# User Interface Guidelines for Tablet PC

# Arabic Educational Applications

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To my father

It hurts to think that you are not here anymore.

# Abstract

This research was motivated by a strong demand to improve user interfaces (UIs) for the Arabic language. Educational applications and tablet PCs were focused on, and the designers and developers of Arabic UIs were targeted.

We propose a systematic approach to develop comprehensive Arabic UI guidelines for tablet PC. The UI guidelines were developed through five main stages. In the first stage, the gap in existing knowledge was identified. In the second stage, designers and developers from Jordan identified issues in relation to UI design for Arabic-language applications. Key components for UI guidelines were also identified. In the third stage, the UI preferences and design principles were collected from Jordanian young people. In the fourth stage, initial guidelines for the Arabic UI were formulated, informed by the literature and the results of the previous stages. The guidelines were refined and verified with designers and developers from Jordan in the final stage.

The research work contributes a set of guidelines, a process for creating those guidelines, and a tool called the Arabic Visual Interface Design (AVID) that facilitates users to experiment with their UI preferences. We hope this research will inspire the Arabic UI practitioners and academic in this field.

Initial responses indicate that the guidelines will assist software companies to improve their productivity and to enhance their UIs for Arabic mobile and tablet PC applications in educational settings. It is hoped that this work will encourage Arabic UI designers to design more suitable educational applications in tablet PCs for Arabic users. It is also envisaged that the process of creating the guidelines and the AVID system will serve as a guide for others wishing to improve their UI designs for other applications and devices.

# List of Abbreviations

3-dimensional (3-D)

Task Analysing for Knowledge Description (TAKD)

Arabic Interface Visual Design preference system (AVID)

Auckland University of Technology (AUT)

Auckland University of Technology Ethics Committee (AUTEC)

Concurrent Think Aloud (CTA)

Eye-tracking (ET)

Goals, Operator, Methods, and Selection rules (GOMS)

Graphical user interface (GUI)

Human–Computer Interaction (HCI)

Information and Communications Technology (ICT)

Information System (IS)

Information Technology (IT)

Intelligent User Interfaces (IUIs)

International Organization for Standardization (ISO)

Mobile Learning (M-learning)

Personal Computer (PC)

Personal Data Assistants (PDAs)

Retrospective Think Aloud (RTA)

Short Message Service (SMS)

Situated co-Inquiry (ScI)

Statistical Package for the Social Sciences (SPSS)

Tablet learning (T-learning)

Thinking Aloud Protocol (TAP)

United Arab Emirates (UAE)

Usability Evaluation Method (UEM)

User Centered Design (UCD)

User Experience (UX)

User Interface (UI)

Windows, Icons, Menus and Pointer (WIMP)

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# Attestation of Authorship

"I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning."

Ahmed Al-Sadi

# Acknowledgment

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# Chapter One

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## INTRODUCTION

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This chapter introduces the research background, problem statement, personal motivation, and research questions of the thesis; discusses the significance of the research; and highlights the thesis contributions. Finally, it outlines the structure of the thesis.

This thesis aims to support Jordanian designers and developers of Arabic educational tablet PC applications by providing material that, if used, would hopefully improve the design of Arabic educational applications for tablet PCs by elucidating the preferences of Arabic users.

## 1.1  Introduction

Over the past decade, the use of mobile and tablet PC applications has risen more rapidly than the use of PC applications in some fields (Chaffey, 2017). Tablet PCs are becoming more popular than desktop PCs because they are portable, have good-sized screens, and are becoming more affordable.

However, when developing tablet applications, designers must ensure that their designs achieve user satisfaction, which is a challenging task (J. Kim & Ryu, 2014). A new UI design must consider the look and feel of the UI and the functions it can offer (Shneiderman, Plaisant, Cohen, Jacobs, & Elmqvist, 2017).

UI guidelines can potentially steer designers and developers towards positive decisions that improve their product designs (Szigeti, 2012). According to De Souza and Bevan (1990), providing direct references and guidance for designers during the design process is the most valuable role played by design guidelines. System designers can use UI guidelines to improve the usability, accessibility, and constancy of their interface (Antle & Wise, 2013).

A successful UI design guideline will systematically cover all design aspects (Kunert, 2009). Guidelines are a type of arranged information, a way of allocating research results and can serve as a prospective design aid. However, the generality of UI guidelines can be problematic for designers (S. L. Smith, 1986). Adapting the guidelines to a particular design problem also presents difficulties (Kunert, 2009). The advantages and disadvantages of various design-support tools, with particular focus on guidelines, will be discussed in section 2.4.

Various UI design guidelines have been developed over the years (Meister, 2000), but UI design guidelines have been limited to applications used in the western world (Corbitt, Thanasankit, & Haynes, 2002; Giordani et al., 2015; Hillier, 2003). The literature showed a relative lack of studies on the design problems facing Arabic, in particular the Jordanian, designers and developers of UIs for tablet PCs.

Indeed, designing an interface, even for a specific group, is a challenging task (Ramachandran, 2009). A practical set of UI design guidelines for a specific culture should assist designers to improve their interface designs, reduce the cost of the design, and to enhance user experiences (Brejcha, Yin, Li, & Liu, 2013; Shen, Woolley, & Prior, 2006; Sonderegger & Sauer, 2013), preferences (Arditi & Tian, 2013; Brown, Chinthammit, & Nixon, 2014), and familiarity (Salman, Cheng, & Patterson, 2012). Therefore, I assumed that by referring to a comprehensive set of Arabic UI design guidelines, Jordanian designers and developers could deliver a positive experience and allow Arabic users to effectively use the designed applications.

From previous experience within the academic field in Arabic countries, and considering the recent improvement of the educational system of Arabic countries where the e-

learning techniques was adopted in the existing systems (Sawsaa, Lu, & Meng, 2012), there is a need for research in the area of UI of Arabic educational systems. This thesis investigates the need for Arabic UI designers and developers to support the UI guidelines (font type, size, colour, alignment, menu, buttons, and religious symbols) of young Jordanian Arabic students using educational applications on tablet PCs.

The Arabic language is the sixth most- used language in the world (UNESCO, 2013) and is dominant in Muslim populations. It is also the language of Qur'an, the holy book of Islam. The Arabic language has unique characteristics such as direction and space-occupying vocalisation marks. Also, it is a bi-directional language in which text is presented and read from right to left, with numbers presenting from left to right and this aspect will be discussed further in chapter 2 section 2.2.2.

As PCs become increasingly embedded in the educational environment, ensuring the appropriateness of their UI designs to different learning contexts and devices is becoming essential. Ongoing efforts to promote the effective use of technology in education have raised the need for characterising the interactions between learners and devices from different design perspectives.

Motivated by the above considerations, in this thesis, I have worked to formulate guidelines for designing an Arabic interface in Jordanian. The guidelines are based on learners' preferences. The distinct demographic characteristics of each learner will influence their preferences (Hsieh & Shannon, 2005). Meanwhile, users' perceptual habits and behaviours depend not only on demographic factors but also on the language of the interface.

Arabic UI guidelines could be very useful tools for novice designer. Designers draft their design to test with end user in order to enhance the UI design. Using a UI guideline could help them to have the default UI before they tested.

An in-depth understanding of the research problem, namely, the lack of UI design guidelines for tablet PC educational applications with an Arabic interface, is developed in the next section.

## 1.2  Research Background

UI design guidelines are typically not aimed at specific groups and only provide general information (Beier & Vaughan, 2003), giving designers a broad set of understandings of users' interactions with the target interface (J. Johnson, 2013; Ratzer et al., 2014). When designing an application UI, the designer must establish a usable and consistent set of design principles and UI preferences associated with the expectations of the targeted groups (W. Park, Han, Kang, Park, & Chun, 2011).

The design of UI guidelines for a specific usage-context usually requires a wide variety of techniques to be developed. Several authors discussed methods of developing UI guidelines such as brainstorming by Gale (1996), literature review J. L. Campbell (1996) and systematic procedure Kim (2010).

In part, this need arises because UI design guidelines tend to promote visual and functional consistency between applications or within an application (Ji, Park, Lee, & Yun, 2006; Wasserman, 2010). Previous studies on similar design topics (e.g., (Lowdermilk, 2013; Page, 2014) have highlighted the need for creating such guidelines.

According to Smith and Marsh (2004), UI design guidelines are effective when optimised to reduce user disorientation while navigating by a certain group. Some design guidelines focus on the presentation and behaviour of the interface, while others address the performance characteristics of the interface during its use.

A literature review (detailed in chapter 2) revealed a notable lack of design guidelines targeting the UI preferences of Arabic users of tablet PCs. In part, this arise the need for creating Arabic design UI guidelines to promote and assist the designers and developers, the novice in particular, while designing an Arabic tablet PC application. This was previously highlighted by Shneiderman et al. (2017) who assured that UI guidelines could greatly assist designers in the initial designing stage.

Culturally aware UI design that combines both the personal values and habits of users may provide more easily interpretable design solutions (Pereira, Buchdid, &

Baranauskas, 2012). Various influential studies have been devoted to values and culture in design (Callahan, 2005; J. H. Kim & Lee, 2005; Nasruddin & Hussin, 2015; Wallace, Reid, Clinciu, & Kang, 2013).

Some studies have recommended considering inter- and intra-cultural age and gender differences in UI- guideline design (Czaja & Sharit, 1998; Marcus & Gould, 2000; Morris, Venkatesh, & Ackerman, 2005; Y. S. Wang, Wu, & Wang, 2009). For instance, information processing is known to differ between men and women. This difference affects various areas of information technology communications and the UI design as well. In their recent review of the current literature, Lin and Hsieh (2016) noted that gender-specific preferences are rarely considered in interface design. They acknowledged the need for interface design criteria that accommodate certain users of different genders in usability related tasks. Gender differences in processing information are important in particular types of tasks such as spatial visualisation, defined as the ability to understand, manipulate, and interpret visual or spatial representations (Kozhevnikov & Thornton, 2006).

The literature shows that gender differences are linked to an individual's ability to understand a presentation, which seems to influence overall navigation performance (Marcus, 2013; C.-M. Wang & Huang, 2015; N. Yu & Kong, 2016). In contrast, age differences appear to influence users' interactions with displays. Roy, Neumann, and Fels (2016) and Loureiro and Rodrigues (2014) noted a limited emphasis on design guidelines and design recommendations of interfaces for age-specific users. Although some research has addressed gender differences and UI design in different contexts, the role of demographic differences (age and gender) in shaping UI design guidelines for educational systems across users is almost totally neglected, particularly for Arabic users of tablet PCs.

## 1.3  Problem Statement

Informal discussions with two senior designers and one developer revealed a lack of support for UI design of tablet PCs for Arabic users. Therefore, this thesis will identify

Arabic student UI guidelines for tablet PC Arabic educational applications to create Arabic UI guidelines to support Jordanian designers, and investigates the usefulness of UI guidelines as a support tool.

As discussed above, UI design became increasingly complicated, as users demand high quality, ease of use, and a fully functional user interface for multiple platforms (Kadlec, 2007). UI designers need tools, principles and guidelines that support their current designing practices (Shneiderman et al., 2017).

The literature supports our initial investigation that no Arabic UI guidelines for tablet PCs are available for Arabic designers. Muhanna and Jaser (2014) concluded that Arabic UI guidelines had been neglected in previous works. Moreover, no studies have investigated the design and usability considerations of tablet PC UIs for Jordanian users, which must involve Jordanian designers and developers. Clearly, each individual is different in many ways from every other person, but gender and age are the plausible and identifiable difference.

To formulate Arabic UI guidelines for tablet PCs in an educational context, the UI preferences for tablet PCs were examined in two studies involving students in secondary schools and universities. A significant gender difference in students' preferences was highlighted. The initial UI guidelines formulated for designers were evaluated in a Delphi study. My own preference is to see this sort of material included in a preamble other than in the body of the thesis.

## 1.4 Personal Motivation

Tablet PC devices are changing the face of learning in the educational system (Al-Fahad, 2009). Therefore, many Arabic countries have adopted e-learning techniques to improve their educational services and to develop their existing systems (Sawsaa et al., 2012). This view is strengthened by the researcher's personal experience as a teacher and lecturer within Arabic educational organisations (schools and universities), where information and communications technology (ICT) has been enthusiastically accepted. Many of these

universities and institutes embrace the latest technology to help students and teachers achieve their learning goals (Sawsaa et al., 2012).

As an academic and member of the wider Arabic world, I hope to see technology work for people, particularly students and teachers. Learning is very important to my family, my community and myself. I envisage that modern devices can be designed to suit the needs of Arabic speakers. Ultimately, I hope to undertake practical research that will benefit both people and my own culture. By improving the educational services in Jordan, I can become actively engaged in Jordan's progress and development cycle.

From personal experience, I recognize the need for designer support of Arabic UIs. Therefore, I accepted the challenge of developing interface guidelines for designers and developers of Arabic educational applications on tablet PCs. Noting that UI design plays a critical role in user acceptance of an application, I aimed to improve the performance and user experiences of Arabic users of educational tablet-PC applications.

## 1.5  Research Questions

The research questions are as follows:

1.  **What are the current UI design practices in use by Jordanian designers and developers?**

2.  **What are the current challenges for UI designers in Jordan?**

3.  **What are the design preferences for Arabic educational applications among students of different gender?**

    *H1. There are significant gender differences in students' preferences of Arabic UIs for educational Tablet PC.*

4.  **To what extent do the proposed design guidelines satisfy the designer needs?**

## 1.6 Research Benefits/Significance

According to the United Nations Development Programme (2013), Jordan has achieved remarkable successes in IT and played a great part in IT practice and development within the Arabic world. Moreover, software development has comprised an increasing share of Jordan's internal and external market (UNDP, 2013). The ICT sectors represent 14–25% of the country's GDP, with the highest export revenue contributed by Saudi Arabia, USA and Iraq (Curley, 2013).

The most important goals of this thesis are to better comprehend the design of UIs for Arabic tablet PCs and to enhance the accessibility of the designed UI. To this end, it proposes a set of Arabic UI guidelines that offer support for Arabic designers of tablet PC UIs in an educational context. The research also highlights some issues regarding Arabic UI design.

This thesis makes contributions to the existing knowledge by referring to appropriate UI design guidelines and principles, Arabic UI designers can provide maximum benefits to Arabic users of tablet PC applications. The findings are particularly significant for learners in Jordan. Moreover, tablet PC educational application designers could create more efficient software for Arabic interfaces. Thereby, I hope this thesis will enhance the usability of educational tablet PC applications with Arabic interfaces. It also identifies effective methods for developing Arabic UI guidelines for tablet PC.

## 1.7 Contributions of this Thesis

The following peer-reviewed papers have been published during this research:

- Al-Sa'di, A., Parry, D., & Carter, P. (2014, April). Usability considerations for educational tablet applications using an Arabic interface. In Information and Communication Systems (ICICS), 2014 5th International Conference on (pp. 1-6). IEEE.

This paper distilled some of the literature regarding the use of tablet PCs in classes and

education (Chapter 2)

- Ahmed Al-sa'di, Parry, D. (2016). User Interface Automatically Identify Preferences for Educational Tablet PC Applications. New Zealand Journal of Computer-Human Interaction, 1(1), 1.

In this paper, I discussed the adaptive UI architecture for educational tablet PCs that enables users to automatically customise their UI preferences (Section 9.3.2 of Chapter 9)

- Al-Sa'di, A., & Parry, D. (2017). Successful User-Centred Design for Tablet PC: A Conceptual Framework. Human IT: Journal for Information Technology Studies as a Human Science, 13(3), 89-114.

This paper presents the user interface design process and its relevance to Jordanian society (Section 2.2 of Chapter 2)

- Ahmed Al-Sa'di, Parry, D., & Carter. (2017). "User Interface Preferences of Young Jordanians Using Tablet Devices." International Journal of Technology Enhanced Learning (IJTEL). **Accepted**

This paper presented the results of the school and university studies (Chapters 5 and 6)

- Ahmed Al-Sa'di, Parry, D., & Carter. (2017). "Toward an Improvement of the Arabic User Interface Design Process" Personal and Ubiquitous Computing. **submitted**

This paper presented the results of the designers and developers study (Chapters 4)

## 1.8 Structure of Thesis

This thesis is divided into nine chapters. Chapters 4, 5, 6 and 8 present the empirical work. The topics of each are briefly mentioned below. Chapter One (the present chapter) introduces the thesis, and Chapter Two presents a literature review. Chapter Three describes the study design. Chapter Four develops the designer and developer interviews and questionnaires (study #1). Chapters Five and Six describe the school and university thinking-aloud experiments, respectively (study #2 and #3, respectively). Chapter Seven proposes the UI guidelines and identifies the user preferences. Chapter Eight presents the

Delphi study (study #4). Finally, Chapter Nine discusses the present findings and suggests directions for future work.

Chapter One overviews the context and general background of the research project, and states the problem. It also outlines the research questions, the contributions and structure of the thesis.

Chapter Two discusses previous studies and the background of the research. The interaction design, usability experience of users, Arabic UIs, the UI guidelines, and design principles are overviewed in this chapter.

Chapter Three explains the research design and the rationale for the selected data-collection and AVID methods. It also designs the system for electing user preferences.

Chapter Four presents the results of the study involving Arabic Jordanian designers and developers. This chapter elucidates the Arabic UI design process in Jordanian companies, the needs of UI guidelines for Arabic designers and developers, the use of usability testing and knowledge sharing among designers in Jordanian companies.

Chapter Five describes the study involving school students, which shows how the students in Jordanian schools handle new technologies, the factors identifying the UI design preferences by users of Arabic tablet PCs.

Chapter Six elucidates the UI preferences of University students, and identifies the main UI preferences of students using PC-based educational applications in Jordanian universities.

Based on the results of the above three studies, Chapter Seven identifies the UI preferences of tablet PC in general and discusses design and data collection issues. It also introduces the developed Arabic UI guidelines for tablet PC Arabic educational applications.

Chapter Eight reports the results of the Delphi study and its experimental procedure used to evaluate evaluating the acceptability and potential usefulness of the Arabic UI

guidelines and principles

Chapter Nine presents the motivation of this research study and discussed answers to the research questions. Also, it elucidates what contributions does this research added to its field as well as the limitations that were exist throughout this research. The possible future works were also introduced in this chapter. In addition, to a short overall summary

# Chapter Two

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## LITERATURE REVIEW

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The following literature review focusses on the design of UIs and the role of UI design guidelines. The chapter contains four main sections that explore UI concepts from various interaction designs and user experiences. The UI preferences of Arabic users are also discussed.

Today, people are surrounded by technology, computers, mobile devices and tablet PCs. These devices are used for communication, entertainment, learning and furthering of goals, and play major roles in the searching and sharing of information (Klyuev & Oleshchuk, 2011). Human–computer interactions (HCI) are important in various fields such as cognitive science and ergonomics (Oh & Moon, 2013). Recently, HCI has become more focussed on usability, user experience and interaction design (S. Garrett & Caldwell, 2002).

## 2.1 Interaction Design

Interaction design emphasises human behaviour and activities and organises the behaviours of the products and services being used for interaction and communication purposes (Huang & Deng, 2008). By comprehensively understanding the goals, routines, needs and experiences of users, interaction design guides users towards the correct action at the right time (Gube, 2010).

Interaction design can also be defined as the technique or medium through which people

relate to and interact with products and services in their environments (Goodman, Stolterman, & Wakkary, 2011). Interactive products are not limited to computers or digital product only. Sharp, Rogers, and Preece (2007, p. 7) defined interaction design as "designing interactive products to support or assist people in their day-to-day lives. Specifically, it is about producing a user experience that improves the way people communicate, interact and work."

A study by Saffer (2010) regards interaction design as the art of enabling interaction or communication among humans through products and services. Saffer also claimed that interaction design focusses on users, finds alternatives, adopts ideation and prototyping, creates appropriate solutions, draws on a wide range of influences, and incorporates emotional responses.

Also, according to Saffer (2010), interaction design is an emerging field, and still defining itself with new disciplines such as information architecture (IA), industrial design (ID), visual (or graphic) design, user experience (UX) design, and human factors. The likely relationships between these disciplines are indicated in Figure 1.
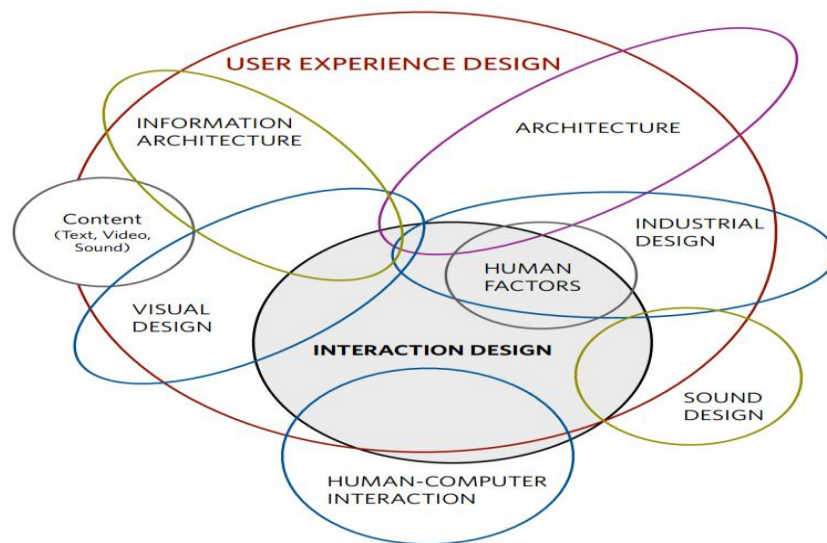


Figure 1: Disciplines embraced by interaction design (sourced from Saffer, 2010, p. 21)

Interaction design is an essential part of the system design process. The UI should match the experiences, skills and expectation of users (Sommerville, 2004). Interaction is

particularly interest in the context of tablet devices. The touchscreens of tablet PC devices not only display visual content, but also play an interactive role. Touchscreens provide opportunities and constants for the designer, forcing them to consider ergonomics, gestures and user-friendly interactions (Pekkala, 2012).

## 2.1.1 User Experience

UX is another discipline concerned with user–product interactions and configuring users' experiences with their products. In everyday life, users seek "an experience of being alive" (J. Campbell, 1988, p. 1).

The definition of UX varies. In the commonly adopted definition, UX encompasses more than the helpfulness and utility of a product (Jeon & Park, 2015). For instance, it might be deeply affected by the user's internal state, the conceptual meanings, and perceptions of the product (Hassenzahl & Tractinsky, 2006). In ISO9241-210 (2010) , UX is defined as "a person's perceptions and responses that result from the use or anticipated use of a product, system or service". Another definition is "All aspects of the end user's interaction with the company, its services, and its products" (Nielson & Norman, 2014).

Users built their experiences with systems through the system interface. The UI is the mediator between the system's core function and the user's task (Dix, 2004). The user inserts an input into the interface to accomplish a task. The individual's ability to use the UI will be related to his/her personal characteristics such as age and gender. At the group level, adoption of the system may relate to how the individual characteristics affect other users. At the society level, users will be influenced by cultural norms. For example, different cultures view privacy from different levels and perspectives, which may affect their use of a system. According to (Courage & Baxter, 2005), the main goals of a good user experience are usefulness and usability. The former enables successful completion of the task; the latter refers to efficiency, effectiveness and satisfaction.

When designing products that meet specific user-experience goals, the designer must identify the users and their requirements (Forlizzi & Ford, 2000). Product design must satisfy users at the practical and hedonic levels; some of the design decision is subjective.

According to (Hassenzahl & Tractinsky, 2006), the UX of users interacting with technology comprises three components; experiential, sensation and effect, which reach far beyond the instrumental perceptions (Figure 2).
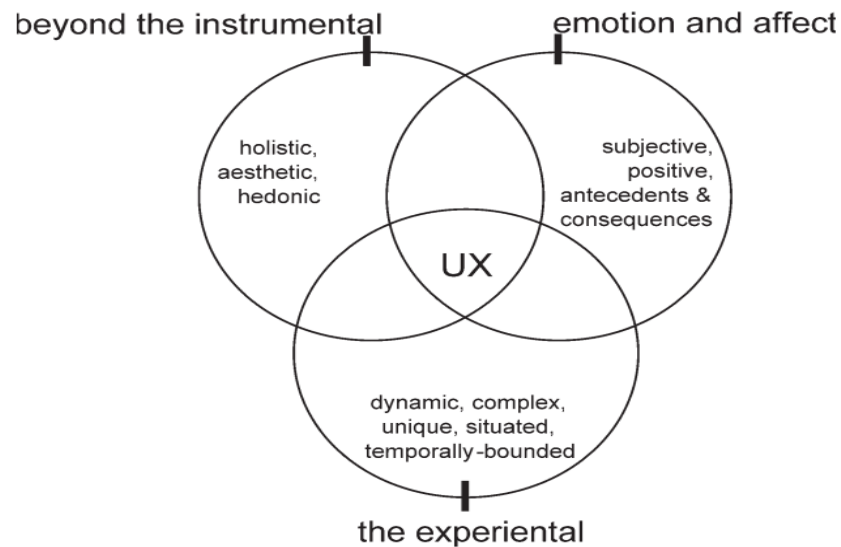


Figure 2: Technology and UX (sourced from Hassenzahl & Tractinsky, 2006)

UX is also "an effect of a user's internal state (predispositions, expectations, needs, motivation, mood and so forth), the attributes of the intended system (complexity, idea, usability, functionality, and so on) and the context (or the environment) within which the interaction occurs" (Hassenzahl and Tractinsky, 2006, p. 95).

According to Low, Hui, and See (2015), some system users will perceive the UI as difficult to use, which poses a UX problem. Therefore, the UI must be enhanced to gain user satisfaction and loyalty. The UI is an important component of our study, whereby UI design practitioners attempt to enhance the Arabic user experience. Therefore, to understand the factors affecting Arabic UI design and the appropriate UI elements, the next section focusses on usability then the UI.

## 2.1.2 Usability

Usability, or ease of use, is one of the main features of an interface assessment. If the

interface is difficult to use, it will likely be abandoned by users. Usability is essential throughout the software industry. A user-oriented application design method benefits not only the users, who enjoy a high-quality application, but also the company that produces and maintains the digital products (Sharp et al., 2007). Thus, usability is regarded as a central issue when designing human–computer interactions.

The target of UI design is a system with high usability (Rubin & Chisnell, 2008). The International Organization for Standardization(9241-11, 1998) defined usability as "the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use" (ISO 9241-11, 1998).

More simply, Nielsen (1993) defined usability as the quality characteristic that assesses how easy a user interface is to use. The term usability can also refer to the method by which ease-of-use is improved throughout the entire design process (Galitz, 2007).

Nielsen (1993) also defines five components of usability: efficiency, learnability, memorability, minimal errors, and satisfaction. By adopting usability concepts, companies can improve their productivity, enhance the quality of their work, increase user satisfaction, and reduce their support and training costs (ISO/IEC, 2011). Table 1 shows the attributes of usability, based on the views of several researchers.

Table 1: Usability as viewed by several researchers (9241-11, 1998); (Nielsen, 1993); (Shneiderman & Plaisant, 2005); (Shackel, 2009).

| ISO9241-1 1998 | Nielsen 1993 | Shneiderman 2005 | Shackel 2009 |
|---|---|---|---|
| **Efficiency** | Efficiency | Speed of performance | Effectiveness |
| **Effectiveness** | Learnability | Time to learn | Learnability |
| **Satisfaction** | Memorability | Retention over time | Flexibility |
| | Errors | Rate of user error | Attitude |
| | Satisfaction | Subjective satisfaction | |

As pointed out by Sharp et al. (2007), human factors (including efficiency and safe, effective interaction between user and tasks) must be considered when measuring and analysing the usability of any system. According to this description, usability is essential to the development of any system.

Difficult or complicated interface designs cause problems for users. In particular, users must work harder to understand and familiarise themselves with the interface. Hence, usability relates not only to ease-of-use of the system, but also to the safety of the interface interaction, and the user's satisfaction with the system. The thesis assumes the usability definition of ISO/IEC (2011).

### 2.1.2.1 Benefits of Usability

The benefits of usability vary among individuals, and also depend on their roles as end users, developers, designers and project managers. According to Van Welie (2001), usability confers several potential benefits that improve the time-efficiency of the use of the device. A well-designed interface allows the user to spend less time completing tasks and to waste less time and effort on understanding the interface.

Poorly organised and deficient interface design increases the user error rate, reducing the efficiency and increasing the training load. Training costs time and money. A good interface is intuitive and closely resembles normal human tasks. By reducing the training and required support, a usable interface reduces the number of problems and the work-hours wasted in communicating with technical support representatives. A usable interface promotes user acceptance and dependence of the system.

### 2.1.2.2 Usability Evaluation Methods

Usability Evaluation Methods (UEM) measure and evaluate human interactions with any product. The UEM involves gathering information about the potential usability of any system, and assessing and improving its interface design (Ssemugabi & de Villiers, 2007). Dix (2004) listed four main goals of UEM; to assess system functionality, to assess the

UI effects and to identify specific problems and errors in the system.

Examining the usability ensures that future users can complete the designated tasks efficiently and satisfactorily. Sharp, et al. (2007) defined evaluation as the process of collecting data on a product from the users' perspective for a specific purpose in a particular environment. Evaluation is essential in product development and in ensuring its perceived ease of use. In fact, evaluation underpins the direction of product development, process design, and perceived outcomes.

The purpose of evaluating usability is to collect the user characteristics and assess the efficiency of the process by which the user understands the application contents and/or performs a task on a specified device (Jaspers, 2009). Albin (2003) suggested visualising the usability aspects of software architecture before the implementation phase, Albin identified three basic components of the user interface: the components required by the task, the ideal components for the user, and the specified component to be implemented.

However, an effective usability evaluation requires feedback from users about the problems they encounter and their degree of satisfaction when using the application. The evaluation must also assess the level of the users' task performance (Zhang & Adipat, 2005).

A study by Faulkner (2000) specified two major types of evaluation: formative evaluation, by which the usability of the interface is improved during system development, and summative evaluation of the developed product. The former is used to redesign and refine the systems, and the latter assesses the usability, impact, effectiveness and overall performance of the application.

Tablet PCs are amongst the most recent devices in the electronics world, and the usability of tablet PC applications can be tested by various methods. Examples are Thinking Aloud Protocol (TAP), Situated co-Inquiry (ScI) and eye-tracking (ET). In the student study of the present work, the UI preferences to include in our target UI guidelines were elicited by a TAP. The coaching TAP is explained in Section 3.4.4 of Chapter 3.

## 2.2  User Interface Design

The UI is among the most important factors that determine the success of a tablet PC application. User experience design mainly considers a sequence of interactions between the user and the application in a system, mediated through the UI. Therefore, understanding UI and its elemental parts is vitally important for UX design.

According to El-Bakry et al. (2010), the term UI in human–computer interactions refers to the presentation of information (graphical, textual, and auditory) to the user, as well as the control sequences on the keyboard or touch screen. Interface design also describes the most effective ways to design the interface elements, facilitating optimal interaction between the user and the functionality of the application (J. J. Garrett, 2010).

According to Lauesen (2005), interface design bridges the gap between the user and the system. The system controls the data, so users can more easily and efficiently collect the information and understand the system (artefact). The role of UI designers is not fixed, but all interface designers must ensure sure that their systems are easy and convenient for the end user (Van Welie, 2001).

The UI provides two main interaction points between user and system (the input and the output), which indicate the effects of manipulation by the user (El-Bakry et al., 2010). Thus, interface design can be regarded as the "front-end" product, which allows users to interact, communicate, and converse with the machine. Meanwhile, code and data represent the "back-end" product (Galitz, 2007).

Sharp et al. (2007) argued that the design of an application's interface significantly affects the user's experience of the human–computer communication process. Cooper, Reimann, and Cronin (2007) went so far as to suggest that the interface design mainly determines user satisfaction. Furthermore, Weiss (1994) mapped the interdependent components of an interface, each distinguished by distinct characteristics. These four components are summarised as follows:

    **A.** The presentation interface, which influences the user's perception of the

information presented. This interface is produced by the design elements on the screen, such as graphics, menu, set page, and colour.

**B.** The conversational interface, which controls the process of the communication scheme and the user, and provides an intermediary between the user and the system (as a means of communication).

**C.** The navigation interface, which controls the user's movements from one type of information to a search for a new type of information.

**D.** The explanation interface, which controls how the system supports "the user's different activities, providing advice and explanation" (Weiss, 1984). This interface operates through text and visual cues, such as icons and breadcrumb trails.

Shneiderman and Plaisant (2005) identified three pillars of successful UI development from a HCI perspective; (1) the guidelines and process lines (derived from both theory and model), (2) UI software tools (developed in a prototype), and (3) usability experts and tests (conducted with a representative group of users). These pillars are shown in Figure 3.
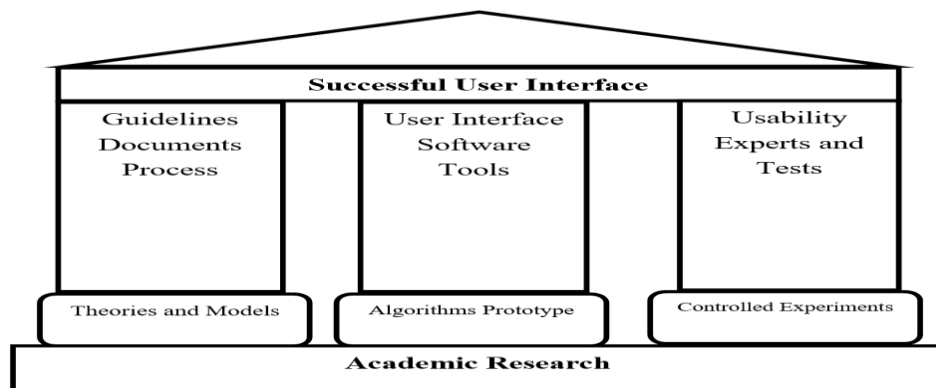
Figure 3: The three pillars of successful UI development (Source: Shneiderman & Plaisant, 2005)

In the early stages of interface design, the designer should generate a working guideline that considers the needs of various users, which vary from project to project (Shneiderman & Plaisant, 2005).

In this thesis, the visual design constitutes the guideline. The user preference of design

elements on the tablet PC screen and the design of an Arabic UI will be discussed in the next two sections.

## 2.2.1    User Interface Preferences

Having selectable UI preferences can enable users to control and adjust the UI features, such as display colour, font size and font type this can allow uses to design a "personalised" UI. In Miñón and Abascal (2012) approach, the UI description and its physical form are separated by a layer of abstraction. The abstract interface elements can be transformed into various concrete and individualised forms, enabling a generic UI.

Users become accustomed to interacting with interface elements in a certain way. Therefore, consistent and predictable options and layouts will facilitate completion, efficiency and satisfaction of the tasks performed. UI design improves the aesthetics of applications or websites by implementing strategies, guidelines and principles regarding colours, fonts, and images. Thereby, UI design builds user confidence and increases comfort during use of these applications (usability.gov, 2006).

## 2.2.2    Arabic User Interface Design

Arabic UI design differs from Western UI not merely because Arabic is a bidirectional language, but also because Arabic and Western users have different characteristics.

As mentioned earlier, only a few studies have focused on Arabic interface design. Ramadan (2011) investigated the Arabic preferences of typeface style, font size, page layout, and background colour grouping for written materials. Ramadan emphasised the lack of previous study on these aspects, and that legibility and readability guidelines written for Western readers were not suitable for Arabic interfaces. They also noted the difficulty of providing exact recommendations that meet Arabic preferences.

To investigate this problem, Marcus, Gould, and Wigham (2011) studied the screen design issues concerning cultural influences on educational websites in Saudi Arabia, investigating several electronic libraries. They reported that by making minor changes to the basic UI design, a designer could create a localised version using the Microsoft Office

interface base format in localised Arabic websites.

A study by Khashman and Large (2011) examined government websites in Egypt, Saudi Arabia, Kuwait, and the United Arab Emirates (UAE). After analysing the cultural effects on these websites, they concluded that analysing these countries as a group through cross-cultural interface design (i.e., by Hofstede's model) is insufficient.

