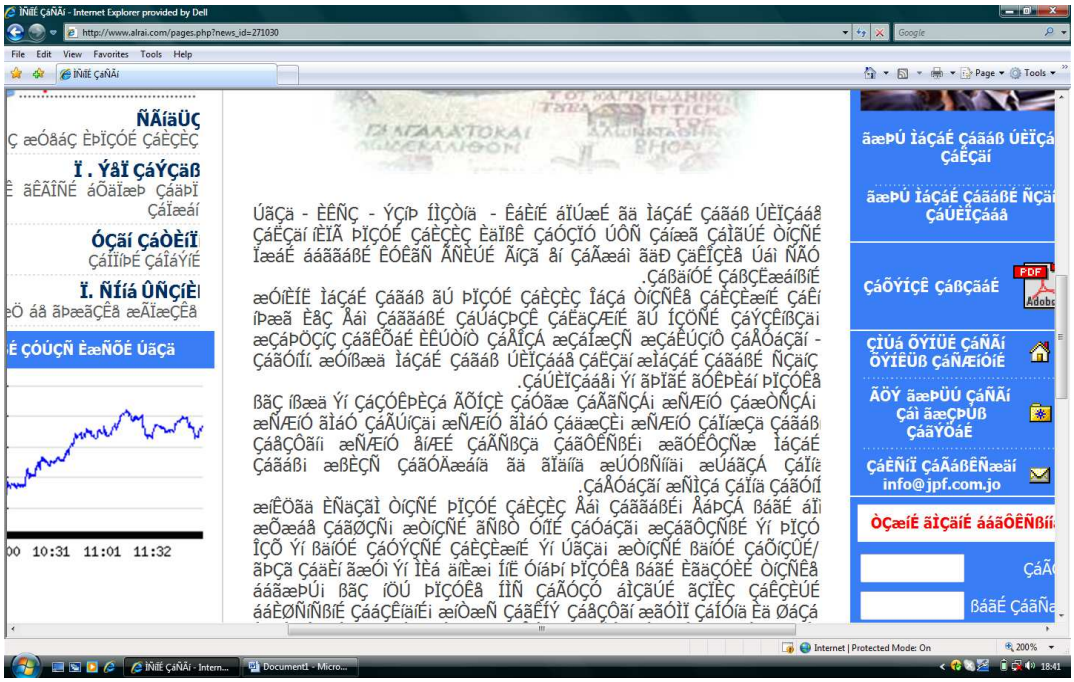

Figure 6.6 Example of miscoded Arabic website. Arabic words but appear as the wrong characters and can't be read.

Blue	code	Yellow	P
(18) Woman using the computer less than men	2.1.a	(44) The social life in Jordan makes the woman focus on in her home after work.	WE
	2.1.b	(45) After she finishes her work she works at home (cooking, cleaning, take care of her child) (46) Woman spends more time visiting family or friend.	WE
	2.1.c	(47) Most women stay at home, and don't like to learn computers.	WE
(19) The usages of computer are different between men and woman	2.2.a	(48) Most of men using the computer at home for (chat, movies, games and music)	E
	2.2.b	(49) The woman using the computer at home for (chat, reading, or getting cooking recipes).	WE

Table 6.2: The affinity diagram of the Green group: (2) Femininity vs. masculinity, and the pink group: (7) Men and women experience.

Blue	code	Yellow	P
(20) Cost of computers	3.1.a	(50) Some people can't buy computers.	E, S
	3.1.b	(51) Cost of buying books is high, we can read it online.	S
	3.1.c	(52) Some company that we work for do not buy help software because of the cost.	E
	3.1.d	(53) Sharing the computer with more than two people at home.	S
(21) Improve equipments	3.2.a	(54) The computers are too slow and need to improve.	E, S
	3.2.b	(55) Some of the equipment and software that we use has been here for a long time and needs to be changed.	E
	3.2.c	(56) The efficiency of the computer are less	E

Table 6.3.a: The affinity diagram of the Green group: (3) Using technology, and the pink group: (8) The availability of the technology.

Blue	code	Yellow	P
(22) Training and practice for using computer	3.3.a	(57) Training for using any special software	E
	3.3.b	(58) Free government computer centres.	IT
	3.3.c	(59) Teaching computers in primary school.	IT
	3.3.d	(60) ICDL (international computer driving License)	IT, E
	3.3.e	(61) Free training courses for the employee	IT, E

Table 6.3.b: The affinity diagram of the Green group: (3) Using technology, and the pink group: (9) Training.

Blue	code	Yellow	P
(23) Trusting new technology to buy and sell products.	3.4.a	(62) Preferring buying from international website rather than local or unknown source websites.	E
	3.5.a	(63) Sometimes they don't deliver to Jordan.	E
(24) Ease of use.	3.5.b	(64) I try to use the personal organizer software in my computer but I can't find it.	E

Table 6.3.c: The affinity diagram of the Green group: (3) Using technology, and the pink group: (10) Trusting.

Blue	code	Yellow	P
(25) Number of hours using the computer at home or work	4.1.a	(65) More than two people using the same computer at home.	E, S
	4.1.b	(66) Social life for Jordanians is important, to visit friends and family, that makes them minimize the time for of using computers	E
	4.1.c	(67) Only a specific group of people use the computer all the time (at home and work).	E

Table 6.4.a: The affinity diagram of the Green group: (4) Time, and the pink group: (11) Time of using the computer.

Blue	code	Yellow	P
(26) How long people have used a compete the computer	4.2.a	(68) Most computer users are young people	E
	4.2.b	(69) The computer has been taught in the primary school for only 6 or 7 years.	E, S

Table 6.4.b: The affinity diagram of the Green group: (4) Time, and the pink group: (12) Experience of using the computer.

Blue	code	Yellow	P
(27) Fit to usage context	5.1.a	(70) We don't need lots of graphics and pictures in our computers to minimize the load on them.	E
	5.1.b	(71) We need a program that meets our needs.	E
	5.1.c	(72), (73) I suggest changing the interface and making it all by touch rather than using the keyboard and mouse because it's easier for older people.	IT, E
	5.1.d	(74) We need more information, sometimes the help messages don't give us enough information that we need, or a software description will not give a lot of information.	E, S

Table 6.5.a: The affinity diagram of the Green group: (5) Identifying with software, and the pink group: (13) Suitability for users.

Blue	code	Yellow	P
(28) Personalisation	5.2.a	(75) I use special software to personalize my calendar by changing the colours, changing the weekdays and weekend days.	IT
	5.2.b	(76) We need to personalize our computer (by pictures and colour)	E, S
	5.2.c	(77) On a special occasion, I sent an e-card for my friend in Jordan in, and after I sent the e-card, next day he contact me and tell me he preferred visiting him to talk to him rather than send an e-card.	E
	5.2.d	(78) I need to have Jordanian Arabic emoticons in the messenger.	W E

Table 6.5.a: The affinity diagram of the Green group: (5) Identifying with software, and the pink group: (13) Suitability for users.

Blue	code	Yellow	P
(29) Focusing on Arabic computer users.	5.3.a	(79) Having some Arabic characters and voices in msn and yahoo messenger.	W E
	5.3.b	(80) Website domain in Arabic language.	E, S
	5.3.c	(81) I have used Google earth to find some places in Jordan, and then I open the map in USA and I find differences between the two maps. In Jordan it's not clear with old pictures and some places can't be found. But in USA map, the images are all clear.	IT

Table 6.5.b: The affinity diagram of the Green group: (5) Identifying with software, and the pink group: (13) Suitability for users.

6.5 Extending the Diamond Model

The affinity diagram structure makes it easier to relate participant responses to cultural variables in the Diamond Model. Table 6.6 below explain the relation between the five green groups and cultural variable (group)s.

Number	Green groups	Diamond Model Segment	Variables
1	**English language**	Language	Familiarity with English
			Text direction
2	**Femininity vs. masculinity**	Social Interaction	Femininity versus Masculinity.
			Family obligation and relationships
3	**Access to, and experience with, Technology.**	Social Interaction	Technology
			Education Training
		Economics	Economic contexts
4	**Time**	Social Interaction	Age differences
5	**Identifying with software**	Social Interaction	Patterns of thinking
		Language	Colour
			High context language or social, for example from table 6.5 code (5.1.e)

Table 6.6 The relation between Green groups in the affinity diagram and the culture variables group.

6.5.1 English language

Arabic is the official language of Jordan. The second most common language is English is understood by most Jordanians. Also some education degree levels are taught in English. Therefore English language is important for Jordanian life, for example for education, communication and jobs English language has been covered in our Diamond model as *Familiarity with English*.

Using the English language seems to be a problem for some Jordanians because not all are fluent in English language, therefore it is not satisfying to use the English language all the time and many prefer using the official language (Arabic). But at this time, the English language becomes more and more important for education and the computer business, because most technology and useful software is in English.

From the affinity diagram, we identify problems for computer users due to their familiarity with English, which include:

1. Direct translation: some software in Arabic translated directly from the English word to Arabic without knowing how the meaning can cause confusion for users because it is not accurate. See table 6.1 (1.2.a). For example, Google translations requested by users are sometimes not accurate and even not understandable for the user.

2. Arabic software: the quality of Arabic software is not as good as English software, which makes people use English software, which a problem for some users because their English is weak. See table 6.1 (1.1.b), (1.1.c) and (1.2.a)

3. English language level: only when computer users are fluent in English can their level of computer skills fully develop, because

most computer usage is in English. See table 6.1 (1.4.a) and (1.4.b).

4. Text direction: the text direction in Arabic is from right to left but in English from left to right, confusing the users by mixing between the two languages' direction when a program uses both languages at the same time, see table 6.1 (1.1.g).

The contrast between Jordan and Syria over the English language requires two further cultural variables. Syria is subject to trade sanctions, which prevent impacts of western software. Thus Syrian have had to develop their own software see table 6.1 (11.e). This reinforces Syrian government language polices on the use of Arabic (rather than French and English).

6.5.2 Femininity vs. Masculinity

There are two types of woman who use computers in Jordan, the first are housewives and the second are working women. We focus on working women because they use the computer during their work more than housewives.

The life style in Jordan prevents women from using the computer as much as men. We found in our interviews that housewives use the computer at home for surfing the internet, chatting, getting recipes for cooking. For example the female IT support expert told us that:

"Some women in Jordan use the internet to find cooking recipes, and to chat with friends"

Working women use computers mostly in their work, but they can't use them at home because after work they spend their times with their children, at home and on family relationships.

Femininity vs. Masculinity is covered in our Diamond model in the social interaction segment.

There is a new variable "*Gender Roles*" under the Femininity vs. Masculinity variables which covered the different use of computers between male and female. Women's computer usage in Jordan differs from that for men. From the affinity diagram's contents, we can identify problems for computer users due to gender roles as follows:

1. Females use computers less than men, because men have more free time at home, and also more time at work too, as there is more uneducated woman than uneducated men in Jordan.

2. Family relationships: In Jordan, family relationships are important, therefore time for using computers at home will be reduced because relationships with family and friend are a priority.

6.5.3 Access to, and Experience with, Technology

Most government and public sector use computers in their work. One much mentioned problem is the lack of training. Using technology has covered in our diamond model in the *technology sub-group*. Interviews revealed the following relations between using technology and Jordanian culture:

1. Cost of technology: some Jordanian users don't have computers at home because of the costs of buying computer or the fees of connecting to the internet are high (economic problem).
2. Sharing computers: the high cost of buying computers makes users at home share computers with their family, with more than two using the same computer.

Computers have entered Jordanian life and now have been improved more and more over time, with the number of computers and users

increasing. With more time spent on the computer, the experience will increase and this we found in this study, although it could be obstructed by problems with English, or social obligations Experience is related to age, but with younger users having more experience than older users. The following time-related factors are important:

1. *Time duration*: when time for using computers increases, experience can also increase. For example, a computer science student at the university said “I try to spend more time at home using the computer to improve my computer skills, by training using some software that helps me in my study”.
2. *Age of users*: most users are young because computers are a new technology and they have learned to use them when they were young, but some older people don’t want to learn any more. For example, a student at the university says “the new generation have more computer experience, because computers entered our school as a new subject, and the computers are more developed than before”.
3. *Time spent on the computer*: time is spent on the computer at work, during study at school/university at home, or in internet cafe.

The development of computer values is complex. Length and intensity of use are culturally independent factors, but there depend on access to computers, which is turn is influences by linguistic (English language) social (age, lifestyles), economic (affordability) and political factors (education policy).

Gender and social life also affects usage of computer by the ability to spend time at a computer. Computers are not accepted as substitutes for face to face interaction. Thus, one respondent had thought that they could manage their social life by just sending an e-card, but this was not acceptable in Jordan and a recipient became angry from this, because they preferring to be visited them rather than just being sent an e-card.

6.5.4 Identifying with Software

Most software that Jordanians use is international. More localisation and personalization is needed, to be more helpful and easy to use. The users' need some design that fit their needs. For example, an student suggested that "we have English version, but at the same time have a translation of the word in Arabic."

Identifying with software is associated with Diamond model factors such as *patterns of thinking, colour,* and *high vs. low context.* The affinity diagram highlighted problems that users face when they cannot personalize the technology, as we can see in the following:

1. Fit to technology usage context: a lot of graphics and pictures slows the computer speed and minimizes its capacity.

2. Personalisation: changing the interface can make it more applicable for users in Jordan. Such as changing the colours and graphics.

3. Arabic users: focusing on Arabic users to give them attention in the global market of software. There are fewer problems here for the internet, because there are lots of Arabic websites. Improvements to Arabic translated software such as Microsoft Word would make them more applicable and easier for users.