In the same vein, Khushman (2010) applied a user-acceptance behaviour model (containing cultural variables) to business websites in Arabic countries. As a case study based on Hofstede dimensions, they studied tourist websites. They concluded that e-commerce websites with low power distance, low uncertainty avoidance, high individualism, and high masculinity cultures (similar to Western cultures) are not optimally adapted to Arab cultures, which are characterised by high power distance, high collectivism, low masculinity, and high uncertainty avoidance (Akheela Khanum, Fatima, & Chaurasia, 2012). However, Khanum et al.'s study neglected some influential factors, such as culture, tasks, the environment, and participants' gender and age. Thus, the wider array of options and criteria considered in this thesis will generalise the recommendation findings.

A range of UI Arabic design elements have been explored in various studies. Some of these studies are summarised in Table 2.

Table 2: Literature on Arabic UI design elements based on user preferences.

| Author(s) | Design principles measured | Design elements measured |
|---|---|---|

| | | |
|---|---|---|
| Alghamdi, Aldabbas, Alshehri, and Nusir (2012) | The Arabic language has a special characteristic. | Typography |
| Ganayim and Ibrahim (2013) | The print text format and layout in the Arabic language | |
| Azmi and Alsaiari (2014) | Arabic text readability and comprehension | |
| Almuhajri (2013) | Examined six Arabic fonts on PDAs from the perspective of legibility and readability | |
| Abubaker and Lu (2012) | Examined two types of Arabic size-4 fonts | |
| Hemayssi, Sanchez, Moll, and Field (2005) | Arabic text design with English text | |
| Alsumait, Al-Osaimi, and AlFedaghi (2009) | Arabic letters occupying different spaces | |
| Almuhajri (2013) | Six Arabic fonts types for Ereader | |
| Isa, Noor, and Mehad (2006) | Islamic User Interface for Islamic Website | Religion |
| Barber and Badre (1998) | Cultural variations in specific orientation and page placement.<br><br>Arabic colours in interface design, including background, borders, images, and hyperlinks | Orientation, Colour |
| (Marcus & Gould, 2000) Marcus and Gould (2000) | Organised display.<br><br>Effect of Arabic culture on navigation | Script direction.<br><br>Orientation |
| Marcus et al. (2011) | Screen-design -and cultural issues for educational software in Saudi Arabia | Typography, Colours, layout |
| (Ramadan, 2011) | Effects of Arabic typeface preferences, font size, page layout and background colour grouping of written materials | Typography, Colours, layout |
| Akheela Khanum et al. (2012) | Arabic interface analysis based on cultural markers | Typography, Colours, layout, Symbol |
| Bakar and Long (2013) | The UI appeal of Web learning | typography and |

There are some gaps in the previous studies. First, these studies were based on websites or windows applications for desktop PCs rather than portable devices such as tablet PCs. These newer devices differ considerably from traditional designs; especially, a touchscreen UI responds to a finger or stylus. Second, the earlier studies applied different collection and analysis methods from those adopted in this thesis.

The previous literature emphasises the lack of Arabic UI guidelines for tablet PCs, and especially for educational education applications, that would help designers and developers to know the UI preferences of Arabic users. Muhanna and Jaser (2014) arrived at the same conclusions. They also noted the usability challenges facing designers of Arabic UIs for tablet PCs.

Accordingly, this thesis will focus on the most frequently discussed UIs elements identified in the literature; typography, colours, menu type, button type and alignment section.

**Language (Typography)**

Arabic is a bi-directional language, in which text is presented and read from right to left, and numbers are presented from left to right. Additionally, Arabic letters occupy different spaces from English letters, depending on whether or not they are attached to other letters (Alsumait et al., 2009). Arabic font variation is currently lacking on tablet PCs, since the Arabic script is complex to design, and faces technical and design problems.

As shown in Figure 4 and cited in numerous studies, the Arabic language has unique characteristics (Alghamdi et al., 2012; Chahine, 2016; Hemayssi et al., 2005), these characteristics are listed below:

- Direction: writing flows from right to left, so any application or website should enable characters that present in this direction. Accordingly, bulleted lists, paragraph indentations, and menus are aligned to the right.

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- Arabic alphabetical order: this affects the sort-item functions. For abbreviations, and acronyms not found in Arabic, the designer should specify the full term before translation.

- Arabic words occupy more space horizontally than English words, and should be set with a typeface up to four points larger than English fonts.

- The form of Arabic letters depends on their glyph location; that is, whether the letter occupies the beginning, middle, or end of the word. This alters the rhythm of ascenders and descenders, and Arabic fonts require bolding to increase their legibility.

- Legibility at small sizes: Small or no inner forms tend to be confusing at low point sizes because the forms become incomprehensible. Because of the dots and diacritic signs, many characters begin to look similar or resemble ink blobs.
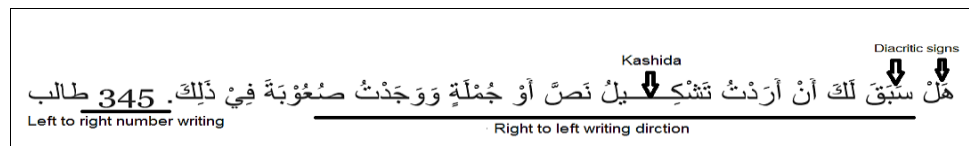


Figure 4: Some of the unique characteristics of the Arabic language.

- Spacing problems: As mentioned above, Arabic script is joined. Therefore, spacing in Arabic is differs from that of Latin scripts.

- Diacritic signs (also called vocalisation marks) appear above or below the letters. Arabic letters are allographs, meaning that their shapes differ depending on their neighbours. In particular, the shape of an Arabic letter depends on its position in the word, as demonstrated in Figure 4. Six letters in Arabic (indicated by * in the figure) cannot be the connected to the left side.

Table 3: Position-dependent shapes of Arabic letters (sourced from "Welcome to the Basic Arabic Course," 2009)

| sound | name | name | end | middle | start | isolated |
|---|---|---|---|---|---|---|
| ā | alif | ألف | ـا | ـا* | ا* | ا |
| b | bā' | باء | ـب | ـبـ | بـ | ب |
| t | tā' | تاء | ـت | ـتـ | تـ | ت |
| th | thā' | ثاء | ـث | ـثـ | ثـ | ث |
| dj | djīm | جيم | ـج | ـجـ | جـ | ج |
| H | Ḥā' | حاء | ـح | ـحـ | حـ | ح |
| kh | khā' | خاء | ـخ | ـخـ | خـ | خ |
| d | dāl | دال | ـد | ـد* | د* | د |
| dh | dhāl | ذال | ـذ | ـذ* | ذ* | ذ |
| r | rā' | راء | ـر | ـر* | ر* | ر |
| z | zāy | زاي | ـز | ـز* | ز* | ز |
| s | sīn | سين | ـس | ـسـ | سـ | س |
| sh | shīn | شين | ـش | ـشـ | شـ | ش |
| S | Ṣād | صاد | ـص | ـصـ | صـ | ص |
| D | Ḍād | ضاد | ـض | ـضـ | ضـ | ض |
| T | Ṭā' | طاء | ـط | ـط | طـ | ط |
| Z | Ẓā' | ظاء | ـظ | ـظ | ظـ | ظ |
| c | ᶜayn | عين | ـع | ـعـ | عـ | ع |
| gh | ghayn | غين | ـغ | ـغـ | غـ | غ |
| f | fā' | فاء | ـف | ـفـ | فـ | ف |
| q | qāf | قاف | ـق | ـقـ | قـ | ق |
| k | kāf | كاف | ـك | ـكـ | كـ | ك |
| l | lām | لام | ـل | ـلـ | لـ | ل |
| m | mīm | ميم | ـم | ـمـ | مـ | م |
| n | nūn | نون | ـن | ـنـ | نـ | ن |
| h | hā' | هاء | ـه | ـهـ | هـ | ه |
| w, ū | wāw | واو | ـو | ـو* | و* | و |
| y, ī | yā' | ياء | ـي | ـيـ | يـ | ي |

There is no standard classification for Arabic typography. Commonly, the Arabic style relates to the cultural context, and can be classified according to the functionality, the general content, or the history (Almuhajri, 2013). Typeface functionality is sub-classifiable into three main divisions: display, text, and decorative typefaces, each designed for a specific function and purpose. For instance, the display typeface is mainly used for large titles and posters, the text typeface is the typical on-screen typeface, and the decorative typeface (which has an exclusive style) is used for special occasions (Isa et al., 2006; Zoghbi, 2007).

Arabic type style is characterised by its classification features, similarly to serif and sans serif in Latin. The two commonest traditional divisions in Arabic are the Al-Kufi and Al-Naskh styles. In Al-Kufi typeface, the letters take a geometric structure with a flat baseline. In the Cursive style, the letters are based on fluid handwriting calligraphy (AbiFares, 2001).

Finally, Arabic type style is commonly classified by its history. The most widely used Arabic font types throughout Arabic history have been Al-Kufi, Thuluth, Diwani, Al-Naskh, Persian, Al-Rekaa, and Maghebi. Al-Naskh font style represents the Arabic equivalent of standard English text. Persian font types were established by the Persians. The Al-Rekaa font style refers to the Arabic synonym of a piece of leather, on which the text was written. The Maghrebi font type is the Arabic synonym for Morocco, and is derived from the Al-Kufi font type (AbiFares, 2001; Almuhajri, 2013).

**Font Colours**

Font colours strongly affect the interface design, and their meanings depend on culture. Barber and Bader (2001) showed that governmental sites in all countries (with some exceptions), including Saudi Arabia, use the colours of their national flags in their interface design elements such as background, borders, images, and hyperlinks. Barber and Bader (2001) listed several colours and explained their connotations in various cultures. For example, red symbolises happiness in China, but means danger in the USA.

In addition, Simon (2000) showed that Asians prefer "less bright colours", while Europeans and North Americans favour lighter or brighter colours and a greater number of images to achieve a modern look. Therefore, colours are an additional factor in user expectations concerning navigation, content, links and overall satisfaction.

**Alignment**

Text alignment describes the way that the text is presented on the screen (left, right or central). Text alignment varies the margins (Ling & van Schaik, 2007). A study by B. M. Yu and Roh (2002) showed that layout and design provide web visitors with a contextual and structural model for understanding and accessing information and facilitating communication with the system. Specifically, the term layout refers to banner placement, menu placement, and/or positioning of the search function.

On the other hand, Barber and Bader (2001) showed that specific orientation and page placement varies by culture (for example, France uses the centred orientation). Pictorial

information is presented and organised for display according to the script direction of the user's first language (Marcus and Gould, 2000). Additionally, Sun (2001) found that users from low-context cultures prefer logical and structural layout, whereas high-context cultural users prefer visuals.

Accordingly, Arabic text requires a different alignment from the Latin language, as Arabic is always left-justified whereas Latin text is right-justified. Thus, in the student study, I will examine the text-alignment preferences of Arabic users of tablet PC educational applications.

**Navigation Menu and Buttons**

Helping users for easy navigate should be highly priority for designers. According to (Whitenton, 2015) navigation menus are "are lists of content categories or features, typically presented as a set of links or icons grouped together with visual styling distinct from the rest of the design." . Yu and Roh (2002) reported that the design effort focuses on enhancing the ease and speed of site navigation.

Another study revealed that when confronted with elements with no clear and facilitated path to information, users will become lost within the web or application structure, being mindful of the fact that navigation refers to numbers, types of navigation tools, menu format, types of links, and search capabilities (Bernard, 2003).

In addition, Marcus and Gould (2000) found that navigation is affected by culture, so cultures with prevalent anxiety, feelings of uncertainty, or unknown matters prefer navigation schemes that strongly prevent users from becoming lost.

**Religious Symbols**

Religion is a main facet of Arabic cultures, especially in Jordan. The majority of Jordanians are Muslims (approximately 92% are Sunni Muslims) ("Culture and Religion," 2015). Christians (most of them Orthodox or Catholic) represent 6% of the total population. People tolerate each other with openness and acceptance. Therefore, when designing any application for Arabic UIs, the designer should consider the beliefs

and respect the culture of Arabic users.

Especially for Arabic users, religion is an important factor that designers should incorporate into the design. More specifically religious texts should attract the user's attention to the religious symbolism. Animal symbols differ among cultures; for example, pigs in Islamic culture should be avoided because they connote uncleanliness. Therefore, to avoid cultural confusion, the symbols should be designed to respect the users' culture and religion.

The religion of Jordan (Islam) must be considered when creating interface design and content for Jordanian users. Therefore, the content and interface design of an e-learning application for tablet PCs should follow and respect Islamic rules by removing references to drinking alcohol or eating pork (Lim, 2011).

## 2.3 The user interface design process

The fundamental idea behind User-Centred Design philosophy is to emphasise the needs and characteristics of users. Differences in personal user factors such as gender and age affect the user's behaviour when interacting with a system (V. Cho, Cheng, & Lai, 2009; Gefen, Karahanna, & Straub, 2003). User gender and age also influences UI design preferences.

UCD aims to produce a high-usability system (Rubin & Chisnell, 2008), where usability relates to the efficiency and effectiveness of the UI (Hansen, 1998).

To achieve a successful UI, the designer requires a balanced approach during the development life cycle, which typically involves design, implementation and testing phases (Microsoft, 2012). This thesis focuses on two personal characteristics (age and gender), and their differential influences on the UI design preferences for tablet PCs.

The UI development process is simply evolving as a general software development (Nielsen, 1993) with four core strategies: user research, the generation of many possible ideas, prototyping, and iterative refinement (B. Hartmann, 2009). Gottfredson (2014)

conceptualised the design process as an iterative sequence of planning (research), design and evaluation, which eventually realises a high-quality design output. Buxton (2010) divided the UI design process into three main phases; user analysis, system prototype and interface evaluation.

Inspired by Gottfredson (2014), Hartmann (2009) and Shackel (2009) developed a framework encompassing four principal components of HCI. Most UI designers follow the framework shown in Figure 5, which includes the research, design and evaluation components.
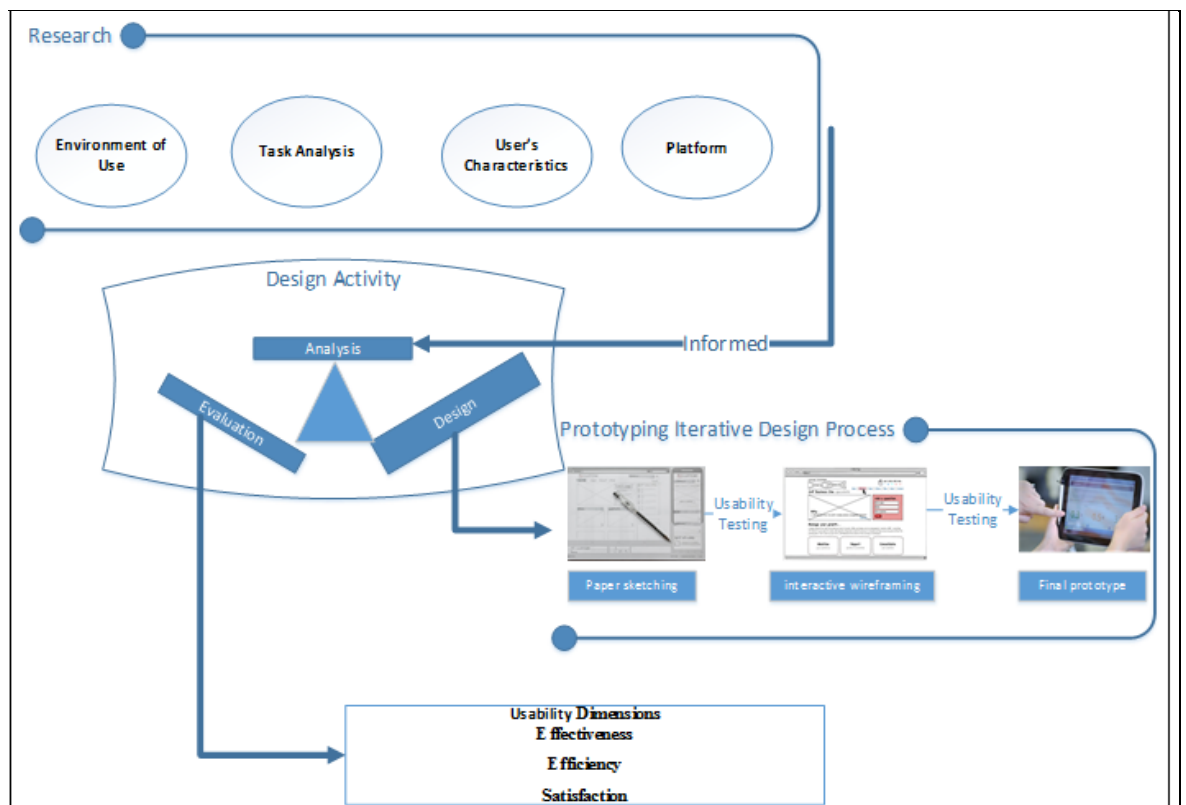


Figure 5: Framework of the UI design process.

The first component (Research) is represented by four contextual factors (user characteristics, task analysis, environments and tools (application types and tablet PC specifications). These are listed below.

- **Environments of use**: the physical place in which a student performs specific tasks through the interface. Typical environments are school, class and home.
- **Task Analysis:** Identifying and understanding the structure, flow and attributes of UI tasks through various techniques.
- **User characteristics:** the psychological and physiological characteristics of the target users.
- **Platform**: the hardware and software aspects (in our case, the platform is a tablet PC).

The second component (prototype design activity) is essential for achieving an innovative, usable, compelling, and ultimately successful user interface. However, this objective is rarely achieved during the first round of development. Therefore, the UI design process is an intrinsically open, iterative and incomplete process (Coyette & Vanderdonckt, 2005). Iterative design, which refines the early-stage design through repeated design–evaluations, is the main way of maximising the usability of a UI. The idea is first sketched on paper, then expanded through an interactive process called interactive wireframing, and finally developed into a functional prototype.

To maximise the usability of the final product, UI designers should evaluate the usability dimensions in order of their listings in Table 4. First, the designer should test the effectiveness of the UI. Based on the new result, the designer should re-design the UI, test its efficiency and finally evaluate its satisfaction.

To ensure the quality of an educational UI for Arabic users of tablet PCs, both designer and developer must follow the usability criteria in Table 4. These criteria, which are applicable to any system, were inferred by surveying the literature related to usability (ISO9241-210, 2010; Nielsen, 1993; Tintarev & Masthoff, 2011).

Table 4: Usability dimensions

| Criteria | Explanation |
| --- | --- |
| **Effectiveness** | Good learning decisions |

| | |
|---|---|
| **Efficiency** | Fast learning decisions |
| **Satisfaction** | Enjoyment of learning |

Figure 6 shows the factors that influence UI design for tablet PCs. The UI design process is primarily affected by the user, designer and tablet PC specifications. User characteristics (including culture, age and gender) strongly affect user preferences (C. M. Johnson, Johnson, & Zhang, 2005) and users' acceptance (Tarhini, 2016), of a tablet PC application. In this thesis, the factors influencing UI design are age and gender (educational and cultural factors are excluded). The next section overviews studies focused on user characteristics; the following sections narrow the focus to user gender and age.
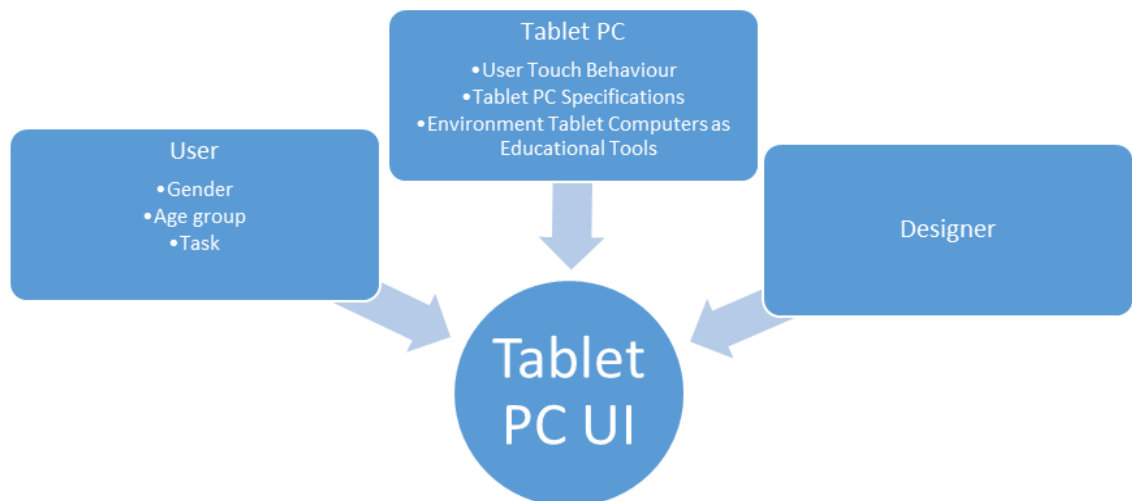


Figure 6: Actors influencing UI designs for tablet PCs

## 2.3.1 Users Characteristics (Analysis)

User characteristics should be a major focus of designers of designers, as end users are the ultimate targets of the interface design. As such, identifying the interaction level of the UI with the area of the domain application is an important task.

Many studies have classified users or defined user characteristics. For instance, M. N.

Burns, Montague, and Mohr (2013) identified the essential characteristics of users as physical characteristics, cognitive and perceptual abilities, personalities and general abilities. These characteristics apply to general users, not necessarily to potential users of a specific UI. Jaramillo and Vargas-Lombardo (2013) classified users based on their knowledge of the system. Cultural differences are also important factors when designing any art factual interface.

The focal point of any design is the end user (in the present study, Arabic learners). James (2009) classified three general types of learning styles; visual, auditory and kinaesthetic. Most learners learn best by combining all three learning styles, but some learners need a particular style. Hackos and Redish (1998) mentioned that physical disabilities, colour blindness and problems with distinguishing small objects present special challenges to interface users. In several studies of Arabic user-learning styles (C. C. Park, 2002; Reid, 1987), Arabic students were found to be more visual learners than other students.

To engage with the UI of any system, learners rely on several factors, including their own memory. Dix (2004) classified human memory into the following three categories:

- Sensory memory: this memory provides a buffer for incentives received through each of the senses.
- Short-term memory: this memory stores the required information fleetingly. It has limited capacity but is rapidly accessible.
- Long-term memory: this memory has unlimited capacity but is slow to access. It comprises episodic memory (our social lives, experiences and events) and semantic memory (which stores our facts, concepts and skills).

As mentioned above, this thesis is not primarily concerned with comparing cultural factors, but overviews the most important studies on culture and cultural effects on learners. Many researchers have reviewed the topic and provided materials that connect cultures and UI design. Geert Hofstede's model is among the most widely accepted models of cross-cultural challenges. Cultural dimensions in the Hofstede model were derived from an enormous sample of multinational International Business Machines Corporation studies conducted throughout the 1960's, 70's and 80's. Four cultural

dimensions were identified; power distance, individualism, masculinity, and uncertainty and ambiguity. In 1982, Hofstede extended his model to include ten additional independent countries and three additional regions, and thereby added a fifth cultural dimension called long-term ordination (Akheela Khanum, Fatima, & Chaurasia, 2012; Al-Harthi, 2005).

E-learning in Arabic culture is affected by several factors. Religion and language play critical roles in Arabic e-learning systems since Arabic countries place strong emphasis on these factors (Akinyemi, 2003).

A study by Fernandes (1995) showed that user interfaces in different locales are affected by nationalism, language, social context, time, currency, units of measure, cultural values, symbols, and aesthetics (look and feel).

UI design is an essential element of e-learning systems, because a good UI design ensures that the learner gains enjoyment and convenience from the learning process (Bakar & Long, 2013). To enhance the learning process, the designer must consider the learner's needs and customise the UI design accordingly. However, educational theory is beyond the scope of this thesis.

In addition, the language of Arabic students is an intrinsic part of their culture (Duncker, Sheikh, & Fields, 2013). The characteristics of the language should also be considered in an Arabic UI design, as mentioned above. Owing to the political environment of the Arabic world, security is higher valued than free and creative thinking.

Moreover, religion affects the choices of Arabic students and their reactions to the interface (Lim, 2011). Religion is a mainstay of Arabic cultures. The majority of Arabic peoples (92%) are Muslims. Symbolic meanings vary among different religious societies; for example, Islamic culture avoids pigs because its religious sanction associates them with "pollution/impurity".

The attitudes, characters and preferences of users interacting with tablet PC interfaces can be understood through several methodologies. Sharp, Rogers and Preece (2007)

mentioned that pinpointing users' mannerisms could thoroughly reveal user attitudes. They also mentioned four essential challenges to collecting data from users: a) setting goals, b) establishing a relationship with participants, c) triangulation and d) conducting pilot studies.

A study by W.-C. Wang (2011) which summarised the advantages and disadvantages of comprehending users by general methods. Their summary is adapted as Table 5.

Table 5 : Pros and cons of comprehending users by various methods (adapted from W.-C. Wang, 2011, p. 34)

| Methods | Results | Pros | Cons |
| --- | --- | --- | --- |
| **Interviews** | Mostly qualitative | cheaper than ethnographic observation; getting people's experience by their own words | Time-consuming, interviewer's experience might influence the result |
| **Questionnaire** | Quantitative and qualitative | Cheap, easy for analysing data rapidly, good for specific questions | Not as flexible as interviews, questionnaire design is crucial |
| **Observation** | Mostly qualitative | Directly obtains information about people's natural behaviour | Context might influence the participant's performance |
| **Audio and video data recording** | Mostly qualitative | Repeat reviewing the data | Time-consuming, might be limited in public places |
| **Diary study** | Mostly qualitative | The participant fills the gap when the observer is absent | Might need more time to analyse a large amount of data from participants |
| **Focus group** | Mostly qualitative | Allows raising of diverse issues | Time-consuming for analysing the recorded conversation |
| **Field research** | Mostly qualitative | Understand people's natural behaviour in the studied context | Time-consuming and costly for collecting information; sample size might small |
| **Performance measures** | Quantitative and qualitative | Provide both quantitative and qualitative data for analysing users' interaction behaviour with the system | Principles of calculating times, errors, interrupts and silences are essential |

| | | | |
|---|---|---|---|
| **Think aloud protocol** | Mostly qualitative | Understanding the participant's thoughts while operating a device | It might difficult for participants to talk out loud and exploit the device at the same time; time-consuming for transcribing the audio recording |
| **Log file analysis** | Quantitative | Collects data without interrupting the system performance | Ethical considerations may arise due to observation of participants without their perception |
| **Ethnography** | Qualitative | Understanding details of people's lives | Data collection might take weeks or even years |

Population The nature of the definition of a population is a critical factor in some of the above methods. Population has been defined in different ways by different authors; for example, (Ary, Jacobs, Sorensen, & Walker, 2013) regarded a population as the gross number of group members sharing one or more characteristics of interest to the researcher. In  Denscombe (2009) definition, a population is the group in which the researcher can propagate the outcomes of the study. When all outcomes are achieved, the population saturates. Saturation occurs when the number of subjects no longer affect the study results; that is, no new standpoints or data are added to the study results. However, in qualitative studies, the proper number of participants is not easily determined in advance.

According to Patton (2005), participant number is decided by the specified study time, the obtained resources, and the study goals. Other researchers, such as  (Glaser, Strauss, & Strutzel, 1968), highlighted the importance of the saturation concept in determining the sample size in qualitative studies . Mason (2010) determined the saturation sample size as 30–50 participants for ethnography and grounded theory, but six participants is sufficient for phenomenological studies. Meanwhile,(Creswell, 2002) found that 20–30 participants are appropriate for grounded theory, whereas 5–25 participants are adequate for phenomenological studies.

The Delphi technique is a widely accepted social communication method for gathering data and refining a system. This technique converges participants' opinions on a particular

issue in the real world (C.-C. Hsu & Sandford, 2007). The process begins with an open-ended questionnaire, then moves through successive questionnaires, each seeking further information from the participants (Brancheau & Wetherbe, 1987). The process concludes when adequate information has been collected, or when the participants agree that sufficient information has been gathered (Miaskiewicz & Kozar, 2006). This thesis conducts an electronic Delphi through a website that allows participants to submit their responses online. Delphi studies are suitable for research taking a subjective judgment approach rather than an objective or analytical approach (Linstone & Turoff, 1975).

Software interface design is interdisciplinary, involving design, language, operational elements, and structural aspects. However, the relationships and interplay between these factors need to be modulated and coordinated. Anstey, Wood, Lord, and Walker (2005) identified four biological factors of ageing. These factors are accompanied by physical processes involving sensory changes. The capability of the sense organs decreases with increasing age. Especially when making layout decisions, software interface designers must account for age-related changes in the visual system, such as choice of colours, contrast, font, type size, and the size and design of objects (such as buttons) (Wirtz, Jakobs, & Ziefle, 2009).

Users typically prefer interfaces that satisfy their desires and needs. Interface preferences are affected by factors such as gender, age, cultural background, and individual habits (Zorrilla et al., 2011). Nevertheless, understanding common traits is useful for targeting an interface towards a designated group of people. From this viewpoint, there are some common features within an interface which are acceptable to most target users.

The interface choices of individual users (such as colour, font, and background) reflect their personal preferences in everyday life. When performing tasks, these choices also depend on the physical constitution and ability of the individual (Hackos & Redish, 1998).

This study aims to assist Arabic Jordanian designers by providing them with tools (UI guidelines) that can enhance their UI designs for tablet PCs used by Arabic-speaking Jordanian students. The importance of demographic characteristics on user satisfaction and experience has been highlighted in several recent studies (Ji et al., 2006; Lu, Yu, Liu,

& Yao, 2003; Shneiderman et al., 2017). User preference selection is largely independent of gender and age differences (Passig & Levin, 2001). The literature related to gender and age in technology is discussed in the following sections.

### 2.3.1.1 Gender in Technology

Several studies have identified different UI preferences in men and women. Individual differences extensively influence users of hypermedia systems such as websites and mobile educational applications (Baker, Al-Gahtani, & Hubona, 2007; Karjaluoto, Riquelme, & Rios, 2010; Morris et al., 2005). As a major factor among these individual differences (Shneiderman et al., 2017), gender might be the most easily observed and accommodated factor by system interface developers and designers (Lin & Hsieh, 2016).

The different UI preferences between males and females have been recognised in UI design studies (Colman, 2001). Many of these studies are focussed on gender-related preference differences in website design (Lin & Hsieh, 2016; Passig & Levin, 2001; Ratzer et al., 2014). H. Liu and Mihalcea (2007) determined the male–female gender differences by analysing 150,000 weblog textual entries submitted by men and women. They chose weblog entries because they depict the entrants' individual viewpoints and aspects of their personal lives. The research findings were pegged on factors such as colour, time, cravings, sociability and size. The results of the weblog analysis closely corresponded with the responses derived from the study respondents.

Males and females also differ in their preferences for design creation. For example, Cyr and Bonanni (2005) reported that males preferred dark colours such as black and blue, while females preferred light colours. Such gender differences in preferences are arguably related to innate factors. Kimura (1992) suggested that men prefer 3-D design because their visuospatial imagery is inherently superior to that of women. In contrast, women have superior colour vision Gregory (2015), which may explain their different colour preferences from men (Colman, 2001; Ratzer et al., 2014).

As men and women prefer different images and colours in their website designs (Ling & Van Schaik, 2002; Madden, Hewett, & Roth, 2000), both genders might respond more

favourably to products designed by someone of the same gender. The above research implies that the layout and design preferences noticeably differ between males and female users.

Maltby, Chudry, and Wedande (2003) found that males are more information orientated, whereas females seek visual expression or emotional value in internet financial services. Moss, Gunn, and Heller (2006) reported gender differences in the visual contents of consumer websites and in the linguistics of learning. Similarly, C.-M. Wang and Huang (2015) reported that males gave higher aesthetic-preference ratings to children's websites than females. This finding supports the earlier findings of Madden et al. (2000), who explored the aesthetic preferences of undergraduate students towards designed websites. Females preferred websites with clearer and more organised information design than males, which might clarify the more favourable impressions of standard aesthetics by females than males. Consistent with this, Lavie and Tractinsky (2004) investigated the gender differences in the standard factors of aesthetic perception, using traditional attributes of aesthetics such as cleanness, clarity and symmetry.

On the other hand, Abdinnour-Helm, Chaparro, and Farmer (2005) found no gender differences in user satisfaction or perceived usability in a validation survey of an end-user computer. Similarly, a survey conducted in the early 2000s on computer usage demographics in the workplace found no difference between male and female users in any aspect of computer usage, except for anxiety; young females reported higher levels of computer anxiety than males or older females (Knight & Pearson, 2005). S. G. Campbell and Norman (2007) found significant gender differences only in the effect and performance of spatial visualisation. This finding suggests that the observed gender differences are attributable to differences in spatial visualisation ability.

In other words, the attractiveness of an interface depends not only on the characteristics of the stimuli, but also on the viewer's perceptions of these characteristics. Ample evidence exists that males and females have different perceptions of attractiveness. This difference is grounded in the interactionist paradigm of aesthetics. The different aesthetic values of males and females have been explored in several studies  (Moss et al., 2006).

Males and females also differ in their preferred layouts and presentation of stimuli (Djamasbi et al., 2007b).

## 2.3.1.2    Age Groups in Technology

Age factors in UI design have been examined from various disciplinary and methodological perspectives, including psychology, computer science, economic studies and engineering (e.g., Czaja and Lee, 2003; Schneider, Schreiber, Wilkes, Grandt, and Schlick, 2008; Zajicek, 2001; Ziefle and Bay, 2005, 2006, 2008).

Age-related bodily changes influence the mobility, muscular strength, and fine motor skills of humans (e.g. Vercryssen, 1997). Fine motor skills may be degraded by factors such as tremor, immovability, and decreased sense of touch in hands and fingers. Consequently, many older people experience difficulty handling electronic devices such as a mouse or touchpad, and especially struggle with small operating elements located at the corners or in small quarters of the screen. These difficulties must be considered when designing relevant components (such as size, type, and the spaces between elements).

Cognitive changes affect intelligence, information processing, and memory capacity. Cognitive abilities are divisible into fluid components and crystallised intelligence components. The former includes reasoning abilities, abstract thinking, and problem-solving, which are independent of learning processes (A. Dix, 2004). On the other hand, crystallised intelligence components refer to cumulative knowledge, expertise, and experience, and include skills that are socially developed and culturally inherited, such as speaking, reading, and writing. Fluid intelligence tends to decrease as age increases, whereas crystallised intelligence remains unchanged or even improves. The latter is closely linked to social factors, such as the quality and level of education. Therefore, biological factors are not the only factors to be considered in system design. Combinations of various factors, often with close relationships and interactions among the factors, exert significant impacts on computer usage (Mandel, 1997).

As shown in Figure 7, Jordan has a relatively young population, with a median age of 21.8 years (females 21.6, males 22.1). Furthermore, a considerable segment of the

population is of high school or college age (Department of Statistics, 2011). This may make age –related differences particularly important and it may be beneficial to pay particular attention to UI presences of younger people.



| | 0-4 | 5-9 | 10-14 | 15-19 | 20-24 | 25-29 | 30-34 | 35-39 | 40-44 | 45-49 | 50-54 | 55-59 | 60-64 | +64 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| male | 417805 | 412685 | 392565 | 360725 | 350580 | 300635 | 259775 | 210320 | 155410 | 109210 | 81010 | 69920 | 65305 | 107035 |
| female | 396195 | 391970 | 371105 | 340000 | 325555 | 270435 | 239845 | 194500 | 146740 | 104140 | 79500 | 72420 | 58340 | 104255 |
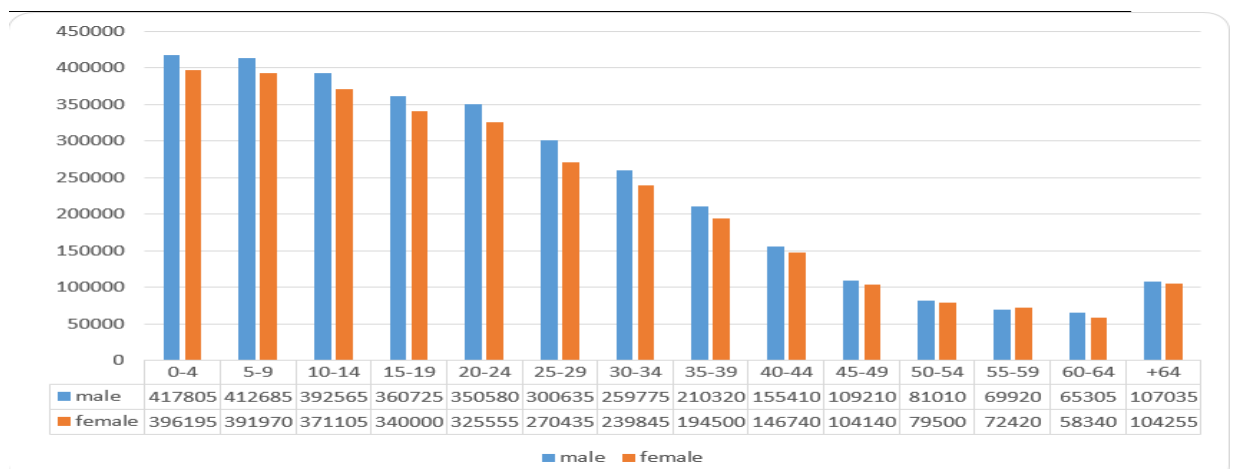
Figure 7: Age distribution of Jordanian population, showing the sex ratio of males per 100 females in each age group, at the end of 2011 (Department of Statistics, 2011)

### 2.3.1.3    Task Analysis

Task analysis helps to identify the actions and cognitive processes by which a user completes a task to achieve a particular goal (Affairs, 2013; Brown's, 2006). Tasks in the design process must be clear and comprehensible. The task analysis must define the model and support methods for designing a usable and useful interface. Tasks can refer to the functions required by users to accomplish or achieve their goals. According to Brown (2006), a UI task refers to the jobs, activities and objectives to be achieved. Tasks may involve action, actors, grouping, objectives, information sources, tools, relationship importance, decompositions, and terminology.