A range of factors, mostly design related, thus influences the extent to which Jordanian users can identify with the software that they use. However, an extra cultural variable is added to the Diamond Model to capture this, rather than rely on designers tracing 'light paths' here: while Jordanian users seek ways to adapt software to their needs and preferences they also expect western technology to be superior (Section 6.3.2.2). A further variable needs to be added to the Diamond Model. Together, these two new variables illustrate the concept of *Glocalisation* (Shen et al. 2006). where consumers mix and match elements of their

local and international cultures. This is also seeing in Western Countries with the adoption of world music.

6.6 The Evolution of the Diamond model

We conclude from our studies that we found issues which would not arise in the same way, or as often, in a western country. These include the influence of family obligations and relationships (e.g., nepotism in employment), which causes overstaffing problem at work that increases the number of employees and delays work by throwing it onto another person.

After studying Jordanian computer users and how they reported to problems that face them in chapter, four, five and six, we have added new specific cultural variables. The new diamond model is thus as follows:

1. Material Culture
    - *1.1 The Arts*
    - *1.2 Buildings, houses and monuments*
    - *1.3 Crafts and Decorative Art*
        - **1.3.1 Colour preferences, polychromic (new variable added in this chapter)**
    - *1.4 Foods*
    - 1.5 Literature arts and media

2. Language
    - 2.1 Nonverbal communication
    - 2.2 Familiarity with English spelling across cultures
    - 2.3 Text direction
    - *2.4 Context*
    - 2.5 Information flow
    - 2.6 Colour
    - **2.7 Direct translation (new variable added in this chapter)**

3. Political Processes

3.1 Political contexts.

3.2 English fluency and the role of educational systems and colonialism.

3.3 Government Support for IT Training. (added at chapter four)

3.3.1 IT Education in Schools (added in chapter four)

3.3.2 IT Training Centres in Communities (added in chapter four)

3.4 Trade Sanctions (new variable added in this chapter)

3.5 Government Language Policy (new variable added in this chapter)

3.6 Authority and policy of the companies (new variable added in this chapter)

4. Economics Processes

4.1 Cost of equipment

4.2 Availability of International Products and Services. (added at chapter four)

4.3 Affordability of IT Access **(new variable added in this chapter)**

4.3.1 Affordability of Computers **(new variable added in this chapter)**

4.3.2 Affordability of Internet Access **(new variable added in this chapter)**

4.3.3 Affordability of Training **(new variable added in this chapter)**

5. Social Structure and Interaction segment

5.1 Time of day, dates and numbers

5.2 Patterns of thinking and values

5.3 Long-term versus short-term orientation

5.4 Attitude to the environment

5.5 Individualism versus collectivism

5.5.1 Individual responsibilities towards computers

5.6 Femininity versus masculinity

5.6.1 Gender roles (new variable added in this chapter)

5.7 Uncertainty avoidance

5.8 Concepts of times and space

5.9 Business etiquette

5.10 Neutral or emotional

5.11 Structure and achievement versus Ascription

5.12 Power distance and Authority conception

5.13 Age differences (added at chapter four)

5.14 Personal experience/knowledge. (added at chapter four)

5.15 Attitude to Work. (added at chapter four)

5.16 Religion (added at chapter four)

5.17 Access to, and Experience with, Technology (added at chapter Five)

5.18 Attitude to Time. (added at chapter Five)

5.19 Family obligation and relationships (added at chapter Five)

5.19.1 Nepotism in the Workplace. (added at chapter Five)

5.20Software and Identify (new variable added in this chapter)

5.21 Attitudes towards Western Technology (new variable added in this chapter)

Note: Variable (group)s in *italics* can not be related to in any affinity diagram in chapters four or six, or to the analyses in chapter five.

6.7 Summary

Colour preferences, and direct translation new variables could be organisational cultural variables and not an individual differences because it common between group (more than one users) and organization of people in Jordan. Trade sanctions, authority and policy of the companies, gender roles, attitudes towards western technology, and software and identify could be

more national variables because it more common a cross Jordan nationality which is not an individual differences.

We conclude that the final current version of our Diamond model will be as shown in tables 6.7 to 6.11 below. The tables show the segments, sub-segments, groups, and instances from our studies. The full version of the Diamond model can give a ‘big picture’ of cultural influences on computer usage in Jordan. Not all instances are shown in these tables, for reasons of space see appendix H.

Segments	Sub-segment	Groups of Variables	Instances
Material Culture	Objective variable	The Arts	None
		Buildings, houses and monuments	None
		Foods	None
		Literature arts and media	Few difficulties with Arabic websites.
	Subjective	Crafts and Decoration/ Colour preferences, polychromic	Some times I prefer to change the layout of the windows to make it easier for me such as, the order of the icons, the shape, the way of display icons and files and changes in the colours too.

Table 6.7 Material Culture segment, sub-segments, groups, variables and instances of the Diamond model

Segments	Sub-segment	Groups of Variables	Instances
Language	Objective variable	Nonverbal communication	I need to have Jordanian Arabic emoticons in the messenger.
		Familiarity with English spelling across cultures	English language, it's important for our career life.
		Text direction	The direct translation make us more confused and some time the word will be reversed, *because the text direction in Arabic is from right to left which opposite of English text direction.*
		Context	We need more information, some times the help messages don't give us enough information that we needs, or a software description will not give a lots of information
		Direct translation	The direct translation make us more confused and some time the word will be reversed

Table 6.8 Language segment, sub-segments, groups, variables and instances of the Diamond model.

Segments	Sub-segment	Groups of Variables	Instances
	Objective specific variables	Information flow	The company should have a help desk to contact the IT expert directly to solve the problems as soon as possible.
		Colour	We need to personalize our computer (by pictures and colour). The default layout and colour of the systems are the same for all systems; we prefer to change it to several colours, rather than one colour across all the system.

Continue of Table 6.8 Language segment, sub-segments, groups, variables and instances of the Diamond model.

Segments	Sub-segment	Groups of Variables		Instances
Political Processes	Objective	English fluency and the role of the educational systems		English language is important for our careers.
		Government Support for IT Training	IT Education in Schools	The computer has been taught in the primary school for only 6 or 7 years.
			IT Training Centres in Communities	Free government computer centres. Free centre in small town and village to teaching the principles of computer.
		Trade Sanctions		In some Arabic countries such as Syria they use Arabic software all the time and they don't have any problem when they using it because all the software and products are in Arabic not in English.
		Government Language Policy		Most big companies use English software communicates with the rest of world.

Table 6.9 Political Processes segment, sub-segments, groups, variables and instances of the Diamond model.

Segments	Sub-segment	Groups of Variables	Instances
Political Processes	Objective	Authority and policy of the companies	I have used Google earth to find some places in Jordan, and then I open the map in USA and I find differences between the two maps. In Jordan it's not clear with old pictures and some places can't be found. But in USA map, the images are all clear.

Table 6.9 continue: Political Processes segment, sub-segments, groups, variables and instances of the Diamond model.

Segments	Sub-segment	Groups of Variables	Instances
Economics Processes	Objective	Cost of equipment	Some people can't buy computer. Cost of buying books is high, we can read it online.
		Affordability of IT Access	Some of the equipment and software that we use has been here for a long time and needs to be changed.
		Affordability of Training	Free training courses for the employee. Training for using any special software.
		Availability of International Products and Services	Sometimes they don't deliver to Jordan.

Table 6.10 Economics Processes segments, sub-segment, groups, variables and instances of the Diamond model.

Segments	Sub-segment	Groups of Variables	Instances
Social Structure and Interaction	Subjective	Patterns of thinking and values	We don't have the spirit of work and don't enjoy our work; the only important things are how we can get our salary.
		Concepts of times and space	None
		Business etiquette	None
		Long-term versus short-term orientation	None
		Attitude to the Western technology	We trust the western technology more than local one. Preferring buying from international website rather than local or unknown source websites. Some users prefer English in higher education software because there are lots of problems in Arabic version.
		Individualism versus collectivism	Employees prefer to ask IT support to fix problems, but users should try to solve problems themselves to know next time how to solve them.

Table 6.11 Social Structure and Interaction segment, sub-segments, groups, variables and instances of the Diamond model.

Segments	Sub-segment	Groups of Variables	Instances
Social Structure and Interaction	Subjective	Femininity versus masculinity/ Gender roles	The social life in Jordan women focusing in here home after work.
		Uncertainty avoidance	None
		Neutral or emotional	Despite the results in chapter five, Jordanians do often display anger and other strong emotions.
		Structure Achievement versus Ascription	Nepotism in employment.
		Power distance and Authority conception	Most big company impose English software. Authority of employees to fix computers is very limited Managers don't want employees to damage them more.
		Age differences	The new generation have more computer experience, because computers entered school as a new subject, and are more developed than before.

Table 6.11 Continue: Social Structure and Interaction segments, sub-segments, groups, variables and instances of the Diamond model.

Segments	Sub-segment	Groups of Variables	Instances
Social Structure and Interaction	Subjective specific variable	Access to, and Experience with, Technology	Sharing the computer with more than two people at home.
		Family obligation and relationships	The number of employees in the same department is more than what we need; some employees will be recruited because they have a relation (friends and relatives) with the manager.
		Software Identifier	We don't need lots of graphic and pictures in our computers to minimize the load in our computers. I use special software to personalize my calendar by changing the colours, changing the weekdays and weekend days to Arabic calendar style. I need to have Jordanian Arabic emoticons in the messenger

Table 6.11 Continue: Social Structure and Interaction segments, sub-segments, groups, variables and instances of the Diamond model.

6.8 Conclusions

In this chapter we have extended our diamond model, adding more new instances and specific variables than in chapters four and five. The new variables that emerged appear to have more impact than the new ones in chapter four and five, for example, variables in the Political Processes segment of the Diamond Model. We conclude from this chapter that variables related to usage are more influential than ones related to design preference, although we have seen instances of design preferences in the more open interviews carried out for this chapter.

For example, the economic situation of a developing country will impact computer usage. The income of people, their standard of living, and computer equipment, software and training prices are all variables that impact computer usage. Developing countries thus gain less experience of using computers and new technology. Solutions for these problems include government training schemes for IT literacy and more affordable computers and internet access.

The studies in chapters 4, 5 and 6 have extended the Diamond Model and provided instances of many of the variables. Refer to third hypothesis of thesis, Existing *HCI design approaches can be modified to communicate cultural factors relevant to interaction design and computer usage*, which have been reached through this chapter by extending the Diamond Model.

At this point, we can ask whether the Diamond Model provides adequate support for designers. Or do we need complementary representations to help them? To answer these questions, we need to review different representations in use in HCI and choose the most applicable one as complements to the Diamond model, or modify and merge them to produce a new design representation to communicate cultural differences. Complementary representations could also overcome some limitations of the Diamond Model. Although through the diamond metaphor light can take many paths, the presentation is a hierarchical taxonomy. Further more variable

groups are vague and ambiguous (Kamppuri et al. 2006), and could plausibly be located in a different (sub) segment or group. For example, patterns of thinking and values are placed in the social subjective sub-segment, but it is actually a general term for all subjective sub-segments. Also, language variable groups associated with pragmatics (how language is use socially and in media), i.e., non-verbal communication and high vs. low context, could also be associated with the objective sub-segments of material culture and social structure and interaction. Pragmatics; by their very nature, span language, media and social interaction. Their placement in the Diamond Model reflects the best fit to a single segment.

Ambiguities and alternative interoperations will district designers and may district their understanding of Jordanian culture. Thus design representations that are complementary to the Diamond Model should compensate for its limitations.

6.9 Limitation of Computer Usage Experiences in Jordan

The limitation on this chapter is on the sample size of our study, A bigger sample size could discover more cultural variables and more instances. Hence increasing the sample size would increase the possibility of discovering more variables and instances. It would also increase the possibilities for individual differences to appear, but also would allow common trends to be more reliably identified as cultural factors, and not as the result of random individual differences. However, this study has revealed examples of design preference and acceptability of existing design features that did not emerge in Chapters four and five. Thus even with a relatively small sample, many new instances and several new variables emerged, rebalancing the version of Diamond Model away from an emphasis on variables associated with how users evaluate their usage experiences.

Chapter Seven

Communicating the Diamond Model

7.1 Introduction

From the last study in Jordan we found further evidence of (groups of) diamond model variables that influence computer usage in Jordan: English language, femininity versus masculinity, access to technology, and identifying with software. Focusing on these could improve computer usage and help international software developers to better understand users in Jordan. We thus need to find concrete ways to communicate the impact of cultural variables.

The key questions for this chapter are thus:

1) How can we best cover the Jordanian instances of cultural variables?
2) How can we best express the Jordanian instances of cultural variables?
3) How can we author representations to answer Questions 1 and 2?

We could just use the Diamond model "as is", as presented in Appendix H. While this clearly covers all Jordanian instances, and needs no further authoring, it may not best express Jordanian cultural variables in a way that provides good support for developers.

We thus need to complement the Diamond Model with alternative representations. There are at least three possible options:

1. Develop *Cultural Personas* from the Diamond Model.
2. Develop *Cultural Contextual Models* from the Diamond Model.
3. Develop *Cultural Scenarios* from the Diamond Model.

The above are the best well known HCI methods for expressing aspects of usage contexts to developers. We will now consider each of these options in turn as complementary representations to the Diamond Model.

The Diamond Model could be hard for designers to understand sometimes, especially for understanding specific Jordanian examples of usage experiences and outcomes. The structure of the Diamond Model is a potential distraction too. We do not want to waste designers' time and effort through wondering if groups' variables and instances are in the right place, or whether further sub groups and sub subgroups are needed!