The first stage of designing a new interface is considering the user goals. Although the goals may not change, the steps to achieve these goals may change. If the user's goals are not considered in the user interface, the interface might not engage the user's interest. Task analysis with understanding of the user goals is critical stages in successful product design (Hackos & Redish, 1998). In the task analysis, the designer must know how users

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move from goals to action (Hackos & Redish, 1998).

User-centred systems should help users to achieve their goals. For this purpose, the system should be clear and easily understandable, and its design should be guided by questions such as "What is the target task?" and "What is the nature of this task?" Task analysis techniques reveal the user activity characteristics and provide a framework for analysing current practices, thereby allowing the design of a compound system (Hackos & Redish, 1998).

Methods and techniques for task analysis have developed slowly over the last 40 years (Van Welie, 2001). Task analysis tools include Hierarchical Task Analysis (HTA) by Annett and Duncan (1967), Goals, Operator, Methods, and Selection rules (GOMS) by Newell and Card (1985), and Task Analysing for Knowledge Description (TAKD) by P. Johnson (1992).

Some tasks are important for usability testing purposes; that is, for assessing positive or negative reactions in a usability study. There are two types of tasks: structured tasks, which systematically guide the user through the task, and uncertain tasks, in which users cannot guarantee to find their required information while using the application.

In his master's thesis titled "Think Aloud Methods with Eye Tracking in Usability Testing", Røsand compared retrospective think aloud (RTA), concurrent think aloud (CTA) and eye-tracking (ET). He compared three different types of tasks; an easy interactive task, a reading task and a complex problem-solving task (Røsand, 2013). Zhao (2013) identified two types of usability-testing tasks; articulation tasks and formatting tasks, which can be presented in two main dyads (direct tasks or scenario tasks). A scenario task is presented as a story, whereas a direct task is purely instructional and can be open-ended or closed. A closed task guides the user through specific instructions to accomplish the task, whereas an open-ended task contains minimum information and provides less specific directions to the user.

## 2.3.2   Platform (Tablet PC)

Touchscreen devices combine input and output features into a single device by enabling direct interaction with the screen using a finger or stylus (Pekkala, 2012). Touchscreen technology was pioneered in 1965 for flight control systems (E. Johnson, 1965).

Modern hardware technology has improved the accuracy and reliability of touchscreen technology. Therefore, if the application and program are properly designed, the interactions in modern touchscreens can provide fast operations with little or no training (Kurtz, Fenwick Jr, & Ellsworth, 2007).

A tablet PC is a portable PC with the advantage of a multi-touch screen interface. A tablet PC is a cross between a smartphone and notebook.  The screen size, weight, and functionality of tablet PCs exceed those of smartphones. On computers, such as mobile phones and tablet PCs, users interact with the system through gestures (Gonzáles, Santos, Garvin, & Ruegger, 2013). Therefore, Gonzáles et al. (2013) suggested developing UI design guidelines that are specific to these devices to improve their usability.

The first version of Microsoft's tablet PC, released in 2000, was heavy and often faulty, so was an unviable option  (Pekkala, 2012). Since computer giant Apple introduced the iPad, the tablet PC has evolved significantly (Gonzáles et al., 2013).  Start-up software companies in the new information age need to keep pace with this development.

A common feature of tablet PCs and smartphones is the multi-touch technology, which allows the system to detect at least three points simultaneously. This feature has considerably improved users' experience of touchscreen systems. Touch-interaction has become the default method in speedy, efficient interfaces (Benlloch-Dualde, Buendía, & Cano, 2010). In the next section, I discuss the touch behaviour of users interacting with tablet PCs.

### 2.3.2.1  User Touch Behaviour

A finger-interactive interface poses a challenge in producing a clear touch design on a

tablet PC. How we interact with touchscreens is an important factor for other reasons also, such as minimising action paths, prioritising essential features, ensuring easy site navigation and creating appropriately sized touch targets.

Microsoft studied the behaviour of two groups performing various touch actions using buttons of different sizes, and measured their success as a function of size of the touch target. The larger the touch target, the faster the subjects were able to tap. The chance of one's fingers covering an adjacent icon is slim, but its occurrence generates an undesired outcome (Microsoft, 2011). The user–UI interaction must be straightforward and fast, requiring a unique display and an interactive design.

A touchscreen experience that focuses on a tablet PC allows more intimate interaction between users and the device content through the use of gestures such as sliding, tapping, and other user-interface actions. Saturating the screen with UI components should be avoided; instead, the design should exploit gestural interactions. For example, instead of pressing a button to zoom into an image, users can now use the pinch gesture (Zhai, Kristensson, Appert, Anderson, & Cao, 2012).

When a user taps on a tablet PC using his hands and fingers, he or she is performing a natural movement. User touch has been mentioned in a range of studies. The gestures suggested by Wroblewski (2010) are listed below and in figure 8:

- Single figure
- Single finger motion
- Single finger motion plus button presses
- Two finger motions (move in the same direction)
- Two finger motions (toward each other or away in opposite directions)
- Multiple finger motions (move in the same direction)
- Multiple finger motions (toward each other or away in opposite directions)
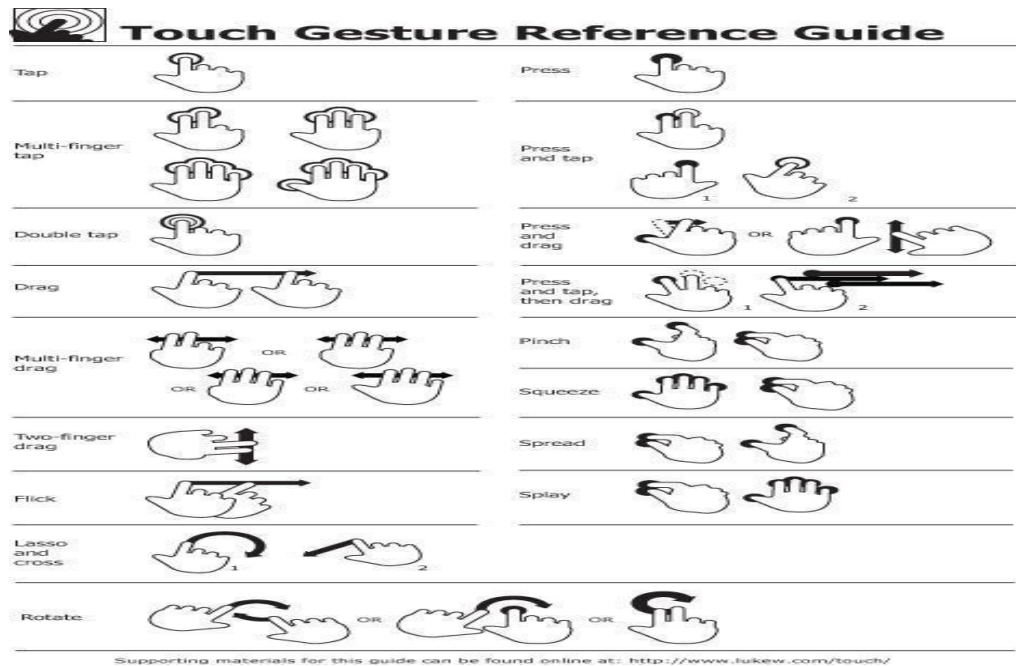
Figure 8: Reference guide for touch gestures (Wroblewski, 2010).

According to touchscreen developers, tablet PC applications should include general instructions that developers can follow when designing the interface. For example, users who are not familiar or competent with the interfaces of Apple applications can understand and interact with the contents more quickly and easily through Apple's UI (Heikkilä, 2013).

## 2.3.2.2    Tablet PC Specifications

In this section, I classify the specifications of the tablet PC into software and hardware elements, as recommended by Kaur (2013). Tablet PCs have been classified in a few studies.

Among these was the study of Singh, Sakpal, and Mathur (2012), who attempted to classify the tablet PCs of vendors such as Apple, Samsung and HTC. They identified three main factors: hardware components, software components and wireless/network protocol supports for internet connectivity. They failed to find a clear classification for tablet PCs, because of the variety of criteria in the classification (Singh et al., 2012).

Pekkala (2012) reported that the components of tablet PCs differ from those of laptop PCs and mobile phones because the sizes, displays, connections, cameras and other technical specifications differ among the devices.

The second category of a tablet PC's specifications is the software, which comprises the operating system and applications. The operating system is the environment in which applications control the tablet PCs. It enables execution of the application, and mediates the interface between users, application software and hardware. There are many operating systems for tablet PCs. Some of them are open sources (for example, Google's Android); others are licensed such as Apple's IOS, or Microsoft's Windows for tablet PCs.

## 2.3.2.3    Environment -Tablet PCs as Educational Tools

ICT is now regarded as a major learning tool (Roschelle et al., 2007). Today's educational technology revolution is replacing traditional teaching tools such as blackboards and chalk with modern tools such as mobile devices (including tablet PC devices) (Albirini, 2007).

Some educators believe that the use of tablet PCs and other novel technologies will exploit concepts from educational instruction and pedagogy. Students often enjoy and enthusiastically participate in technology-based learning activities (Wise, Toto, & Lim, 2006).

Tablet PCs can be regarded as tools that enhance learning and thinking by introducing modern methods (Cromack, 2008). The major objective of these modern tools is to motivate learning by students and boost their confidence (Earle, 2002). Schools and colleges have begun converting to tablet PCs as educational tools (Manuguerra & Petocz, 2011).

Handheld devices such as PDAs (Personal Data Assistants), mobile devices and smartphones can obtain and provide educational contents. Apple Inc. reported that 1.5 million of their iPads are already employed in educational institutions, with over 1000 schools having one-to-one iPad programs (Apple, 2013).

PCs have well penetrated into classrooms and have proven their effectiveness as educational tools (Stigler & Hiebert, 2009). However, owing to their natural advantages (lightweight and portability), tablet PCs might expand and replace the use of large computers. Unlike bulky desktops and laptops, tablet PCs require only a charger. They can be carried anywhere by both students and teachers and are easily shared with others who have forgotten their own devices or who require help. The anytime–anywhere availability of tablet PCs is a major perceived benefit of their use as educational tools(Carol, 2013).

Tablet PC are designed to automatically connect to the internet. Hence, activities such as sharing, obtaining help, collaborating with others and researching more details become easy and intuitive, encouraging a rich learning culture. Furthermore, tablet PC devices use natural touch-based interactions. They are cheaper than PCs; when students or their families cannot afford to buy them, schools are beginning to loan or rent them to students for an enriched learning experience (Harper, Rodden, Rogers, & Sellen, 2008).

With the current use of tablet PCs within the classroom context, researchers have recently examined the effectiveness of tablet PCs in facilitating the learning process. Several studies (Ambikairajah, Epps, Sheng, Celler, & Chen, 2005; Anderson, Schwager, & Kerns, 2006; Kurtz et al., 2007; Rogers & Cox, 2008) have reported that by using tablet PCs in the classroom, students can effectively interact, collaborate, and share information through the allocation of function between the user and system interface.

The learning environment is a critical factor when designing educational systems involving e-learning processes (Harel & Papert, 1990). The learning environment refers to the space in which the tablet PC learning occurs. It can be indoors (home, school, office), or outdoors (public spaces, transportation). Users' environments can be classified as individual or group environments. Working at home or in the public arena, such as schools and communities, requires a personal or collective sense of competence and confidence in one's ability to achieve one's goals through group learning.

Designers tend to infer a user's needs or behaviours from their own knowledge and experience. Consequently, the mental model of the products differs between designer and

user (Chamorro-Koc, Popovic, & Emmison, 2009). The greater the disparity, the higher the risk of design miscalculations. The design process is generally viewed as dynamic, complex, cyclic, evolutionary, opportunistic, and rarely linear or sequential (Hinkelmann & Kempthorne, 2012). These aspects (at least) must be considered in any design guidance that aims to stimulate the design process.

## 2.4 User Interface Designer Supports

Today's revolution of complex cognitive tasks has presented several challenges to designers, including increased time pressure in the design process (Goellner, 2007), limited project budget and large time consumption. Therefore, the design process is typically characterised by a fuzzy front-end, and poses an ill-defined problem (Cross, 2006).

Several factors can affect designers and the design process, such as the aspirations of different users and the interactions of product parts, which complicate the overall process (Reinmoeller, 2002). UI design assesses the ease of communication between users and the application. However, as interfaces grow more complex, maintaining a simple, easy-to-use UI presents a significant challenge to designers (Ramachandran, 2009). Therefore, adapting UI guidelines and principles to different types of users will improve the usability of the application.

Designers can be classified into novice or expert designers. The novice designer has formal training but limited practice (Uduma & Morrison, 2007). According to Pan, Kuo, and Strobel (2013), UI guidelines provide valuable assistance to novice designers in the initial learning stage; "It can enhance their chances to succeed and boost up their confidence."

Designing a UI involves designing interface elements that facilitate the interaction between the user and the functionality of the artefact. The first investigation of the potential value of tablet PCs explored the most distinctive attributes of a basic multi-touch screen in equilibrium with the inherent mobility devices (Funk, Sahami, Henze, &

Schmidt, 2014).

Moreover, a detailed design with high usability is difficult to create (Van Welie, 2001). Therefore, all documents used by the designer and developer when designing a new interface, or when facing a UI design problem, must be properly defined. These documents can be principles, guidelines, or style guides and interactions patterns (Kunert, 2009).

Several authors (Goellner, 2007; Kunert, 2009; Ponn, Baumberger, & Lindemann, 2004) have pointed out the advantages and disadvantages of design guidelines, style guides, principles and patterns. Their conclusions are summarised in Table 6.

Table 6: Advantages and disadvantages of the four sources of design guidelines
(Goellner, 2007; Kunert, 2009; Ponn et al., 2004)

| Type of design guideline | Advantages | Disadvantages |
|---|---|---|
| Guidelines | Fast to read. | No discussion of trade-offs with other constraints. |
| | Easy to remember. | |
| | Useful for Novice designer. | Difficult to interpret the applicability of guidelines to a particular design problem. |
| | They are generally based on established knowledge. | Difficult to find suitable guidelines. No graphic examples of their implementation. |
| | They need a tiny introduction. | No justification or evidence for the guidelines (rely on the author's credibility and authority). |
| | They are readily available. | Difficult to integrate into application design process. |
| | They cover all design aspects systematically. | |
| | They can provide cross-disciplinary knowledge. | Designers are frequently challenged with an overwhelming amount of design tools making it difficult for them to locate the right ones. |
| | They offer reference material. | Time and cost limits often compromise the designers' incentive to use design guidelines. |
| | They can stimulate the designer's imagination. | |
| | They can be applied at any point during | |

| | | |
|---|---|---|
| | the design process. | |
| | They support designers in large design processes. | |
| Principles | Applicable to new technologies and contexts of use. | Difficult to interpret for a specified context of use. |
| | Support for design innovations. Long lasting. | Difficult to apply to specific design problems. |
| | Fast to read. | No detailed design guidelines. |
| | Easy to remember. | No justification or evidence for the guidelines (rely on the author's credibility and authority). |
| | | Difficult to integrate into application design process. |
| | | Difficult to use for new designers. |
| Style guides | Concrete design instructions. | No support for design innovations. No justification or evidence for the guidelines (rely on the author's credibility and authority). Short lasting due to technological advancements. |
| | Sets of rules and do not include conflicting guidelines. | |
| | Include graphic examples. | |
| | Easy to use for inexperienced designers. | Designers are frequently challenged with an overwhelming amount of design tools making it difficult for them to locate the right ones. |
| | Fast to read. | |
| | Easy to remember. | Time and cost limits often compromise the designers' incentive to use the design guidelines. |
| | Useful for novice designers. | |
| Patterns | Discussion of design alternatives | Much text to read |
| | Design and design trade-offs | Examples can be short lasting due to technological advancements |
| | Patterns provide arguments for design decisions. Justification/evidence of guidelines. Support for deciding whether a guideline applies to a particular design problem from comprehensive background information | |

| Include graphic illustration and concrete implementation examples |

### 2.4.1 User Interface Design Guidelines

The design guideline provides a uniform language to harmonises the constancy, appearances, and action sequences for different designers (Apple, 2015). The design guideline document must be based on practical experience or experimental studies with appropriate examples. Therefore, to design a usable UI that helps designers to achieve their goals, designers and developers need to consult guidance documents and evaluate the result on end users.

In general, UI design guidelines constitute a collection of recommended or suggested documents that help designers and developers to create application UIs. Guidelines offer more specific design aides at a lower level of abstraction than principles. Whereas principles are the design goals, guidelines show how to achieve these goals within a specific context (Shneiderman & Plaisant, 2005).

As emphasised by a few authors, graphical user interfaces (GUIs) lack clear design standards despite their importance (Cheon & Grant, 2009). Visual design elements focus on artistic qualities such as colour and unity. However, some guidelines and principles of interface design require a cognitive perspective and evaluation in usability studies (Nielsen, 1993; Donald A. Norman, 2007).

To gain the confidence of designers and provide a tangible rationale for the guidance document, the guidelines should be based on usability principles (Quesenbery, 2001). The UI components should be determined after the principals are determined. The suitability of a guideline component depends on its applicability to the platform UI. In its final stage, the guideline should address the properties (font sizes, colours and layouts) of all UIs (Kunert, 2009). Therefore, the usability principles, UI components and guideline properties are critical factors in the design and development of UI guidelines (W. Park et

al., 2011).

UI design guidelines (or more concisely, guidelines) convey the existing usability and UI knowledge to software developers and designers (Henninger, 2001). Guidelines can be platform-independent or platform-specific. Examples of style guides are the Apple Human Interface Guidelines and the Windows interface guidelines. Examples of design guidelines are the ISO 9241 standard (parts 10–17) and the Research-based Web Design and Usability Guidelines (Quesenbery, 2001).

As evidenced in published design procedures, software UIs and HCIs have become increasingly important in representative guidance for designers since the 1980s (Reed et al., 1999).

In addition, guidelines can reduce the mental and physical stress placed on designers. In the long term, referral to guidelines in the development process can truncate (although not eliminate) the number of repeated designer assessments or evaluations in the growth-and-development cycle of HCI design (Henninger, 2001). Nonetheless, the usability of existing design guidelines is beset with problems (Tetzlaff & Schwartz, 1991; Vanderdonckt, 1999; White, 2013). For instance, S. L. Smith (1986) revealed that only 58% of users found their required information in the design guidelines. A significant 36% reported that they usually cannot find the information they need.

Several inadequacies were revealed in the literature review. First, the appropriate information is not easily accessible and recoverable by designers. Second, the guidelines are too immaterial and abstract to be interpreted easily and applied directly, causing numerous mistakes and damages. Third, designers cannot easily prioritise conflicting guidelines. Finally, the guidelines may not be compatible with latest technologies.

Under these limitations, guidelines could not be a vital part of the design process (Montgomery, 2008). Consequently, some designers consulting the guidelines take no or little interest in the details of the guidelines. The findings of most studies have highlighted numerous problems in current design guidelines, and the lack of any unified style for interface design (Palalas, 2012). However, the behaviour of designers and the need to

improve and create effective design guidelines has not been explored in the literature. Another problem, which has been remarked by software designers and usability specialists alike, is the generalisation of guidelines. Therefore, which guidelines are most suitable to the designer's specific situation is difficult to ascertain. However, as noted by Mosier and Smith (1986), higher specificity would reduce the suitability of the guidelines to a variety of system design applications. This means that the usefulness of guidelines depends on the number of guidelines.

Therefore, in this thesis, I target to develop Arabic UI guidelines that overcome some of the common problems in guidelines such as the generalisation. Accordingly, our guidelines will be specified for particular users; the young Arabic learner; and will involve specific contents about user preferences. Moreover, appropriate and accessible information will be provided to the Jordanian designers.

## 2.4.1.1    Developing UI Guidelines

The UI design process must consider three factors: the designer, the user, and the platform (see Figure 7 of Section 2.2). Design methods for UI guidelines are plentiful in the literature. As an alternative to literature surveying, Gale (1996) suggested a brainstorming process and collaboration among developers and users. Although intended to generate more representative guidelines, Gale reported that the resulting UI guidelines might specify only general design requirements. Many methods purporting to overcome these issues have been proposed. For example, J. L. Campbell (1996) and Kim (2010) proposed a systematic procedure for developing ergonomic guidelines that provides the general rules at each design phase. However, as pointed out in several previous studies, this approach may not truly reflect specific design needs.

Some researchers (e.g., Vanderdonckt (1999) and Vogt (2001)) argued that the challenges imposed by design guidelines might compromise their role as a supporting tool in the design stage (Campbell, 1996). This can be reasoned to that UI guidelines might have been mainly designed to reflect the general design requirements (Gale, 1996).

The brainstorming process collects ideas and information during regular meetings

between the developers and users, which was regarded as too subjective for the present study. Thus, the qualities of the expressed opinions will depend on the members' expertise, which increases the difficulty of editing and updating the UI guidelines. Instead, this thesis proposed novel systematic procedures and techniques for developing UI guidelines for Arabic tablet PC applications. Supporting our claim, Bevan and Spinhof (2007, p. 10) stated that "a good set of guidelines is composed of a combination of more specific guidelines for the application at hand and more generic guidelines that refer to more general aspects of the interface."

As evidenced in the literature review, most previous studies have tried to improve the organisation or developmental process of the guidelines (C. M. Burns & Vicente, 1996; Gelb & Gardiner, 1997; H. Kim, 2010; Quesenbery, 2001; Vogt, 2001), without suggesting a specific method. Consequently, I believe that accommodating the users' needs in the design characteristics is difficult for both designers and developers. Noting this difficulty, W. Park et al. (2011) proposed a systemic approach to UI development, with less emphasis on users' needs.

### 2.4.1.2    UI Guideline Contents

UI guideline components have been reported in various studies. For example, H. Kim (2010) suggested that UI guidelines are typically structured into title, guideline explanations, and examples. Similarly, Leavitt and Shneiderman (2006) argued that UI guidelines should contain a title, explanations, comments, sources and examples.  In contrast, the usability.gov (2006) website suggests four main elements of UI guidelines; input control, navigation, informational, and containers.

Due to the competitive nature of companies developing tablet PCs, each company must develop or adopt an operating system that fits its own rules. Therefore, companies responsible for these operating systems have based their guidelines and principles for applications and UIs on their own terms (Xu, 2013).

H. Kim (2010) divided the UI guideline structure into title, guideline explanations, and examples. Other contents are organised into design factors (navigation, structure and

links), ergonomic criteria (content quality) or the guidelines themselves (specific instructions such as "don't rely on colour alone.").

Such guidelines and principles help and encourage designers to adopt the same appearance and feel as the platforms that will run their devices. Thereby, companies can ensure that their application works with the operating system, and meets the individual user expectations of each platform (Xu, 2013). To accomplish these requirements, designers and developers need resources and concise, clear guidelines that ensure the usability of their developed applications and websites. Therefore, many manufacturers have based their UI guidelines on user experience, usability and principles. Examples of guidelines are listed below.

Apple (designed for iOS 7). The Apple guidelines for the iPad tablet PC (IOS 7) outline the principles and usage of common UI elements for designers and developers, aimed at user satisfaction (see Figure 9).
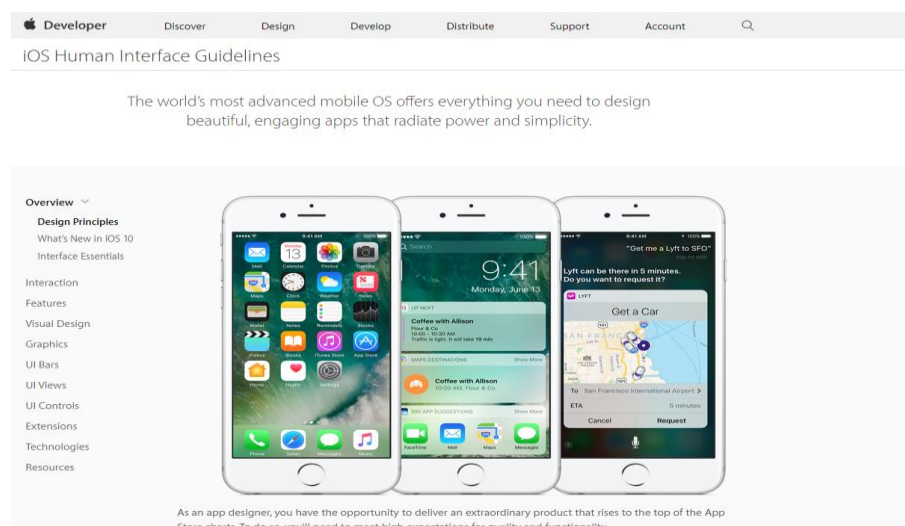


Figure 9: IOS online UI guidelines

The IOS guidelines include the UI design basics (animation, branding, colour, layout, typography and design strategies) that embody the themes of deference, clarity, and depth (Apple, 2014).

Figure 10 shows the Google (Android UI Guidelines). Android began as a mobile

operating system based on the Linux kernel. Since then, Google has developed a user interface based on direct manipulation by touch input. Google has provided guidelines and principles for Android open- source software that integrate smoothly with the Google Play Store. All applications must meet their compatibility guidelines and requirements (Holly, 2014), and must be licensed by Google. The Android UI guidelines include an overview, and specific instructions for layout, input control, menus, notifications, style and themes (Android.com, 2015).
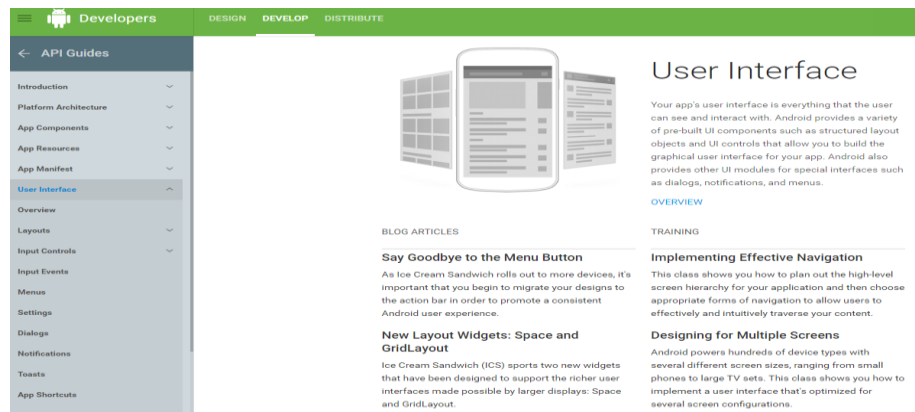


Figure 10: Android online UI Guidelines

The main contents of UI guidelines given in previous studies are summarised in Table 7.

Table 7: Main contents of UI guidelines

| # | Guideline elements | | Details |
|---|---|---|---|
| 1 | Spacing | | Many novice designers underestimate the need for white space. Where on mobile and tablet PC space is very critical due the limited screen size |
| 2 | UI Elements | Typography | Need to define the typefaces to use: font's type, size and colour |
| | | Colour | Always include colour palettes and what the colours should be used for. Semantics and the meaning of colours in Arab culture. |
| | | Layouts and Navigation | While the design comes with two diminutions, (landscape and Portrait orientation) this best practices of promoting consistency and |

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| | | | readability. Navigation bars make it easy to explore and switch between, three main attributes, which are usage, colour and space |
| --- | --- | --- | --- |
| | | Button | Very important to keep the consistency where it could be customizable background and it could be title or icon. |
| | | Icons and Symbols | Defining size and spacing and where to use icons is another great way to promote consistency (in addition to symbol meaning and how) |
| | | Branding | To keep consistent with all applications and pages |
| | | Toasts | A toast provides simple feedback about an operation in a small popup. |
| | | Animation | Animation can convey status, provide feedback, enhance the sense of direct manipulation, and help users visualise the results of their actions. |
| | | Style and themes | The main style of the application |
| 3 | General UI principles | | The main UI design principles to advise designers and developers. |
| 4 | Touchscreen gesture references | | Include all possible movements and figure interaction with screen |

UI design guidelines contain many kinds of information, and should be accessible and easily understood by UI designers (H. Kim, 2010). Several factors and criteria (such as scope) are involved in the organisation and structure of any UI guideline (Initiative, 1999). In this thesis, I will discuss the contents of target UI guidelines with Jordanian designers and develops in order to develop a suitable guideline that fit their requirements.

### 2.4.2 Design Theories and Principles

A Focuses on this PhD not on the design theory. However, I would mention some of theories that used. User interface design is not based around a single generally accepted theory. However some authors for example J. Hartmann, Sutcliffe, and Angeli (2008) Have used adaptive decision making theory

In the same vein, Payne, Bettman, and Johnson (1993)  Which  states that people make

decisions , on the quality and attractiveness of a user interface, based on the task being performed , the context of the use of the interface, and their background-experience. Thus, it is important that user-interface testing reflect the potential real-world. Guideline and design principles come from a wide array of sources including empirical testing, rather than from a single theory-based approach.

Also, there are some different user interface models that have functional variations such as GOMS which developed for text editing application but could use to other task domains (Obilade, 2016). The goal is what the user needs to do, and the operator is the motor. The perceptual action that could takes the place to achieve the goals. They are controlled by application that used by user.

Mandel (2002) describe the UI models as a user's model, programmer's model and designer's model. User interface model that would use as a conceptual navigation and presentation for system interface designers (Hennicker & Koch, 2001).

The UI design principles of many researchers are targeted for easy UI applications in HCI systems (Han, Yun, Kwahk, & Hong, 2001). Because UI principles provide the designer with a rationale behind each guideline, this section explores and analyses the principles applicable to the UIs of tablet PCs. Early examples include (Cheriton, 1976), who suggested UI design guidelines for earlier interactive (time-shared) computer systems, and Donald A Norman (1983), who presented design rules for software UIs based on human cognition. The best-known UI principles, compiled by Nielsen and Molich (1990) and (Shneiderman et al., 2017), are presented in Table 8.

Table 8: The best-known UI principles

| Nielsen and Molich (1990) | Shneiderman et al., 2017 |
| --- | --- |
| Strive for consistency | Consistency and standards |
| Cater to universal usability | Visibility of system status |
| Offer informative feedback | Match between system and real world |
| Design task flows to yield closure | User control and freedom |

| Prevent errors | Error prevention |
|---|---|
| Permit easy reversal of actions | Recognition rather than recall |
| Make users feel they are in control | Flexibility and efficiency of use |
| Minimise short-term memory load | Aesthetic and minimalist design |
| | Help users recognise, diagnose, and recover from errors |
| | Provide online documentation and help |

In a similar compilation, W. Park et al. (2011) collected 65 literature surveys and compared their similarity, inclusiveness, and relevance. They identified 20 principles, which they summarised in a table (see table 9).

Table 9 General principles of mobile UIs (sourced from W. Park et al., 2011).

| Principle | Explanation |
|---|---|
| Simplicity | The user interfaces and interaction methods of a product should be simple, plain, and intuitively recognizable (cognitive load, explicitness, modelessness, nonoverwhelming)[a] |
| Directness | Any user operations should be designed to give a user the feeling of direct manipulation |
| Accessibility | Any functions and user interfaces should be easy to approach when a user wants |
| User control | Authority to control all the functions and the appearance of user interfaces should be given to a user |
| Learnability | The user interfaces and the interaction methods should be easy to learn how to use |
| Memorability | The user interface and the interaction methods should be easy to remember once a user experiences a product |
| Familiarity | The user interfaces and the interaction methods should be familiar to a user, using previous experience or knowledge (unconstraining, comfortable) |
| Predictability | The interaction method and the meanings of user interfaces should accord with user's expectation (congenial, compatible, agreeable, suitable) |
| Consistency | The user interface and the interaction methods should be consistent in a product and within the same product family (uniform) |
| Informativeness | The meaning of user interfaces should be easy to understand and clear (expressive, understandable, meaningful, clear, concise, accurate, correct, comprehensibility) |
| Visibility | The information presented on the product display should be visible and clear to a user (visualizable, conceivable, organized or structured, precise, exact, associative, continuous, aesthetically pleasing) |
| Flexibility | The user interface and the interaction method should accommodate changes to the tasks and environments beyond those first specified (extendible) |
| Adaptability | Modification of user interfaces should be feasible to fit different users and conditions according to users' experience, knowledge and preference (adaptable, adaptive) |
| Error prevention & recovery | The user interfaces and the interaction methods should be designed to prevent a user from making any mistakes or errors (error-preventing or –minimizing, fail-safe, correctable, recoverable, accurate) |
| Forgiveness | Ability for a user to take corrective actions when an error was recognized should be provided |
| Helpfulness | Any helpful information that a user may need should be provided whenever necessary |
| Feedback | The status of a product and the consequences of any user operations should be immediately and clearly provided (feedback-providing, responsive in time) |
| Effectiveness | Every function users want should be implemented in a product (operability, interoperability, powerful, usable, versatile, reliable) |
| Efficiency | A product should be designed to allow a user to perform any functions in a quick, easy and economical way (task accomplishment) |
| Effort | A product should be designed to minimize user's effort in conducting tasks (stress-reducing or –minimizing) |

These and other studies highlight the general UI principles that improve the usability of a UI. The principles convey the rationality of UI guidelines (W. Park et al., 2011). In the present literature survey (Android, 2014; Apple, 2014; Arriaga, 2017; W. Park et al., 2011; Shneiderman et al., 2017), I collected 54 UI principles. After comparing the

principles and grouping those with similar attributes, I identified 28 general usability principles that would support UI guidelines for Arabic designers and developers. These principles are summarised in Table 10.

Table 10 :General UI principles

| # | Principle | Explanation |
|---|-----------|-------------|
| 1 | **Simple** | Simple, plain, and intuitive |
| 2 | **Clear Affordance** | The design indicates what action is required |
| 3 | **Clear signifier** | The design indicates where the action takes place |
| 4 | **Direct** | Operation is direct |
| 5 | **Accessible** | Any user, anywhere, anytime. |
| 6 | **User control** | User has authority to control the functions and the appearance of the user interface |
| 7 | **Learnable** | The interface and the interaction methods are easy to learn |
| 8 | **Memorable** | Interaction is easy to remember |
| 9 | **Familiar** | Interface and interaction is familiar to a user |
| 10 | **Predictable** | In accord with user's expectation. |
| 11 | **Consistent** | Essentially, the consistent location and function of interface controls are vital for free errors. |
| 12 | **Informative** | The meaning is easy to understand and clear |
| 13 | **Visible** | Visible and clear |
| 14 | **Flexible** | Accommodates changes beyond those first specified(extendible) |
| 15 | **Adaptable** | Modifications to fit different users and conditions according to users' experience, knowledge and preference |
| 16 | **Easy Error prevention & recovery** | System should be able to detect the error and offer a simple, comprehensive mechanism for handling the error. |
| 17 | **Forgiving** | User can take corrective action |
| 18 | **Helpful** | Design need to give user all option |
| 19 | **Useful Feedback** | User should be informed |
| 20 | **Effective** | Achieves the required function |
| 21 | **Efficient** | Good learning decisions |

| 22 | **Appropriate Formatting** | Layout fits the screen of a mobile and tablet device without zooming or scrolling horizontally. |
|----|------------------------|--------------------------------------------------------------------------------------------|
| 23 | **Touch Controls** | Touch gestures make interaction easy and natural. |
| 24 | **Hits Targets** | Controls measure at least 44 pixels x 44 pixels so they can be accurately tapped with a finger. |
| 25 | **Text Size** | At least 12 points |
| 26 | **Contrast** | Ample contrast between the font colour and the background so text is legible. |
| 27 | **No text overlap** | Improve legibility by increasing line height or letter spacing. |
| 28 | **Satisfaction** | Enjoyment learning. |

## 2.5 Summary

This chapter discussed the related work and UI design concepts necessary to understand the terms and to explore the keywords of this thesis. Moreover, it is important to review all Arabic UIs, with special focus on Arabic tablet PC students, as no guidelines or principles currently exist for Arabic designers and developers.