The structure of the Diamond Model evolved from Chapter 2 to Chapter 6 by restructuring and extension. In Chapter 2, cultural variables in the HCI and general cultural literature were identified and organised into an initial structure. By Chapter 6, this had been simplified (five rather than six segments, some variables regrouped and merged), as well as being extended by cultural variables and instances that were identified in the field studies of Chapters 4 to 6. The current version could change with further reviews of new literature and further field studies, but any restructuring is likely to be limited. Even so, the current model is a pragmatic achievement. It is not meant to be a taxonomy, and has not been optimised to streamline current and future use.

The aim throughout has been to provide a structure against which Jordanian instances of cultural differences can be classified, with expansions as and when necessary.

Working directly with the current Diamond Model could be a distraction for designers as they try to understand its structure, and perhaps critique it, when no claims are made for it as an optimal taxonomy. For efficient and effective use, it may be better to *complement* the Diamond Model with alternative representations.

Our last research question for this thesis is thus how can we complement the Diamond model (with Jordanian instances) of cultural variables to improve designers' understanding of it? In the next section, we discuss three possible options for complementing the Diamond Model.

7.2 Develop Cultural Personas from the Diamond Model

Personas are based on interviews with real people that include behaviour patterns, goals, skills, attitudes, and environments. A few fictional personal details to bring the persona to life, also it may be possible to express cultural differences through personas (Goodwin 2005).

To bring personas to life, we should know how each persona is unique and what they like and dislike, and their needs, goals and desires. Personas help designers by expressing a real vision of users, and their values. We should minimize the number of personas required to explain key goals and behaviour preferences. Each persona should have three or four important goals that help to focus a design.

Pruitt and Adlin (2006) introduce six process steps for conception and gestation of personas. There are three conception steps:

1. Identify important categories of users. Identify the important users to the business and product domain. This identification will help to structure data processing and build a bridge between the ways

people think of users today and the data driven personas that are created.

2. Process the raw data to extract information relevant to users and product domains and then identify themes and relationships.
3. Identify and create skeletons. Evaluate the processed data to verify the categories of users and identify subcategories of users.

There are three gestation steps

4. Prioritize the skeletons. Once there is a set of skeletons, it is time to get feedback from all stakeholders. The importance of each skeleton for business and product strategy is evaluated, and the skeletons are prioritized.
5. Develop selected skeletons into personas. Enrich the selected skeletons to create personas by adding data, concrete and individualized details, and some storytelling elements to give them personality and context.
6. Validate personas. Once details are added, it is important to double check to make sure that final personas still reflect the data.

There are three main aspects to designing personas: users' goals, users' roles and users' segments. The users' goals are based on the communications between the designer and stakeholders. The users' roles are company specific, e.g., job title, typical activities, and important atypical activities. (Pruitt and Adlin 2006) The users' segments can be characterised by elements such as market size and influence, international considerations, and accessibility considerations.

7.2.1 Complementing the Diamond Model with Personas

From the above, six process steps for conception and gestation of personas (Pruitt and Adlin 2006) must be followed to create cultural personas.

For the first step: Identify important categories of users, in Chapters 4 to 6 we interviewed most computer users and IT managers in Jordan from different backgrounds: student (university, college, and school students), employee (IT experts), business users, and unemployed users (housewife and retired people). We could create separate personas for each, but these would hide the cultural similarities across the user groups.

The second stage is process the raw data to extract information relevant to users and product domains and then identify themes and relationships. The data available from Chapters 4 to 6 are instances of cultural variables, and none of these are associated with specific software, computer devices or by Jordanian user categories. While some of this information could be recovered this would add distracting detail that could hide cultural factors. In most cases, there are no specific product details. Therefore it's hard to find relationships between users and product to draw on in our data for the second step of persona conception.

For the third stage, Identify and create skeletons, we again lack the details and specificity in our data to define subcategories of users or to associate specific goals with specific user (sub) categories .

Our case studies do not directly support all three steps of persona conception. We could base user's segments on our three different sectors; education, banking, and telecommunications. However, we have few specific users' goals, since we did not identify these with specific stakeholders. Users' roles are specific to their work or home contexts, and revealed through their typical activities, but in our case we did not focus on specific roles of users because our research was mostly focused on broad undifferentiated groups of Jordanian students and employees, not on specific user roles, which makes it hard to base personas on users' roles. However, it may be possible to focus on employment segments alone as a basis for cultural personas, which communicate what is common to demographic groups rather than to specific work roles. However, it is not clear that this would be a good structure for

cultural personas, as cultural similarities across groups would be obscured by the separate personas.

Our aim in considering cultural personas is to find a way to complement the Diamond Model to make it easier to access and to understand specific Jordanian instances of cultural variables. However, creating good general cultural personas is not straightforward, and may not be possible given the nature of our data for Jordanian instances. It is thus better to consider other options before committing to facing the challenges associated with creating good cultural personas, since we cannot work directly from the Diamond Model here, but would have to revisit our data to recover missing elements required for persona conception and gestation. The aim for this chapter is to complement the Diamond Model, not to replace it.

Personas were developed and have evolved for use in specific project contexts, where users, stakeholders and activities can all be clearly identified. To succeed as complements to the Diamond Model, cultural personas would have to be more general and could not rely on project specific details. It is not clear how generic skeletons could be developed for cultural personas, which while possible, may not improve on direct understandings that would follow from consulting the Diamond Model in its existing format.

7.3 Developing Cultural Contextual Models from the Diamond Model

> Contextual design is a customer-centred process. It supports finding out how people work, so the optimal redesign of work practice can be discovered (Beyer and Holtzblatt 1998).

We could try to communicate cultural differences with contextual design, which provides a complete structure for the front end of design. Project teams have used it very effectively, incorporating additional techniques and processes as the need arises. Also contextual design keeps designers focused on the data and leads the team through the process of discovering

design implications for developing, redesigning and structuring system, which will at the end help the designer to find out cultural differences between users.

Beyer and Holtzblatt (1998) developed five types of work models for contextual design:

1. The Flow Model
2. The Sequence Model
3. The Artefact Model
4. The Cultural Model
5. The Physical Model

As with cultural personas, we will consider whether these models can be used to better express cultural variables as a complement to the Diamond model. Again the aim is to make the Jordanian instances in a Diamond Model easier to access and understand for designers and developers, and to avoid distraction by a pragmatic structure that could be mistaken for an optimised taxonomy, which it is not. Instead the Diamond Model is a practical structure that continuously evolved as an organizing device for a initial literature survey and then a structuring device for the findings from a series of field studies.

7.3.1 The Flow Model

Flow models divide up responsibilities among roles that coordinate with each other while doing work. The key issue in the Flow Model is how people's roles are defined and how they communicate to get the work done.

All the work in Flow Model involves other people to some extent. For example, when writing book for an audience, the text is based on sources submitted to reviewers and passed to publishers. In this model, one person alone cannot get the work done and the work must be broken into parts, then it must be coordinated. The flow model represents this communication and coordination necessary to get work done.

The work flow defines how work is broken up across people and how people coordinate to ensure that the whole job gets done.

Coordination: any artefact received or handed on indicates coordination with someone else. Also it includes any discussion with someone else, through a phone call, email, or by dropping in personally also indicates coordination.

Roles: what makes a role coherent is shown in the tasks that people do. These require similar knowledge, tools, procedures, or data. For example, if we need to know the history of problem and prior attempts to fix it in order to serve the customer well, then if problem calls are handed out to the first available person, regardless of history, service will be poor.

Applying the Flow Model to our Diamond Model in Jordan

The flow model offers a view of the organization, shows its people and their responsibilities, the communication paths between people independent of time, and the things communicated (either tangible artefacts or intangible coordination). Flow models represent roles as ovals, annotated with their position and responsibilities. Flow is indicated as arrows between ovals, with the kind of communication written on the line. Artefacts are shown in boxes on the arrows; informal communication and actions are written without a box.

As with cultural personas, our instance data has limited of specific roles, because instead allows generalisation across a wide range of computer users at. Also, a flow model may be hard to understand for because of the complexity of a model (ovals connected with each other by arrows). As such, it may not be a good complement to the Diamond Model.

7.3.2 The Sequence Model

Sequence models communicate the actions people that take in doing their work, revealing their strategy, their intent, and what matters to them. A system that builds on sequence models can improve the work that is supports. Understanding the real intent is the key to improving work practice.

The goal is to change the work steps to make work more efficient, but the system must support all the intents concealed in the work, not just the primary espoused intents. This contract with persona's three of four important goals to focus a design.

A sequence model represents the steps by which work is done, the triggers that kick off a set of steps, and the intents that are being accomplished. Sequence models supply the low level step by step information on how work is actually done that designers need to make detailed design decisions. The sequence model starts with the overall intent of the sequence and the trigger that initiates it. Then it lists each step in order, at whatever level of detail the interviewer collected. Sequence models do not attempt to show pattern or repetition (Beyer and Holtzblatt 1998).

One way to collect sequence model data is to interview by watching people work or by getting a detailed retrospective account of their work. But the hardest thing about seeing sequences is know what pay attention to and this changes depending on the project focus.

It would be hard to use full sequence models because we did not watch people work or collect any detailed retrospective account of their work, so we don't have appropriate data. Our instances of cultural variables apply to many Jordanian computer users across tasks, so is it hard to provide specific details of people's work. As with personas, contextual models were developed to support specific design projects, and are not well suited to expressing cultural generalities. What we do have from our field data are not full work sequences, but 'snapshots' from people's computer usage. These can be thought of as 'flashbacks' that capture short memories of a particular episode. This may provide a basis for complementing our Diamond Model, i.e., as sequences that are incomplete, tying flashbacks together into a narrative.

7.3.3 The Artefact Model

Artefacts are the tangible things people create or use to help them get their work done. When people use artefacts, they build their way of working right into them. Artefacts show what people think about when they work. Artefact models expose the assumptions, concepts, strategy, and structure that guide the people who work with it. Artefacts could be 'to do' lists forms, documents, spreadsheets, or physical objects under construction. All artefacts have structure; the structure reveals how the work is organized. The artefact's content is the information, specific to the work, which the artefact carries. The content tells a story of a part of the work how the content was put in, how it was used and who use it. (Beyer and Holtzblatt 1998)

In our case it is hard to use Artefact Model to the Diamond model, because it was not possible to see what people do, such as the student assignment. We do not have full enough evidence to form such models, due to our reliance on recall and reporting in interviews and diary studies.

7.3.4 The Cultural Model

Cultural Models express expectations, desire, policies, values, and the whole approach that people take to their work (Beyer and Holtzblatt 1998). Issues of cultural context are hard to see, because they are not concrete and they are not technical. Beyer and Holtzblatt (1998) state that culture is invisible, but can be assumed from things that can be seen or heard such as tone, policies, and organizational influence. They thus overlook the existence of objective culture which is covered separately by the other four contextual models. Organisational cultural thus determines what makes a work support system valuable: "A valuable system helps people be who they want to be" (p.111), "a valuable system makes conforming to policy easy"; "A valuable system reduces friction and irritation in the workplace".

Giver their focus on subjective culture, Beyer and Holtzblatt (1998) describe Cultural Models as 'tangible representations for intangible forces'. A cultural

model represents influences, people, organizations, and group. Figure 7.1 shows a cultural model.

Figures 7.1 represents influences as arrows piercing the circles and arrow labels to represent the type of influence. Cultural models do not map to organization charts. They show only how power is experienced by people, rather than the formal power of the organization.

Cultural Models can be built directly from Jordanian instances in the Diamond Model, but would be more complicated and harder to read for the designer and developer than the Diamond Model itself. It would lose structure by flattening out the Diamond Model into a complex set of overlapping circles, which would not be easier to take in completely. The existing content could be randomly spread across the model, making it hard to recognize specific instances. There would be no separation and classification as in the Diamond Model, which would make the Diamond model more easy to use than a single Contextual Design Culture model. Of course, we could prepare several separate cultural models for segments or variable groups, but this would lose the light path interactions within the Diamond Model, and add little complementary value.

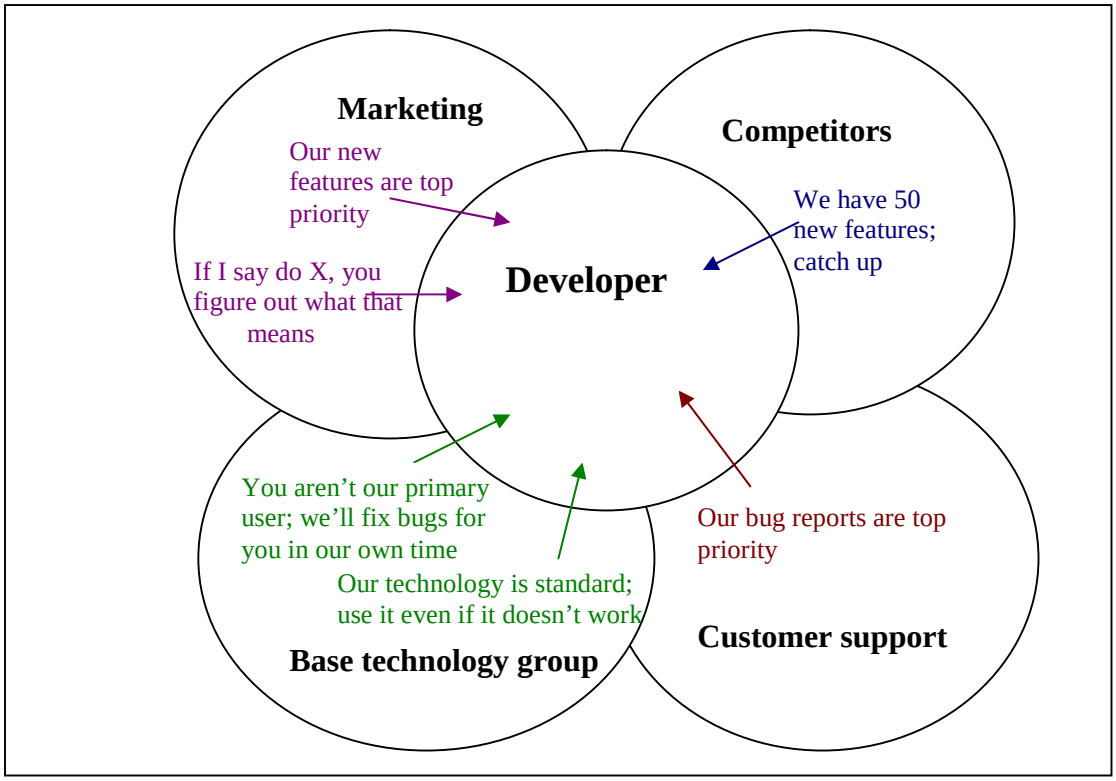

Figure 7.1 Cultural Models in a product development organization (Beyer and Holtzblatt 1998); page 113.