The literature revealed a dearth of studies on Arabic UIs for tablet PCs, and complete neglect of Arabic UIs for tablet PCs. The components and structures of UIs were also discussed. Finally, 28 usability design principles were collected for use in the targeted guidelines. The next chapter discusses the research approach and data collection methods.

# Chapter Three

## DESIGN OF THE STUDY

This chapter outlines the five main stages of the research. It describes the research methods used, development of the AVID system and the ethical considerations. The research projects were organised into three empirical works (a designers-and-developers study, a student study and a Delphi study).

In order to answer the research questions, both qualitative and quantitative research methods were used. Previous HCI researches found this approach is one of the best ways to understand the user preferences and linking it to the design goals to improve the designed application (Kuniavsky,2003).

An empirical research approach was adopted in this thesis. This method will allow the researcher to directly observe and deal with end users (Newbert, 2007) while they are interacting with tablet PC applications and ending with more accurate data to be collected. Several empirical research methods were used in the thesis such as interview and coaching thinking-aloud, see section 3.4 for more information.

A chapter is devoted to each study. The five research stages include three-empirical works and two further stages (see Figure 11).

## 3.1  Research design

The UI guidelines were developed through five main stages (from A to E). **Stage A**, identified the gap in existing knowledge; **Stage B**, confirmed the gap and collected the

target guidelines requirements; **Stage C**, collected the UI preferences in the student study; **Stage D**, formulated the initial guidelines; Finally, **Stage E**, evaluated and refined the guidelines. Figure 11 outlines the five stages of guideline development and the output of each stage. The progress of the final guidelines is presented at the right-hand-side of the figure.
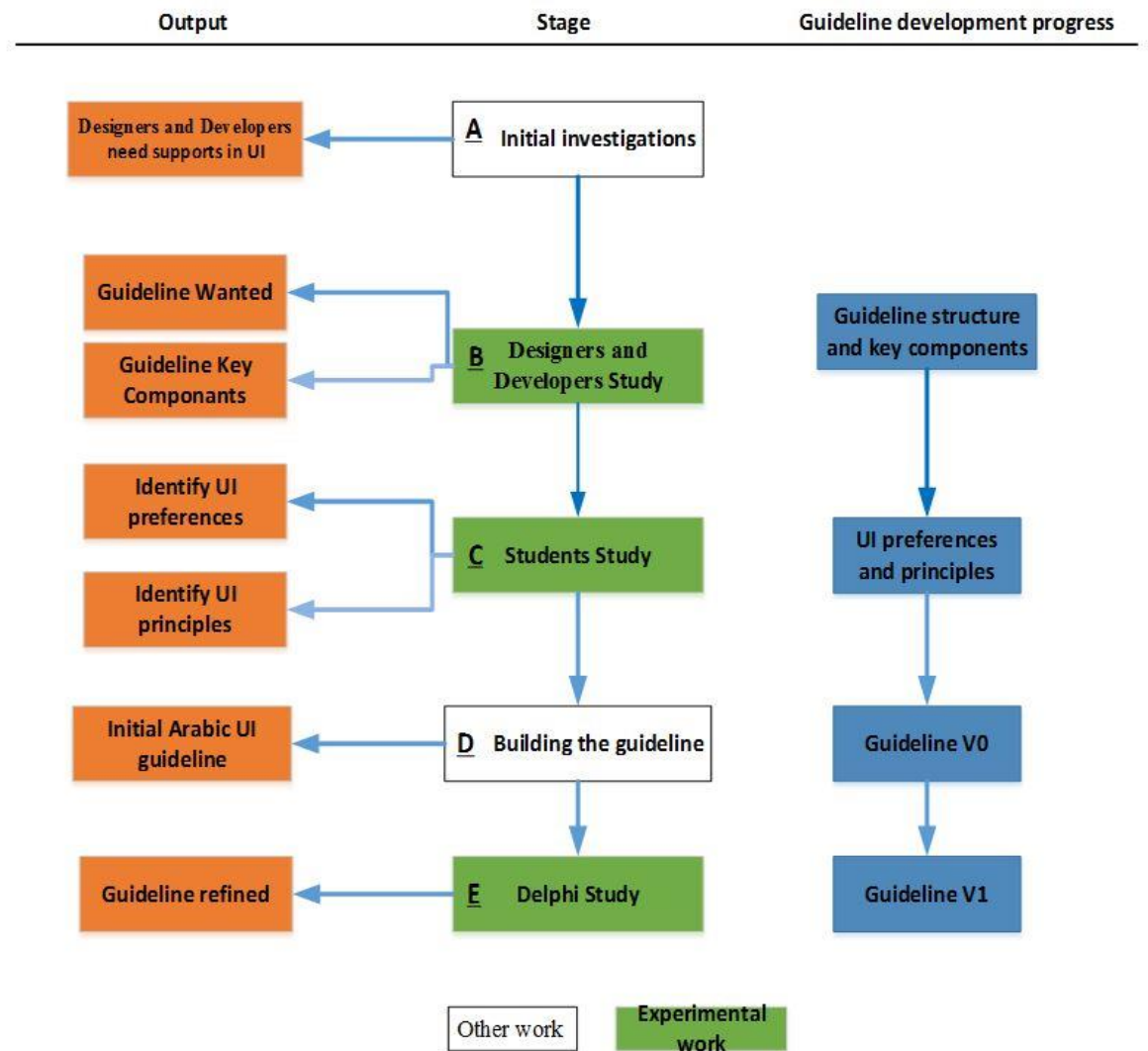


Figure 11: Research Design

This research project was guided by the main research questions, stages, and objectives. The objectives of the research design and their corresponding objectives are summarised in Table 11.

Table 11 :Research design

| Research Questions (RQ) | Stage | Objectives | Research Methods |
|---|---|---|---|
| **What are the current UI design practices in use by Jordanian designers and developers?** | Stage **B** | To understand the UI design process in Jordan and the needs of UI guidelines | Interview, questionnaire and video conferencing |
| **What are the current challenges for UI designers in Jordan?** | Stage **B** | To identify the challenge of UI supporting tools and offering the Arabic UI guidelines as a solution. Then determine the key components of target UI guidelines | Interview, questionnaire and video conferencing |
| **What are the design preferences for Arabic educational applications among students of different gender** | Stage **C** | To identify users preferences for an educational Arabic tablet PC application. | Coaching thinking aloud |
| | Stage **D** | To design Arabic UI guidelines for an educational Arabic tablet PC application. | Coaching thinking aloud literature survey |
| **To what extent do the proposed design guidelines satisfy the designer needs?** | Stage **E** | To refine and assess UI design guidelines that produced the previous research question | Delphi Study |

## 3.1.1 Stage A: Initial Investigations

Initially, I approached designers and developers to obtain their views and experiences. Jordanian designers and developers were targeted because they undertake most of the Arabic IT development in Jordan and other Arabic Middle East countries as well, as mentioned in sections 1.3 and 1.5 of Chapter One.

Two senior designers and one developer raised several points of concern based on their experiences. In general, they believe there is a lack of support for Arabic designers of tablet PC UIs and no scientific references are available for Arabic user preferences since

most of the available references were published in English and targeted at western users. In addition, from my previous experiences and the informal discussions, I assumed that support for Arabic UI designers is much demanded, and could be provided by Arabic UI guidelines. According to the outcomes, a further in-depth investigation with designers and developers would be very beneficial.

### 3.1.2    Stage B: Designers-and-Developers Study

**Stage B** consisted of two main steps. In the first step, I surveyed and interviewed ten Jordanian designers and developers. Sessions were conducted in Amman (Jordan) from late 2014 to early 2015. The first step was intended to understand the main issues and difficulties faced by Jordanian designers and developer, and to familiarise myself with their design processes. In the second step, according to the previous agreement, the results were reviewed by five designers and developers (via Skype and Facebook Messenger) to confirm and better understand the findings of the first step.

The results identified a clear need for support when designing an Arabic UI for tablet PCs. Guidelines were confirmed as potentially useful. The initial components of the guidelines were identified by talking to designers and developers. The contents were identified in an in-depth literature search and confirmed with designers and developers. An initial set of four main sections (with nine subsections in the UI-elements section) was created (see section 2.4.1.2 of Chapter 2). These sections were then analysed against the experience and requirements of the designers and developers, and a set of four main components and six subsections was formulated (section 4.3.2.3, Chapter 4).

To develop the guidelines, a deeper familiarity and understanding of the UI preferences for the traditional elements (font type, size, colour, alignment, menu type and button type) and the religious text and symbols must be gathered from the end user. This goal was also reached in the designers-and-developers study.

### 3.1.3    Stage C: Student Study

As mentioned above, before creating the Arabic UI guidelines, I need to explicitly define the preferred UI elements, in addition to the religious text, from the end users (in our

cases, students using tablet PCs). Therefore, to find out and investigate the user preferences, I developed an Arabic Visual Interface Design (AVID) preference system. The AVID is described later in Section 3.3 of Chapter 3.

To gather the UI preferences of students, I applied the usability technique (coaching-thinking aloud) while using the AVID for preference capture rather than testing the AVID itself. Twenty-one participants were recruited for the study; 11 students from a Jordanian government high school (five males and six females) and 10 participants from two universities (five males and five females). Sessions were conducted in early 2015. A school teacher was required to join the researchers when interviewing the high school students (16–18 years of age). Agreement from the consultant of the Ministry of Education in Jordan was also required. To follow cultural sensibilities and to promote user comfort and free-flow speech, each user was assigned a facilitator of the same gender. All sessions were conducted in the Arabic language. After filling out a demographic questionnaire, participants were instructed to use the AVID while talking aloud. The coaching thinking-aloud technique was adopted for this purpose.

## 3.1.4    Stage D: Guideline Building

After collecting the experimental results of the student study and combining them with the survey findings, I drafted the first version of the guidelines. The first set of guidelines comprised three main components, formulated as follows.

- A. **General Design Principles:** Fifty-four principles of usability and UIs were collected from literature studies (see section 2.4.2). After refining these principles based on their similarity, 28 general usability principles were identified from the literature. Design principles were also collected from the students' study; these were merged with the literature findings. Nine general design principles were used in the final UI guidelines. The rationale behind each design identifies the principles that applicable to Arabic users of tablet PCs in an educational environment. These principles should guide decision making by UI designers of tablet PCs in vague and uncertain situations.
- B. **UI Preferences:** The UI preference elements (font type, size, colour, alignment,

menu type and button type) were elucidated from stage C.

C. **Religious UI Guidelines:** Five religious text principles were identified in the students' study.

## 3.1.5   Stage E: Delphi Study

Before creating the final version of the UI guidelines, the initial guidelines were reviewed by experts (Jordanian designers and developers) in a Delphi group. Design practitioners are the natural choice for examining the initial guidelines in the Delphi study, as they are the target users of our artefact.

The Delphi study tested the first draft of the UI guidelines for educational applications delivered via tablet PCs. To refine the initial guidelines, a panel of six experts worked through the online website. These experts suggested, added, deleted and recommended what is workable in the UI preference guidelines. The guidelines were newly drafted as follows:

I.   **General Design Principles:** Nine UI principles.

II.   **UI Preferences:** UI preference elements (font type, size, colour, alignment, menu type and button type)

III.   **Religious UI Guideline:** Five religious principles and a table of religious symbols were added.

IV.   **Other Components:** An introduction, why the UI guideline is needed, a touch gesture reference guide, and some concepts were written. The Introduction and need for the UI guideline were written to introduce the work and show the benefit of using the guideline, respectively. The touch gesture reference guide and concepts were derived from the literature review.

# 3.2  Participants

When selecting the population of the first study (designers and developers), several factors were considered. First was the number of companies and designers in Jordan developing tablet PC applications. According to the Ministry of Industry and Trade,

approximately 19,000 Jordanian employees work in the IT sector and communication sectors collectively cover 639 Jordanian companies.

To ensure that the designers-and-developers study covered different IT companies working on tablet PC and mobile applications with Arabic interfaces, a comprehensive list of 94 companies with ICT and programming activities was obtained from the Jordanian Ministry of Industry and Trade (Appendix L). Companies were contacted by email or telephone call. Only five companies were interested in joining our study. Meanwhile, some of the other companies apologised because of the workload before the seasonal holidays due date, while others showed no interest or did not reply to our emails.

In the second and third studies, I recruited eleven Jordanian school students (5 from a boys' school; 6 from a girls' school) aged 16–18, and ten university students (5 of each gender) aged 18–25.

User preferences were gathered by a usability testing technique. Nielsen (2000) argued that (on average) five users in a test can detect 85% of the existing usability problems. Similarly, Turner, Lewis, and Nielsen (2006) confirmed that the first three to five users detect most of the usability issues. Therefore, I assumed that to gather UI preferences would require a similar number of users in each group.

The initial guidelines were refined in stage E. The participants involved in the first study (designers and developers) were invited to participate in this stage also, but only five of them accepted, in addition I invited one new participant (more details in chapter 8). In Table 12, all participants in the first and fourth studies are adult Jordanian designers and developers. Table 12 summarizes the study settings of all participants.

Table 12: Study settings

| Stage | Study | Method | Participant Gender and number | Participant Age Group | Facilitator Gender | Place |
|-------|-------|--------|-------------------------------|-----------------------|--------------------|-------|

| | | | | | | |
|---|---|---|---|---|---|---|
| **B** | Designers and Developers study | Face –to-face interview Questionnaire video conference | 10 Jordanian designers and developers. Five for the video conference | +18 | Male | Jordan and Online |
| **C** | Experiment (Secondary School) | Coaching Thinking Aloud | 5 Male secondary school students | 16-18 | Male | Jordan, government schools |
| | | | 6 Female secondary school students | 16-18 | Female | |
| | Experiment (University) | Coaching Thinking Aloud | 5 Male universities students | 19-25 | Male | Jordan universities |
| | | | 5 Female universities students | 19-25 | Female | |
| **E** | Designers and developers | Delphi Technique | 5 (Designers and developers), One PhD student | + 18 | Male | Online |

Throughout the experiments, all participants were fully informed about the process and purpose of each session. There was no deceit or intimidation. Participants could withdraw from the study at any time before their data were analysed.

# 3.3  AVID

The AVID was designed and developed for use in the empirical work stage C). The AVID system is designed to be similar to the real educational tablet PC applications used by students, and assumed to increase their comfort and sense of realism. It is also expected to help the students to express and test their favourite UI elements on real applications

After asking the users to select their preferences, the Arabic Visual Interface Design (AVID) preferences system was designed for an automatically generated system interface. When started, the system interface constructs the six main UI design elements (font type, size, colour, alignment, menu type and button type) identified in the literature review and the pilot study. The AVID was developed in Xcode V5, programmed in

Objective C. The data were recorded in SQLite.

The participants (students) use AVID to customise and choose their preferred UI design elements. The use of AVID in the empirical work is detailed in section 5.1.2 of Chapter 5.



Figure 12: Initial design for the Arabic Visual Interface Design (AVID) preferences system

Figure 12 shows the initial lesson design for the AVID. The texts occupy the left side of the screen, the media (photos, videos) are presented in the centre and the lesson menu and preference icons are listed at the right.

## 3.4 Data Collection Methods

The data collection methods used at each stage are described below.

### 3.4.1 Stage A

From the responses given in unstructured informal interviews, I generated ideas/hypotheses about the design situation and problems. In Stage A, I held informal discussions with three design practitioners in Amman, Jordan.

### 3.4.2    Stage B

Stage B was divided into two steps. In the first step, I distributed individual questionnaires, then conducted interviews (of individuals and groups). In the second step, I ran a video conference involving five participants (for more details, see **Section 4.1** of **Chapter Four**).

### 3.4.2.1    Questionnaire

In the first study of Jordanian designers and developers, I used the questionnaire technique for two main reasons. First, I wanted to collect the demographic information, which is important for analysis purposes and for connecting the results. Second, by collecting statistical information, I can better understand the current situation in Jordan and the questions that should begin our discussions (interviews).

In the designers-and-developers study, the questionnaire consisted of three main parts; the demographic information of the participants, the participants' working experience, and the development process and usability testing in Jordan. (See Appendix G for more details about the questionnaire)

### 3.4.2.2    Interview

According to Flick (2009), the interview method provides the best understanding of a participant's perception and experiences. By interviewing Jordanian designers and developers, I gained insight into their questionnaire answers, and enabled them to speak freely and share what they wanted to explain. During the interview, the main researcher avoided academic language and allowed the participants to express their ideas in their own language (Coviello, 2005). All interview sessions began with the following procedure, adapted from (Robson, 2002).

The interview began with a brief description of the study, a review of the consent form and a recap of the filled-in questionnaire. The researcher reminded all participants that they could withdraw from the study at any time. Interviews were recorded digitally.
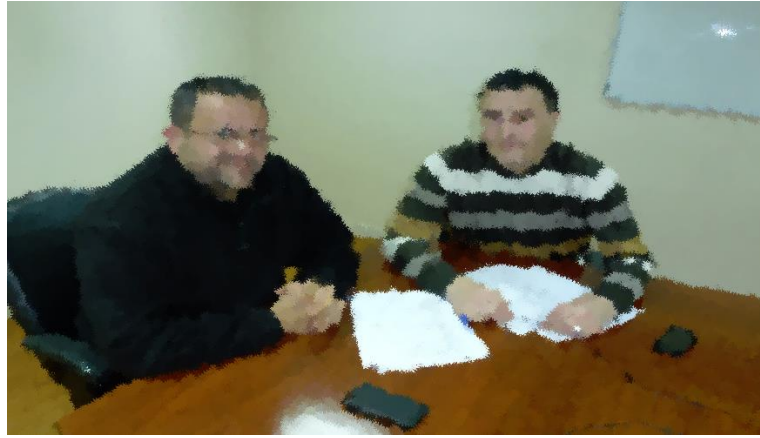
Figure 13: Researcher with a designer in an interview session, Amman (Jordan), 2014.

### 3.4.2.3    Video Conferencing

With the first researcher based in New Zealand, returning to Amman (Jordan) for Step 2 was unrealistic due to financial and time constraints, and other logistical considerations (Deakin & Wakefield, 2014). Instead, I conducted online (video streaming) interviews with five Jordanian designers and developers. All five participants who consented to the Skype interview had earlier participated in the first study.

## 3.4.3    Stage C

In this stage, I constructed Arabic UI guidelines intended to help Jordanian designers and developers in their tablet PC educational design. For this purpose, I required the UI preferences of the end users (students). To obtain these preferences, I applied the think-aloud technique.

### 3.4.3.1    Coaching Thinking-Aloud Protocol

Nielsen (2012), who pioneered the usability concept, considered the think-aloud technique as among the most valuable usability evaluation methods. The coaching thinking-aloud protocol usually slows complex tasks but is not unduly lengthy for simple tasks (Pekkala, 2012). Moreover, the think-aloud technique is limited to some extent, because the researcher is not allowed to question the users, meaning that pertinent points may remain unclarified. For these reasons, I adopted the coaching thinking-aloud protocol

to better understand the user preferences (Borsci & Federici, 2009; Kay, 2004). This protocol forces the participants to focus on the issues related to the UI design elements of an Arabic application on tablet PCs. It also allowed the facilitator to interact with the users (participants), so was not based on user action alone (Dumas & Loring, 2008; Shi, 2009; Shi & Clemmensen, 2008). Furthermore, to implement the coaching thinking-aloud, I required a system in which participants could select their preferred UI behaviours. The AVID (detailed and explained in **section 3.3**) was developed for this purpose.

## 3.4.4    Stage E

After formulating the first draft of the Arabic UI guidelines in stage D, I refined this version by asking the designers and developers of study one along with PhD student to review the initial guidelines.  Therefore, I sought methods for evaluating and shaping our drafted guidelines. These methods must also consider the geographical separation between the Jordanian designers and developers and the main researcher (who based in New Zealand).

### 3.4.4.1    The Delphi Technique

The Delphi technique was appropriate for the following reasons:

1. The study required the knowledge and experiences of experts in tablet PC and mobile UI design. The experts were the same designers and developers I had previously interviewed in Jordan. The designers and developers were mixed between intermediate (less than 5 years) and experts with over 8 years' experience.
2. The Delphi study requires no direct communication among the group members, saving travel time and cost.
3. In the Delphi method, the experts can recognise and rate the elements of the design guidelines through their experiences of the previous project on Arabic interfaces.

Delphi studies are often used to discover a consensus view amongst experts. More details about using Delphi to refine the initial UI guidelines will be presented in Chapter Eight. The final UI guidelines emerged after the Delphi study.

## 3.5 Summary

This chapter presented the research design used in this thesis. The research questions addressed for each stage, and the methods used which are all outlined in Table 11. Also, this chapter describes the data collection methods in each empirical works.

The research was initiated in the researcher's home country of Jordan, which is occupied by different tribes and minority ethnic groups. The researcher was aware of the prevailing ethnic positions. Ethics forms are displayed in Appendix D.

# Chapter Four

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## DESIGNERS-AND- DEVELOPERS STUDY
## (STAGE B)

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This chapter presents the results of interviewing ten Jordanian designers and developers in Amman, Jordan. In the first section, I review the problem, the study method with information about the participants, and the study procedure. Next, I present the data analysis and results, and finally I briefly summarise the study.

Informal discussions with some Jordanian designers in Amman revealed a need for design support, especially for novice designers of Arabic UIs. Furthermore, the literature was devoid of studies on the design problems facing Jordanian designers and developers of UIs for tablet PCs. To bridge this knowledge gap, the researcher investigated the support needs of these designers and developers. I hypothesise those Arabic UI guidelines for tablet PCs in an educational context will assist Jordanian designers and developers. I crystallised our assumptions into two main questions:

1. **What are the current UI design practices in use by Jordanian designers and developers?**
2. **What are the current challenges for UI designers in Jordan?**

I also discussed the challenges in the design process and the roles of developers, and highlighted the usability issues.

## 4.1  Study problem

Designers and developers play a significant role in the usability engineering lifecycle. UI designers and developers face various challenges. Studies on Arabic UIs are rare in the literature.  Designers should ensure that the quality of their design meets user satisfaction (J. Kim & Ryu, 2014). Whenever a new UI is designed, the designer must decide upon the look, feel and function of the UI (Shneiderman et al., 2017).

## 4.2  Methods

The researcher surveyed and interviewed 10 Jordanian designers and developers in Amman, Jordan, and later video conferenced (via Skype and Facebook messenger) five of these participants. Multiple methods were used to view the data from various perspectives. In the first stage, I aimed to understand the main difficulties facing Jordanian designers and developers of Arabic UIs. In the second stage, I sought to understand the design process of new projects and to triangulate the results of the first study. I adopted a qualitative approach that invited the practitioners to actively contribute to the whole research process.

### 4.2.1    Participants

The participants were ten professional designers and developers working on mobile and tablet device applications and website applications in major Jordanian IT companies. Table 13 summarises the participants' demographic information and indicates the participants who were Skyped in the later interview.

Table 13: Demographic information of expert IT participants

|  | **P #1** | **P #2** | **P #3** | **P #4** | **P #5** | **P #6** | **P #7** | **P #8** | **P #9** | **P #10** |
|---|---|---|---|---|---|---|---|---|---|---|
| **Age group** | 25-34 | 25-34 | 35-44 | 25-34 | 35-44 | 35-44 | 25-34 | 18-24 | 18-24 | 25-34 |
| **Gender** | Male | Male | Male | Male | Male | Male | Male | Female | Female | Male |

| Experience | 2-4 years | <1 Year | >8 Years | 5-8 years | >8 Years | >8 Years | 2-4 years | 2-4 years | 2-4 years | 5-8 years |
|---|---|---|---|---|---|---|---|---|---|---|
| **Video Conference** | | | X | X | X | | | X | | X |

All participants were Jordanians with Bachelor degrees. Three interviews were carried out in groups (one group of three and two groups of two participants), and three interviews were individual. Table 14 summarises the information of the interviews conducted in Jordanian IT companies.

Table 14: Information of interviews conducted in Jordanian companies

| Interview # | Number of participants | Period | Company name |
|---|---|---|---|
| **1** | Group of 2 (P#2,3) | 40 minutes | Galaxy International group |
| **2** | Group of 2 (P#9, 1) | 35 minutes | Imagine Technologies |
| **3** | Group of 3 (P#4,5,7) | 45 minutes | Protech - Pro Technology |
| **4** | 1(P#10) | 30 minutes | Protech - Pro Technology |
| **5** | 1 (P#6) | 35 minutes | Eskadenia Jordan |
| **6** | 1 (P#8) | 35 minutes | Diamond Jordan |

## 4.2.2   Procedure

This study was divided into two main steps. As mentioned in Chapter Three, the first step included a questionnaire and interview session.

To refine the questionnaire and interview question, the main study was preceded by pilot studies. The pilot interviews were informally conducted by a researcher in Amman, Jordan. The interviewees were two designers working in IT companies. Both designers had had more than 5 years' experience in developing and designing mobile Arabic applications. Based on the pilot study, the questions were modified to focus more on the design process activities in Jordan and the challenges faced by designers.

All sessions were run in Amman, Jordan, from 26 November of 2014 to 5 February of 2015. Each participant completed the questionnaire before starting the interview on the same day. The interviews were performed individually or in groups (see Table 2). In the group interviews, the researcher recorded notes but did not compare the participants' questionnaire answers.

Arabic was the primary language of the interviews, although the questionnaire was compiled in English. All interviews were then transcribed from the audiotape in Arabic and were analysed by categorising the answers into several themes. Communicating in Arabic increased the comfort and freedom of expression of both participantsts and the first researcher, who originates from Jordan and is a native Arabic speaker.

The researcher started the session by introducing himself and explaining why he is doing the interviews. He then reassures the interviewees of the ethical integrity of the study, and asks permission to record if appropriate.

1- The interviewees confirmed that they had read the information sheets and were informed that any questions would be answered by the researcher.
2- Every participant completed the questionnaire and returned it to the researcher.
3- The researcher read the answers and made notes as quickly as possible.
4- In the warm-up session, participants were asked general questions such as demographic information.
5- In the main session, the questions were presented in logical sequence and dissected in group interviews
6- In the cool-off period, the interviewees were invited to add further information if desired.
7- In the closing session, the interviewees were thanked and the recorder was switched off.

The final version of the questionnaire comprised 24 questions and the interview script included 14 questions. The questionnaire was divided into three parts: demographic information, work experience and app development process. The questionnaire provided additional useful information and initial results that guided the start of the interview.

In the face-to-face interview, which lasted 30–45 minutes, the participants discussed mobile and tablet device applications and website UI design processes, UI guidelines, usability testing and knowledge sharing. The interviews were recorded by digital voice recording. Two of the interview questions were related to the roles of designers and developers, four questions were concerned with usability testing, another four questions regarded the principles and guidelines of UIs, and three questions were devoted to knowledge sharing. The interview finished with a closing question. The following section provides the study results and briefly explains the data collection and analysis procedures.

In Stage 2 of the research, I interviewed five Jordanian designers and developers by online video streaming. The five designers and developers who consented to the Skype and Facebook Messenger interviews had also participated in the first study.

## 4.3  Data Analysis and Results

The data were analysed by the following steps.

● **Familiarisation with the data**: The data acquired from the interviews (face-to-face, Skype) were transcribed and copied to a Microsoft Word document.  The transcript was read twice to gain familiarity with its content. During the second reading, notes were taken for the next phase of the research. As the interviews were recorded in Arabic, selected examples were later translated into English for presentation in the result section.

● **Grouping answers**: To identify the similar ideas among the participants' answers and to understand the main ideas, all answers to each question were collected and read sequentially. All notes and codes recorded from the text were identified and highlighted by different colours.

● **Matching the answers of the questionnaire and face-to-face interviews**: Themes were built by matching the participants' questionnaire answers to their interview responses. To search for the wide-ranging and repeated data, I combined differently related codes with possible similar meanings, or considered a particular aspect within the dataset. This approach also identified the differences among participants' answers. Therefore, combining these themes was a necessary part of the analysis.

● **Defining and naming the themes and subthemes**: The scope and focus of each theme were clarified in a detailed analysis. To understand the themes, the most significant and frequently used words in the text were highlighted in a word cloud (see table 15). The word cloud (in Arabic) was generated by an online word cloud tool (https://www.jasondavies.com/wordcloud/ ).

Table 15 Example of word clouds generated by an online tool.

| Themes | Subthemes | Keywords |
|---|---|---|
| Arabic Mobile and Tablet Devices UI Design in Jordan | Designers and Developers' Multiple Roles |  |
| | Usability Testing in Jordanian Companies |  |
| | Knowledge Sharing |  |

| Design Support Documents Used in Jordan | Guidelines and General Principles Use |  |
|---|---|---|
| | Guideline contents and Format |  |
| | Using Guidelines Challenge |  |

Prior to generating the word clouds, I removed the Arabic stop words from the data. Owing to their common use in the language, these stop words are of near-zero value in the analysis. The Arabic stop words were identified by observation and by reference to the ranks.nl website. The compiled list is presented in Table 16. I assumed that approximately 30–40% important words were omitted from the word cloud.

Table 16: Stop words in the Arabic language sourced from author observation and the ranks.nl website

| | | | | |
|---|---|---|---|---|
| لا | عند | في | ولم | االتى |
| ما | عندما | كل | ومن | التي |
| مع | على | لم | وهو | اكثر |
| هذا | عليه | لن | وهي | ايضا |

| | | | | |
|---|---|---|---|---|
| واحد | عليها | له | يوم | الذى |
| واضاف | تم | من | فيها | الذي |
| واضافت | ضد | هو | ولم | الان |
| فان | بعد | هي | ومن | الذين |
| قبل | بعض | قوة | وهو | ابين |
| قال | حتى | كما | وهي | ذلك |
| كان | اذا | لها | يوم | دون |
| لدى | احد | منذ | فيها | حول |
| نحو | بان | وقد | عن | حين |
| هذه | اجل | ولا | ان | الى |
| وان | غير | لقاء | او | انه |
| واكد | بن | مقابل | اي | اول |
| كانت | به | هناك | عن | منها |
| واوضح | ثم | وقال | ان | منها |
| ب | اما | وكان | او | قد |

● **Confirm the identified themes with participants**: A draft of the results was sent to five participants subject to prior agreement. Results focussed on the UI design process for Arabic mobile and tablet devices. The participants and main researcher collaborated to modify the UI design activity in the Jordanian companies.

● **Writing up**: In the final phase, the analytical data were extracted in context. Arabic was the primary language of the interviews, and the analyses were also conducted in Arabic. Therefore, to properly understand the data, the final phase must also be analysed in Arabic. Having determined the results, I translated selected quotes for inclusion in this study.

The data analysis revealed five main themes (categories) that characterise the UI design process in most of the small and medium Jordanian companies. The issues relevant to the roles of designers and/or developers, and the common use of usability testing, were identified. UI support documents (with a focus on Arabic UI guidelines) were discussed,

and finally the knowledge sharing was highlighted.

### 4.3.1 UI Design of Arabic Mobile and Tablet Devices in Jordan

During the design process, designers need to identify their target users. User profiles are based on the characteristics, interest, cultural beliefs, gender, social groups and lifestyle of the target group. Our questionnaire revealed that most of the participating Jordanian designers (9/10) collect their UI requirements by interviews. In the next step, they find any previous designs or search for online themes or templates, and customise them to the project requirements.

"*While talking to clients, I usually focus on whether we did any similar project. By using that product, we can reduce our cost and obtain closure with the client* "(P#1)

"*Most of the designers use the same method. We usually keep our previous designs, and when we talk to clients we start to remember which one was similar to the client's expectations.*" (P#10)

If the designers cannot find a previous or online design or from their previous projects, they sketch their ideas using Wireframing online tools such as Balsamiq Mockups and Axure.

"*After our meeting with clients, I look at my template and start editing, or I start sketching my thoughts using computer tools (Balsamiq)*" (P#3)

"O*nce the meeting is finished, I start searching for templates or themes form my own template and edit them based on the user requirements; usually I am lucky, and I can find one*." (P#7)

Wireframing quickly and effectively identifies the usability issues early in the design process. Most of the participating Jordanian designers (8/10) use computer-based Wireframing software to present ideas to clients. Wireframing is usually implemented in basic colours (white and black) and font.
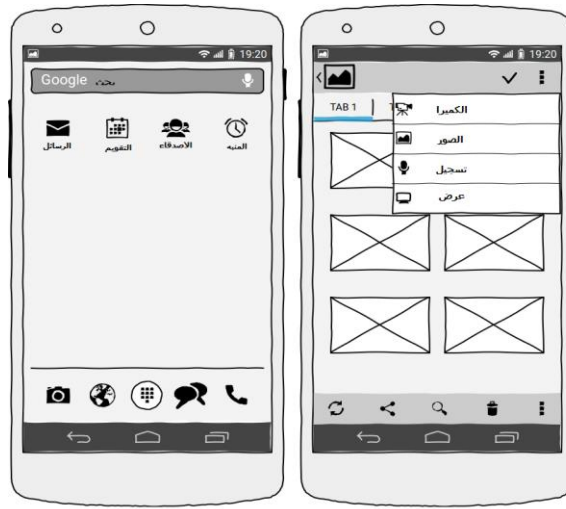
Figure 14: Example of Arabic UI Wireframing.

Whether designers source a previous design or suggest a new one, they invite feedback from their clients. However, before a second meeting with the client, designers meet with a real user, and (if necessary) modify their design based on the feedback provided by that user.

"*I am trying to meet real users in their working field after the first meeting with the client; then I modify the design before another meeting with clients*." (P#3)

Further insight was gained from the participants' sketches of their design process (an example is shown in Figure 15. The participants (9/10) were found to follow an iterative design process, with design evaluations following each major design stage.
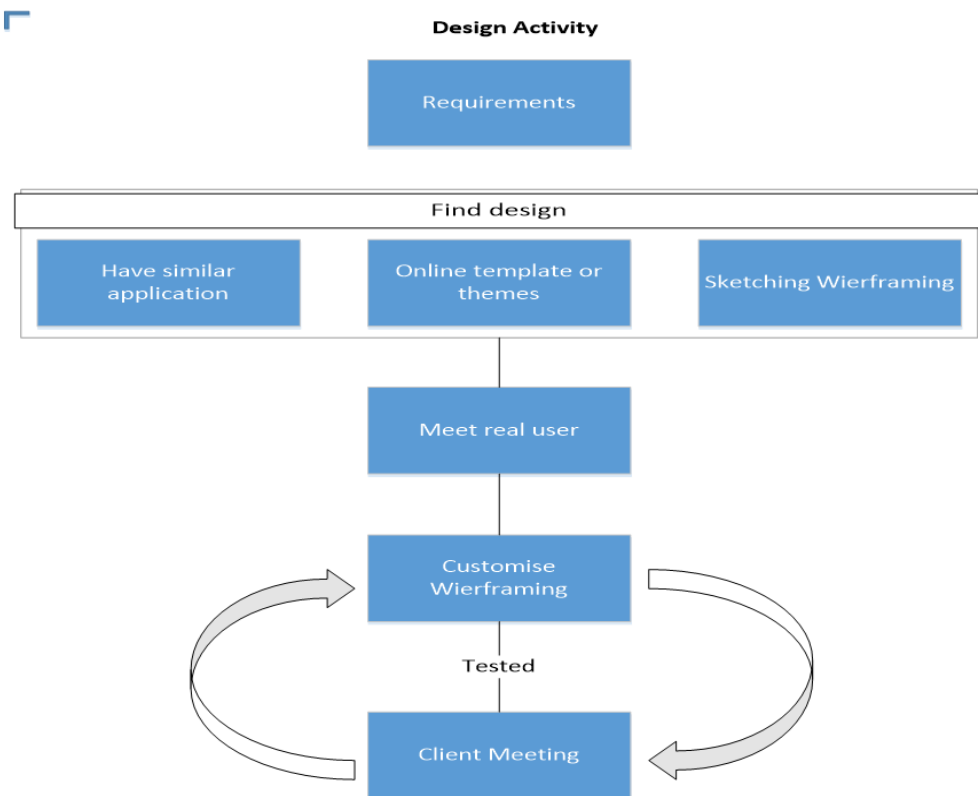
Figure 15: UI design activity in Jordanian companies.