7.3.5 The Physical Model

Work happens in a physical environment that either supports or enables it. Products and systems must live within the constraints of physical environments. Ignoring those constraints creates problems for its users. We need to study the users' workplace to ensure that the system takes the physical environment into account. The physical environment constrains what people can do, but within those constraints people do have some control over their environment. Structuring the workplace will help people, and restructuring their workplace to support doing work in the way they prefer. The physical environment includes the world people live such rooms, cars, and buildings. Also how each of these spaces is laid out so that it supports work; and how they use these spaces in the process of working (Beyer and Holtzblatt 1998) see Appendix E.

The physical models are best suited to specific projects, where the organization or restructuring of a specific workplace must be considered. However, our field work did not focus on a specific workplace, but instead investigated cultural variables that could apply across Jordanian computer usage. Hence a plan or sketch of idealised workplaces would be far less informative to designers rather than the actual photos that were taken for chapter six.

7.3.6 Summary: Contextual Design and the Diamond Model

In trying to translate from Diamond Model data to contextual design models we appear to either lose information or do not have the information that we need. However, sequence models have some promise, although we do not have the appropriate data for complete sequences. This needs to be remembered when considering scenarios.

7.4 Scenarios, Vignettes or Something Else?

Reflection on the suitability of sequence models from Contextual Design indicates that we may have appropriate data for some short form of scenarios as a way to communicate the Diamond Model to designers and developers.

Scenario based methods describe people using technology, and are seen as essential in discussing and analyzing how a technology is or could reshape human activities. (Rosson and Carrol 2002). A user interaction scenarios is a story about people and their activates. A simple example of scenario given by Rosson and Carrol (2002 is):

> "An accountant wishes to open a folder displayed on his screen in order to open and read a memo. However, the folder is covered by a budget spreadsheet that he also needs to see while reading the memo. The spreadsheet is so large that it nearly fills the display. The accountant pauses for several seconds, then resizes the spreadsheet, moves it partially out

> of the display, opens the folder, opens the memo, resizes and repositions the memo, and continues working".

Rosson and Carrol (2002) identify seven main characteristic elements of creating scenarios:

Setting: situational details that motivate or explain goals, actions, and reactions of the actor(s).

Actors: human(s) interacting with the computer or other setting elements; personal characteristics relevant to scenario.

Task goals: effect on the situation that motivates actions carried out by actor(s).

Plans: mental activity directed at converting a goal into behaviour.

Evaluation: mental activity directed at interpreting features of the situation.
Actions: observable behaviour.

Events: external actions or reactions produced by the computer or other features of the setting; some of these may be hidden to the actor(s) but important to scenario.

The Jordanian instances in the Diamond model data don't cover all of these scenario characteristic elements. Some could be recovered from the interview data, but this again would not complement the Diamond Model, but would replace it. For the first element "setting" our data has few specific details of work, motivations or the goals. There was a limitation on the information given by the participants because they could not remember the entire story with full detail including actions and reactions. The participants mention what they remember about a situation and what happened, which means the "setting"

elements will be incomplete. Similarly, we know who the actors are only some of the time, but not others (e.g., Chapter 4 indirect sample via IT experts).

Also, in our data, many user and expert recollections don't have "task goals" to give information as to why the actor carried out actions and how he/she did it. The same applies to plans and actions. Only some events are included in recalled data, but we have some evidence of how users evaluated the situations that they recalled.

It seems that most scenario elements are not well supported in our Jordanian instances, but we do have some instances of what is needed. This suggests that some form of scenario, may be possible but with different categories and elements that could fit our available data.

The question is thus what form of scenarios is a good fit to the available Jordanian instances, given that a complete narrative of actors, settings, task goals, plans, actions, events and evaluations is not available for any of our instances. At their most abstract, scenarios are *use stories* that are real or imagined experiences of people; what they do and what they want. Scenarios may be abstract or concrete stories about usage.

Abstract scenarios contain minimal detail, but are still focused on usage, and are used for generating ideas and developing an understanding of the domain. These are not suitable for communicating cultural differences, as they are focused on design generation, rather than on understanding how a design and its use would be received in a specific culture.

Concrete scenarios are useful for prototyping and walking through design ideas, and for preparing use cases as the formal specifications required by software developers (Benyon and Macaulary 2002). Figure 7.2 shows as example of detailed scenario by Cockton (2009) for a hypothetical van hire web site. It can be used to assess the suitability of our Jordanian instances for

generating concrete scenarios to communicate the Diamond Model to software developers in the future.

The first step of building such a concrete scenario is to provide a context for a usage story especially the people involved, for example their names, ages, or jobs. We could use our Jordanian instances for something similar to the first paragraph in Figure 7.2. With the scene set, we would then need to complete the scenarios by adding details on how problems could arise or be avoided.

1. Sally saw a classified advert in the Carlisle paper and agreed to buy a chaise longue after visiting the owner to have a look and check its measurements (206x107x84cm,). She and her husband Harry now need to go and pay for and collect it, so they visit www.lovelyvan.com, the web site of a national van hire franchise. They have seen a press campaign for the company, and friends in London have used it and recommended it.
2. Sally lets Harry drive their PC. He finds a prices and availability link, but Sally asks him to check depot locations. There's no point in checking on prices and availability if the nearest depot isn't close enough. There's a clear area on the home page for finding your nearest depot. Harry types in their post code. A map appears in the large blank space below showing nearby depot locations with an information list below. Sally points to the nearest depot on the ring road. Harry clicks on it. The map changes to a local one for the depot, with address and phone details, and driving directions.
3. "Cool!" exclaims Harry (there's a cute animation as the map and info change). Another animated transition places a circle of vans in the blank area to the left. Next to each van there's an example load and below that, there's the van's load space dimensions. Sally immediately spots the van with a settee next to it. "That should do" she says. "Hang on," says Harry "Let's check the small print. OK, load space dimensions 240 long by 170 wide by 140cm high. Something 206 x 107 x 84cm will fit in easily, and there'll be enough room down one side to manoeuvre it from inside the van. So, we want a medium panel van".
4. Harry clicks on an obvious red "Book Me" button over the right edge of the van photo (no fancy animations this time). The other vans disappear and a calendar appears in between the medium panel van and the depot details. It clearly indicates that there are medium panel vans available for the coming weekend. Below the calendar is a clear informative statement on hire periods, prices and depot opening times. Vans can be hired for up to 24 hours, or for short four hour hires. The local depot is open from 8AM to 8PM over the weekend. Harry notices a 'hire planner' button below the information and moves the mouse to click it. "Hang on" says Sally, let's see how much it is first." "I can see," says Harry "it will be £44 for four hours". "The chaise longue was only £100" said Sally "that hardly seems worth it". "A new one's over £500," said Harry "and you said it was as good as new. I can take some things to the recycling centre on my way back". "In four hours?" asked Sally. "Maybe not, let's see" said Harry and he clicks on a chunky 'hire planner' button. A simple spin box appears with 2 in it, labelled 'Number of drops/pick ups'. Harry clicks this up to 3: "let's see, there, here, recycling, yes, that's 3". He clicks on OK and text boxes pop up one by one to the right of the spin box. At either end is the depot's post code in a non-editable text box, with the OK button moved to the right as well, but disabled. "That's smart" says Harry "I just need to fill in the seller and recycling centre post codes and ours". He sees a link to UK post code look up, clicks on it. A web-site opens in a new window and Harry gets the two post codes that he needs.
5. Harry types in each post code into a blank text box, and presses the OK button once it is enabled. Three more spin boxes appear below the post code ones labelled 'time needed at each drop off/pick up' with default editable times of 20 minutes in each. There's an OK button at the end again, and Harry presses it: "If we're quick, 20 at each will be enough". A summary of the route comes up 'From the van depot to … From … to your location. From your location to … to the 12van depot. It's all clearly laid out, with a time estimate for each leg for the date and time, and a total time based on these legs and the time at each drop off/pick up. Below this is a very obvious clear statement that while lovelyvan have done their best they can to be accurate, they cannot guarantee time estimates. Sally is really impressed "that's so helpful" she cries out. The total estimated time is three hours. "That's enough leeway for us" says Harry "especially if we have everything clear for getting the chaise longue in and the recycling stuff is stacked up ready to go". Harry selects a date and a time period, and navigates to the booking details and payment page, where Sally helps him with credit card and checking all details, which she does quickly as the details are so complete and thorough, and laid out in a format that makes them easy to check. Harry saves and prints the booking confirmation page.
6. Within minutes Harry has an email from lovelyvan. It's a well laid out html message with a link to an on-line pdf as an alternative layout. Harry follows the link to the pdf out of curiosity. "That looks very smart" says Sally. The document contains details of the hire, the depot and directions to it, the documents that drivers need to bring, instructions on what to do at the depot, time estimates for these activities, and a map with the route between drop offs. There's legal information at the end, but this is clear and well set out, and written in a reassuringly straightforward tone. Harry prints the pdf off, staples it, and pins it to the cork board near the PC. The print out even looks good when pinned up.
7. "I'm really looking forward to getting the chaise longue now" said Sally. "I'll be glad to get the stuff to the recycling too" said Harry "really easy".

Figure 7.2 Worth Delivery Scenario for Good Plan UX, by Cockton (2009) page 21.

For a scenario similar in detail and structure to the rest of the example in Figure 2 (Steps 2 to 7), we could try to go through and find similar data on which to base a cultural scenario, but the limitation of our instance data would not support such a lengthy usage focused scenario.

Scenarios extend over at least a moderate period of time, although not a specific period (typically minutes, but possible hours for abstract scenarios). However, our Jordanian instances of cultural variables in the Diamond Model are based on 'snapshots' or 'flashbacks', giving us a limited basis from which to narrate the problems of users over a realistic time period. Thus we cannot use our data to create concrete usage focused scenarios as usually understood and used in HCI. We do not have coherent related examples to cover Rosson's and Carrol (2002) seven main characteristic elements, nor enough related examples to sustain description of a detailed concrete scenario.

However, we could try to use shorter stores. For example, Blythe and Wright (2006) have developed pastiche scenarios based on "Vignettes" that focus on a short time and specific problem. These may provide the complement to the Diamond Model that we are seeking (This while personas and Contextual Models are best suited to expressing usage contexts for specific design projects, and thus general cultural differences cannot be readily expressed well enough using these approaches, the shorter format of *vignettes* may be an appropriate complement to the Diamond Model,

Vignettes are short descriptive literary sketch, also defined as a brief incident or scene (Merriam-Webster 2008). Vignettes will give us an impression of the *people* (computer users), *work* (what they use the computer for), and the *place* (place of work). To complement the Diamond Model, we could focus on computer users in Jordan at the current time, and communicate the most common problems according to their own usage evaluations and explanations, how they react to difficulties, and how can we relate differences to Western user experiences to cultural variables.

A vignette is a scenario that focuses on a short period of time, people, places and things in specific moment, which offers a good match to the snapshots and flashbacks from our field research, letting us tell short stories from our interviews and studies in Jordan. However, there may also be opportunities to make some use of aspects of personas or contextual models. This would be difficult wholly within a detailed usage focused narrative format, but a creative use of other text genres may let us add elements from all three major HCI approaches to expressing usage contexts.

An example of pastiche scenario done by Blythe (2004), the pastiche scenario was: *Maureen, are you tied up at the moment?* This is based on character's from Laurie Taylor's column in the British *Times Higher Education* Supplement.

Not at all, Professor Dingbat, I was simply idling away a few minutes putting Dr Quintock's Cultural Studies slides on line for the first years, sending out a reminder that no one has yet paid their ten pounds towards the examiners dinner and trying to revive Professor Lapping's rubber plant.

Jolly good Maureen, you know about this Net Neighbours scheme don't you? The one where you can do a bit of online shopping on behalf of an older person?

Yes, that's the one. I thought at first it wouldn't take very long but they've given me three to look after and some of them blather on for an absolute age. You wouldn't believe what I have to listen to, their neighbour kids this and their bilious distress that. You've no idea how annoying it is -people blithering away about their problems while you're trying to get things done!

I think I can just about imagine it.

Well anyway, I've got this cheque through the post from one of my old dears - "Old dears", Professor Dingbat? Dr Quitntock's slides state very clearly that the term "old dears" is sexist, ageist and offensive.

Ah, of course, where would we be without Dr Quintock's unfailing guidance. Quite right Maureen, well one of my elderly ladies

Dr Quintock's slides go on to note that the term "elderly" is also contested. Age is a social as well as a biological construct.

Well what am I supposed to call them? Chronologically challenged? Ha ha ha!

Professor Dingbat! That's just the kind of reactionary humour that has made "politically correct" a term of abuse. Dr Quintock says that "older people" is the phrase currently used by those of us who aren't quite so keen on being offensive.

Well it's a good thing that Dr Quintock isn't here then isn't it? Now listen carefully, one of my coffin dodgers has sent me a cheque to cover the shopping I ordered for her. Make yourself useful and run along to the bank with it sometime this week will you, I haven't got time myself. Oh and here's a list of the ones who haven't paid yet, ring them up and remind them when you've got a spare moment or two.