Before meeting their clients, Jordanian UI designers usually review the design in an unscheduled meeting with the team leader and project manager. While designers are working on the design, the developers and other team members will be setting up the database and other infrastructure.

 "*We start working directly after the client meeting where we meet as requested. While developers work on the backend, we work on the initial design*" (P#5)

When designing for mobile and tablet devices, the designer must consider the small-size screen, the attached acceleration sensing, and animation in two orientations. Along with the difficulties faced by most designers of mobile and tablet device interfaces, Jordanian designers are challenged by the language limitation (most UI support is only available in English), the lack of resources in Arabic and the lack of studies on Arabic users and Arabic-language UI problems.

Arabic designers expressed their need for a study that could help them understand Arabic design issues and user preferences. For instance, designers 4 and 8 stated that

*"It is hard to find any Arabic articles or books about UI design... I searched and what I found is something that does not mention respect for the English language, and… contains no important information."* (P#8)

*"Usually I search in English content or guidelines … [I asked why] … to my knowledge I have never heard about Arabic content…, my English is not perfect, but I can understand 70–80% of the articles. "*(P#4)

Therefore, this study confirms that Arabic designers and developers require Arabic-language supports to reduce their time and effort expenditures.

## 4.3.1.1    Multiple Roles of Designers and Developers

One problem facing designers and developers in Jordan is the multiple roles plays within their teams, including data analysis, design, development, and testing. The interview began with general questions regarding the interviewer's role in his or her company. In Jordan, the job title may not accurately reflect the role of the employee. For example, designers may participant in most of the project cycle. Most of the participants (7/10) played multiple roles in a given project, causing confusion and discomfort regarding their main tasks. This problem is widespread throughout the IT industry.

*"I am a developer in my company, but they are always asking me to do analysis and design the interface, which makes me feel dissatisfied"* (P#8).

*"My boss is asking me to do everything, he asks me to be involved in all of the application development lifecycles …., I am a designer who needs to focus on designing the interface instead of coding or gathering the requirements!"* (P#2).

It appears that management is unaware of the different roles, abilities, and competencies required for successful completion of a mobile and tabletting device development project. For instance, an expert programmer with less experience in other IT tasks is often

expected to undertake graphic design and usability testing.

## 4.3.1.2    Usability Testing in Jordanian Companies

When assigning a project to a team member, Jordanian companies consider three main factors; cost, project size and delivery time. Participants reported that cost was the most important factor, as it may affect the number of teams or change the delivery time.

To cut costs and reduce the development time, Jordanian companies are currently avoiding usability testing unless requested and paid for by the client.

"*Once we have a first draft prototype, we ask clients for their feedback. We try to avoid testing the system with the end user to reduce cost and deliver the system on time*" (P#10).

"*Some clients ask us to test the prototype with the end user. However, this will increase the cost of the project*" (P#5).

Some of the interviewed Jordanian designers (5/10) prefer to omit usability testing, regarding it as a luxury that requires an expensively equipped lab, and a long time to acquire the results.

"*In our company, development of any application usually goes through the normal process steps, but if there is a time limitation or the client does not want to pay too much (low-cost application), then we skip the usability testing step*" (P#7).

"*To make a good UI you need to consider usability, UI interface design, colours and things like that; having some arts creativity is also good. As UI problems are subjective, there is no correct answer or easy way to validate whether it was correctly done*!" (P#6)

When the opportunity arose, usability was most commonly evaluated by interviews (8/10). Secondary methods reported by participants were heuristics evaluation checklists, cognitive walkthroughs, pluralistic walkthroughs and questionnaires/surveys. Heuristic evaluation was considered justifiable when time is limited, or costs money in the company. Moreover, it requires no expert users or extra equipment.

"*I prefer the heuristic evaluation methods; it is easy to find the checklist online and it does not take that much time*" (P#2).

"*Heuristic evaluation methods are easy to use and there's no need to be an expert; it just requires some knowledge of UI*" (P#4).

However, some of the participants reported that evaluating Arabic interfaces is difficult because of cultural limitations and the lack of a common language with the users. For example, a team leader in one group meeting explained:

"*I do not prefer speaking with any client face-to-face, although we have to do that. Users find it hard to describe what they want exactly; therefore, we introduce several designs for the interfaces so they can choose the required one. However, after they approve one design, they may come back and ask for changes to the final design. This causes us much fatigue*" (P#5).

### 4.3.1.3    Knowledge Sharing

Software development could be a cooperative and knowledge-intensive process that combines and interweaves the knowledge distributed across various specialised domains (Bertolino, 2007; Patnayakuni, Rai, & Tiwana, 2007). Knowledge sharing is very important in cooperative groups generally (S. Garrett & Caldwell, 2002; Tsai & Cheng, 2012), and in software development groups especially (Ghobadi, 2015; Yang & Maxwell, 2011). Design practitioners interact during repetitive development cycles. In these interactions, speedy reflections disseminated by intensive information sharing are essential for understanding various experiences and for exploring existing and potential opportunities in software development(Chakraborty, Sarker, & Sarker, 2010; Nerur & Balijepally, 2007).

The participants expressed their preferences for exchanging their own experiences. Knowledge between designers and developers was usually shared by face-to-face communication (8/10 participants), followed by email (7/10 participants) and phone calls/short message service (SMS) media sharing (such as Facebook and documents)

(4/10 participants).

The interviews focused on how the designers and developers fixed their design problems, cooperated with others, and shared their knowledge. Participants emphasised that when solving design problems, they prefer to consult their team leader or company managers. Design problems and their solutions are also commonly discussed in break-times, as explained by one participant:

"*Break-time is my preferred time to talk with my colleagues when we can interchange and discuss our ideas and advice. Moreover, the people with real experience in designing interfaces help us to know what we should do at the next step*" (P#9).

In general, designers lack sufficient experience to undertake many stages of the software development process, placing extra time demands on experts and team leaders. Moreover, there are no clear guidelines for software applications and websites in the Arabic world. One design expert who is also a team leader stressed this point as follows:

"*Sometimes it's good that the novice designers ask us when they face problems, but in many cases they just come and ask without searching for solutions. I believe that they need to improve their knowledge by reading and browsing different design guidelines, as there is no specific design guideline in the Arabic language for mobile device and tablet devices*" (P#6).

## 4.3.2    Use of Guidelines and General Principles

Guidelines are intended to improve the consistency of applications created by developers and designers. In their questionnaires, our Jordanian participants reported that expert opinion is their main source of information. One of the interview questions was "*Did you use any design guidelines in your recent projects?*" Some of the interviewees answered that they used no formal guidelines or principles, but sourced their solutions from the internet.

"*We do not have any such documents. We have our logo and themes that we use by*

*default. If a new designer is employed, we tell him/her about our UI that we usually use*"
(P#3).

Other companies had developed internal UI guidelines based on default preferences, but these were transmitted verbally rather than documented. The type of UI guidelines, which varied among companies, was supported by an expert's opinion (here, the expert refers to the project manager or team leader).

"*Usually, the difficulties begin when we start thinking about the interface design, since it is hard to understand the client's needs exactly, and we may re-design the interface or do many changes on it which are time-consuming. Unfortunately, our internal guideline is not documented, and we verbally inform each other... when a design problem presents*"
(P#9).

Consequently, most Jordanian IT companies have no specified documented guidelines or references for designing Arabic UI applications. Instead, they solve a single design problem by searching the internet, which increases the complexities of the design problems and pressurises the interface designer.

Participants were asked to select one or more UI guidelines and rules they had used in their designs. Participants in the group interview acknowledged the benefit of using specific UI guidelines as a supplementary tool to support the design process. In the same interview, participants reported that appropriate UI guidelines improved the ease of creating the UI designs and applications and increased the usefulness of the applications. Participants' responses included

"*I believe that UI guidelines will enhance my design and make me more confident while designing*" (P#2).

"*I usually notice that my application is working well when I use the usability checklist*"
(P#7).

The designers and developers confirmed that they asked their team leader o refer to internet when solving design problems. Seeking expert opinion was one of the preferred

choice for solving design problems; otherwise, the participants consulted published research or company guidelines such as Apple or Android guidelines.

A specific interview focussed on the solutions for design problems, which were indicated in the participants' questionnaire answers. Pattern libraries were thought to provide useful guidelines and were usually referred in specific design problems, as they offered successful solutions to the designer. One female designer said:

"*Using pattern libraries is my first option, it is very good and useful for finding the solutions to the interface design problems that I usually face, and my most dependable resource is the Yahoo pattern interface library*"(P#8).

Another developer added: "*Designing an interface for web applications is one of the hardest things that I have to do. Users need an interface that is easy to use, pleasant, comfortable and efficient. Sometimes, I face problems with the interface design, such as navigation issues and entering complex data, colours and fonts. That leaves me feeling confused about the methods that I can use to solve these issues; sometimes I use Welie patterns that offer multi-useful treatment options such as list builder*" (P#10).

Patterns were also used by designers facing design problems. However, some of these design problems were difficult and demanded further information. As one designer explained:

"*I do not think patterns help me when I need to start my design or choose user preferences. I can tell that we face difficulties in setting out the design process, since many clients do not accept our colours or fonts, especially in the Arabic interfaces*" (P#2).

Patterns provide a general repeatable solution to common usability problems in interface design. A typical pattern consists of seven elements: the problem, when to use the pattern, the principle, the solution, why the pattern is used, an example and an implementation (Folmer, 2014)

The participants acknowledge the great impact that design principles on their design as some of them express.

*"The Design principles is core for designing; these principles could help me to make right decisions "* (P#2).

In general, guidelines describe the requirements and provide examples with rules, whereas patterns are the most useful tools for solving interface design problems. In fact, UI guidelines are most useful in the initial interface design. Also, the UI design principles has an important positive on the design and the designers should remember them such as the clarity, flexibility and consistency and structures. They help to deliver a consistent design product and suggest the final look of the application. However, no specific guidelines have been designed for Arabic interfaces.

## 4.3.2.1 Challenges of Using Guidelines

Designers reported that challenges remained while using UI guidelines. Thus, the interviews focused on identifying these challenges. Limited designer experience is among the challenges that affect the design process. One participant highlighted a salient point about designer experience:

*"In our team not all of us have the same level of experience. Therefore, when we are using the interface design guidelines or looking for the usability rules, some of us cannot understand them and need help to clarify what some point means. Since most of the guidelines are in the English language, sometimes the guideline language is complicated and hard to understand, so you need help from the experts to explain the scientific terms"* (P#4).

The size of UI guidelines is also problematic, as long guidelines are more difficult to access and understand. Finding the UI rules is especially difficult when the designer prefers to use the hardcopy of the guideline rather than the softcopy version. Moreover, excessive information can bore or overwhelm the designers.

*"Usually, we do not have time to read; we prefer to find what we are looking for in an easy and fast way. In our team, some of the guidelines contain much repetitive information; thus, we waste much time and effort to find the correct information"* (P#10).

To maintain readers' concentration, the functional UI guidelines should be linked and well organised. Accordingly, the rules and examples of a given topic should be linked and grouped for easy reading and comprehension.

Application design is a long process and most applications are developed over an extended period (in some companies, the design takes 3–5 years). Therefore, the applications become extremely complicated and difficult to understand for new programmers or designers. A project leader pointed out this problem as follows:

"*I found that the new programmer and designer had difficulty in working with the old project, even if we assign a limited area of these applications due to the learning curve required*" (P#5).

An expert designer emphasised the same problem by saying:

"*Working on a project sometimes takes a year, through which changes in staff may occur resulting in new employees becoming involved. The newly employed designers took time to teach and needed explanations of our projects to understand our ideologies*" (P#6).

Designers and developers reported difficulties in applying UI guidelines. Some designers and developers working in medium and small Jordanian IT companies, particularly graduates of computer science from universities, were trained in computer programming only. They had learned how to run programming code from a command line, and implement efficient algorithms for programming problems. However, they were poorly trained in good UI design.

"*As a programmer, after graduation I found what we had studied was not close enough to the real work requirement; since we had been taught how to program, not how to design. Our teaching courses focused on the functionality of the code, not the user interface*" (P#1).

Another participant reported a nearly identical sentiment: "*I had graduated from […] which is considered one of the best universities in Jordan and we learned to be good programmers, not designers*" (P#2).

Programmers and designers consider that UI tools are useful for simple usability problems, but are less functional in complex user scenarios. When the usability problems are outside the domains of the guidelines, the task becomes much harder, and the programmer must resort to more complex tools such as Xcode and HIView object. Although efficient, these tools are difficult to use.

"*I face difficulties in UI works as well as some UI frameworks; I have been the programmer at .NET for more than five years. The frameworks for creating web applications are great, but, the frameworks for coding mobile applications are more complex*" (P# 4).

Another participant emphasised the same point:

"*My team leader asked me to learn the Interface Builder editor within Xcode. I am working on that right now, but I feel it is a hard and complex tool that is not easy to use for designing*" (P#8).

The designers and developers in Jordanian IT companies are more familiar with English than Arabic UIs, and prefer non-Arabic interfaces for their tools. However, these tools should support the Arabic language.

## 4.3.2.2    Guideline contents and Format

Several factors contribute to the use of UI guidelines, such as the appearance of the guideline, the preferences of the designer and the environment of use.  Our questionnaire included no specific questions about the guideline content and format; instead, interviewees were asked to state their preferred guideline format and why they preferred this format. Their various answers can be summarised into three main guideline formats:

**Online**: most of the designers and developers preferred online guidelines. Online guidelines were viewed as easily accessible, easy to search, well organised, convenient and highly reliable.

**Offline**: Some participants preferred an electronic version that can be accessed at any

time. The preferred format was pdf. Offline documents are accessible even when internet access is lost, are easier to navigate than online sources, and can be printed out when needed (as noted by one participant).

**Printed**: Other participants preferred hard-copy guidelines. One participant said: "*It is good to have it in front of you*". Another preferred the hard copy "*so I can draw and write some comments*". A third participant explained that hard copy "*is healthier for my eyes; so I prefer reading papers.*"

The structure and contents of the UI guidelines were discussed with our participants (see interview question 10 in Appendix F). The Jordanian designers and developers responded that the target Arabic guideline should include the main components of UI (typography, colour, layout, navigation, button and icons preferences) with direct examples from the end user.

*"It is critical for any designers to select the proper UI. Therefore, I believe it will be better if we can get it direct from the end user"* (P#1).

How and where to use religious text and symbols in text-based applications should be understood. In the group interview (interview #3), the importance of religious-text examples in the guideline principles was mentioned by some participants:

"*I cannot see you include any staff about religious text*" (P#3). This statement was confirmed by participant #9: "*Most of our books include religious text and symbols, I would appreciate it if I can see something in your guideline*" (P#9).

Some of the participants considered that the main UI principles applicable to mobile and tablet PCs should be explained. These elements are summarised in table 17.

Table 17: Key components and structure elements of UI guidelines

| # | UI elements | | Details |
|---|---|---|---|
| 1 | UI | Font Type | Identified the preferable font's type from end user |
| | | Font Size | Identified the preferable font's size from end user |

| | | | |
|---|---|---|---|
| | Font Colour | Identified the preferable font's colour from end user | |
| | Alignment | Identified the preferable alignment (right, centre, left) from end user | |
| | Button | Identified the preferable buttons type from end user | |
| | Menu type | Identified the preferable navigation menu make it easy to explore and switch between pages. | |
| 2 | UI Principles | Find out the principles that could apply to touchscreen and Arabic user | |
| 3 | Religious text and symbols | Include the main design principles for religious symbols and text | |

## 4.4  Summary

This study confirmed that designers and developers of UIs for tablet devices in the Arabic language lack design support, but would benefit from it. The use of tablet devices and their applications has expanded from entertainment into work and practical life. The main findings of this study are summarised in Table 18.

Table 18: Summary of study findings

| Section | subsection | details |
|---|---|---|
| **Arabic Mobile and Tablet Devices UI Design in Jordan** | | UI Design activity in the Jordanian companies still needs to be improved. Designers and developers are working hard to deliver useful Arabic UI with apparently little support. |
| | **Designers and Developers' Multiple Roles.** | Having multiple roles sometimes creates confusion and compromises the quality of the work. |
| | **Usability Testing in Jordanian Companies** | Most of the Jordanian designers prefer interviews as the first option for usability testing.  Some also used heuristic evaluation checklists, cognitive walkthrough, pluralistic walkthrough and questionnaires. |
| | **Knowledge Sharing** | Teamwork and mentoring needs to be developed and nurtured to build competence and confidence throughout the team. |
| **Use of Guidelines and** | | The participants agreed that UI guidelines could be useful to support and enhance UI |

| General Principles | | practitioners design in Arabic. |
| --- | --- | --- |
| | Challenge of Using UI Guidelines | Jordanian designers and developers have limited experience with using UI guideline documents where they need to know how and when they can use it. |
| | UI Guideline Contents and Format | Guidelines will be enhanced by including examples and detailed touch screen principles for Arabic and touch screen devices. |

Among the most difficult steps in UI design is closing the gap between the analysis and detailed design. Moreover, considering the usability issues, detailed designs are hard to create (Van Welie, 2001). Therefore, it is important to define all documents used by designers and developers when designing a new interface or facing a UI design problem. According to Kunert (2009), these documents can be principles, guidelines, style guides, and interaction patterns.

Owing to the competition among companies developing mobile and tablet devices, each company must develop or use a system that fits its own rules. Consequently, the companies responsible for developed and published guidelines and principles for applications and UIs on their own terms (Xu, 2013).

Such guidelines and principles help and encourage designers to follow the look and feel of the platforms running the device. In this way, a company ensures compatibility between their application and the operating system, and can meet the user expectations on individual platforms (Xu, 2013). To accomplish this successfully, designers and developers need resources and concise, clear guidelines that guarantee usability of their developed applications and websites. Therefore, many manufacturers have developed UI guidelines based on user experience, usability and principles. Examples are Apple (iOS 7) and Google (Android User Interface Guidelines).

The current study answered our research questions and revealed the current UI design practices used by Jordanian designers and developers. The challenges of utilising UI design guidelines in Jordanian companies were also investigated. The research questions will be discussed in Chapter 9.

# Chapter Five

## SCHOOLS STUDY (STAGE C)

This chapter consists of four sections as listed below. It first introduces the school experiment and highlights its role in the thesis. It then illustrates the AVID designed for this study and the required tasks, and describes the coaching thinking-aloud technique and how the participants were recruited. The experimental environments and data collection procedure are discussed, and the raw collected data are analysed. Finally, the chapter content is summarised.

This experiment aims to determine and identify the UI preferences of Jordanian school students using tablet PCs. The study findings will assist Arabic designers and developers to establish design guidelines for Arabic UIs in tablet PC educational applications, and to identify other design issues. Consequently, Arabic applications for tablet PCs will be improved, and devices will become more appropriate in Arabic educational environments.

Accordingly, this chapter identifies the UI preferences of school students using Arabic educational applications on tablet PCs. The experimental study was conducted in Jordan, where school students represent 30% of the population (عميش, 2014).

## 5.1  School Experiment

This experiment is a qualitative study involving 11 participants; five male and six female high school students attending Jordan government schools. As mentioned, I adopted the

coaching thinking-aloud protocol with the AVID system to lead the students towards stating their UI preferences for Arabic tablet PCs. This study will also highlight the issues related to UI design of Arabic applications on tablet PCs.

Sessions were performed in Irbid, Jordan, from 20 December of 2014 to 6 February of 2015. Agreement from the consultant of the Ministry of Education in Jordan was required. Because the students were minors, a schoolteacher was required to join the researchers during the experiments. Besides admitting the teacher, I ensured that the facilitators were of the same gender as the 16–18-year-old participants. In Jordan, 16 is the legal age of consent to participate in such experiments. Therefore, parental permission was not sought. The permission of the school and ministry is a substitute for parental permission (see Appendix C).

Participants used the AVID for approximately 30–40 minutes. Arabic was the premier language of the interviews. The participant interviews were recorded by digital voice recording and the tablet PC interface screen was captured by video. All sessions were transcribed from the Arabic audiotape and analysed. The details will be presented later in this chapter.

### 5.1.1  The AVID

As mentioned in Chapter 3, the AVID was designed for iPad tablets and landscape orientation based on the pilot study. The literature indicated that 60% of iPad users prefer the landscape mode (Hughes, 2013). Therefore, the participants were instructed to use the iPad in the landscape orientation (the default orientation of the application).

To start using AVID, the user must login by registering with our system. After setting the preferences, the students were assigned reading tasks. The AVID is designed to resemble typical software applications, so can be handled in familiar ways by the participants.

The AVID system interface was constructed from standard UI design elements (font type and size, font colour, button type, alignments, and menu types).
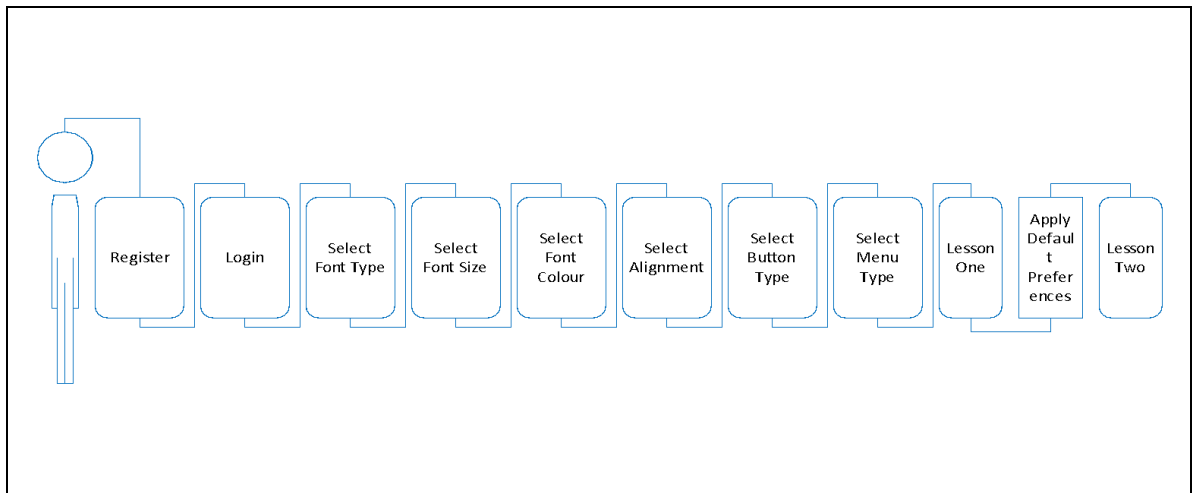
Figure 16: Selection process in AVID

Figure 16 shows the selection steps, starting from the first page of the AVID (the registration and login page). Once the users had logged in, they chose their preferred system-interface elements in the following order: font size, font type, font colour, layout buttons type, layout alignment types, and layout menu type. After setting their preferences selection, the users completed Lesson One (Figure 17) and Lesson Two (Figure 18).



Figure 17: AVID Lesson One

Both lessons were reading tasks. Lesson One included general content that was useful for

us to know students preferences. In this lesson, participants' used their first selections of the AVID interface UI design elements, but (through the AVID) could change their selected typography, colour and alignments preferences at any time. The buttons and menu preferences could not be changed. The aim of this lesson was to allow the participants to practice their preference selections and to view their appearance when applied to real text. Also, the AVID allowed the participants to try different preferences until they found what they expected and wanted from these preferences.
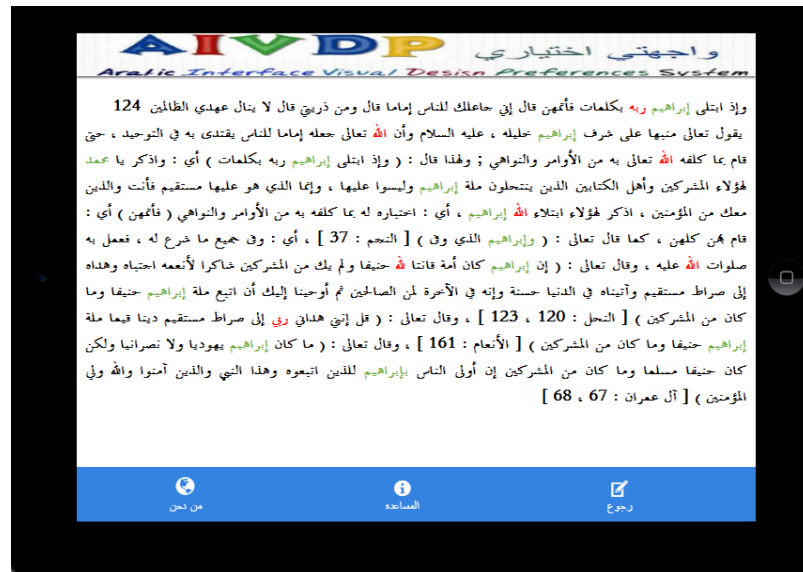


Figure 18: AVID lesson two

Lesson Two, which included a religious text. This lesson was unchangeable (that is, the preference selections were excluded). Lesson Two asked participants to interpret part of the Holy Qur'an. The religious text, such as the name of Allah (God) "الله" and the name of the prophet ابراهيم (Ibrahim), were coloured to highlight the religious nature and content for the reader. The UI design elements were also selected by the researcher to match the holy book of Qur'an (see Table 19). This selection is commonly found in printed versions of the Holy Quran and its appearance will be familiar to students.

This lesson aimed to assess whether the users favoured the colouring of the religious text, as they were familiar with it in their religious textbooks. The text colour must be acceptable in tablet learning of religious study. Lesson One investigated whether the students wished to change their originally selected preferences, whereas Lesson Two

investigated their attitudes to religion.

Table 19: UI preferences in Lessons One and Two

| Preferences | Lesson One | Lesson two |
| --- | --- | --- |
| **Font Type** | User selection | Al-Naskh |
| **Font Size** | User selection | 14 |
| **Font Colour** | User selection | Coloured |
| **Alignment** | User selection | Right |
| **Button Type** | User selection | N/A |
| **Menu Type** | User selection | Bottom |

## 5.1.2  Tasks

Through these research tasks, the researcher interacted with the end users and thereby collected the required data on their UI preferences. Three factors were considered when designing the testing task; the time allocated to the task (here decided as 30–40 minutes), the demographics of the end users (individual male and female high-school students aged 16–18 years), and the role of AVID, which was discussed in Section 5.1.1

Prior to starting the test task, the students were assigned a short task list written in Arabic. This scenario introduced the task steps and illustrated the system UI-element options from which the participants selected their preferences.

There were three main tasks, to be completed in the following order:

- Open the AVID application. Please go to the registration page and enter the required data to register and login.
- After login, select your preferred options for the type, size, and colour of the font. Also, select the alignment, button type, and menu type. Your selected preferences will be applied in Lesson One. Read the first paragraph aloud.
- Please return to the main page, and choose Lesson Two. Please read the text.

During the task testing, the facilitator asked specific questions of the participants to clarify some points and to gather more data. A typical question was "Could you please tell me why you chose this font type?"

In summary, the participants were given the testing task instructions before using the AVID. As the AVID is intended for iPad tablet PCs, it was introduced to the students in landscape orientation. Through the AVID, users selected their preferences before starting the first reading lesson. During Lesson One, they could change their font (type, size and colour) and alignment preferences at any time, but could not change their pre-selected menu and button types. During Lesson Two, the users revealed their acceptance of colouring for religious texts and religious principles.

### 5.1.3  Participants' Recruitment

To meet our study objectives and processes, the participants should be school students of both genders, aged 16–18 years old and with prior experience of PCs. This group would easily understand our experiment, be able to use the device, and be familiar with multi-touch screens.

Through school board announcements and class invitations, the researcher recruited 11 students (six females and five males) from government high schools in Irbid. The participants read the information sheet explaining the study, then signed the agreement paper. Before the task sessions, they also completed a demographic-focussed questionnaire (see Appendix B).

To collect further information on the participants, the researcher observed the students using the tablet PC, and noted their hand–screen interactions. Five female participants used their right hand; the remaining female used both hands. In contrast, all of the male participants used both hands. Most of the students interacted predominantly with their right hand. In Islam, the right hand is preferred over the left hand when eating, greeting and performing various other activities (Wehbe-Alamah, 2008).

Table 20: Hand use of the participants interacting with a touchscreen

|  |  | Hand use | | |
| --- | --- | --- | --- | --- |
|  |  | Right only | Left only | Both |
| **Gender** | Male | 0 | 0 | 5/5 |
|  | Female | 5/6 | 0 | 1/6 |

Table 20 summarises the handedness information of the participants. One female and one male participant wore prescription glasses. The other participants had good natural vision.

## 5.1.4  Experimental Environment

If the in vivo environment resembles the participants' normal environment, the participants will display their typical behaviours. Therefore, the experimental sessions were conducted in the computer laboratories of the male and female schools, and all participants used the same prototype (AVID) on the same tablet PC (iPad 2).

From his previous teaching experience in the Arabic world, the main researcher believes that female students are more concerned about personalisation issues than male students. However, for cultural and religious reasons, they do not speak freely with males. Therefore, each participant in the thinking aloud sessions was assigned a same-gender facilitator. Appointment of a female facilitator ensured the comfort of female students throughout the sessions, which was essential for successful implementation of the research experiments.

As an experienced lecturer, the female facilitator was familiar with the environment, systems and roles of an educational setting. She also demonstrated good communication skills with students. Thus, she could provide the students with the support and confidence they required to complete the experiments in a stress-free environment. Moreover, because she owned a tablet PC, she was proficient in its use. In figure 20, the female facilitator interacting with a female student.

Figure 19: Female facilitator with a female school candidate

The main researcher explained the research objectives and experimental process to the female facilitator. To ensure that she understood the details of AVID and the task steps, the facilitator was provided with an example of the task. She read the questionnaires and was given all the information she required or requested.

Consequently, the female facilitator was the primary contact person in the female experimental sessions. She greeted the participants and explained the experimental tasks to them. A female teacher and the main researcher (male) were present as technical support only; they did not interrupt the sessions. All contact with female participants was made by the female facilitator alone.



Experimental setup in female school | Experimental setup in male school
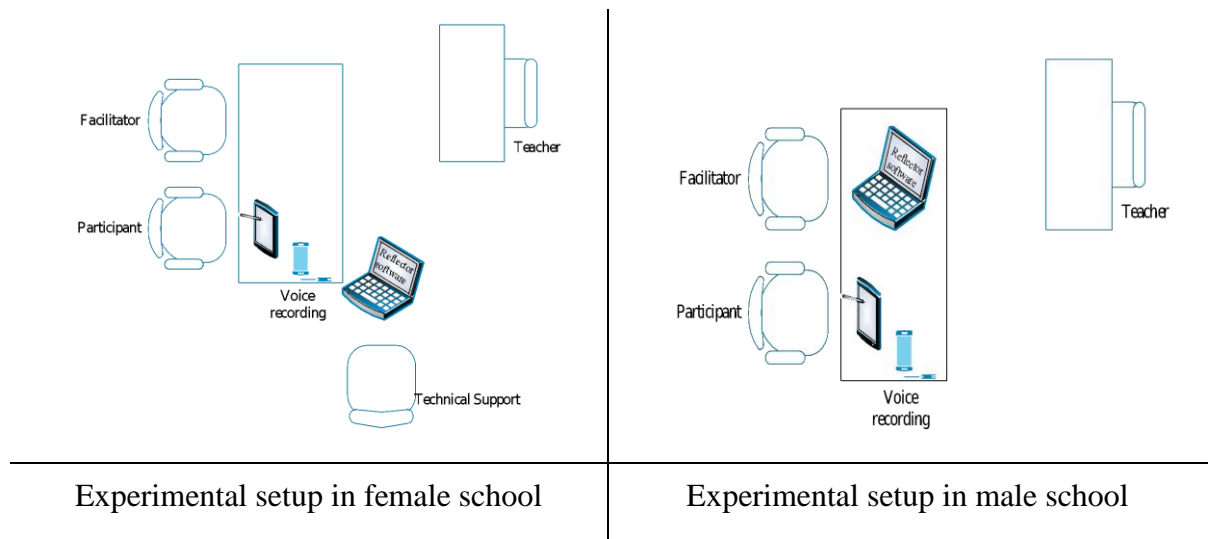
Figure 20: Experimental setup of the schools study

In the male schools, a male teacher also occupied the experimental room (computer laboratory), but the facilitator was the researcher himself. He greeted the participants and explained the experimental tasks. Additionally, he took notes and observed the participants during the sessions.

## 5.2  Data Collection and Analysis

Prior to the experiments, a consent form and information sheets were handed to the consenting students. The students were asked to read the information sheet and to fill in the participation consent form. If any of the participants or their parents wished to ask questions, they could contact the researcher by email or telephone, which were provided to the schools and displayed in the consent form.

The school teacher or school principal informed the researcher and the students of a suitable time for the experimental sessions, and the participating students were contacted as decided in the mutually agreed schedule.

At the due date of each session, the facilitator introduced himself and explained the study goals, the process steps of the task, and the instruments. The facilitator reassured the interviewees of the study's ethics and asked permission for recording. The facilitator informed the participants that he would apply the coaching thinking-aloud technique. An example of thinking aloud was given, but no practice was done before the recording. The participant was then assigned a demographic questionnaire, which was completed and returned to the facilitator before starting the tasks.  All sessions were conducted in the Arabic language.

The coaching thinking-aloud procedure followed the protocols of Borsci and Federici (2009) and Kay (2004). In a pilot study conducted in Jordan from 26 March to 4 April of 2014, the coaching thinking-aloud, the procedure was found to be most suitable for Arabic users. Therefore, to ensure high-quality, valuable and reliable data collection while maximising the comfort of participants and minimising their interference, the coaching thinking-aloud process was implemented by the following steps.

- Introduction. The facilitator and participants introduced themselves.
- Instructions. The facilitator invited the participant to start the tasks and instructed him or her to verbalise everything s/he did while performing the tasks.
- Promoting. The facilitator encouraged the participants to keep talking aloud.
- Interaction. Sometimes the facilitator asked specific questions for more clarification. Also, the facilitator intervened when the participant was unable to proceed or express themselves verbally.

The participants' comments were recorded by a voice recorder. The tablet activities were recorded by CamStudio and Reflector2. A timeline of the experiment is presented in Figure 21.
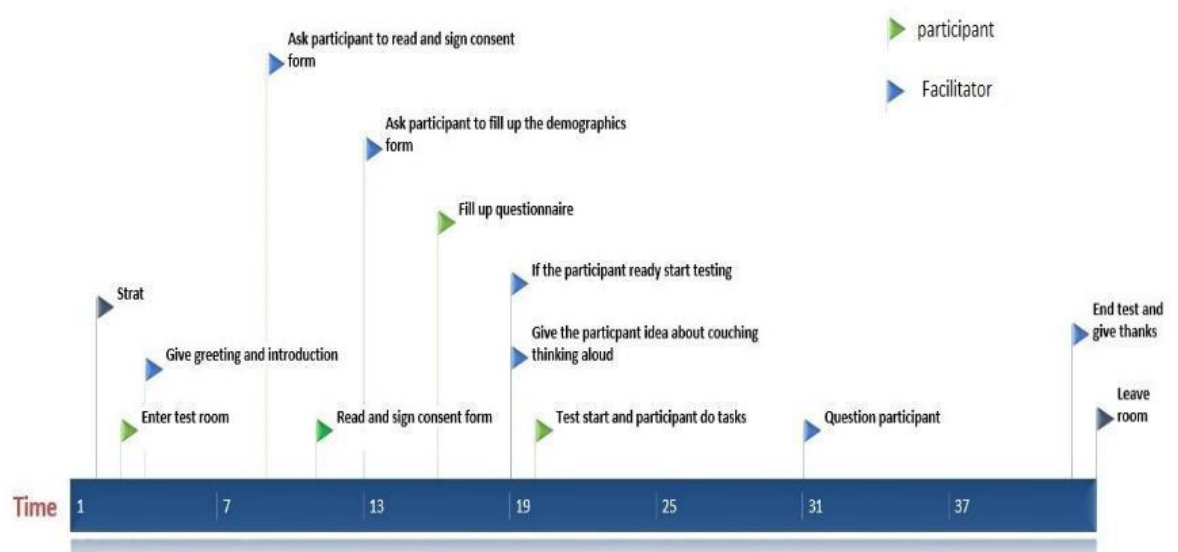


Figure 21 Timeline of the techniques used to identify the UI preferences of school students

The collected raw data were presented as audio and video data. The audio data contained the participants' voices as they performed the task. The video data captured the screen activity on the tablet as the participants completed the tasks, including the start and end times of the task. The data were processed by the following steps:

1. Transcription. The researcher transcribed the audio data.
2. The researcher re-listened to all audio recordings of the users and checked them

against the transcription. By listening to these recordings, the researcher also became more familiar with the data.

3. To better understand and analyse the slang usage of participants, the researcher created a table. Vocabulary presented a challenge while transcribing the audio data. During the experimental sessions, the participants sometimes used slang words and phrases with ambiguous meanings. The researcher was unfamiliar with these words but reluctant to interrupt the participants to inquire of their meaning. Therefore, when transcribing the audio data, the researcher collected the participants' slang words and created a table that matches these words with their meaning (Appendix H). To create this table, the researcher first attempted to understand the culture and the local slang language used by the young participants, which includes updated terminologies such as "taqaa, طقع", meaning "perfect". Like any other language, Arabic contains many words with the same spelling but a different meaning.

4. The preferences of each user, and the reasons for these preferences, were compiled into a table (see Table 21 for example). There were 11 tables in total. Note: Because the transcripts were made in Arabic, English-language tables were not constructed for all participants.

Table 21: Example of preference selection by one participant in the school's study.

| UI Design Elements | Initial select | Any change | Reasoning |
| --- | --- | --- | --- |
| **Font Size** | Big 10 | Big 13 | "the font appears too small for the first selected size, I thought it would be clear to read " |
| **Font Type** | Al-Naskh النسخ | Al-Naskh النسخ | - |
| **Font Colour** | Black | Blue | "Blue is comfortable to see, comfortable to read with a white background I think, unlike black, which gives rigidity to the page." |
| **Alignment** | Right | Centre | "I thought right best suited the Arabic language, but it seems centre is better." |
| **Menu Type** | Expanding Menu | Expanding Menu | "I usually use google drive on my iPad, and I find the menu so clever, I need more space and when I need menu I just expanded |

| | | | it, wow!" |
|---|---|---|---|
| **Button** | coloured button | coloured button | " I find the button used in this prototype "coloured button" is really clear and not confusing me" |

5. All preferences and reasoning were collated into 11 tables, one for each UI element.

6. Meanwhile, the "Extracted data" was collected as notes transcribed from the data and written in a list. The repeated notes were then combined and re-written as points in a list, with each point representing one idea. The extracted data were also gathered into principles and themes identified in the literature review. Different related ideas with similar meanings were combined into the same UI principle.

7. Reviewing outcomes: To check the participants' preferences against the dataset in the tables, the UI selection tables were compared with the video-screen capture data and the voice recordings. This checking step revealed any missed data.

8. In the final phase, the data of each UI element were treated separately by comparing between male and female participants.

## 5.3  Results

This section presents the results of the coaching thinking-aloud sessions. The participants' preferences, along with other design-relevant information, were collected and analysed.

### 5.3.1  User Preferences

**Font Type Preferences**

The Arabic language has a unique characteristic. Therefore, the chosen font types can determine whether the tablet PC application is successful or chaotic and aesthetically displease. When designing the target UI guidelines, I considered the users' viewpoints on which Arabic font types should be included in Arabic tablet PC applications.

The AVID presented participants with the four main Arabic font types; Al-Naskh. Al-Roka, Al-Farsi and Al-Kufi (see Figure 22). The participants selected their preferred font

type from these four options.



Figure 22: The four main Arabic font types in AVID

The data collected from the coaching thinking-aloud sessions were processed to determine the font type preferences of the users. The results are summarised in Table 20. This table compares the selected font types between male and female participants. As shown, the females' choices were limited to Al-Farsi and Al-Kufi font types, which were selected by five and one out of six students, respectively. Meanwhile, the males' choices were limited to Al-Naskh and AL-Roka font types (4 and 1 out of five participants, respectively).

Table 22: Font type preferences of school participants

| Fonts type | Female | Male | Font example |
|---|---|---|---|
| Al-Naskh النسخ | 0 | 4/5 | بِسْــــــــــــــمِ ٱللّٰهِ ٱلرَّحْمٰنِ ٱلرَّحِيمِ |
| Al-Roka الرقعه | 0 | 1/5 | بــم الله الرحمن الرحيم |
| Al-Farsi الفارسي | 5/6 | 0 | بسم الله الرحمن الرحيم |

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بسم الله الرحمن الرحيم

After choosing their font-type preferences, the participants completed their tasks through the AVID with no further changes in font type.

**Font Size Preferences**

The AVID presented participants with small (size 10), normal (size 12), large (size 14) and very large (size 16) fonts (see Figure 23). The initial size selected by the participants could be changed at any time.



Figure 23: The four main Arabic font sizes in AVID

After processing the font-size data of the coaching thinking-aloud sessions, the font sizes selected by the participants were identified and collected into Table 23. The female students varied in their choices; the normal (12) and big (14) font sizes were each selected by two students, the small (10) font size was selected by one student, and the very large (16) font size was selected by two students. On the other hand, three of the male participants preferred the very large (16) font size. The remaining two preferred the normal (12) font size. None of the males selected the small (10) or large (14) font size.

Table 23: Font size preferences of school participants

| Fonts Size | Female | Male |
|---|---|---|
| **Small 10** | 1 | 0 |
| **Normal 12** | 2 | 2 |
| **Big 14** | 2 | 0 |
| **Very big 16** | 1 | 3 |

Three of the female participants changed their selected font size after starting Lesson One. When prompted by the facilitator, they gave the following reasons for their choice:

Participant #1 "*It seems that the font is too small and I need to make it bigger. Moreover, yes, it is clearer now*."

Participant #5 "*I felt more comfortable with the big font.*" When the facilitator inquired "*but, why did you choose the small font at the beginning?!*" the participant replied "*I thought it would be big enough to read*!"

Participant #6 "*I like to change the font to see how it will look.*" When the facilitator enquired: "*Do you feel more comfortable with your regular changing*?" this participant answered "*I like to see how it will look, and then I will decide which one is more suitable for reading.*"

Multiple of male participants changed their font size. Three out of the five male participants changed their font size when beginning the reading tasks. When asked why by the facilitator, one participant replied:

"*I think this size is better, and I can read better now*" Participant #8.

Owing to the frequent tendency for participants to change their font-size choices, choosing the font size in the UI design was difficult and confusing for the designer.

**Colour Preferences**
The colour of an application is an important assessment criterion, as it largely determines

the perceived "goodness" of the application. Colours are also linked to the content and characteristics associated with the manufacturer. The colour frequently reflects the trends of the application's identity.

The students' colour preferences were assessed through the AVID system. As shown in Figure 24, the user can select fonts colour. The researcher notified the participants of the default background (white). Later, the participants were invited to change their font and background colours as desired.



Figure 24: Font colours in AVID

The Arabic tablet PC educational application AVID allowed the participants to choose their preferred font colour while reading Arabic text. Before making their choices, participants were sent a text message informing them of the white background. Participants' choices were found to be limited to three font colours, as shown in Table 24.

Table 24: Font colour preferences of school participants

| Text Colour | Female | Male |
|---|---|---|
| Black | 4 | 3 |

| | | |
|---|---|---|
| **Green** | 1 | 0 |
| **Blue** | 1 | 2 |
| **Yalow** | 0 | 0 |
| **Red** | 0 | 0 |
| **purple** | 0 | 0 |

The majority of male and female participants preferred the black colour font as a final decision for their choices. Blue and green were also selected by some of them.

"*I love reading books using my tablet PC; I prefer green with a white background. Green is the comfortable colour for me*" said female participant #1.

In the coaching thinking-aloud sessions with AVID, the female school students showed a preference for dark colours as a final decision for the font colour. As well as, the male students also preferred dark colours, but they changed their font colours choice less often.

Five out of six female students changed their first choice for font colours after they had read the text.

" I found the *blue is comfortable to see and comfortable to read with white background than the black colour. I found the black rigid to the text*" female participant 9# explained.

**Alignment Preferences**

Tablet PC applications require radically different interface designs from traditional PCs. For instance, tablet PCs support two orientations and different screen sizes, requiring an adaptive layout design. Text alignment is important for understanding and accessing information and for bridging the user and the interface. Figure 25 shows the UI alignment options available in the AVID system.

Figure 25: Alignment-selection page in AVID

Arabic is a bi-directional language. Text is read and written from right to left, whereas numbers are read and written from left to right. This bi-directionality affects the interface when students are trying to write a text that include a combination of Arabic and English words.

In the coaching thinking-aloud sessions, the participants' text alignment choices were limited to two types; right-placed and centre-placed. The former was selected by three female participants; the latter was selected by all male participants and three female participants. The results are summarised in Table 25.

Table 25: Text Alignment Preferences

| Text Align | Female | Male |
| --- | --- | --- |
| Left | 0 | 0 |
| Right | 3 | 0 |
| Centre | 3 | 5 |

None of the male students changed their preferences from their initial choice. In contrast,

two female students changed their alignment choices after starting the AVID. One participant stated that:

"*I thought right best suited the Arabic language, but it seems centre is better*" participant #1.

"*As a default, the right alignment for Arabic text is the preferable. Nevertheless, I want to try the centre first. After I had started reading, I felt that the centre was not a good choice for text appearance. So, the right alignment is better, and it increases my concentration and reduces the dispersion*" participant #1.

Some of the male students elucidated why they considered centre alignment as the best choice. They considered that digital materials contain more elements than text books, since the digital one can accommodate figures or videos on screen sides. Moreover, they reported that because the menu and buttons of the application are often located at the right or left, the centrally aligned text contexts would not be overlapped with the side-screen activities.

"*In the textbook I believe that the right is the best alignment option for Arabic text. However, in an electronic one, I think centre alignment is better. Why?! .. Because there could be more elements on both side of the text. So, overlap may occur while dragging the menu or button list.*" participant #1

**Navigation Menu**

The study participants shared their thoughts on the menu and their menu preferences. The four menu choices offered by AVID are displayed in Figure 26 and discussed below.
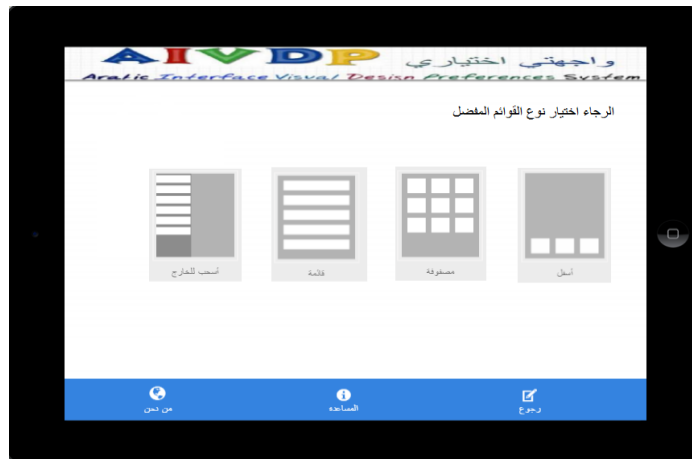
Figure 26: Menu selection in AVID

### List-type menus

This menu combines colour with a refined line-style icon and bold typography, allowing the user to navigate easily through the application (see Figure 27).



Figure 27: List-type menu in AVID

- **Grid -style menus**

This menu style emphasises navigation of the screen contents. The navigation in this menu style is clear and intuitive (Figure 28).

Figure 28: Grid-style menu in AVID

● **Bottom Menus**

Bottom menus provide navigations aids to inner functional sections or separate widgets (see Figure 29).



Figure 29: Bottom menu in AVID

● **Expanding Menu**

Expanding menus help the designer to handle highly informative applications, allowing a menu icon to be placed anywhere in the interface. Expanding menus are often found in the top-right corner of an Arabic interface. The AVID expanding menu is shown in Figure 30.

Figure 30: Expanding menu in AVID

The participants' preferences of the AVID menu styles are summarised in Table 26, showing the differences between males and females.

Table 26: Menu-type preferences of participants in the schools study

| Menu Type | Female | Male |
|---|---|---|
| Expanding Menu | 1 | 3 |
| List-type menus | 1 | 0 |
| Grid -style menus | 1 | 1 |
| Bottom Menus | 3 | 1 |

Female participants were more attracted to the bottom menu than to other menu styles, finding it easier to find and implement.

Participant #3 said, "*I liked the AVID menu position, which is easier for me to find, unlike an expanding menu that does not give any sign it exists*!"

Another female participant echoed these sentiments: "*Bottom menu is nice and it is easier to find*" Participant #2.

On the contrary, male students preferred the expanding menu, because it cleverly hides

and opens only when required. One male participant expressed his thoughts thus:

 "*I usually use Google drive on my iPad and I find the menu so clever, I need more space and when I needed the menu I just expanded it, wow*!" Participant #1.

Participant #10 confirms that: "*I do not like any menus that hide the screen or the top of my application, I can expand it once I need; that is my favourite*."

Menu type designs should not only look modern, sophisticated and stylish, but should also provide students with the details they need, such as links, search and other features.

**Button Type Preferences**

To determine the button preferences of the participants, I designed three button styles (coloured, shaped and typography (text)). The participants' preferences of the three styles are summarised in Table 27.

Table 27: Button type preferences of school students

| Button | | Female | Male |
|---|---|---|---|
| coloured button | دخول | 2 | 3 |
| Shaped button | من نحن | 3 | 1 |
| Typography button | رجوع | 1 | 1 |

The button choices differed among the participants. Three of the female participants preferred the shaped button, whereas two preferred the coloured button and one liked the typography buttons. The male participants also expressed different opinions, with three

preferring the coloured button, and one each preferring the shaped and typography buttons.

**Religious Symbols**

Religion is an essential aspect of all Arabic cultures. Jordan is an Islamic country with a Sunni-Muslim majority (92%). Christians, which represent 6% of the total population, are predominantly Orthodox or Catholic ("Culture and Religion," 2015).

Therefore, when designing any application for Arabic users, the designer must accommodate the religious beliefs of these users. For example, pig features should be avoided in Islamic culture because this animal is associated with pollution and impurity, and is prohibited to be eaten by Muslims. Therefore, Muslims will object to symbolisms of pigs in any application.

In this study, how Arabic Jordanian students responded to the colouring of religious symbols was evaluated in Lesson Two. The required characteristics of religious symbols were also clarified.

The researcher asked the following question during the coaching thinking-aloud sessions: "Do you have any colour or symbol that represents any religious meaning for you?" I did not ask the students to state their religion.

The students' answers are summarised below.

- Avoid using any pictures or icons with sexual connotations
- Do not use the images of animals deemed undesirable in Islam
- Use red to refer to Allah's name and a green theme in religious text.
- Use clear and significant fonts for religious texts; avoid fancy fonts.
- Use religious symbols such as Halal minarets of the mosque.
- Colours carry meanings and connotations in Arab and Islamic cultures. For instance, green colours are related to Muslim religious aspects.

Therefore, religious topic and themes in Islam should be rendered in green. Although religious references or signs are discouraged in most guidelines, Muslims users prefer to

see green religious symbols in the text contents.

## 5.3.2 Design Issues

**Legibility of font**

Some fonts are designed for printing, and fonts in school books are designed for maximum legibility. Textbook fonts include Arial in English, and Lotus Linotype font in Arabic.

Font legibility is among the most important determiners of text readability. If the text is not written and formatted to support reading, users become confused and frustrated.

Readability is largely determined by the distance between the lines of text, and by the distance between the words on each line. Both spacing must be logical and suitable for reading. If the spaces are insufficient, the text becomes unclear, and if they are too large, the readers may perceive the text as a different paragraph. These problems were expressed by participant #7:

"*Sometimes while reading, some text confuses me; they designed the text so far apart, which made me feel they do not link, although they should!*" Participant #7.

The screen sizes of tablet PCs vary widely. Therefore, the text should be readable to students and comfortable to read. It is highly recommended that designers and developers adopt a font size that works for any screen size.

**Brightness**

Most of the students expressed disappointment in designers who apply bright colours in text to attract attention. For example, one male participant said

"*Using a bright green background colour with orange text led me to close the text and I do not want to return to it again*" Participant # 7.

**Colour Blindness**

The designer must also consider users with colour blindness, who cannot distinguish between degrees of certain colours. The most common colour blindness is red–green colour blindness, in which the patient cannot distinguish between varying degrees of red and green, and sees both colours as blue.

None of the participants in our schools study was colour blind, but one student mentioned this problem:

"*Colours are very important in application design; we prefer to see cold colours that make us feel more satisfied. Also, some students are colour blind which makes them suffer from vivid colours*" participants #6.

Given that colour blindness can negatively affect a user's perception of the interface, designers and developers should improve their understanding of colour blindness by referring to the scientific literature.

**Significance of the Importance**

Colours convey semantic meaning to users. Word colour is an important factor to be considered by the designer, especially in the Arabic language, where colours are used to highlight important religious words. Designers should consider the importance of colour in determining the connotation of the text. For example, the name of Allah (God) in the Holy Quran and in most religious Muslim texts is written in red.

## 5.4 Summary

This chapter described the study of Jordanian school students. It discussed the UI preferences of these students while using educational applications on tablet PCs. The key points that should determine the UI designs of Arabic tablet PC interfaces are highlighted in Table 28.

Table 28: Summary of user preferences obtained in the schools study.

| UI Design Elements | Female | Male |
| --- | --- | --- |
| Font Size | variety | Big 13 |
| Font Type | Al-Farsi الفارسي | Al-Naskh النسخ |
| Font Colour | Black | Blue, Black |
| Alignment | Centre, Left | Centre |
| Menu Type | Bottom Menus | Expanding Menu |
| Button type | Shapes | coloured button |

To generalise these results, I must combine the preferences of the school study with those of university students. The University study (stage C of the research) is described in the next chapter.

# Chapter Six

## UNIVERSITY STUDY
## (STAGE C)

This chapter introduces the experimental university study. It then describes the participants and the experimental environment, followed by the data collection procedure, data analysis and results. Finally, it summarises the study findings.

This study followed the method used in the school's study (Chapter Five). By using the same prototype in the school and university studies, I ensured that the instrumental factors were fixed in both studies. Therefore, the results are generalizable to a wider population of young people.

## 6.1  University Experiment

Since the instrumental factors were standardised in the schools and university studies, the tasks were also standardised in both studies and were performed in the same order under the same instructions from the researcher. The procedures and lessons of the school study (also applied in the University study) were presented in Section 5.1.3 of Chapter 5. As in the school study, the thinking aloud protocol was used (see Section 5.1.4 of Chapter 5).

### 6.1  Participants' Recruitment

The Jordanian Ministry of Higher Education and Scientific Research has registered 29 public and private universities. The number of students continues to increase, and

approximately 92,000 new students entered Jordan's universities in 2013 (Jordan, 2013).

The participants in the university study were five males and five females attending two major government universities. Jordan University is the main and oldest University in Jordan and is located in Jordan's capital, Amman. Al Yarmouk University is located in Irbid, the second-largest metropolis in Jordan (after Amman). Recall that the school study was limited to Irbid.

The demographic information of the participants was collected from the demographic questionnaire, which participants completed at the beginning of the study. Some of this information was also observed by the researcher during the experimental sessions.

All recruited participants were Jordanians aged 19–24 years. As age was a precondition, the participants' ages were not recorded. Table 29 shows the partial demographic information of the 10 participants involved in the study.

Table 29: Partial demographic information of participants in the university study

| P # | Gender | University | City | Major |
|---|---|---|---|---|
| 1 | Female | Jordan University | Amman | Management information system |
| 2 | Female | Al Yarmouk University | Irbid | Computer Science |
| 3 | Female | Jordan University | Amman | Computer Science |
| 4 | Female | Al Yarmouk University | Irbid | Accountant |
| 5 | Female | Jordan University | Amman | Dentist |
| 6 | Male | Al Yarmouk University | Irbid | Art |
| 7 | Male | Jordan University | Amman | Accountant |
| 8 | Male | Al Yarmouk University | Irbid | Arabic |
| 9 | Male | Jordan University | Amman | Management information system |
| 10 | Male | Al Yarmouk University | Irbid | Management |

Table 30 shows the tablet PC usage of the participants. Eighty percent and 60% of the male and female participants, respectively, used tablet PCs daily, confirming that all

participants were familiar with tablet PCs. None of the subjects was completely unfamiliar with the devices.

Table 30: Tablet PC usage of the university participants

|  |  | Tablet Usage | | |
|---|---|---|---|---|
|  |  | daily | Weekly | Occasionally |
| **Gender** | Male | 4 | 0 | 1 |
|  | Female | 3 | 1 | 1 |

During the experimental sessions, the researcher observed that 4/5 of the female participants preferred the right hand when interacting with tablet PCs; the remaining participant used both hands. Meanwhile, 2/5 of the male participants preferred to interact with both hands, while 3/5 used the right hand (see Table 31). As mentioned in Chapter Five, this right-hand bias may reflect Islamic culture, which urges the use of the right hand.

Table 31: Participants' hand choice when interacting with the tablet PC

|  |  | Hand use | | |
|---|---|---|---|---|
|  |  | Right | Left | Both |
| **Gender** | Male | 3 | 0 | 2 |
|  | Female | 4 | 0 | 1 |

One male participant wore eyeglasses throughout the experimental sessions. None of the female participants presented any vision problems.

## 6.1.1  Experimental Environment

The experimental sessions were run in the computer laboratories of the universities. These laboratories contained the required space for the experimental equipment, and were

sufficiently quiet that participants could complete the tasks without disturbance. Moreover, the clear voice recording could be easily transcribed. The test environment was controlled by assigning each participant the same tablet PC (an iPad 2) in the same environmental setting. In the school study, a female facilitator was employed for the coaching thinking-aloud sessions with female students. Therefore, to maintain the same conditions, all participants conducted the coaching thinking-aloud sessions with a same-gender facilitator. The facilitator, who was the only contact person throughout the test, greeted the user and explained the experimental tasks. The room setup of the experiments is shown in Figure 31.
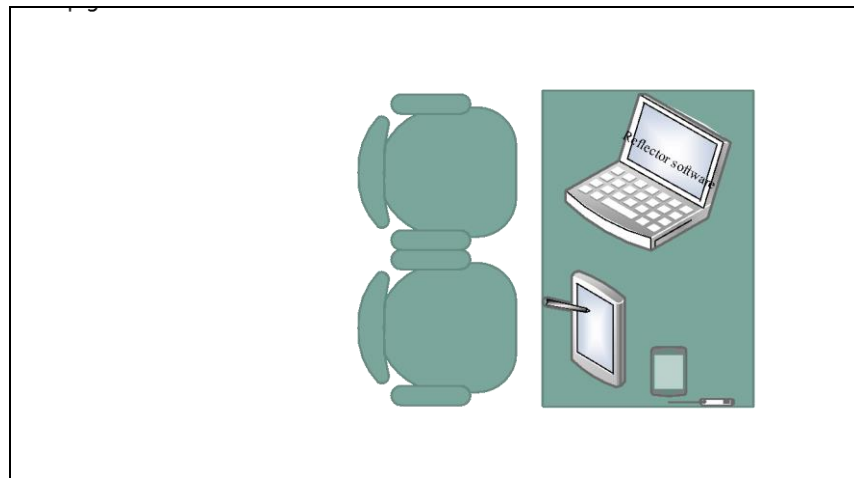


Figure 31: Room setup of the University experiments

Figure 32 shows the main researcher preparing a new session with one of the participants.

Figure 32: Facilitator with one university candidate while preparing the session.

## 6.2 Data Collection and Analysis

The participants had been notified through university billboards and visits to university clubs by the main researcher, who invited students to leave their email addresses for participation. When students decided to participate, they informed the main researcher by the researcher's email or telephone number, and received the consent form and information sheets (Appendix A and Appendix E) by email. The participants were asked to read the information sheet and confirm their participation by signing the consent form.

The participants were scheduled for the experimental sessions by mutual agreement. If any of the participants wished to ask questions before the meeting, they could contact the researcher through the email or the telephone number provided in the recruitment letter. Participants received no monetary award, but were given a bar of chocolate and juice during the session.

All sessions were conducted from 10 January of 2014 to 6 February of 2015. Interviews were conducted primarily in Arabic and lasted approximately 30–40 minutes.

The raw data gathered from the coaching thinking-aloud sessions were presented in two forms: audio and video data. The raw data were analysed by the procedure used in the school study, namely, the data were transcribed and processed as described in Section 5.2. The processed data were of two types: data related to the preferences of the targeted UI elements of our Arabic tablet PC application (task-targeted data), and data related to

the design issues mentioned by the participants (extracted data).

## 6.3  Results

The outcomes of the data analysis are detailed in the following sections:

### 6.3.1  User Preferences

**Font Type Preferences**

Through the coaching thinking-aloud sessions, I acquired the preferences of the university students towards four main Arabic font types: Al-Naskh, Al-Reka, Al-Farsi, and Al-Kufi font. The female students' choices were limited to Al-Naskh and Al-Farsi fonts (4/5 and 1/5 students, respectively). The male students chose Al-Naskh and Al-Kufi fonts in equal proportion (2/5 students); the remaining male student chose the Al-Reka font. The students' preferences are listed in Table 32.

Table 32: Font type preferences of university participants

| Fonts type | Female | Male |
|---|---|---|
| **Al-Naskh** النسخ | 4 | 2 |
| **Al-Reka** الرقعه | 0 | 1 |
| **Al-Farsi** الفارسي | 1 | 0 |
| **Al-Kufi** الكوفي | 0 | 2 |

As observed in the school study, none of the participants changed their preferred font type after the initial selection.

- **Font Size Preferences**

The AVID presented four font sizes: small (10-point), normal (12-point), large (14-point), and very large (16-point). All of the male university participants selected the 14-point font, which they considered as the most suitable size. Three of the female participants

also preferred the 14-point font, but two preferred the 10-point font. The font size preferences of the university students are listed in Table 33.

Table 33: Font size preferences of the university participants

| Fonts Size | Female | Male | Example |
|---|---|---|---|
| **Small 10 points** | 2 | 0 | بسم الله الرحمن الرحيم |
| **Normal 12 points** | 0 | 0 | بسم الله الرحمن الرحيم |
| **Big 14 points** | 3 | 5 | بسم الله الرحمن الرحيم |
| **Very big 16 points** | 0 | 0 | بسم الله الرحمن الرحيم |

Throughout the coaching thinking-aloud sessions, the participants explained their preferred font sizes. The male students regarded large fonts as better than small fonts. Table 31 shows the font types that the students had selected when starting the AVID.

Whereas the male students maintained their preferred font sizes, four of the female students changed their font size while reading Lesson One. When asked "Why?" by the facilitator, they emphasised that they had expected the font size to change when applied to the text, or that they wished to experiment with different font sizes.

"*When I selected my first font size preferences, I expected that normal 12 would be big enough. However, I would say now, big 14 looks better and is readable*" Participant #1 said.

Meanwhile, Participant # 3 commented that "*font size 14 is too big; I expected something else in my mind, so I changed it to normal 10*".

Participant #4 changed her font size because "*It is just a type of curiosity, I want to see how font size 14 will be and I liked it. It is more readable and clearer*".

Participant #5 mentioned that "*I usually hesitate about my first choices and want to see how it would be if I choose another option. It seems big 14 is the best option to me.*"

In contrast, the male students were fully comfortable with their initially selected font size.

"*I can read the text without zooming. I mean, usually if I cannot see the text properly, I need to zoom in to make it bigger and sometimes the text becomes scattered and unordered*". Participant 7 emphasised.

**Font Colour Preferences**

The AVID allowed the participants to choose their preferred font colour while reading Arabic text. The female university participants selected only two font colours. Four preferred the black font while reading the text, and one preferred the blue colour. Black and blue were each preferred by two of the male participants, while red was preferred by the remaining male (see Table 34).

Table 34: Colour preferences of the university students

| Text Colour | Female | Male |
|---|---|---|
| Black | 4 | 2 |
| Blue | 1 | 2 |
| Red | 0 | 1 |

Although the participants could change their colour preferences throughout the sessions, all of them maintained their originally selected font colour. Accordingly, when the facilitator assessed the participants' reading performance as excellent, he or she invited comments from the participants on their font colour. All of the participants reported no problems with their choice, and were satisfied that their choice was the best. This sentiment was clearly expressed by Participant 3:

"*Black is the best choice when the background is white; it is clear for reading and I felt comfortable when I saw it because it was used in the textbook, so we were accustomed to it.*"

Similar opinions were expressed by other participants. However, Participant 5 preferred

to highlight special parts of the text, such as the Holy name of God "Allah'', by a different font colour:

"*I chose black because it is the natural colour for reading, sometimes it is good to see different colour in the text for the words that needs to be marked, such as the Holy name of Allah*'' Participant #5.

Some of the male participants remarked that font colour should depend on the application purpose. They considered that different colours for different topics was a useful feature. When asked for clarification by the facilitator, they responded as follows:

"*I usually choose the black colour since it is my favourite colour for reading, but sometimes it feels boring, and I wonder if I can change it*" Participant #6.

"*Blue is my favourite colour, I love to use it and I feel it is clearer when I am reading, I do not know why, but maybe because I am used to it in my handwriting! Who knows*?'' Participant #8.

**Button Type Preferences**

The button type is a critical consideration in the design of tablet PC applications. When designing the button type, designers refer to published online guidelines such as IOS or Android. To design applications that satisfy Arabic users, we must know the types of buttons preferred by these users. To this end, the researcher identified the button preferences of our participants in the university study, as a lead for designers of Arabic applications.

I designed three button types for the AVID; the coloured button, shaped button, and the typography (text) button. The participants' preferences for the three types are listed in Table 35.

Table 35: Button type preferences of the university students

| Button | Female | Male |
|---|---|---|

| | | |
|---|---|---|
| coloured Button | 2 | 2 |
| Shapes button | 2 | 2 |
| Typography button | 1 | 2 |

The button-type preferences of both male and female participants were mixed. The coloured and shaped buttons were each chosen by two of the female students, while the remaining female preferred the typography button. On the other hand, the males' most preferred buttons were the coloured and typography buttons (each chosen by two students). One male participant chose the shaped button.

**Alignment Preferences**

In the AVID, the user can select the basic layout of the application. The alignment selection is a way of customising the application interface to suit the user. The most important rules of application design for tablet PCs are standardisation, simplicity and consistency. By applying these rules, the designer saves cost and time.

The text alignment choices of the university students were limited to two types (see Table 36). Centre-placed and right-placed alignments were selected by two and three of the female participants, respectively. All of the male participants chose the right-placed alignment.

Table 36: Layout Preferences.

| Text Align | Female | Male |
|---|---|---|
| **Left** | 0 | 0 |
| **Right** | 3 | 5 |
| **Centre** | 2 | 0 |

None of the participants changed their text alignment preference during the tasks, since all were happy with their first choices.

**Navigation Menu**

To optimise the touch navigation menu, the designer must multiple variables such as the size and placement of the icons. The design of a touchscreen navigation differs from that of desktop PC navigation. Designers can adopt different types of menus in their touchscreen applications. In this study, the researcher focused on the types of menu typically preferred by users. The preferred menu types of the male and female university participants are summarised in Table 37.

Table 37: Navigation menu preferences of the university students

| Menu Type | Female | Male |
|---|---|---|
| Expanding Menu | 2 | 2 |
| List-type menus | 0 | 0 |
| Grid -style menus | 0 | 2 |
| Bottom Menus | 3 | 1 |

The expanding menu was chosen by two male and two female participants. The grid-style menu was selected by two male students. The bottom menu was mostly preferred by female participants (three females and one male selected this option). None of the participants chose the list-type menu.

## 6.3.2 Design Issues Identified

**Font legibility**

Designers of typographic applications need to create pages with clear access to the content and legible presentation of the accessed contents. For this purpose, they must consider multiple aspects. Here I focus on these two requirements; readability and legibility.

The Arabic users in the university study chose their preferred font types and sizes, but also provided comments that designers should note. The participants considered that the whole text should be presented in different font sizes or types, depending on the content. For instance, headlines and similar text should be displayed in large font sizes.

Participants also mentioned that readability is critical; the words must be arranged so that the students' eyes can access the content easily. For example, one participant expressed the importance of sufficient margins and spacing:

"*I saw some Arabic application content which had an improper spacing type, there were not enough margins, and as you know Arabic letters are attached and it is necessary to skip this mistake*" Participant #8.

**Religious Symbols**

Understanding of religious symbols is critical when designing interfaces for Arabic users. In a UI communication, the religious symbols must be applied clearly and precisely. The culture of the target group must always be understood and respected when designing a product for that group. Ideally, the designer and user should embrace the same culture. In this study, I investigated the impact of symbols in an Arabic UI for educational applications run on tablet PCs.

Two main factors affect the perceived meaning of symbols; the symbol itself and its colour. Besides their cultural significance, colours evoke different emotional responses in different people. Therefore, colours can be personalised to each user but the designer needs a more general view. In the Arabic world, and more specifically in Jordan, red symbolises the top tier of many objects and emotions. Depending on context, red can signify dangerous or emotional intimate relationships, and in religious books such as the Holy Quran, the name of God (Allah) is written in red.

Green is the preferred colour in Islamic culture, as it frequently features in mosques, and was the favourite colour of the Prophet (Mohammad-peace upon him). Green is visually soothing and relaxes the eyes because it is associated with nature. In addition, it appears on Muslim flags, as mentioned in the literature. All of the participants agreed with most points in Section 5.3.1.5 (Religious symbols), echoing the school participants' thoughts on Arabic religious symbols.

"*Islam is usually related to a green colour, it was our prophet's favourite colour and I like it. If I see it in a symbol, it should be related to Islam''* Participant #2.

"*If we were talking about the text colour in general, I would prefer the black colour. However, sometimes I think it is good to use the red colour to discriminate the holy names of Allah in the text; you can see this obviously in the holy book of The Quran''* Participant #9.

## 6.4  Summary

This chapter investigated the UI preferences of students in two universities. Specifically, it addressed the question: what are the main UI preferences of students in Jordanian universities using educational tablet PCs? The study results are summarised in Table 38.

Table 38: Summary of UI preferences in the Jordanian university study

| UI Design Elements | Female | Male |
|---|---|---|
| Font Size | Big 12 Points | Big 12 Points |
| Font Type | variety | Al-Naskh النسخ |
| Typography | Black | Blue, Black |
| Button | variety | variety |
| Background | White | White |
| Alignment | Centre, Right | Right |
| Menu Type | Bottom Menus | variety |

Collectively, the schools and university studies revealed the main UI preferences for users of Arabic educational tablet PCs. Specifically, they determined the UI preferences of Jordanian students (aged 16–24 years) working on tablet PCs, which will assist the design of Arabic UI guidelines for Jordanian designers and developers. The research also investigated the impact of gender (the main differences in the UI preferences of males and females), which will enhance the learning process and help knowledge-building within the community. The combined results of the schools and university studies will be presented in Chapter 7.

# Chapter Seven

## UI PREFERENCES AND PRINCIPLES FOR BUILDING AN INITIAL GUIDELINE (STAGE D)

This chapter presents the first draft of the Arabic UI guideline by summarising the results of the school and university studies. Also, it briefly discusses the issues with collecting data methods. Finally provides a summary.

The first draft of the Arabic UI guideline consisted of three main sections. The main components of the first draft are described in Table 39. The draft version of the UI guideline was created by combining the data of the school and university studies and the insights gained from the literature review. The data combination was based on the requirements of the designers and developers (see Figure 7 in section 3.1). Before application, these initial guidelines must be validated by Jordanian designers and developers.

Table 39: First UI guideline draft

| NO | Components | | Source |
|---|---|---|---|
| **1** | UI preferences guideline | Font type, | Students studies |
| | | Font Size, | |
| | | Font Colour | |
| | | Button Types | |

| | | Alignment | |
| --- | --- | --- | --- |
| | | Menu Types | |
| **2** | General UI Principles | 9 principles | Literature + Students studies |
| **3** | Religious UI Guideline | 5 principles | Literature + Students studies |

# 7.1  UI Tablet PC Preferences

By studying Arabic students, we began to understand the main UI preferences of these students when using Arabic educational tablet PCs. This information will play a significant role in designing Arabic UI guidelines for Jordanian designers and developers, because it identifies the elements that Jordanian high school and young university students (age range 16–24) desire in an Arabic UI design for tablet PCs, while highlighting the effect of gender.