Blythe (2004) uses pastiche scenarios to exploit well known characters in fictional settings as in the example above to communicate details of, and evaluations of, a proposed Net Neighbours system. However, to pastiche scenarios for different culture such as Jordan we would have to draw on some popular fictional settings from films, television, magazines or books. However, it will be hard for non-Jordanians unfamiliar with the fictional source to understand the main characters in the stories and what the cultural meanings associated with each character. Pastiche scenarios are thus not suitable

because they depend too much on cultural familiarity. However, the vignette form used may be suitable once stripped of its pastiche elements.

Therefore we can explore new techniques based on the vignette form of pastiche scenarios, which can combine recollections of several separate real world interactions for our Jordanian instances, but do not depend on familiarity with any elements of the represented culture.

The starting point is the dramatic elements of vignette scenarios. Dramatic genres combine casts, scene setting, stage directions and dialogue to place the dialogue in a descriptive context. We could thus use *dramatic sketches* as a modification of vignette scenarios incorporating elements of personas, and contextual models in one scene setting. The basic idea is to borrow, when convenient and relevant, aspects of personas and contextual models, and express these as part of 'setting the scene' before a short dialogue (as in Blythe's (2004) *pastiche scenarios*), which can be closely related to snapshots and flashbacks reported by respondents in our field studies. The flexible use of scene setting lets us avoid fixing on specific skeletons for personas, or specific aspects of a contextual design model, and it also provides the information that is provided indirectly from the pastiche elements of pastiche scenarios, i.e., the reliance on familiar characters and settings. In dramatic sketches, these are made explicit.

7.4.1 Dramatic Sketches of Jordanian Computer Usage

The computer has become a part of the Jordanian life, but still not as much as in Western countries. The most common usages of computer in Jordan are at work, for study and for social and entertainment purposes. These will form the focus for the dramatic sketches illustrated below. Other relevant contextual factors are also now briefly summarised.

Most Jordanians using the computer at work tend not to take as much individual responsibility as Western users when they face a computer problem. They don't try to solve the problem by themselves, but ask for specialist support most of the time, perhaps even when they could solve the

problem themselves, because they are afraid to cause any damage and be held responsible. Also relations between employees and management involve considerable power distance, thus employees may be afraid of managers if they don't finish their work on time and are penalized. This may also reduce employees' confidence in trying to solve problems on their own.

Lacking experience of using computers will affect users' feeling of self-efficacy and will increase the problems that face the users in Jordan. In most of our field studies, we found that experience is important in improving the strength of users when using the computer, therefore when the skills and knowledge of users increases the problems that face the users will decrease, although not at the same rate as someone who is using well designed software in their first language. Both constant reliance on help from others and difficulties with English will reduce the potential of experience to develop over time into strong IT skills.

Social life in Jordan impacts computer usage directly or indirectly. Users still need more time to accept technology and deal with it, for example, most users in Jordan don't trust online websites for buying and selling, especially Arabic or local websites. Users in Jordan trust and prefer to use Western technology most of time, because it' is more secure and better developed. Most Jordanian users prefer the English version of the software rather than Arabic one, because they think it will be easier for them, have fewer problems and will improve their English.

Having 'set the scene' above in general terms for Jordan, we now present examples of Dramatic Sketches. Each sets its own focused scene and follows on with an imaginary dialogue. The latter may be exaggerated for effect in order to emphasise Jordanian instances of relevant cultural variables, and may be interrupted by further scene setting. Dramatic sketches are intended to complement, and not replace the Diamond Model. Therefore each sketch ends with direct references to specific instances of cultural

variables in the Diamond Model, and may also comment further on the role of these variables in the dialogue.

Dramatic Sketch 1: Ahmad and Dr. Lila

Ahmad is an IT expert who works at AL Zaytoonah University of Jordan, Ahmad is a specialist in IT support who help students and employees' at the university to solve computer problems, such as technical problems, software problems, hardware problems, and network problems. Ahmad is 29 years old and has worked at the university for 6 years, so he has good experience in solving the computer problems that face the users in the university. Ahmad works every week day from Sunday to Thursday, from 9:00 am to 5:00 pm. He works at the computer centre (computer service for students and employees). One day, Ahmad is sitting at his desk working on his computer, programming some database tables for the registration department of the university, while he was seating in his office his phone rang, and he answered. A member of staff working at the nursing school needs help to solve her problem.

Ahmad asks Dr. Lila: what is the problem in your computer?

Dr. Lila says: this morning I try to turn on my computer but it doesn't work.
Ahmad: did you turn the power on?

Dr. Lila: yes I did, and it's still not working.

Ahmad: then give me half an hour, I have some work to do after I finish it I will come to your office to solve the problem.

After 45 minutes Ahmad arrives late at Dr. Lila's office.

Ahmad says: sorry I am late (10 minutes) I had problem in some programs on my computer and it took time to solve.

Dr. Lila: no problem, could you please check what is the problem in my computer.

Ahmad: sure, that's why I am here, let me see you computer please.

Then Ahmad looks at the computer and checks that the computer is connected to the electricity and it was connected. After that, he press the power button and the computer works, but still nothing appears on the screen, then Ahmad looks at the screen but the power light on the screen is not lighting. Ahmad presses the power button on the screen, then it's turned on and works.

Ahmad says: the screen was not turned on therefore you can't see anything appear on the screen. You thought that the computer was broken and does not work, and the only problem is that the computer screen was not turned on.

Dr. Lila says: really, I am so sorry I didn't know because my computer knowledge is so poor.

From the first Dramatic Sketch: *Ahmad and Dr. Lila,* we can refer to a *cast* of Jordanian instances of Diamond Model variables (attitude to time, individualism, power distance, and personal experience/knowledge). For example, we draw attention to Jordanian attitudes to time keeping in the dramatic sketch above. Note that the weekend is different in Islamic countries and that power distance is high in Jordan. This is the basis for authoring a dramatic sketch, i.e., the author reviews the Diamond Model for a coherent set of instances that could form the basis for a short story. This 'cast' of instances are then assembled into a dramatic sketch, filling in some details fictionally if necessary. Ideally, it should be possible to form the scene setting and dialogue wholly from instances for a specific culture.

Dramatic sketches are authored by researchers who are familiar with the cultural model and instances on which they are based. This familiarity, often

extending to knowledge of the original field research, allows a researcher to select instances that support scene setting and dialogue generation. They are in a form that complements the Diamond Model with a lively communication of Jordanian experiences of, and attitudes towards, computers.

Dramatic sketch authoring could start by listening to recorded interviews as a basis for selecting a cast of instances, based on the skeletons of usage and evaluation stories recalled during the interviews. These can then be connected into dialogues between people. Each dramatic sketch has a cast of instances that can cover a good range of cultural variables in the Diamond Model. Each time we write dramatic sketches, we should look for the skeleton of a story to guide us through this. Beyond this, we don't have any specific method for authoring dramatic sketches. There is no expectation that software developers would be given a Diamond Model with national instances and be expected to author dramatic sketches themselves, although they may be able to extend a set of dramatic sketches provided to them by reference to the instances of a Diamond Model's cultural variables. However, an initial set of sketches would be written by researchers familiar with the field research and the resulting instances of cultural variables.

Dramatic Sketch 2: Amjad and Tariq

Computers should help to accelerate work and make it easer, but not all cultures want to be speeded up. In Jordan, employees may enjoy the rest that can accompany a computer breakdown. When their computer stops working, they don't feel any responsibility to solve the problem or even call the IT support until they've benefited from a rest. In a second Dramatic Sketch, *Amjad and Tariq,* the 'cast' is formed from of Jordanian instances for cultural variables of attitude to time, individualism vs. collectivism, power distance, and attitudes to work. These are used to set a scene and form a dialogue.

Amjad is 30 years old and has worked in IT support a mobile company, (The Global for Mobile Phone Services) for more than 10 years. Amjad works at the company all weekdays (Sunday to Thursday) from 8:00am to 5:00pm. He

works in the programming department and also in IT support, helping employees to solve technical problems with their computers. There are another 5 IT support workers in the same department.

Amjad faces lots of technical problems during his work because most work at his company depends on computers such as connecting the mobile phones to the computer to update data and for programming mobile phones for customers.

Tariq works in the data-entry department and most of his work depends on computers. One day, Tariq's computer breaks down and by default Tariq should call the IT support to fix his computer and solve the problem, but this does not happen, and Tariq stays in his office sitting in his chair and relaxing. He didn't tell any one immediately about his computer. At the same time, Tariq is supposed to have some work at the computer to submit to his manager today. While Tariq is sitting in his office, the phone rings, Tariq's manager is calling him to ask about the paper that Tariq should submit today.

Manager: when will it be finished?
Tariq says: I am sorry I can't finish it today, because my computer has broken down and I can't continue my work now, I will wait until the computer is fixed and then I will continue my work.
Manager: OK, I will wait until your computer is fixed and then I need the papers.

After the manger finished his call with Tariq, he calls IT support to check to ask if fixing the computer will take much more time, because Tariq had lots of work to do today. Amjad answers the phone.

Manager: Hi, your department received today a computer from Tariq to fix, and I need you to fix the computer as soon as possible please because he has lots of work to do today.

Amjad: one minute please I will check with my colleagues.

Amjad; sorry, but we haven't received Tariq's computer and also he did not call us today to ask for any help.

Manager: Ok, thank you I will check that with Tariq.

After that, Amjad called Tariq immediately and asked him if his computer has broken down or not.

Amjad: Hello Tariq, did you have any problem in your computer or not?

Tariq: Yes, my computer has been broken from more than 4 hours.

Amjad: Then why you don't call us to fix your computer today?

Tariq: In fact, I don't want to call the IT support centre to fix my computer now.

Amjad: Why?
Tariq: I came in today and I found my computer broken and I don't want to call you to fix the problem, because I had lots of work to do today, and I need to have a rest and relax. Therefore when I saw the computer was broken, I decided not to call IT support to fix it. I will call them later to fix it, and during this time I will take break from the work.

Amjad: But I knew from your manger that you have work to submit today.

Tariq: Yes that's right, but I prefer to have a rest from the work and tell my manager that my computer broke down and we need time to fix it. And you know Amjad that any problems with a computer will take time to solve and my manger will accept that.

Dramatic Sketch 3: Anas and his teacher

The third Dramatic Sketch: *Anas and his teacher* communicate how the English language could be useful to learn in Jordan. The cast of instances is formed from the following Diamond Model variables: English fluency and the role of the educational systems; attitudes towards Western Technology; familiarity with English spelling; Government Language Policy; text direction (language and semiotics); and authority and policy of companies. A wide and diverse cast of cultural variables is combined for a single dramatic sketch that covers a range of factors that will affect the usage of computer, e.g., forcing use of English software rather than Arabic. Also, Government policies are different to private sectors ones, where users should use Arabic software but in the private sector, Jordanian companies use English software. There is difference between private and public sector practices: most private companies using English software to communicate with the world. But in the government sectors, they are using Arabic software because it will be simpler for the users (the public people in Jordan) who don't speak or write English therefore they use Arabic software.

Anas is a student at Jordan University, who studies computer science. Anas uses his computer at home for studying, playing, graphic design and for internet use. Anas and his friends are in the same school, studying most subjects in English and using English software. One day, one of Anas' teachers asks students whether they prefer English software or software translated from English to Arabic.

Anas answers the question: Truly, I use some Arabic programs translated from English to Arabic and I face lots of problem, therefore I decide to use the English versions.

Teacher: Why Anas? And what are the problems that you face?

Anas: Some Arabic programs translates the word directly without anyone thinking about what it really means. Therefore it causes some changes in the meaning and sometimes causes confusion for us.

Teacher: what else Anas?

Anas: Also, when I use English software I develop my English language by reading and learning some new words. Typing and reading will be in English, therefore I will learn more and get more experience with the English language. The teacher: That's true but sometimes we need to use Arabic programs, especially in the government and education sectors, because most of them use Arabic software.

Anas: Yes, but on the other hand there are private companies who prefer their employees to speak and write English fluently, and also have skills in using English software.

Dramatic Sketch 4: Nasser and Jamal.

Patterns of thinking and values, access to, and Experience with, Technology, and affordability of internet access form the case of variables for a fourth Dramatic Sketch.

Nasser, 30 years old, has worked at bank in Jordan for more than 8 years, Nasser is using the computer all the time, at work or out of work.
Nasser uses the internet most of time for chatting and sending email for his friends or family inside or outside Jordan.

Nasser says: Most of time I am busy in the official holidays with my family and relatives and I don't find enough time to visit my friends therefore, I use the internet to send an electronic card by email to my friends at work and out of work.
One day he faced a weird situation, as Nasser himself told us:

It was special event (Eaid EL-ADHA) and I though about sending an electronic card to all my friends before one day of the Eaid because during the Eaid day I don't have enough time to use the computer and send e-card or even visit my friends.

Therefore, I sent the e-card for more than 6 friends and all my friends received it.

After that, when Nasser return to his work, he saw his friend at work Jamal (38 years old) who was one of Nasser's friends who was sent an e-card at the Eaid. Jamal look angry at Nasser, and he said: I don't accept your greetings of the Eaid this year.

Nasser: Why Jamal, if there is something wrong? I sent to you and all my friends an e-card.

Jamal: And do you think that is greeting, it just an electronic card that is available on the internet.

Nasser: You don't like the e-card?

Jamal: No, the problem not in the e-card. The problem is the idea itself, and the principle of this idea.

Nasser: What principle?

Jamal: The traditions on this special day is to visit each other, sit and talk or even talk through the phone, not just send an e-card. Also I don't have an expensive internet connection in my home and I don't check my email all the Eaid's days therefore I just saw the e-card yesterday.