In the following sections, I combine the results of the school and university studies, and analyse the data by a Fisher test. The Fisher test, which is highly recommended for small sample sizes (Agresti, 1992), detects whether the gender differences between the young Arabic male and female learners are truly significant. The main researcher also consulted a statistical expert (Dr Robin Hankin from Auckland University of Technology) who recommended the Fisher test for the small sample size of the current research.

However, because only one difference between groups showed statistical significance and the numbers are very small, it would be unwise to put too much store on such results so they are not reported in detail

The school and university studies were designed to examine the main UI design elements, namely, the typography (type, size, and colour of the font), button size, text alignments, and menu type (see Table 38). These elements were evaluated through the AVID.

## 7.1.1  Font Type

The font type significantly affects users' acceptance of an application. Therefore, both the school and university studies sought the font-type views of Arabic students and the font types that they liked and disliked. The students' preferences for four main Arabic scripts (Al Naskh, Al-Roka, Al-Farsi and Al-Kufi) were identified on the AVID system.The AVID also allowed the students to change their initially selected font later in the lesson.

Figure 33 shows the preferred font type differences between the male and female school students. Male students preferred the Al-Naskh font whereas the female students preferred the Al-Farsi font.



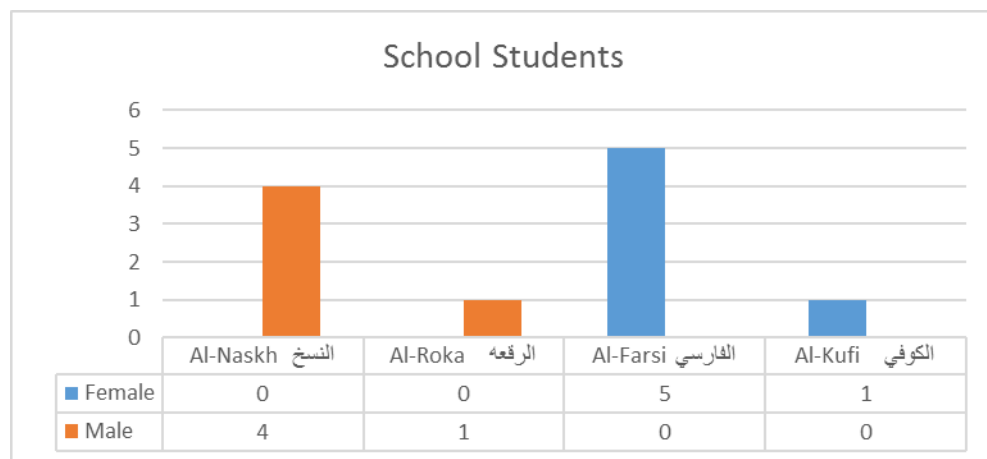| School Students | Al-Naskh النسخ | Al-Roka الرقعه | Al-Farsi الفارسي | Al-Kufi الكوفي |
|---|---|---|---|---|
| Female | 0 | 0 | 5 | 1 |
| Male | 4 | 1 | 0 | 0 |

Figure 33: Font-type preferences of Arabic male and female school students

In the university study, Al-Naskh was the most preferred font overall (see Figure 34).
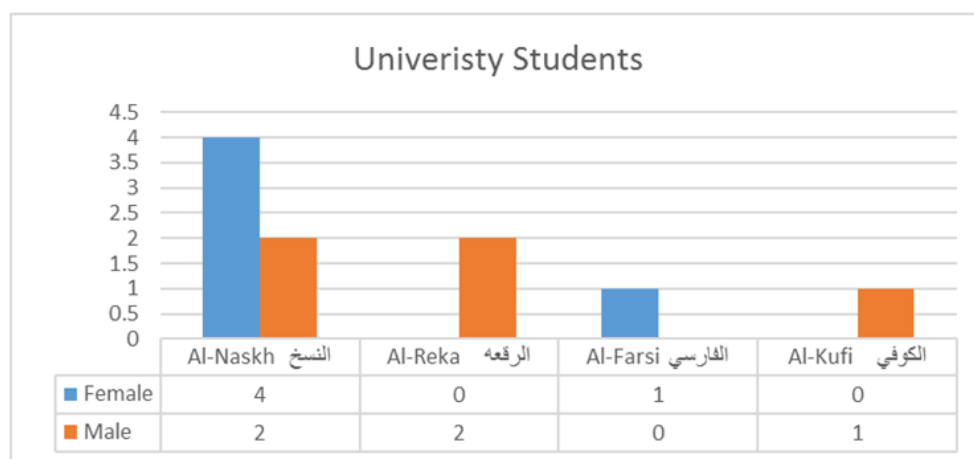
Figure 34: Font-type preferences of Arabic university students

To discern whether the differences between the male and female students were statistically significant, I combined the results of both studies, as shown in Figure 35. The Al-Naskh font was most favoured by male students in both studies, followed by Al-Reka and finally the Al-Kufi font. The Al-Farsi font, which was most preferred by female students, was not selected by any of the male participants. After Al-Farsi, the female students preferred the Al-Naskh font, followed by the Al-Kufi font.
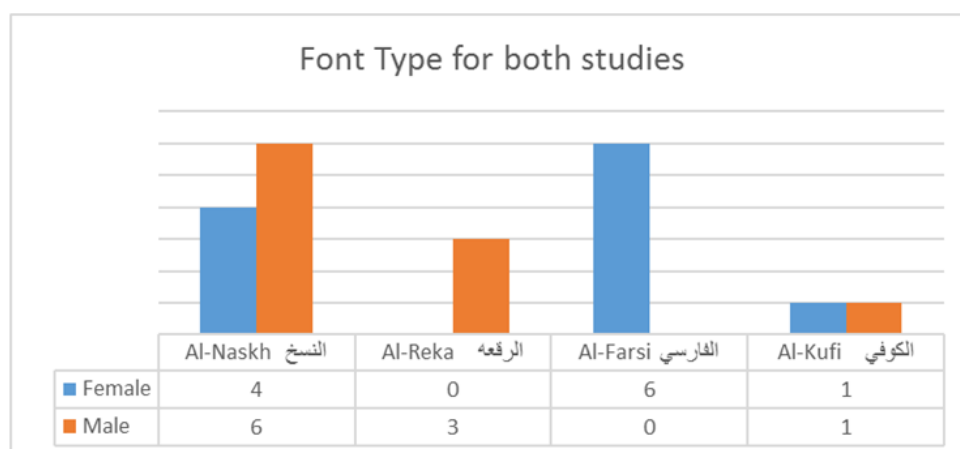


Figure 35: Combined font type preferences of students

The Fisher Test confirmed that the font-type preferences of male and female students were statistically significant ($p = 0.01078$).

In this part of the research, I focused on the preferred font size of Arabic students using tablet PCs. For this purpose, the students were presented with four font sizes in the AVID system. Figure 36 shows the various font size preferences of the school students.
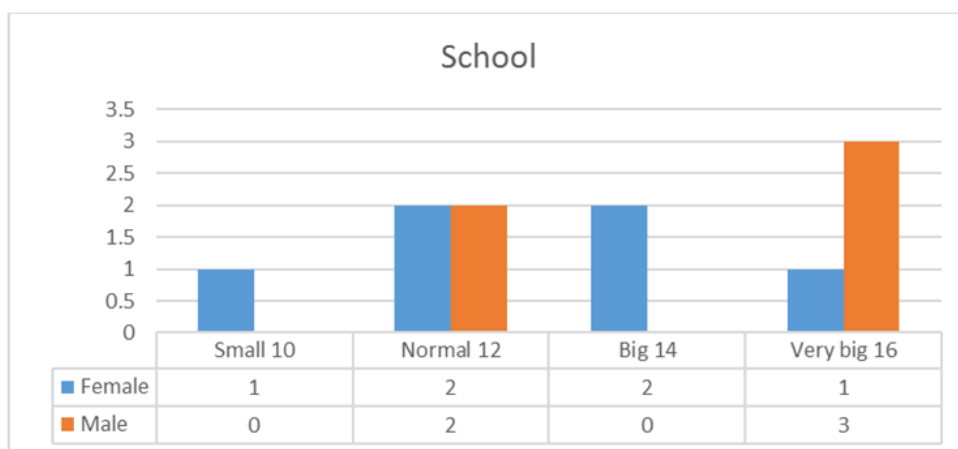


Figure 36: Font size preferences of Arabic school students

The font size preferences of the Arabic university students are shown in Figure 37. The university students overwhelmingly selected the large font size (14).
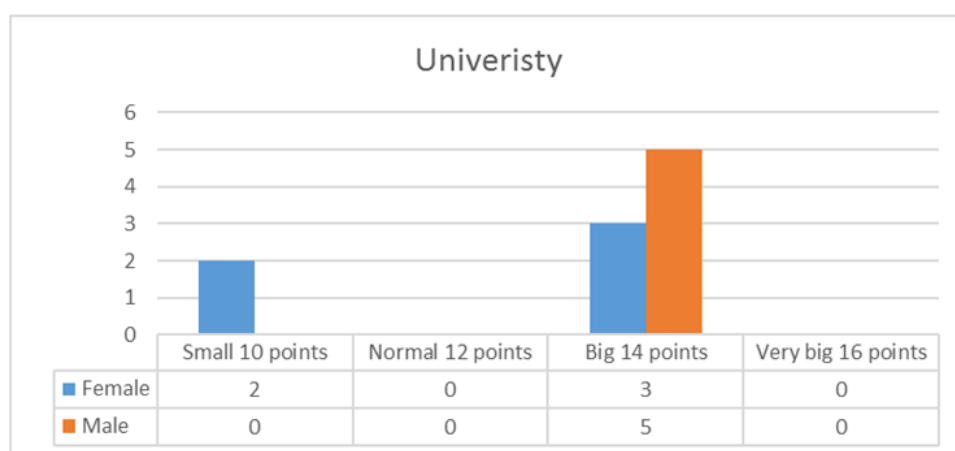


Figure 37: Font size preferences of Arabic university students

The font size preferences of both study groups are combined in Figure 38.

**Font Size**

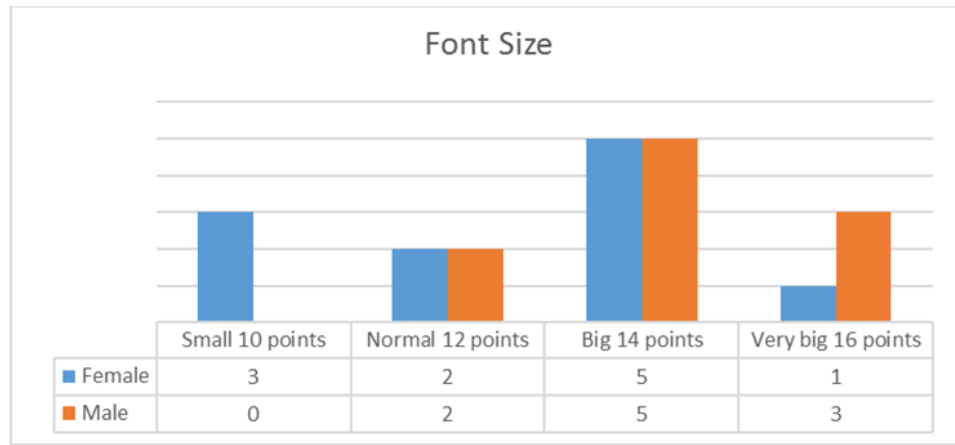| | Small 10 points | Normal 12 points | Big 14 points | Very big 16 points |
|---|---|---|---|---|
| Female | 3 | 2 | 5 | 1 |
| Male | 0 | 2 | 5 | 3 |

Figure 38 Font size preferences of all students

The font size preferences of the male and female Arabic students were statistically compared by the Fisher test. The results were not significantly different ($p = 0.3594$), indicating that font size does not significantly depend on gender.

## 7.1.2   Font Colour Preferences

Colour largely affects the general appearance and aesthetics of any application. Colour is also linked to the content and the characteristics associated with the manufacturer, and often indicates how the application's identity is trending. In our research, the AVID presented various colour choices to users. Among the six colours, both male and female Arabic school students selected only black, green, or blue (see Figure 39). Meanwhile, the university participants selected only black, blue, and red (Figure 40).
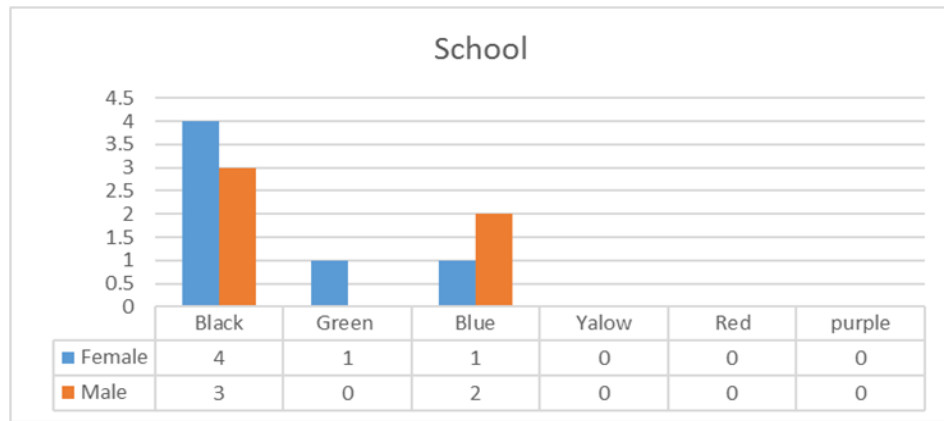
Figure 39: Font colour preferences of Arabic school students.
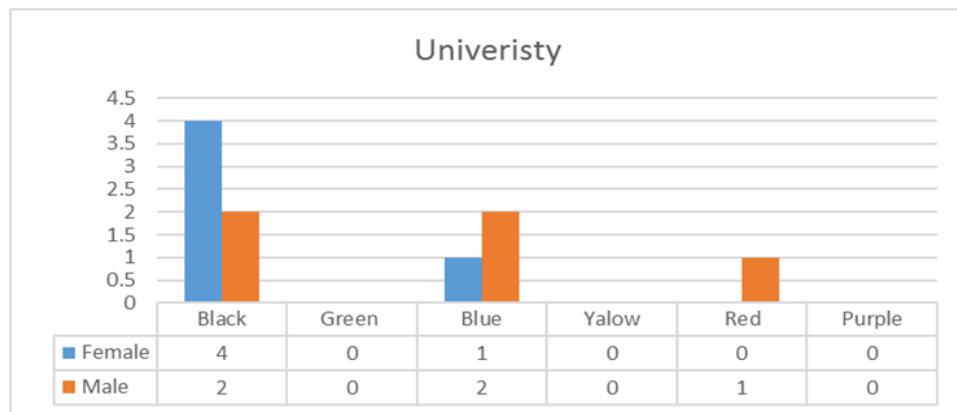


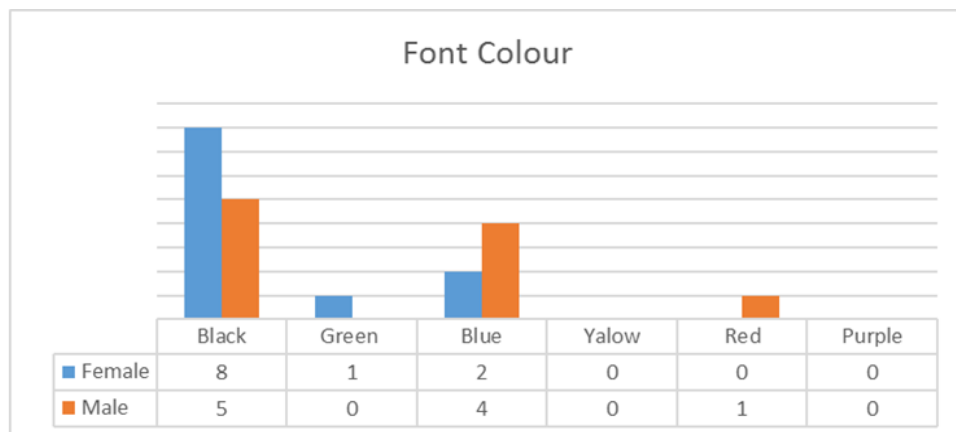Figure 40: Font colour preferences of Arabic university students.



Figure 41: Font colour preferences of all participants

The font colour should increase the readability and accessibility of the text. The combined results of both studies confirmed that black font against a white background was the most readable combination of colours for both genders, as shown in Figure 41.

The Fisher test revealed that preference for black font did not significantly differ by gender (p = 0.3432). This result was consistent with expectations, as the majority of students were accustomed to black font in textbooks, which gives the strongest contrast against the white background.

### 7.1.3  Button Types

At the end of any application, most students know that they must submit the completed form. However, distinguishing among several options sometimes confuses students. The button design assists the user in taking the correct action. Therefore, it is important to understand the users' preferred button types to help them to accomplish their goals. The button preferences of the Arabic school and university students are shown in Figures 42 and 43, respectively.



| School | coloured button | Shapes button | Typography button |
|---|---|---|---|
| Female | 2 | 3 | 1 |
| Male | 3 | 2 | 1 |
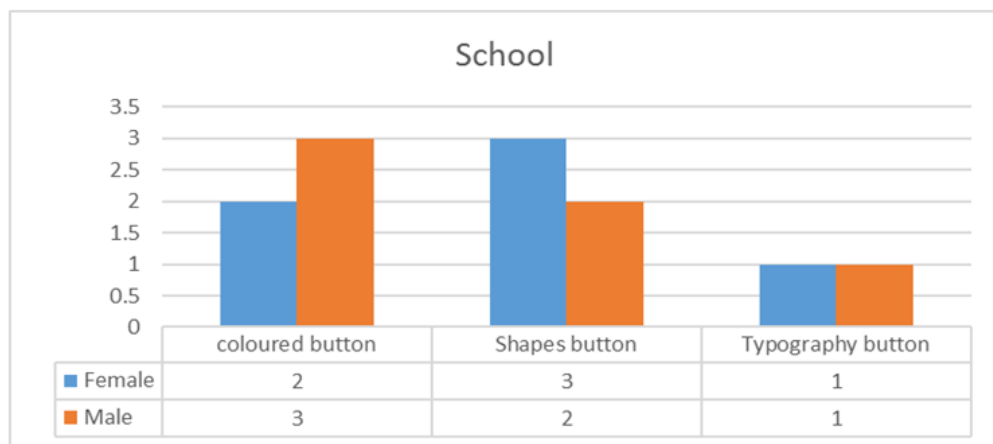
Figure 42: Button preferences of Arabic school students.
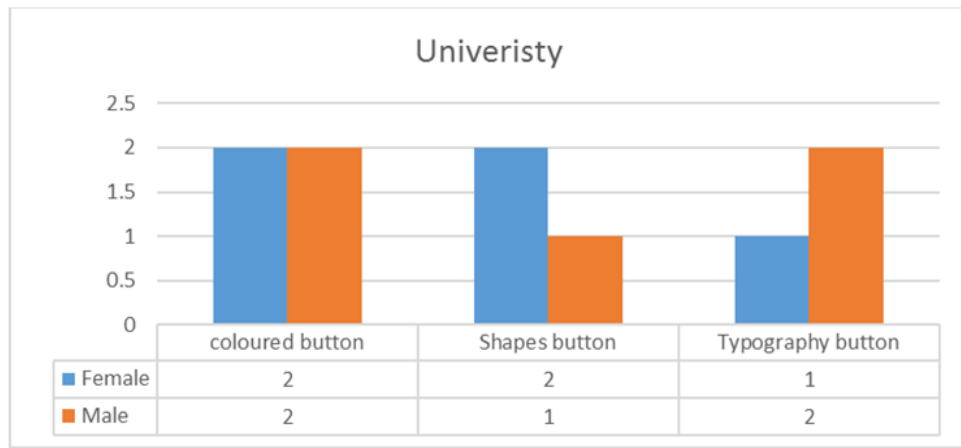
Figure 43: Button preferences of Arabic university students.

Three button types were designed in the present study; coloured, shaped, and typographic (text). After combining the results of both studies, it was found that all three button types were preferred by both female and male students, with small variations.



Figure 44: Button type preferences of all participants.

In addition, the Fisher test revealed no significant differences between the button preferences of both genders (p = 0.7499).

## 7.1.4 Alignment

The interface design of a tablet PC application is very different from that of a traditional

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PC. In particular, a tablet PC interface must support two orientation schemes and various screen sizes, which requires an adaptive layout.

Besides connecting the user to the interface, the text layout and menu design play a significant role in understanding and accessing information. In this thesis, layout refers to the text alignment.
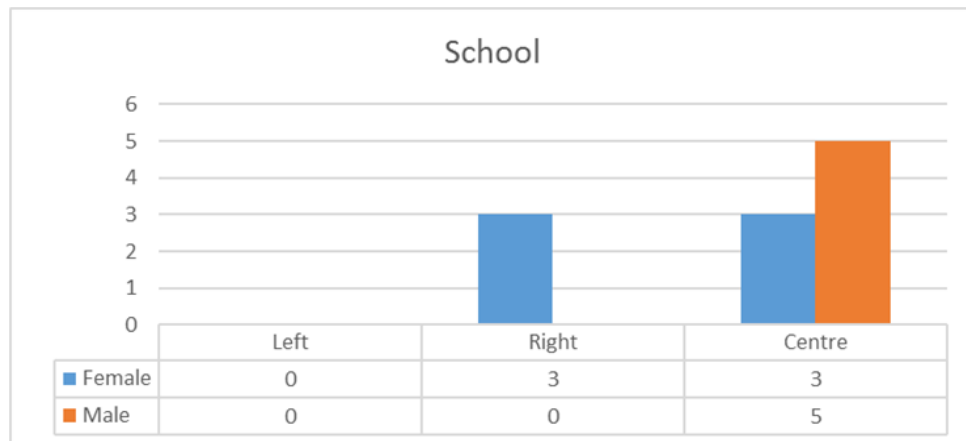


Figure 45: Alignment preferences of Arabic school students.
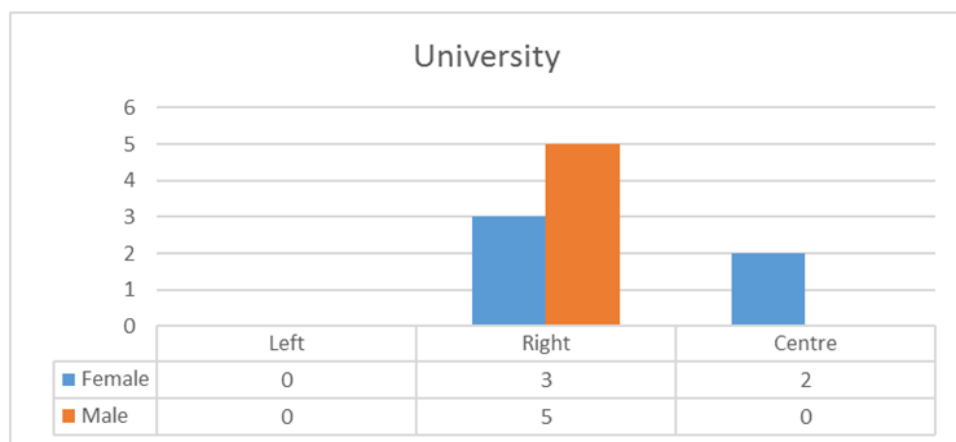


Figure 46: Alignment preferences of Arabic university students.

In the coaching thinking-aloud sessions, participants in both study groups selected only two text alignments; right and centre.
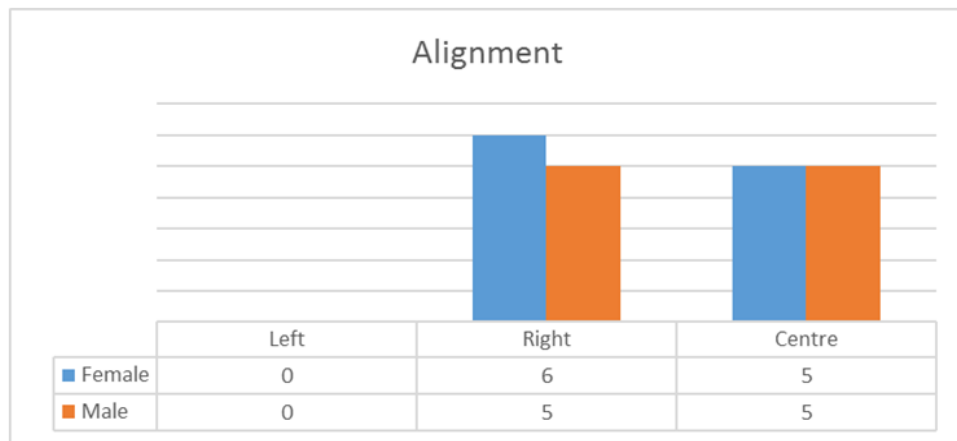
Figure 49: Alignment preferences of all participants.

The Fisher test showed no significant difference between the alignment preferences of male and female students (p = 0.999).

## 7.1.5   Menu Types

According to Galitz (2007), menus list the commands and properties that can be applied to objects, windows and documents. Applications usually contain a large amount of information for students and perform a variety of functions, which are informed and guided through the menu. Menus are important in educational applications, because they evoke the powerful response of recognition rather than the weaker response of recall. The menus provided by designers prompt users of the available options that may have been unknown or forgotten.
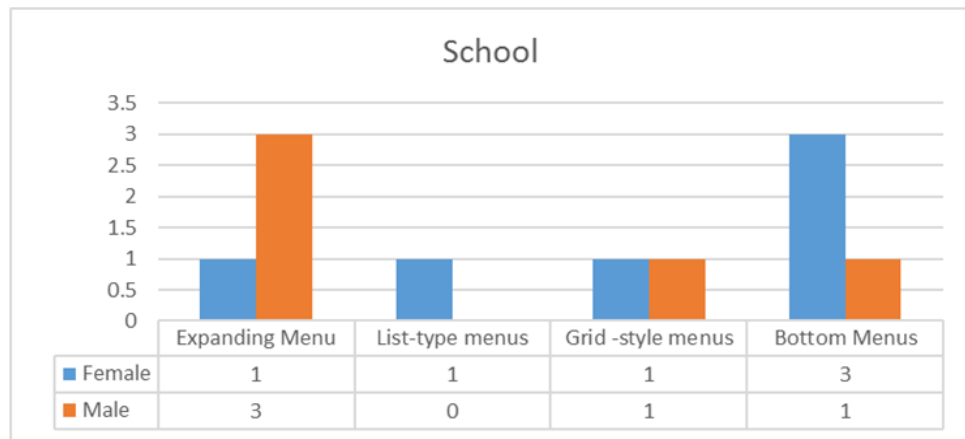
Figure 47: Menu preferences of Arabic school students
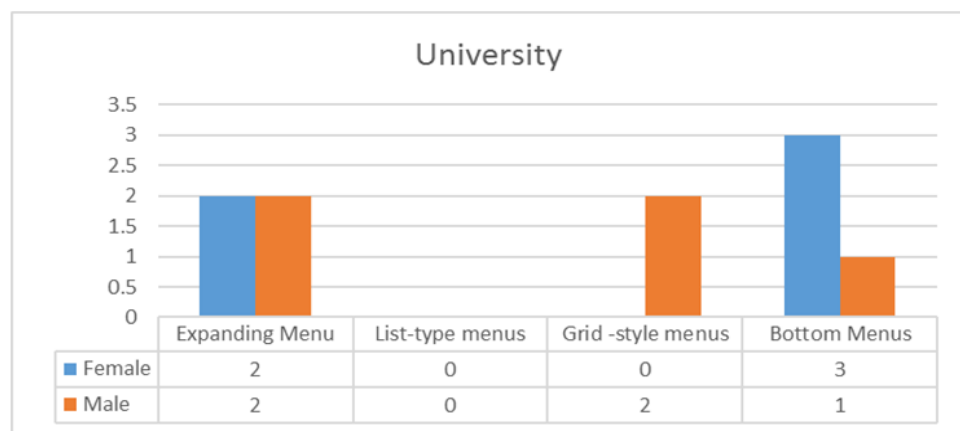


Figure 48: Menu preferences of Arabic university students.
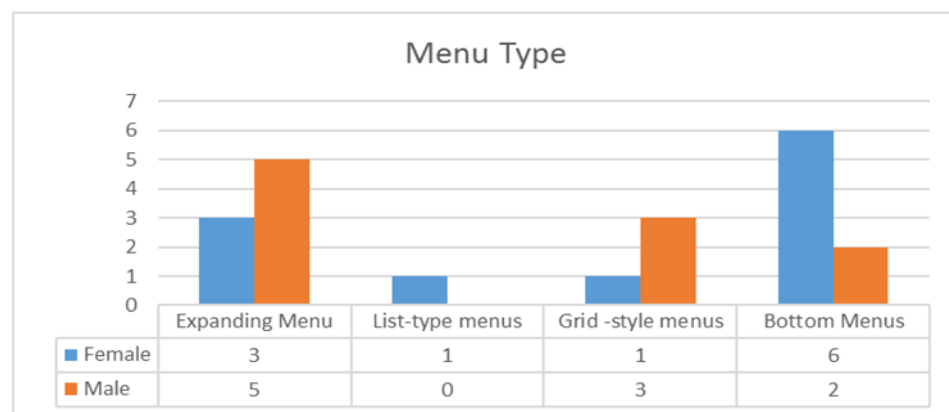


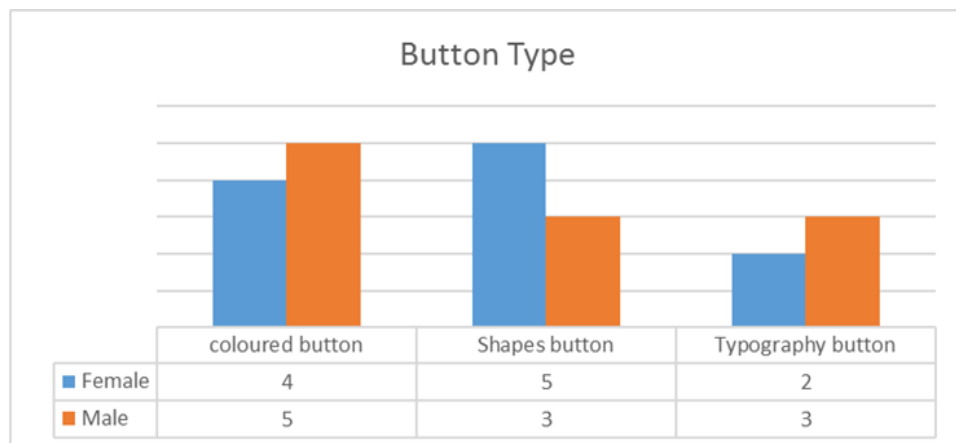Figure 49: Menu type preferences of all participants

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The Fisher test revealed no significant differences between the menu preferences of male and female students (p = 0.2387).

### 7.1.6  Summary of UI Preferences

Table 37 shows the results of all Fisher tests. Our H1 hypothesis is "there are significant gender differences in students' preferences of Arabic UIs for educational Tablet PC applications".

From Table 40, we can conclude that no significant differences in font size, font colour, button type, alignment, or menu type exist between the genders. However, the font-type results supported our hypothesis.

Table 40: Gender differences in preferred UI design elements

| UI Design Elements | P -value | Gender differences |
| --- | --- | --- |
| Font Type | 0.01078 | Yes |
| Font Size | 0.3594 | No |
| Colour | 0.3432 | No |
| Button | 0.7499 | No |
| Alignment | 0.999 | No |
| Menu Type | 0.2387 | No |

Small numbers of subjects were involved because of the use of usability testing (methods for obtaining the preferences. Despite this, I checked to see if there was any statistical significant difference between groups. Only in one case was this found so sweeping conclusions of significance are not appropriate.

Because the experiments were relatively complex to set up it was not possible to run large numbers of tests in the time available, which would be needed to quantify differences between groups at a statistically significant level.

## 7.2 General UI Principles

The researcher conducted two studies involving end-users of Arabic tablet PCs. Arabic users shared with us their preferred UI designs for educational tablet PCs. They also raised several key requirements of Arabic UI tablet PCs. In this section, I discuss these issues and provide examples of each.

Together with the literature review, our studies identified the basic concepts of UI guidelines for Arabic educational tablet PC applications. The principles revealed in the present experiments and those supported by the literature studies are summarised in Table 41.

Table 41: UI design issues

| No | UI design principles | From experiment | From Literature Table 7 |
|----|---------------------|-----------------|-------------------------|
| 1 | Add vocalisation marks | Yes | N/A |
| 2 | Design for maximum legibility | Yes | 2,3,7,8,9,27 |
| 3 | Significance of the importance | Yes | 13, 22 |
| 4 | Consider user characteristics factors (age and gender) | Yes | N/A |
| 5 | No dead end pages | Yes | 25 |
| 6 | Simplicity and consistency | Yes | 1,11 |
| 7 | Don't use tiny clickable areas | Yes | 24 |
| 8 | Understand user gestures | No | 23 |
| 9 | Organise the content well | Yes | 12,22 |

1. **Addition of vocalisation marks**: The experimental participants expressed the need for vocalisation marks, which are placed above or below Arabic characters to avoid confusion in educational and religious texts. Both male and female participants expressed this need:

"*Reading the text with vocalisation marks is better because I have a problem sometimes*

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*that I cannot distinguish meanings of some words*" Participant #3.

"*Vocalisation marks are essential in Arabic while reading the Holy Quran to distinguish meanings*" Participant #9.

"*No one denies the importance of adding vocalisation marks to any text. Sometimes I think it is critical to religious text, but sometimes I think it should be with any Arabic text*" Participant #6

In lesson two, where users needed to read and decipher religious texts, the students considered that vocalisation marks would have clarified the reading. Figure 50 shows how the vocalisation marks give the text its full meaning. In particular, they can change the meaning of a word or phrase:



Figure 50: Example of text with vocalisation marks.

The Arabic texts in Figure 50 have the same pronunciation, but inserting the vocalisation marks alters the meaning, wherein the first part 1,when we used the vocalisation marks the sentence will mean "That God has suffered Abraham what he ordered" and if we don't use the vocalisation marks as shown in part 2 the meaning will be "That Abraham had suffered from what God commanded him" . Therefore, including the vocalisation marks would enhance the reading experience for students, and reduce the number of reading errors.

2. **Maximum legibility**: The font should be clear and readable. If we are limited to one font size, one colour, one menu type and one alignment for both genders, then the most preferred combination is Al-Nasikh 14- point black.

Arabic script has a looping, overhanging feature that degrades the readability and legibility if handled incorrectly (Rhodes, 2015). In addition, the spacing between words and characters (kerning) is particularly important in Arabic.

The distance between the lines is one of the most important determiners of readability. Moreover, the distance between the words on each line must be logical and suitable for reading. If these spaces are too narrow, the text will be clustered and difficult to read, whereas if they are too large, the text will appear to be spread over different paragraphs.

Participant #7 confirmed this when he said: "*Sometimes while I am reading, some text confuses me; they designed the text so far apart, and that made me feel it is not linked together, although it should be!*" Participant #7.

Another important determiner of readability is text layout. Latin text is justified by expanding or contracting the spaces between the letters (Medlej, 2015). In contrast, Arabic script is justified by a technique called *Kashida*, which involves stretching the letters themselves. Kashida does not necessarily equalise the text (see Figure 51 for an example).

| ( وإذ ابتلى إبراهيم ربـــــه بكلمات فأتمهن قال إني جاعلك للنـــاس إماما قال ومن ذريتي قال لا ينال عهدي الظـــــالمين ( 124 ) ) | ( وإذ ابتلى إبراهيم ربه بكلمات فأتمهن قال إني جاعلك للناس إماما قال ومن ذريتي قال لا ينال عهدي الظالمين ( 124 ) ) |
|---|---|

Figure 51: Arabic letter stretching in justified text

1. **Right colours in the right places**: Words of special significance that students should focus on should be coloured differently from the main text. For example, in Figure 52, the red text highlights the name of Allah (God). In our study, Arabic students preferred black fonts with a white background. However, designers sometimes change the font colour for specific reasons. Therefore, I recommend the use of high-contrast colours, such as blue against a grey background.