Nasser: But I though that the e-card was a good substitute for a visit.

Jamal: No, that's not acceptable for me in our society; we must visit each other or at least talk by phone.

Nasser: I am sorry Jamal, next time I will visit you and not just send e-card.

Jamal: I prefer that, thank you.

7.4.2 Micro Sketches of Jordanian Computer Usage

In four dramatic sketches, we have covered a good range of relevant cultural variables from our Diamond model through detailed Jordanian instances; whish supports the argument that a broader set of dramatic sketches could cover most common cultural variables and their Jordanian instances. Some remaining variables could be efficiently communicated via *micro sketches*, which may involve no or little scene setting and a very short dialogue (or even monologue or a single response from an interview). Generally, it is best to have some scene setting and not expect a short quote to speak for itself. Also, while micro sketches need not simply correspond to quotes from field data, there is no point in adding to or revising quotations that clearly communicate Jordanian instances of cultural variables.

Micro Sketch 1

Where there is no dependency on using the computer for most work, users will not be frustrated when facing problems and don't care about usage problems very much. Here, the micro-sketch is just a quote from an interview:

*"Most of my work doesn't depend on computer and if the computer stops working, I have other work to do until IT support fix my compute*r".

Inefficiencies in Jordanian workplaces are often related to the social or economic situation, including the income of employees, that makes them less motivated about their work. Also we found issues that are rarer in western

countries such as Nepotism in employment, which causes overstaffing at work that increase the number of employees and delays work by passing it between different people.
The cultural variables that affecting the computer usage from this micro sketch are attitude to work and family obligation and relationships.

Micro Sketch 2
The social life of woman in Jordan affects the usage of computers. Woman goes back home after work to prepare food and take care of children and don't have enough time to use computer at home. A female employee says: "*After I finish my work I go home to do some works such as cooking, cleaning, take care of her child, visiting family or friend*".

In the Diamond model, the gender roles impact usage of computers, letting men use computers more than women, which could affect computer skills by increasing the experience of the men when compared to women.
The main cultural variables that affecting the usage in this micro sketch are gender roles, and family obligation and relationships.

Micro Sketch 3
As a final example 'micro sketch', differences in age between teachers and learners impact the usage of computer in Jordan. Older people reject learning from younger people, which could cause trouble for a company to convince them to learn from experts who are younger than them. One IT support expert said: "*Sometimes older people at work don't accept people younger than them teaching them how to use computers*".
In this micro sketch the main cultural variables that affecting the usage are patterns of thinking and values, and age differences.

7.4.3 Coverage of Jordanian Instances for the Diamond Model
The above sketches cover many cultural variables: attitude to time variable, individualism vs. collectivism variable, power distance variable, and personal experience/knowledge variable covered through the first Dramatic Sketch.

The second Dramatic Sketch covered: Attitude to time variable, individualism vs. collectivism variable, power distance variable, and attitudes to work variable.

English fluency and the role of the educational systems variable, Familiarity with English spelling across cultures variable, government language policy variable, text direction, and authority and policy of the companies' were the variables covered through the third Dramatic Sketch.

The fourth Dramatic Sketch covered the following variables: patterns of thinking and values, access to, and Experience with, Technology and affordability of internet access.

The first micro sketch covered attitude to work and family obligation and relationships. The second micro sketch covered the gender roles, and family obligation and relationships. The third micro sketch covered patterns of thinking and values, and age differences.
The overall variables and Jordanian instances that covered through Dramatic and micro sketches are:

1. Attitude to Time
2. Individualism vs. Collectivism
3. Power Distance
4. Personal Experience/Knowledge
5. Attitudes to Work
6. English Fluency
7. Role of the Educational Systems
8. Familiarity with English Spelling Across Cultures
9. Government Language Policy
10. Text Direction
11. Authority and Policy of the Companies'
12. Patterns Of Thinking And Values

13. Access to, and Experience with, Technology
14. Affordability of Internet Access
15. Family Obligation and Relationships
16. Gender Roles
17. Age Differences

The cultural variables and Jordanian instances that not been covered through Dramatic and micro Sketches are:

1. Nonverbal communication
2. Context
3. Information flow
4. Colour
5. The Arts
6. Buildings, houses and monuments
7. Crafts
8. Foods
9. Literature arts and media
10. Time of day, dates and numbers
11. Long-term versus short-term orientation
12. Attitude to the environment
13. Uncertainty avoidance
14. Concepts of times and space
15. Business etiquette
16. Neutral or emotional
17. Structure and achievement versus Ascription
18. Software and Identify
19. Femininity versus Masculinity
20. Political contexts.
21. Government Support for IT Training.
22. IT Education in Schools
23. IT Training Centres in Communities
24. Trade Sanctions

25. Affordability of IT Access
26. Affordability of Computers
27. Affordability of Training
28. Availability of International Products and Services
29. Cost of equipment

The four Dramatic Sketches and three micro Sketches cover 17 of the Diamond Model 46 variables which is over 1/3, but some of these variables are unlikely to apply in all HCI settings, such as material culture variables where there is no strong relation between these variables and computer usage. So, although it may be possible, using a similar range of cast sizes to the examples above, to cover all 46 identified cultural variables using 11 dramatic and 8 micro sketches, fewer should be required to cover the Jordanian instances identified in this research. The expectation is that such a set of dramatic and 8 micro sketches would be more understandable and memorable than a Diamond Model with Jordanian instances.

7.5 Conclusion

We created Dramatic Sketches for a specific Diamond Model that should complement it to make it easier to understand and use, but still it's a suggestion and not have been tested yet with actual software designers. However, what has been successfully demonstrated is the ability to select a cast of instances and to use these as a basis to author the scene setting and dialogues of dramatic sketches.

Dramatic Sketches are only a representational approach, not a structured method. They are based on a cast of cultural variables, but sketch authors' choice of these variables depends on their familiarity with the instances in a Diamond Model, and also their familiarity with the originating field work.

Our full version of the Diamond Model can thus guide authoring of dramatic sketches through the instances that provide a range of cast elements for scene setting and dialogue generation.

Although currently untested, dramatic and micro sketches do appear to be a good complement to the Diamond Model because they can refer to specific moments of time and place that we encountered in snapshots and flashbacks, simultaneously giving an accessible impression of people, their work and their work place. They are not concrete usage scenarios, but, like the interviews that they are based on, they are mainly dialogues about recalled usage experiences, combining memories of specific actions and events with evaluation and discussion of one or more specific usage experiences. While related to scenarios via the vignette form of pastiche scenarios, they are a novel and distinct form, especially compared to the most common form of scenario, the concrete usage scenario that tells the detailed story of a complete interaction.

Hopefully, collections of dramatic and micro sketches can help designers and support them in understanding users from cultures different to their own such as Jordan. Dramatic and micro sketches can hopefully provide designers with information on the main usages of computer in Jordan and the problems that users face, and how these arise in relation to cultural variables, and how these problems could impact usage.

Dramatic and micro sketches should reduce the time spent on familiarisation with Jordanian or other cultures. However, evaluating the effectiveness of these novel communication formats is a research task for the future. The aim for this chapter has been to review alternative complements to the Diamond Model, and the result is a creative synthesis of existing HCI approaches to expressing usage contexts. This lets the somewhat dry Diamond Model from Chapter six be re-expressed in a more readable and accessible form, without the distraction of its complex evolving structure and the false impression of a finished taxonomy.

Dramatic sketches overcome problems for Diamond Model communication associated with more project-oriented representations such as Personas, which need to be based on interviews with real people that include project-

specific behaviour patterns, goals, skills, attitudes, and environment, with a few fictional personal details added to bring the persona to life. The skeletons required for personas add unnecessary complexity and cannot be readily related to the forms of data that underlie the Diamond Model, e.g., we lack the specific goals for users that are critical in designing personas. Such representations have proven value in specific development contexts, but the needs of complementary representations to the Diamond Model are different. The issues here solely concern the suitability of established HCI representations for a novel specialised task of complementing cultural models with good representations for communicating with software designers.

Dramatic sketches are more appropriate for the specific needs explored in this chapter than Personas and Contextual Models, and are simpler and more straightforward than these and also concrete usage scenarios. They should be able to cover most, if not all, of the Jordanian instances for the Diamond Model from our studies.

7.6 Limitations of Communicating the Diamond Model

Through our studies in Jordan we reach the final stage of the research reported in this thesis by creating dramatic sketches. Dramatic sketches were created after reviewing personas, contextual design, and alternative forms of scenarios. We tried to apply these three approaches to our Diamond Model and instances of Jordan, but were unsuccessful for many reasons which have been reported in detail. These all relate to the nature of the data available as instances of cultural variables.

Dramatic sketches have been successfully applied to a broad range of ‘casts’ of cultural variables. This is the main basis for the claims of success in this chapter, which are restricted to the completion of first step in developing complementary representations to the Diamond Model. At this stage, we can offer limited advice on the practice of authoring dramatic sketches beyond our own experiences. We hope that there is a basis here for a more robust design method based on a novel scenario. The main limitation of this chapter is that

dramatic sketches as a complement to the Diamond Model have not been tested with software developers. This is discussed as part of further work in the final chapter of this thesis.

Chapter Eight

Conclusions and Future Work

8.1 Introduction

There are three main research questions had been raised in this thesis, the first question is 1) Where do we see more impact from cultural differences: in design acceptability? or in users' reactions to and evaluations of usage difficulties, and their explanations of these.

From this thesis, we can answer that users' evaluation of their interaction and not just design acceptability, is impacted by cultural variables. As far as the instances of cultural variables encountered in our three studies are concerned, most instances relate outcomes of usage difficulties and not breaches of design preferences. The colours of icons etc. were rarely an issue, but reactions to usage difficulties were ability and willingness to respond effectively to usage difficulties has also see to be strongly influenced by cultural factors in Jordan.

We had already concluded from the literature survey that cultural differences in usage explanation and evaluation have been less studied in HCI than cultural differences on interface acceptability. Culture's influence on usage evaluation has not been studied in HCI as much as culture's influence on design preferences and usage. The key point is that how users *feel* about their interaction is as important as what they do when they interact. The question thus arose as to how we can improve the balance between usage evaluation and other usage and design factors in our understanding of the impact of culture within HCI.

We can improve the balance between usage and design by focusing more on user's evaluations in cultural HCI. To get a proper balance between design and usage, there should be more research on usage evaluation in cultural HCI and what makes usage different between two users from different cultures, especially how they evaluate and explain their interactions with computers.

The second question in this thesis was "which major cultural differences are relevant to the usage of interactive computer systems?"

Table 2.1 in chapter two covered the cultural variables that can impact both computer usage and design preferences. It showed the most common cultural variables that could impact usage of interactive computer systems, with these variables all covered in our Diamond Model. We concluded at the end of the literature survey that the range of cultural variables that could affect computer usage was more extensive than the cultural variables that could affect design preferences. In particular, these variables could impact how user's evaluated their interactions as well as how they behaved when faced with difficulties.

From our studies, we can conclude that the cultural variables that can strongly impact evaluation and explanation of computer usage for cultural HCI will be the following (in no particular order):

1. Software and Identify
2. Information flow
3. Patterns of thinking and values
4. Family obligation and relationships
5. Individualism versus collectivism
6. Femininity versus masculinity
7. Gender roles
8. Access to, and experience of, technology
9. Power distance and authority conception
10. Cost of equipment
11. Age differences
12. Government Support for IT Training
13. Trade Sanctions
14. Government Language Policy
15. Personal experience/knowledge
16. Attitudes towards Western Technology

There could well be further relevant variables that we have not yet identified, but the cultural variables listed above were the main ones in our studies that had an impact on evaluation and explanation of computer usage.

The second part of the second question for this research is “what are the common causes of usage difficulties and design acceptability in specific cultures?”

There are many causes of usage difficulties and design acceptability for users in specific cultures, many being cultural variables. For example in chapter four, when we investigated Jordanian usage problems in the education, telecommunication and banking sectors, we found the most difficulties were usage problems, software and equipment problems, and the impact of several political, social and economic issues. All these difficulties affected computer usage, with only some related to design preferences such as having particular colours in the user interface.

The third research question for is “how can we represent cultural differences between Jordan (and more generally, Arab countries) and Western Countries, with the aim of providing support and guidance for software developers?”

The main answer to this question is our new Diamond Model, which covers Hofstede’s (1980) five cultural dimensions and other variables that have not been studied in HCI before. Some variables will have instances specific to Jordan such as the Government Language Policy variable. Some will have similar instances in Jordan and other Arab/Islamic countries such as for the family obligation and relationships variable. Others may have common instances in Arab and some western countries (e.g., Greece) such as the individualism versus collectivism variable.

The main aim of our Diamond Model is to support designers and software developers in the future to understand the difference between users from different cultures and how cultural variables can affect users’ evaluations of both designs and their usage.

The structuring of the Diamond Model make these variables and the Jordanian instances relatively simple to access within a broad group of variables for cultural HCI. Dramatic sketches will hopefully make these instances easier to understand for designers.

8.2 What do Jordanian Computer Users and Organisations Need?

There are different types of users in Jordan and we can not generalize all of them into an identical user stereotype, but we can conclude form this thesis that there are common needs between users in Jordan from different backgrounds (education, communication, banking, IT experts).

Users in Jordan continue to have different needs that have steadily reduced in western countries such as the US and UK, but were more apparent in the 1980s and 1990s when computers started to spread through the workplace and then homes.

Some common problems face both users in Jordan and users in western country, but on the other hand there are difficulties that face users in Jordan that the western users have not faced before.

- Some user needs in Jordan include better support from English software, which does not use their first language. Many seek to develop their English language; also some company policies force employees to use English software rather than an Arabic version.
- At the same time, some users in Jordan suggested the use of Arabic tool tips in the software to help them translate the word from English to Arabic. For example see Figure 8.1 below.

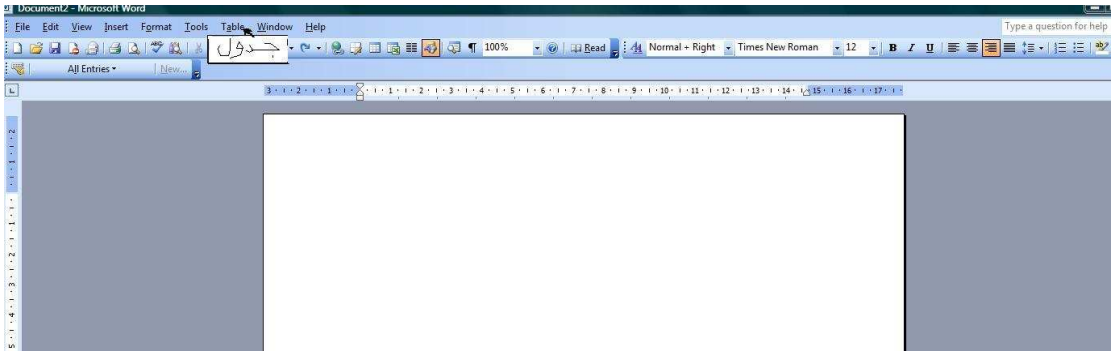

Figure 8.1 Suggested Arabic tool tips in Microsoft word

- Some users in Jordan would like special emoticons to express their special Jordanian emotions when they chat with friends or family such as, for common phrases that only Jordanians say for example when they say “Hi” to each other. Greeting people properly is very important in Jordan. People like to have their own way to say and express their emotions when greeting others with special words that mean “Hi”, or just a symbol that means “Hi”. One example of a Jordanian specific emotion could be to have a famous Jordanian cartoon character (Abu Majoob) say “Hi” in Arabic language and Jordanian accent.
- Users need better support when translating from English to Arabic because sometimes localisation translates the word too directly from English, changing in the meaning of the word. The word can also be reversed. The way of writing in Arabic is from right to left; the opposite

direction to English; therefore sometimes the translation from English to Arabic will be reversed (word will be written from left to right) which change the word and it will be unknown for the reader. For example see Figures 8.2 and 8.3 below. In figure 8.2 the box on the right side should be in Arabic but the word have been reversed; the last sentence written on the small brown box was (ان ع م ب ع ل ا) and it should be written in Arabic as (العب معنا), which means in English (play with us).

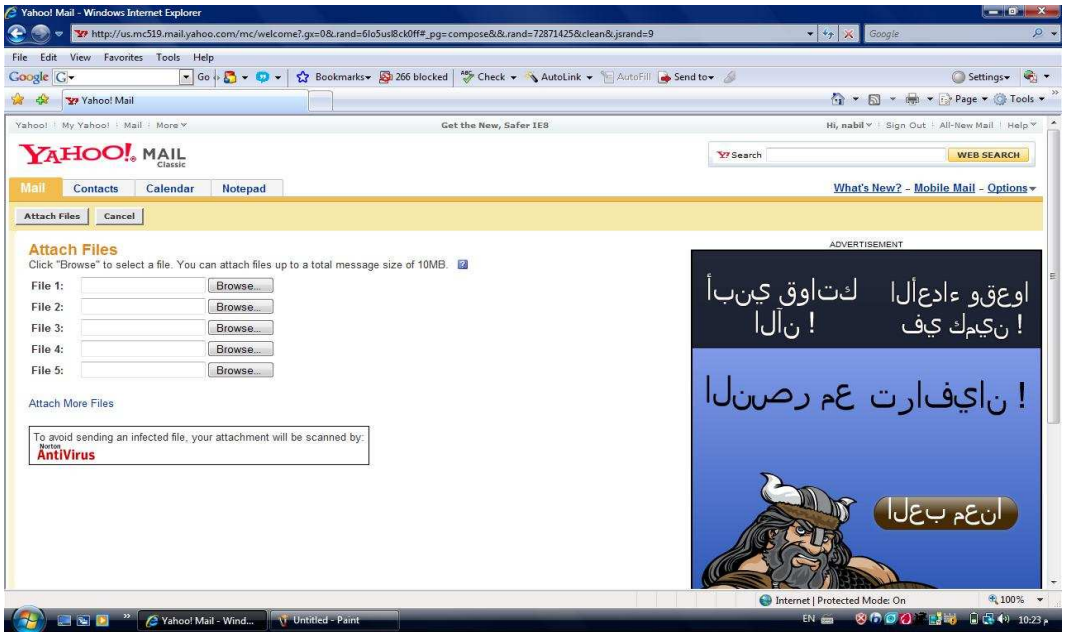

Figure 8.2: example of reversed Arabic word.

Figure 8.3: example of Google translator that translates the sentence from English to Arabic in wrong way.

- Keyboards with both Arabic and English alphabets causes some problems for users because sometimes users forget to press the 'change from Arabic to English' button therefore users get confused when they realise that the keyboard has not changed from Arabic to English or opposite.
- Help messages in some localised Arabic software are not as supportive as they should be, because some help messages will be in Arabic, but not with full details as the English ones: only part of the help tools may be translated, not all messages. Or in some Arabic versions of software, all the interface will be in Arabic but the help messages will stay in English, which is not helpful for users with weak English. Generally, Jordanian users need more contexts in help messages.
- To make the help messages easier for the users, *Diagrammatic Help* could be better than text help messages, because it could show the solution of a problem step by step by showing pictures or sketches of how to solve a problem, reducing or even avoiding language problems.
- High bandwidth internet connection are still high cost for regular users in Jordan, which makes them use low bandwidth connections, therefore it would be much better if web designers minimize uses of pictures and large colour images in websites to make the website open quicker and faster than one fully loaded with pictures.

Another idea from our research that was not suggested during interviews was the idea is having software record what users have done with their personal computer applications, which could make it easier for IT support to understand the causes of problems and fix them. This would have to be for just tracing how problems have happened and not to spy on users, giving IT support the ability to understand problems without looking at any personal file and documents. Ideally these usage logs could be used collaboratively with users to help them to develop their IT skills.

8.3 Employers and Government Responsibilities

Not all usage difficulties can be overcome by software design. Employers and governments have a role to play in reducing the difficulties that Jordanian users face with computers (even if these difficulties rarely annoy them relative to Western users). Desirable interventions here include:

- Educating users to teach them how to use new technologies, and what to do when they face problems.
- Training is the key issue for effective usage. Once users are trained, they should face fewer problems, and users will have more experience, which will support their work and knowledge.
- IT support should be available for users when they need any help, such as having a call centre or help desks in any company or establishment using computers.
- Free courses for teaching the principles of computer skills, and how to deal with computers, and with award of a certificate of computer skills.
- Viruses are a common problem for computer users all over the world, and in Jordan they are also a big problem because they affect users' trust when computer hackers enter their computers, or when a virus damages a user's computer. Therefore, the developer and designer should focus on how to protect the computer from the viruses.
- Restricting users' authority, to limit their ability to 'damage' their computer.
- Simplifying the web user interface, especially for government websites, because users will be from different education levels, work sectors, and computer experience.

Employee users can be limited in solving computer problems because users are afraid to cause any 'damage' to the computer while they solve it, as the employee will be responsible for any 'damage' caused when they solve the problem.

8.4 Using the Diamond Model

The final research challenge was “how can we best cover the Jordanian instances of cultural variables from the Diamond model?”

In chapter seven, we reviewed three approaches: cultural personas; cultural contextual design; and cultural scenarios and tried to apply these three approaches to our case in Jordan. We found that we cannot adequately communicate a Diamond Model with Jordanian variables through these three approaches for the reasons mentioned in chapter seven. As none of these were appropriate; we developed *Dramatic Sketches* a novel format for scenarios. Several Dramatic Sketches combined with their short form of ‘micro scenarios’ can cover most usage Jordanian instances of cultural variables relevant to design, usage and users’ evaluations of both. Each Dramatic Sketch has an accompanying list of direct references to specific instances of cultural variables in the Diamond Model.

Dramatic sketches complement the Diamond Model without replacing or ignoring it Hopefully, Dramatic sketches should help designers, developers, employers, governments and other organisations to understand Jordanian instances of cultural variables through easy and quick presentation of multiple instances. This will help designers to understand the Jordanian users and their needs.

8.5 Contributions of Thesis

The thesis shows the balance of cultural influences on design and usage of computers, and what makes each acceptable to Jordanian users. The focus on how users evaluate their usage is novel, and has not previously been researched in cultural HCI.

This thesis shows how both design and usages, and also how users evaluate each, are all subject to cultural influences. We conclude from this thesis that there are many strong relations between culture and HCI which extend beyond design acceptability, design adaptation and appropriation in use.

Successful designs tat meet users' needs, and to do designers and/or developers need to study and understand users' cultures. In this thesis we have developed a new Diamond Model that covers most cultural variables that have been identified in the HCI and general literature. New variables and Jordanian instances were added through a series of field studies. A novel representation, Dramatic Sketches can communicate to cultural variables in simple way to designers, complementing the Diamond Model with narrative presentations of Jordanian instances and variables.

Dramatic sketches should help designers and developers to understand the Jordanian user before starting the design, which could help them to cut the time and cost in the future, and help them to explore the designing options that support culturally appropriate design and use.

8.6 Limitation of Thesis

From this thesis, the conclusion is that there is a strong relation between culture and users' evaluations of both design and usage, therefore the relation need to be further studied in the future. The literature review and field studies in this thesis are not exhaustive, so cultural variables and Jordanian instances relevant to HCI will have been overlooked.

In chapter five the field study sample size of the triangulation interviews was small; this limits confidence in the ability to generalize the results.

In this thesis there are some limitations of testing the Diamond Model and accompanying Dramatic Sketches with designers and developers, who have not been able to comment on it. The only test of the Diamond Model has been carried out by the author; the author tested the Diamond Model through the thesis studies, finding new variables and instances to build up to the final Diamond Model in Chapter 7. The Diamond Model and accompanying Dramatic Sketches has not been used by real designers and developers. There are thus no examples of how their use could improve designs and usage in specific cultures.

Also there are some limitations by testing the Dramatic Sketches. Dramatic Sketches need to be tested by software developers to find how Dramatic sketches could improve their understanding of Jordanian users' needs according to their culture. The potential advantage of using Dramatic sketches to understand the users within specific moment and short scenario according to cultural differences have not yet been demonstrated.

8.7 Future Work

This research took place in developing country, where there are currently limitations on technology and computer usage. This may change over time, and needs to be monitored. Also, in the future, technology will change and new technologies will be added to simplify the interface, new problems that face the users could appear which show new variables that affecting the usage and design. Therefore, in the future the Diamond Model needs to be updated to add these new variables or groups.

The Jordanian instances of cultural variables will change across the current generations; therefore new instances could be added through the time. Culture's effect in HCI will not be stop or decrease, but could change, but the relation between culture and HCI will remain important in the future.

The Diamond Model should be extensible for any territorial culture (e.g., countries such as Jordan) and it could be updated in the future to add new variables and instances. Although the Dramatic sketches in this thesis are written for Jordanian computer users only, they could be authored for (revised) Diamond Models with different cultural instances. Further research is needed to test the applicability of the Diamond Model across a range of territorial cultures.

Since this research began in 2004, HCI research in developing countries (HCI4D, ICT4D) has greatly expanded. The Diamond Model has not been checked against this rapidly expanding literature. This could result in the

addition of major segments, for example for geographical factors (e.g., size of country, obstacles to transport and human movement), or for technological factors (e.g., quality of country's technological infrastructure).

Also, the influence and effectiveness of Dramatic sketches not evaluated in this thesis and need to be evaluating in the future and further evaluation of dramatic sketches with software designers is thus required. Dramatic Sketches are a technique, not a method; our understandings of best practice in using them need to develop through studies of their use, through which we can evaluate this technique.

8.8 Conclusions: the Relationship between Culture and HCI

There are strong relation between culture and HCI, which affects both computer design and usage, and how both are evaluated by users. The impact on each of these varies according to culture differences.

There is a relation between cultural variables and computer design and usage. Some of cultural variables have strong impact and some have weak impact on. Culture does affect design such as preferences for interface layout, colour, font, etc. Also culture, impacts the usage of computers such as, how they are used, how users evaluate their interactions, and their motivations for dealing with usage difficulties.

Therefore, designers and developers need to study users' culture before designing. Designers who can connect between design, usage and culture greatly improve the chances of successful design.

.

References

About Economics. (2005). Political Science. [Internet]. Available from :< http://economics.about.com/od/economicsglossary/g/political.htm>. [9 July 2005]

Balanced scorecard institute. Basic Tools for Process Improvement: Affinity Diagram. Available from :<www.balancedscorecard.org/Portals/0/PDF/affinity.pdf>. [25 January 2008]

Barber, W. and Badre, A. (1998). "Culturability: The Merging of Culture and Usability". Proceedings of the 4th Conference on Human Factors and the Web.

Barnouw, V. (1973). Culture and personality. Homewood, IL: Dorsey Press.

Benyon, D. and Macaulary, C. (2002). Scenarios and the HCI-SE design problem. Interacting with Computers. Elsevier, 14, 397-405.

Beyer, H. & Holtzblatt, K. (1998). Contextual design: Defining customer-centered systems. San Francisco, CA: Morgan Kaufmann Publishers.

Blythe, M. (2004). Pastiche scenarios**.** ACM, 11/5, 51-53. USA.

Blythe and Wright (2006). Pastiche scenarios: Fiction as a resource for user centred design. Interacting with Computers. Elsevier, 18/5, 1139-1164.

Bødker, S. (2006). "When Second Wave HCI meets Third Wave Challenges". *NordiCHI 2006*, pp. 14-18.

Bohannan, P. (1969). Social anthropology. London: Holt, Rinehart & Winston.

Bourges-Waldegg. M and Scrivener. S. (1998). Meaning, the central issue in cross-cultural HCI design. Interacting with computers. 9: 287-309.

Brenda Barros. (2004). Literature Reviews. [internet]. Available from :< http://www.uh.edu/writecen/faculty/BIOE1197/APAStyle.pdf>. [27 June 2005]

Carroll, J. (2002). Human-Computer Interaction in the New Millennium. India: Pearson Education Asia.

Central Intelligence Agency (CIA). (2008) The World Factbook: Jordan. Available from: < https://www.cia.gov/library/publications/the-world-factbook/geos/jo.html>. [10 March 2008].

Cha. H, Oshlyansky. L and Cairns. P. (2005). Mobile phone preferences and values: the U.K. vs. Korea. International Workshops on Internationalisation of products and Systems 2005, Amsterdam.

Chetty, M., and Grinter, R. (2007). HCI4D: HCI Challenges In The Global South. CHI 2007: USA.

Choi, B., Lee, I., Kim, J. & Jeon, Y. (2005). A Qualitative cross-national study of cultural influences on mobile data service design. CHI 2005, ACM, 661-670.

Chuang Tzu. (2005). Long-Term Short-Term Orientation. Available from:< http://www.skagitwatershed.org/~donclark/leader/culture2.html>. [17th of February 2009].

Cockton, G (2004), "From Quality in Use to Value in the World", in *CHI 2004 Extended Abstracts*, ACM: New York, 1287-90.

Cockton, G. (2009). "When and Why Feelings and Impressions Matter in Interaction Design". Interfejs uŜytkownika – Kansei w praktyce. *Kansei page 21.* 2009.

Cohen. D and Crabtee. B. (2006). Qualitative research guideline project. [Internet]. Available from :< http://www.qualres.org/HomeSemi-3629.html>. [3 of February 2008] (Cohen and Crabtee, 2006)

Coombs, M and Alty, J. (1981). Computing Skills and the User Interface. London: academic press INC.

Cooper. A and Reimann. R. (2003). About face 2.0 the essential of interaction design. USA: Wiley.

De Angeli. A, Athavankar. U, Joshi. A, Coventry. L and Johnson. G. (2004). Introducing ATMs in India: a contextual inquiry. Interacting with computers. 16: 29-44.

Del Galdo, Elisa M. and Nielsen, Jackob. (1996). International User Interfaces. New York: John Wiley & Sons.

Dix. A, Finaly. J, Abowd. G and Beale. R. (2004) Human-Computer Interaction. England: Pearson education limited.

Donner, J. (2007). The Rules of Beeping: Exchanging Messages Via Intentional "Missed Calls" on Mobile Phones. Journal of Computer-Mediated Communication. VOLUME 13, 1:1-22.

Dormann. C. (2005). Cultural representations in web design: differences in emotions and values. Human computer interaction 2005: people and computers XIX- the bigger picture.

El Said. G, Hone. K and Ali. M. (2005). National Culture and on-line trust: a study of internet Egyptian users. IWIPS 2005, Amsterdam.

EL Said. G. (2005). *Cultural effect on electronic consumer behaviour*. Published PhD thesis. Brunel University.

Evers. V. and Day. D. (1997). The role of culture in interface acceptance. Human computer interaction; INTERACT 1997.

Falloon. G. (2004). *An analysis of the impact of an e-classroom environment on the social, cognitive and affective elements of student work practices.* Published PhD thesis, Curtin University of Technology.

Ford, G and Gelderblom, H. (2003). The Effects of Culture on Performance Achieved through the use of Human Computer Interaction. Proceedings of the 2003 annual research conference of the South African institute of computer scientists and information technologists on Enablement through technology (SAICSIT). ACM: 218-230.

Ford, G. (2005) *Researching the Effects of Culture on Usability.* Published Master of Science. University of South Africa.

Ford. G and Kotze, P. (2005). Designing usable interfaces with cultural dimensions. Human computer interaction-INTERACT 2005.

Gilbert, J. and Chandler, R. Culture-Specific Human Computer Interaction. [Internet]. Human computer interfaces. Available from :< >. [29 November 2004]. (Gilbert and Chandler)

Gobbin. R. (1998). The role of cultural fitness in user resistance to information technology tools. Interacting with computers. 9: 275-285

Goodwin. Kim. (2005). Perfecting Your Personas. User Interface Engineering.

Griffith. T. (1998). Cross-cultural and cognitive issues in the implementation of new technology: focus on group support systems and Bulgaria. Interacting with computers. 9: 431-447.

Guilford, R. R. (1959). Personality. New York: McGraw-Hill.

Hall. Edward and Hall. Mildred. (1990). Understanding Cultural Differences: German, French and Americans. International Press.

Hensley, Robert. (2003). Insider secrets for diamond shoppers. [Internet]. Available from :< http://www.diamondhelpers.com/ask/0024-cutfaceting.shtml>. [15 July 2005].

Hewett, Baecker, Card, Carey, Gasen, Mantei, Perlman, Strong and Verplank. (1996). ACM SIGCHI Curricula for Human Computer Interaction. [Internet]. ACM SIGCHI. Available from :< http://sigchi.org/cdg/cdg2.html#2_1> [17 April 2005].

Hofstede, G. (1980). Culture's Consequences International Differences in Work-Related Values. USA: Sage.

Hoft, Nancy. (1995). International Technical Communication. Canada: John Wiley & Sons.

Hölscher, U., Liu, L., Gruchmann, T., Pantiskas, C., and Wilcox, S. (2005). "Design of Medical Devices for International Market". IWIPS 2005, Amsterdam.

ISO13407. (1999). 13407. Available from: < http://www.processforusability.co.uk/Usability_test/html/13407.html>.

Jimmy Wales. (2005). Wikipedia: Masculinity vs Femininity. [internet]. Available from :< http://en.wikipedia.org/wiki/Masculinity_vs_femininity>. [18 July 2005].

Jordan's Competitiveness Report 2007, chapter four. (2007). Available from :< http://www.jnco.gov.jo/static/pdf/chapter4.pdf>. [21 of March 2008].

Jordan Government. (2004). Culture, education, science and information. The Jordanian national charter. Available from :< http:// www.kinghussein.gov.jo>. [3 December 2004].

Kamppuri, Bednarik, and Tukiainen. (2006). The Expanding Focus of HCI: Case Culture. NordiCHI 2006. Norway.

Kluckhohn, C. (1951). The study of culture. In D. Lerner & H.D. Lasswell (Eds.), the policy sciences. Stanford, CA: Stanford University Press.

Kroeber, A.L. & Parsons, T. (1958). The concepts of culture and of social system. American sociological review.

Kroeber, A.L., & Kluckhohn, C. (1952). Culture: A critical review of concepts and definitions. Harvard University Peabody Museum of American Archeology and Ethnology Papers 47.

Kuhnt. T. The influence of culture on usability. University of Berlin.

Landauer, Thomas. (1999). *The Trouble With Computers*. MIT Press.

Lazar, J., Jones, A., Hackley, M. and Shneiderman, B. (2006) Severity and impact of computer user frustration: A comparison of student and workplace users. Interacting with Computers. Elsevier, 18/2, 187-207.

Mandryk R. (2005). Evaluating Affective Computing Environments Using Physiological Measures. In Proceedings of Workshop on Innovative Approaches to Evaluating Affective Interfaces at CHI 2005, Portland, USA, 2005.

Marcus. A and Gould. E. (2000). Cultural dimensions and global web user interface design: what? So what? Now what. Aaron Marcus and Associates, Inc. Interactions, 7, 33–46.

Merriam-Webster. (2008). Vignettes. [Internet]. Available from :< http://www.merriam-webster.com/dictionary/vignettes>. [16th of October 2008]

Mifflin, Houghton. (2005). Company. Nonverbal communication. [Internet]. Available from :< http://www.answers.com/Nonverbal%20communication>. [19 June 2005]

Mifflin Company. Status. [Internet]. Available from :< http://www.answers.com/language&r=67>. [28 June 2005}

Mischitz. G. (2001). The History of Human Computer Interaction. Hyperwave. Available from :< http://www2.iicm.tugraz.at/cguetl/education/projects/mischitz/Seminar.htm >. [4th of March 2008].

Noah A., Michelle M., & Christina V. (2000). Elementary Students Define Economics. [Internet]. Available from :< http://www.govwentworth.k12.nh.us/goals2000-4WebSite/economics%20wing/eco/Economics_Definition.html>. [2 July 2005].

Ogden, C. K. and. Richards, I. A. (1923). A Study of the Influence of Language upon Thought and of the Science of Symbolism.

Onibere. E, Morgan. S, Busang. E and Mpoeleng, D. (2001). Human computer interface design issues for a multi cultural and multi-lingual English speaking country-Botswana. Interacting with computers. 13: 497-512.

Oshlyansky, L. (2007). *Cultural Models in HCI: Hofstede, Affordance and Technology Acceptance.* Published PhD thesis . Swansea University.

Oshlyansky, L., Cairns P., Thimbleby, H. (2006). A cautionary tale: Hofstede's VSM revisited. Proceedings of British Human Computer Interaction Conference 2006. London, 11 - 15.

Pakcomments. Pakistani Trucks: Marveling the Extrodinary Available from: <http://www.pakcomments.com/57/pakistani-trucks-marveling-the-extrodinary/>. [24 of March 2009].

Pruitt. J, Adlin. T (2006). The Persona Lifecycle: Keeping People in Mind Throughout Product Design. UK: Elsevier.

Qirem, Fouad. (2005). *First Year PhD Repor*t. University of Sunderland.

Qirem. F, Cockton. G, and Loutfi. M. (2007). Cultural Differences is Severity and Impact of User Frustration. IWIPS 2007, 9-18. Mexico.

Rdillman. (2005). Semiotics (HFCL tutorial). [Internet]. Available from :< http://www.rdillman.com/HFCL/GLOSS/hfclglossS.htm>. [18 July 2005].

Riva, O. (2004).A Conceptual Model for Structuring Context-Aware Applications. University of Helsinki. Available from: < http://www.cs.helsinki.fi/u/kraatika/Courses/Berkeley04/RivaPaper.pdf>. [6th of March 2008].

Rosson, M. and Carrol, J. (2002). Usability Engineering Scenario Based Development of Human Computer Interaction. USA: Morgan Kaufmann.

Rubin, H., and Rubin, I. (1995). Qualitative Interviewing: The art of hearing data. Sage publications. US.

Shen, Woolley, and Prior. (2006). Towards culture-centred design. Interacting with Computers. Elsevier, 18, 820-852.

Smith, A., Dunckley, L., French, T., Minocha, S. and Chang, Y. (2004). "A process model for developing usable cross-cultural websites". Interacting with Computers. Elsevier, 16, 63-91.

Smith. A and Yetim. F. (2004). Global Human Computer Systems: cultural determinates of usability special issue of Interacting with Computers. Whole issue 16 (1).

Statistics software. (2008). Pearson's Correlation Coefficient: this is one in a series of tutorials using examples from WINKS SDA. Available from :<http://www.texasoft.com/winkpear.html> [15 of March 2009].

Stewart and Milton J. Bennett. (1991). American cultural patterns: a cross-cultural perspective. USA.

Storm. G. (2005). Interaction design for countries with a traditional culture: A comparative study of income levels and cultural values. Human computer interaction 2005: people and computers XIX- the bigger picture.

The Arabic Network for Human Rights Information. (2004) The Internet in the Arab World a new Space of Repression? Jordan a Ray of Light. Available form: < http://www.hrinfo.net/en/reports/net2004/jordan.shtml>. [3 of March 2008]

The CIA World Fact Book 2003. Jordan People. All reference. Available from :< http:// www.ALLRefer.com>. [28 November 2004].

Triandis, H. (2002). Subjective culture: Online reading in psychology and culture. [Internet] Available from: < http://www.ac.wwu.edu/~culture/triandis1.htm> [10 of May 2008].

Triandis, H.C. (1972). The analysis of subjective culture. New York: John Wiley.

Trompenaars, Fons. (1993). Riding the Waves of Culture: Understanding Culture Diversity in Business. London Nicholas Brealey.

Usability Net. (2006). ISO 13407; Human centred design processes for interactive systems. Available form :< http://www.usabilitynet.org/tools/13407stds.htm>. [19 of March 2008]

Van Laar. D, Williams. T, Umbers. I and Smeaton. S. (1997). Colour coding of information layers in computer displays. Human computer interaction; INTERACT 1997.

Victor. David (1992). International business communication, Harper Collins, New York, 143.

Wikipedia. (2008) Jordan. Available from :< http://en.wikipedia.org/wiki/Jordan>. [10 March 2008].

Wikipedia. Human computer Interaction. Available from :< http://en.wikipedia.org/wiki/Human-computer_interaction>. [4th of March 2008].

Wikipedia. Vignettes (literatuer). Available from :< http://en.wikipedia.org/wiki/Vignette_%28literature%29>. [21st of May 2008].

Yasin. M. (1996). Entrepreneurial effectiveness and achievement in Arab culture: new evidence to rekindle interest in an old predictor. Journal of Business Research: Elsevier.

Yin Choong. Y and Salvendy. G. (1998). Design of icons for use by Chinese in mainland china. Interacting with computers. 9: 417-430.

Zakaria. N, Stanton. J and Sarkar-Barney. S. (2003). Culture, privacy and IT in the Middle East: Designing and implementing culturally-sensitive IT applications. The interaction of culture values and privacy issues in the Middle East. Information Technology and People. Emerald, 16, 1: 49-75.