يُخَادِعُونَ اللَّهَ وَالَّذِينَ آمَنُوا وَمَا يَخْدَعُونَ إِلَّا أَنْفُسَهُمْ

Figure 52: The name of Allah is highlighted in red

Contrast, which defines the extent to which the text colour differs from the background colour, is another critical determiner of readability. Contrast is dramatically increased by

highlighting the text. Too much contrast can startle the reader's eye. The designer must select the contrast that gives a readable text.  Some students referred to contrast in their responses:

"*I prefer to see the learning texts with black font and a white background since that makes the text readable for me*" Participant #5.

In the coaching thinking-aloud sessions, most of the students disapproved of bright colours that scream for the user's attention. For example, one male participant said:

"*Using a bright green background colour with orange text led me to close the text and I do not want to return to it again*" Participant #9.

The designer must also consider users with colour blindness, who cannot distinguish between degrees of the same colours. As mentioned in subsection 5.3.2, sufferers of red–green colour blindness (the most common form) cannot distinguish between shades of red and green, and sees both colours as blue.

None of the participants were colour blind in the present experiment, but one participant mentioned that

"…*We prefer to see cold colours that make the user feel more satisfied. Also, some students may have colour blindness that gives them problems with vivid colours*" Participant # 6.

In the lesson on religious text, I expressed Allah's name "الله" in red and the Prophet's name in green. Most of our participants found that coloured words in the text helped them to focus and find the target information.

Users view colours in a semantic way. Word colour should always be considered by the designer, and is especially important in the Arabic language (more specifically, in Arabic religious texts), as it draws the user's attention to important religious symbols. Essentially, colour indicates the connotation of the text. For example, the name of Allah (God) in the most religious books (such as the Holy Quran) is highlighted in red.

2. **Age and gender in the UI design**:  One of the main outcomes of this thesis was the significant difference between the preferences of male and female students in Jordanian schools and universities. These gender factors should be accounted for in the UI design. We highly recommended customising the design beads on gender preferences as shown in our result.

3. **Absence of dead-end pages:** Students struggle with applications that lead to "dead ends"; that is, pages that cannot be restored to the homepage or returned to the previous section. Therefore, when presenting information to the students, the number of steps must be minimised as far as possible. Designers should minimise the step number by planning the tasks well, and using gestures in the correct way.

4. **Simplicity and consistency:** Arabic students preferred a simple design with few functions, and emphasised that the design should be logical and familiar. The designer should build a consistent and simple application with maximum functionality and legibility.

5. **Reasonable size of clickable areas:**  Links and buttons should enable easy access to the required information. Therefore, the design should be both easy to tap and have sufficient space for tapping.

6. **Understand user gestures:** Designers need to understand the behaviour and physical capability of the target users. Tablet PCs are tapped using the hands and fingers, which are natural movements of humans.

7. **Good organisation of content:** Tablet PCs are equipped with multi-touch screens, and frequently accommodate a camera, microphones and accelerometers. The typical screen size is 7–13.3 inches. As students prefer an organised content, designers should consider all aspects of the content before starting the design. The designer should also plan the tasks of the application, and the demographics and likely environment of the primary users. It is important to organise the content and define the navigation model of the application by considering the information architecture.

## 7.3  Religious UI Guideline

Our study attempted to understand how Jordanian Arab students thought about the

symbols of the religious side. Religion is the main part of Jordanian culture. The majority of Jordanians are Sunni Muslims. Therefore, the design of any application of the Arab user interface must take into account users and respect their culture. The following is the main point that should I include it in our targeted UI guidelines.

1.    Avoid using any images or symbols bearing any sexual connotations.
2.    Do not use an image of animals that carry an unwanted meaning in Islam
3.    Use red to refer to God's name and green theme in religious text.
4.    Use clear lines, large religious texts, and avoid embossed lines.
5.    Use the evidence to understand the use of religious symbols.

## 7.4  Issues with Data Collecting Methods

Unlike other Jordanian cities, Amman has a multi-cultural environment and freer social interactions between the genders. Therefore, Amman society is less influenced by Jordanian customs and traditions than other Jordanian societies, in which females do not freely communicate with non-relative males in normal situations. However, such cultural issues are still important.

As an Arabic researcher and part of the Arabic community, I understand that Arabic females often feel shy and uncomfortable expressing their thoughts and opinions to a male facilitator during the experiment. To optimise the responses from the female Arabic students and to alleviate the stress caused by interacting with male facilitators, I adopted the same-gender facilitator approach. The experiments yielded some interesting results regarding the user preferences of all participants. Unlike the traditional thinking-aloud approaches, the coaching thinking-aloud approach elicited more research-tailored responses from the users, thereby increasing the accuracy of the findings.

Consistent with the work of  Borsci and Federici (2009), the coachingthinking-aloud approach was deemed the most appropriate approach for investigating the UIs of educational tablet PCs that are preferred by Arabic students. The results were affirmative, and the user preferences were obtained.

Through the coachingthinking-aloud approach, users revealed their developing thoughts while interacting with the tablet PC interface. This defined the preferred fonts, colours, typography, and navigation mode of the interface. The responses of the Arabic students were highly enlightening, and positively impacted on the study results. To reveal the distinct differences between the male and female preferences, a more sophisticated interviewing approach based on intra-gender communication was necessary.

Some bias appeared in the results. The user responses were guided in a given direction by the facilitator's questions and prompts, preventing a natural outcome. Regardless of such bias, the coaching thinking--aloud approach was considered superior to the traditional thinking aloud approach, provided that the protocol used the same gender facilitator. The slight difference between the male and female preferences was unexpected, and has not been reported previously.

Limitations of the present study include the small numbers of students and concentration in the younger age group. However, the research protocol revealed gender differences in the preferred UI designs of young Arabic speakers. To evaluate usability by a culturally appropriate method, the researcher must be aware of cultural norms such as gender roles. Continued development in this area should enable appropriate and high-quality interface designs for this relatively underserved group.

Given the large number of people who speak Arabic and similar languages worldwide, software developers and designers should extend the usability of their existing interfaces, and should further investigate the interface preferences of this group.

## 7.5  Summary

This chapter formulated the initial design guidelines for an Arabic UI interface for educational tablet PCs. The proper type, size and colour of the font, the button type, alignment, and menu type were identified. General design issues were highlighted. Significant gender differences among the young Jordanian students appeared only in font type; the preferred font sizes, font colours, menu types, button types and alignments of

males and females were statistically the same. The preferences for these elements can be included in the standards for an Arabic UI. The initial Arabic UI guidelines and principles will be refined and assessed in the next chapter.

# Chapter Eight

## DELPHI STUDY
## (STAGE E)

As the final phase of our research methodology, the UI guideline evaluated in a Delphi study. The results of the Delphi study are presented in this chapter. The first section poses the research question to be answered in this thesis. The second section assesses the validity and reliability of the information. Next, the experimental procedure and study setup, along with Consensus One and Two, are presented. The chapter concludes with a summary.

The Delphi technique was used to refine and assess the Arabic UI guideline and principles. These included the initial guidelines and principles acquired from the school and university studies and the data from the literature review (chapter 7, stage D), which were assembled based on the requirements identified in the designers' and developers' study.

## 8.1  Delphi Technique

Numerous studies (Abhishek, 2014; Landeta, 2006; Zawacki-Richter, 2009) have highlighted the Delphi technique as a simple source of information. It includes the biases of various experts, and approaches the truth through agreement (Van de Ven & Delbecq, 1974). In addition, the written, controlled feedback in this approach limits the subject– researcher interaction (Landeta, 2006). In this thesis, the Delphi technique was used

because it helps to focus on the ideal rather than the individuals, also, the subjects must be assessed over long geographical distances within the cost restraints and time limits of the study.

For the purpose of the Delphi study, Jordanian expert designers were invited to review the initial guidelines. The Delphi study constituted the final part of the study design, namely, the evaluation phase of the design science research methodology. In this chapter, the researcher answered our main research question: "To what extent do the proposed design guidelines satisfy the designer needs?"

### 8.1.1 Validity and Reliability

According to Marsland, Wilson, Abeyasekera, and Kleih (2000), the Delphi research design provides a more in-depth and detailed analysis than the quantitative research design.

A study by Franklin and Hart (2007) demonstrated that the Delphi study improves the effectiveness of the first-round questions. Accordingly, a thorough review of the literature is essential to confirm that the first-round questions contain recent information. Meanwhile, researchers must ensure that the first-round questions include all components, from which experts can note the most "in the moment" ideas (Franklin & Hart, 2007, p. 245).

On the other hand, the reliability of a first–round questionnaire cannot be confirmed because of the qualitative nature of this assessment (Franklin & Hart, 2007). Therefore, the validity of the questions must be judged by two experts. Franklin and Hart recommended that the validity and reliability of the study depend on the researchers' skills and experiences. Thus, two professors from Auckland University of Technology (AUT) discussed the questions with the main researcher before uploading the questionnaire to the website.

### 8.1.2    Experimental Environment

Traditionally, the paper–based Delphi technique was disadvantaged by the long turnaround time of mailing multiple surveys back and forth (Miaskiewicz & Kozar, 2006). Therefore, the Delphi technique in this study was electronically deployed through the website https://edelfoi.fi (Delphi Decision Aid), which allows the participants to submit their responses online. Using an online service reduced the cost, time and effort of surveying.

## 8.2  Experimental Procedure

As explained by Van de Ven and Delbecq (1974), the Delphi procedures include a minimum of two-round questionnaires and feedback reports. The initial-round questionnaire may contain open-ended questions or questions that respond to formats. After syndicating and analysing the initial-round questionnaire answers, the researcher forms the second-round questionnaire, which reveals the overall group response and the individual responses of participants. When designing this questionnaire, the researcher should refer to the participants' responses in the first-round questionnaire

In the present study, expert designers and developers were invited to participate through the Delphi Decision Aid website. The researcher (administrator) sent a quick welcome and emailed the study intentions and objective to the potential participants. To accept the invitation, the participants clicked on the link attached to the email, which transferred them to the edelfoi.fi website, where they read the guideline documents and answered the questions. Each expert could view the answers by all other experts, enabling free comments. The process was completed when adequate information had been collected, or when the participants agreed that sufficient information had been gathered (see Figure 53).
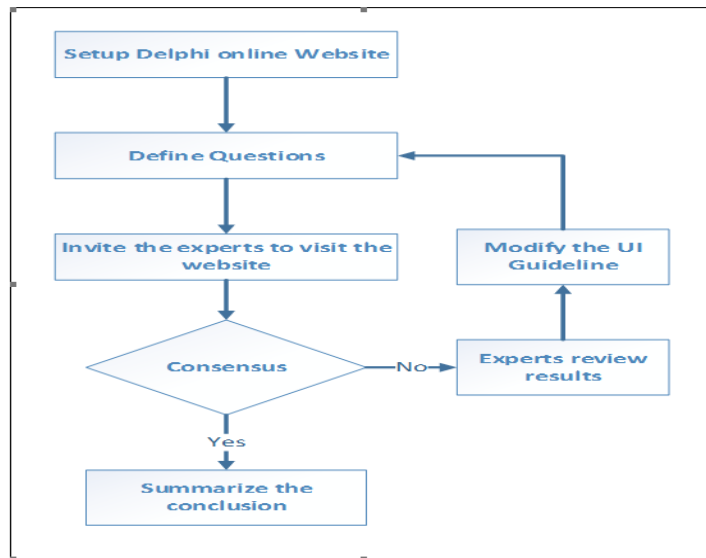
Figure 53: Flowchart of the Delphi Procedure

## 8.2.1 Setup of the Guideline Document Website

In the first step of the Delphi procedure, the UI design guideline documents were set up on the Delphi internet site https://edelfoi.fi/, which offers useful and flexible online tools. Figure 54 shows the initial setup of the guidelines and first-round questions.



Figure 54: Setup of the Delphi study

● Setup Queries (Questions)

The guideline document contains three main sections: the UI preferences (Font Type, Font Size, Font Colours, Button, Alignment, and Menu Type), the religious UI guidelines,

and the general design principles.

- Define the Research Questions

Through the Delphi technique, I refined our UI guidelines and principles. The main Delphi study was implemented as a series of questions. To answer our research questions, the expert panel were anonymously requested to provide qualitative feedback on the UI guidelines and principles.

- Invite Experts to the Panels

Among 13 designers and developers invited to participate by email, I recruited six participants; five Jordanian designers and developers and one Jordanian PhD student. Here, to maximise the neutrality of the study, I invited the designers and developers who had participated in the previous study. The same experts had supervised the development of UI tablet PCs and mobile applications in their Jordanian companies. The PhD student (labelled D1 in Table 42) was recruited to ensure an academic balance of ideas and opinions. The student is specialising in the computer field, so is familiar with the study and its terminology. Table 42 summarises the demographic information of the six participants.

Table 42: Demographic information of participants in the Delphi study

|  | P #1 | P #3 | P #4 | P #5 | P #9 | D1 |
|---|---|---|---|---|---|---|
| **Age group** | 25-34 | 35-44 | 25-34 | 35-44 | 18-24 | 25-34 |
| **Gender** | Male | Male | Male | Male | Female | Male |
| **Experience** | 2-4 years | >8 Years | 5-8 years | >8 Years | 2-4 years | PhD Student |

Adler and Ziglio (1996) noted four requirements of expertise; (i) knowledge and experience with the investigated issues, (ii) ability to participate, (iii) sufficient time to participate, and (iv) communication skills.

All experts were expected to be experienced in designing Arabic UIs for mobile and tablet PCs, and to thoroughly understand the limitations of designing Arabic interfaces for

mobile tablet PCs.

## 8.2.2   Consensus (Round One)

Round One began on 5 July 2015 and ended on 22 July 2015. The responses to the first round were managed by grouping them by similarity of response. This grouping also enhanced the quality of the guidelines.

During Round One, the experts answered fifteen questions (queries), twelve of which related to the UI preferences. For example, the font type guideline was queried as follows:

- Do you think that the (font type) guideline is useful to use?
- Please rate the (font type) guideline from 1–10.

The remaining three questions asked the experts to evaluate the guidelines in general and provide further comments.

- What features should be added to improve the UI preference guidelines?
- In general, how do you evaluate the religious guidelines and design principles?
-  Is there anything you would like to add?

Experts identified a number of problems in each section. Their responses were important for developing the UI guidelines for Arabic users. Experts clearly expressed their good impressions of the first version, but suggested various improvements that were very important in developing our targeted guidelines (the details are given in Table 43).

Table 43: Summary of experts' suggestions in Round One of the Delphi study

| UI Element | Delphi Study main highlighted result |
|---|---|
| General Issues | <ul><li>Guideline still needs expanding to cover more aspects regarding the interface design, and some points need more clarification. *" I prefer if you add more about usability and user experience"*</li><li>Wordy and needs to have some examples to clarify some points.</li><li>The guideline was integrated with UI guidelines such as google and apple.</li><li>This guideline based on a real user experiment, which makes it more credible and designers can trust it. *I think it is good start to have end user preferences, but it is hard to generalise"*</li><li>The general principles are more useful , but need more example and figures</li><li>Designers discover more about usability testing and the importance of involving the user in their design.</li></ul> |

| General Principles | • Experts shared us their thought about general principles; the following are the important points that experts mentioned to improve these principles. Principles are more useful with example. *" could you provide some examples and photo to clear your idea"* |
| --- | --- |
| | • Some of these principles need clarification. I prefer to rephrase again |

| Font type and size: | • Microsoft product well-known in the Arabic world and most people is familiar with Microsoft applications. Therefore, experts think users will be more comfortable with Simplified Arabic and Microsoft Sans Serif fonts. |
| --- | --- |

" I think the font you selected is perfect and I would appreciate if you include more font's next time"

- Female user: a feminine design was more appealing, more effective, and better suited for the purpose.
- Font type could be flexible to the user, so that the user can change the fonts anytime he or she prefer.
- Most of Arabic latter take more space than the other script, therefore we usually change the font type  from Serif to New Roman and we change the font size from 10 to 13 points .Also, and we set the font-weight to be thicker than the Latin script as shown in the following code

| EN : | AR: |
| --- | --- |
| span<br><br>{<br><br>    font-family:Arial, Serif;<br><br>    font-size: 10px;<br><br>    font-weight: 100;<br><br><br><br>} | span<br><br>{<br><br>    font-family:Verdana,Times New Roman (Arabic), Arial Unicode MS,Arial,Transparent,Sans Serif,Verdana, Helvetica;<br><br>    font-size: 13px;<br><br>    font-weight:600;<br><br>} |

| Colours: | • Colours are one of the important preferences for the user to enhance the usability of any application. The educational application should have cold colours to improve readability. |
| --- | --- |
| | • Some experts thought colours are subjective and not easy to choose. Therefore, the design could be something general, not very specific; for example, the female user prefers cold colours and male prefer warm colours. |

*"Colours are always a problem for me, well I cannot determine the appropriate coloursو However could you add more about colours and colour plate in Arabic, please "*

| | • Experts mentioned that guideline does not cover user disability problems.<br>• Experts believed that the guideline could consider the device resolution, which affects the used colour. Because some colours will not appear as they are supposed to be due to the device resolution. |
|---|---|
| Alignment | • Alignment is one of the complicated things in the Arabic user interface design with bilingual design; users still suffer when using the Arabic language with English while writing, in addition to sorting the pages with multimedia.<br>• Experts were asked to explain more about a text with multi-paragraphs and each paragraph containing multi-lines.<br>• Experts thought guideline should consider a case where text was mixed with images and was bilingual. |
| Menu Type | • Regards to the Menu Text Size and Style, most of the Arabic letters are larger than the Latin letters, such as the Arabic letter "(س) Sein" in comparison with the letter "I" " , this could affect the menu or buttons spaces. To solve this problem we used the following code |

| EN : | AR: |
|---|---|
| .Menu:link {<br><br>    font-family:MS Sans Serif;<br><br>    font-size:10px;<br><br>} | .Menu:link {<br><br>    font-family:Times New Roman (Arabic) ,Sans Serif;<br><br>    font-size:12px;<br><br>} |

| Religious symbol | Need to consider other religion's signs. *" If you can add more and find out about Religious symbols' meaning"* . Collect all the Religious symbols' meanings (make it as a table). |
|---|---|
| Touchscreen gesture | Another added that they would appreciate touchscreen gesture explanations with some examples supported by photographs. *"Design for touchscreen is deferent in regard the designer should taking in his account the gesture and how users could they use their hands (figures)" (*P#8). |

In the last five questions of Round one, the experts were asked to assess the draft version of the guidelines. Participants' satisfaction with the guidelines is summarised in Figure 55 and Table 44.

Table 44: Participant satisfaction during Round one of the Delphi Study.

| | Dissatisfied | Somewhat Dissatisfied | Satisfied | Somewhat Satisfied | Very Satisfied |
|---|---|---|---|---|---|
| General Principles | 1 | 1 | 3 | 1 | 0 |
| Font Type | 0 | 2 | 2 | 2 | 0 |
| Font Size | 0 | 2 | 2 | 1 | 1 |
| Font Colour | 1 | 2 | 2 | 1 | 0 |
| Button Type | 1 | 2 | 1 | 2 | 0 |
| Alignment | 0 | 3 | 3 | 0 | 0 |
| Menu Type | 0 | 1 | 2 | 2 | 1 |
| Religious Principles | 0 | 2 | 1 | 1 | 2 |



Figure 55: Participant satisfaction during Round one of the Delphi study

## 8.2.3 Consensus (Round Two)

Round Two ran from 2 August 2015 until 18 August 2015. All participants in Round one replied and participated in the second round. Based on the previous comments and suggestions from the expert panels, I improved the consistency of the guidelines and included more examples and explanations. In particular, the problems identified by the experts in Round one were addressed in the improved guidelines. Table 45 shows the seven sections of the new guidelines:

Table 45 : Final version of the Arabic UI guidelines.

| No | UI Guideline key components (table of content) | Explanation | Source |
|---|---|---|---|
| 1 | Introduction | Introduce the work | Author |
| 2 | Why we need this UI guideline | Explain why The UI guideline is important for Jordanian designers and developers | Author |
| 3 | General principles | UI design principles for Arabic tablet PC UI | Literature + Students studies |
| 4 | UI preferences guideline<br><br>(Font type, Font Size, Font Colour, Button Types, Alignment, Menu Types) | The end user ( students) UI elements preferences | Students studies |
| 5 | Religious UI Guideline | Religious design advices + table of symbol meaning | Literature + Students studies |
| 6 | Touch gesture reference guide | Basic gestures for most touch commands | Literature |
| 7 | Terminology definition | Explain some design concepts | Literature |

- An introduction was added.
- The new section "Why you need to use this guideline" justifies the importance of principles and guidelines in the design of UIs, especially Arabic UIs.
- The touch gesture reference guide compiles touch resources for designers and developers

- The new section "Terminology definition" clarifies some terminologies in usability and interface design, which had confused the designers and developers in Round one.

In Round two of the Delphi study, I queried the experts' satisfaction with the amended version of the guidelines. I asked the experts whether the new guidelines had achieved the required modifications. For each section, the experts were asked the following questions:

- **Are you satisfied with the amendments? If not, please specify why.**

All experts on the panel were satisfied with the amended version of the new guidelines.

- **Do you think that the current version covered all the required modifications? If not, please specify why.**

All experts on the panel agreed that the new version covers most of the required modifications.

- If the current version achieved the required modifications, please rate the new version of the guidelines.

The results of Round two confirmed that the experts were comfortable with the new version of the guidelines (see Appendix K).

When asked to rate the new version of the guidelines, the experts were provided with five feedback evaluation questions, each evaluated on a five-point Likert-scale (1=Dissatisfied, 2=Somewhat Satisfied, 3=Satisfied, 4=Somewhat Satisfied, 5=Very Satisfied). None of our experts rated any of the guidelines or general principles as "Dissatisfied". The experts were more satisfied with the new UI guidelines than the initial guidelines. As shown in Table 46 and Figure 56, the designers were more satisfied with any aspect of the revised guidelines.

Table 46: Experts' satisfaction during Round two of the Delphi study

|  | Dissatisfied | Somewhat Dissatisfied | Satisfied | Somewhat Satisfied | Very Satisfied |
|---|---|---|---|---|---|
| **General Principles** | 0 | 0 | 3 | 1 | 2 |

| | | | | | |
|---|---|---|---|---|---|
| **Font Type** | 0 | 2 | 2 | 2 | 0 |
| **Font Size** | 0 | 2 | 2 | 1 | 1 |
| **Font Colour** | 1 | 2 | 2 | 1 | 0 |
| **Button Type** | 1 | 2 | 1 | 2 | 0 |
| **Alignment** | 0 | 3 | 3 | 0 | 0 |
| **Menu Type** | 0 | 1 | 2 | 2 | 1 |
| **Religious Principles** | 0 | 0 | 1 | 3 | 2 |
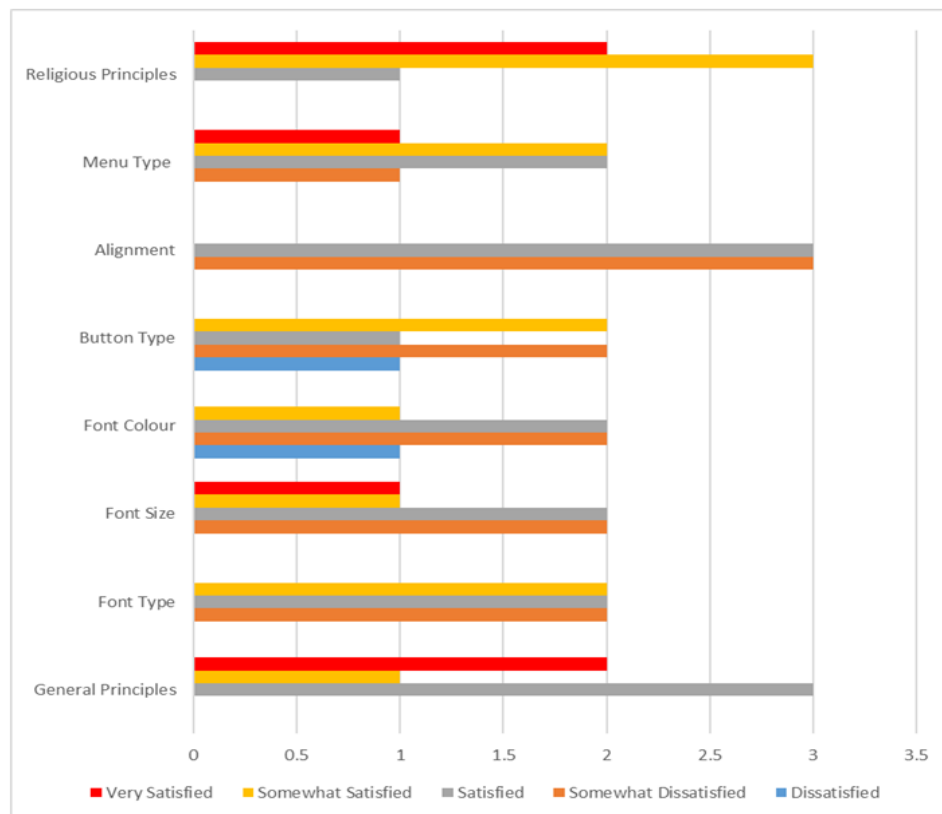


Figure 56: Satisfaction scores of experts during Round two of the Delphi study

## 8.3  Summary

In this chapter, I reported the results of a Delphi study to enhance the quality of the proposed Arabic UI guidelines for tablet PCs. In Round one of the study, Jordanian

experts shared their thoughts and knowledge, and accordingly rewrote our guidelines.

In Round two of the Delphi study, the experts checked whether their requested amendments had been fulfilled, and evaluated the new version of the guidelines. The final version of the guidelines is shown in Appendix M.

# Chapter Nine

## CONCLUSION AND FUTURE WORK

The current chapter discusses the study findings, which are outlined under the four main research questions. This is followed by the discussion on research contributions and implications and then the limitations are highlighted. Finally, ideas for future research are presented in the chapter.

The aim of this thesis is to provide relevant material, which would be useful in improving the design of educational applications for Arabic tablet PC by elucidating the preferences of Arabic users. Based on these preferences, the resultant set of Arabic UI guidelines should help designers and developers to create applications that meet the specific needs of Arabic users.

## 9.1  Motivation for the Study

Applications for mobile and tablet devices are increasingly becoming more complex. This study is motivated by the noticeable increase in the number of Arabic people using mobile and tablet device applications, not merely for recreational purposes but also in their working lives. The research combines questionnaires and the coaching thinking-aloud technique to accurately gauge and appreciate the emerging goals, needs and behaviours of young Arabic users, and hence create Arabic UI guidelines, which may improve the quality of applications. The thesis results are similar to the findings of Marcus and Hamoodi (2009), who identified the lack of structured design guidelines for Arabic UIs. Correspondingly, Bruseberg and Lintern (2007) highlighted that when the design activities not structured, the design styles may not be aligned with users' preferences.

## 9.2 Discussion and Conclusions

The guidelines have been created in five stages with four main studies, each seeking to answer one of the four main research questions. In the following discussion, the study findings are grouped into these main research questions. **Q1: What are the current UI design practices in use by Jordanian designers and developers?**

In this thesis, a suitable UI design for Jordanian users was recognised with the use of research instruments of a survey and interview study. The research aims to contribute to the academic and functional utility of the concepts of i) the UI design activity, ii) design roles, iii) usability testing methods, iv) design support documents and v) sharing of resources and knowledge.

The business model of Jordanian companies is oriented towards providing specific solutions for their customers' particular needs. Although several designers intend to deliver the best UI design for their target users, their applications often fail because they do not follow the ideal design activity (rule) (Aspinall, 2007). This deficiency motivated the primary author to assess the importance of Arabic UI guidelines when designing Arabic applications.

Findings from the structured interviews revealed that Jordanian companies must considerably improve their UI designs to meet the needs and expectations of their end users. For this purpose, most Jordanian designers rely on hints gathered from previous projects, which is unsatisfactory. Moreover, novice designers must practice their design skills with guidance from external design guidelines. This result is consistent with Van Welie (2001), who highlighted that novice designers can make many mistakes and need to learn new skills.

Moreover, Jordanian designers were found to play multiple roles during the design and the delivery of educational applications, which sometimes leads to confusion among the team members and hinders the quality of the design. These results are supported by Humphreys, Leung, and Weakley (2008), who demonstrated that the roles of user

interaction designers must be separated to ensure the team members' engagement in design activity. These results also corroborate the ideas of Rein, Holsapple, and Whinston (1993), who highlighted the need for specifying team members' contributions to the design of an instructional application.

To aid Arabic UI designers, this thesis elucidates the UI elements that are often used when designing Arabic educational applications. These design elements should be considered in the distribution and organization of design tasks among team members. In particular, by enabling designers to become self-organized, these elements could improve the effectiveness of design activities. When each team member can concentrate on their own design role, the design process can better accord with the design flow of other team members.

Another important finding in this thesis was that interviews are the first option for usability testing by most Jordanian designers. However, some designers adopt heuristic evaluation checklists, cognitive walkthrough, pluralistic walkthrough, questionnaires and other tools. The preference for interviews can be attributed to a lack of understanding of modern usability methods and procedures in a design context. Most Jordanian designers regard usability methods as costly and time consuming. Section 7.2 of this thesis summarised a group of principles that should be followed by designers of Arabic tablet PC applications. The application checklist of these principles would improve the effectiveness and organisation of usability testing methods, and ultimately, the satisfaction of Arabic users. These results also highlight the need for appropriate training programmes that should familiarise designers of educational application with appropriate usability methods. Similarly, Tang, Johnson, Tindall, and Zhang (2006) asserted that various usability heuristic categories should be improved in the early stage of software development.

Regarding the support needed during the design phase, our study revealed a remarkable weakness in teamwork functionality. As evidenced by Parsons, Ryu, and Cranshaw (2006), teamwork is important in the design requirements of mobile learning environments. Lack of communication among group members may significantly

compromise the design process. This was shown by Martins and Aspinwall (2001), who investigated the effect of low teamwork profile on designers' understanding of customer needs. The absence of active participation and interaction during the design-problem solving stage has been widely reported as the reason for lack of information sharing among designers (Lumsdaine & Lumsdaine, 1995) and lack of teamwork skills (Hastie, Fahy, Parratt, & Grace, 2016).

The results also showed a lack of knowledge sharing among team members. According to the literature, such knowledge sharing improves members' awareness of the design requirements by stimulating active communication and discussion of design-related issues (Sharples, 2000). Sharing knowledge and finding solutions to UI design problems in a timely, cost-effective manner is difficult for Jordanian designers, since the senior designers cannot always spare their time to help junior designers. In the team collaboration and knowledge sharing process by Jordanian designers, face-to-face communication is usually regarded as faster, easier and more acceptable within Arabic culture than other methods. Attention to design and usability evaluation approaches may also nurture communication between the team members.

It is important to understand how Arabs think about persuasion and the strategies they use for exchanging knowledge. The use of persuasion significantly differs between Arabic and Western cultures (Suchan, 2014) and among Arabic cultures themselves. Nonetheless, language plays a critical role; the used written language is different from the spoken form (Said, 2002). Given the uncertain relationship between the design team members in Jordanian companies, understanding and enhancing knowledge exchange in the Arabic language requires further research. The challenges raised here will be discussed in the next section.

To conclude, the lack of continuous learning means that some designers and developers lack support from their companies, and hence the opportunity for self-development. Stolterman and Pierce (2012) reported that HCI researchers should be close to professional designers, and should understand their competences and professional roles.

The subjective nature and quality of the discussions among designers also challenge the

design of a usable UI. In regard to the present study this subjectivity is likely to slow the overall design process because of the low participation and interaction of designers and developers in the teamwork activities of designing an Arabic UI for educational tablet PCs. Therefore, Jordanian design companies should provide the necessary communication channels that motivate designers and developers to discuss their design requirements.

**What are the current challenges for UI designers in Jordan?**

This question was shaped to help us understand the current challenges faced by Jordanian designers and developers when attempting to apply standard UI guidelines for tablet PCs. By applying our approach, I gained insights into the usage challenges in terms of experience and format.

Prior to this research, an explicit set of guidelines had not been adequately developed for tablet applications using Arabic UIs. UI guidelines are almost always accompanied by itemised checklists, a compliance process, and company-wide computer conferencing (Duncker et al., 2013; Tetzlaff & Schwartz, 1991). Moreover, combining both personal values and habits may provide user-friendly, culturally aware UI designs (Pereira et al., 2012). Although values and culture in UI design have been reported in the literature (Callahan, 2005; J. H. Kim & Lee, 2005; Marcus, 2002; Nasruddin & Hussin, 2015; Wallace et al., 2013), explicit UI design guidelines and methods that support Arabic UI designers have remained lacking. Hence, this thesis proposes a set of Arabic UI guidelines for mobile and tablet device applications, which will potentially help Arabic designers to satisfy both cultural values and system requirements.

The results of this thesis showed that most Jordanian designers and developers have limited experience of using guidelines in their UIs for educational applications. Understanding how and when to use design guidelines was the main obstacle reported by the participants throughout the design phases. UI designers perceived that guidelines require additional time and effort in development (Gelb & Gardiner, 1997). Moreover, some guidelines are too extensive for the designers' requirements (Gale, 1996). As critiqued in previous studies (Vogt, 2001), the complexity of design guidelines may

present a barrier to their adoption by system designers.

The present study revealed that designers of Arabic applications apply inconsistent formats to their applications, which can be linked to the lack of standard guidelines. Palalas (2012) identified the importance of design features in articulating users' attention and their interaction with the display. Similar to our findings, Gu, Gu, and Laffey (2011) and Y. E. Lee and Benbasat (2004) evidenced that the chosen formats must be appropriate to the learning contexts. Moreover, Sharples, Corlett, and Westmancott (2002) stressed that to understand the design format of personal mobile systems for life-long learning by Arabic users, the preferences of those users must be incorporated into certain design elements. According to this thesis, an effective design approach requires systematic procedures and precise techniques, which can be accomplished by adopting specific and preferable guideline contents and formats. In general, a design guideline document can be developed by collecting existing guidelines or applicable research results, and arranging them under certain criteria such as design questions (Evans, 2000).

In the present study, the Jordanian designers and developers stated that Arabic documents would support their design process, especially when considering the UI elements preferred by their end users. This thesis interviewed several designers and developers, discussed their responses, and identified three main guideline formats; online, offline and printed Designers can adopt any of these formats depending on their own preferences and the environment of use. The essential components were also discussed. (subsection 4.2.2.4). It was understood that the selected UI preferences should satisfy the end user. In general, Jordanian companies should introduce active sharing strategies through which designers and developers can exchange their inputs related to the ongoing process.

**What are the design preferences for Arabic educational applications among students of different gender?**

The previous study with Jordanian designers and developers confirmed the need for and the components of an Arabic tablet PC educational application. Therefore, to develop the guideline, the researcher identified the design preferences (type, size and colour of font, text alignment, menu type and button type) of 21 students. The students' UI design

preferences for Arabic tablet PCs were discerned through the coaching thinking-aloud method.

In addition, the following hypothesis was constructed: *H1. Students' preferences of Arabic UIs for educational tablet PCs are significantly dependent on gender.*

Young Arabic Jordanian students using educational applications on tablet PCs preferred two font types; Al-Naskh and Al-Farsi. Similarly, Almuhajri (2013) showed that Saudi students prefer the Al-Naskh font on mobile applications. The font-type choices significantly differed between the male and female students. Male students preferred Al-Naskh for reading Arabic text, whereas females preferred the Al-Farsi font. However, students of both genders reported that Al-Naskh (one of the main Arabic fonts) promoted their reading experience. Therefore, the font-type preferences for learning applications significantly influence the learning experience of Arabic users.

The participants in this student's study regularly changed their selected font size to suit the font type and layout. Thus, in a user-friendly design, users should be able to freely change their font size. Ivanov and Cyr (2014) discussed how font style and layout affect the perceived usefulness of a system. Our study also supports N. Liu and Yu (2016), who identified users' preferences for smartphones from the context of the use and the users' characteristics, and Oyibo, Ali, and Vassileva (2016), who suggested that the preferred font presentation differs between males and females.

Unexpectedly, young students with good vision (not wearing glasses) preferentially chose the large (14-point) font size. Other studies also reported that Arabic users prefer the 14-point font for reading Arabic material. For example, the 14-point font was found to simplify young's reading of Arabic text  (Alsumait et al., 2009). However, Ramadan (2011) found that 12-point is the best font size for Arabic users of Arabic materials. These observations suggest that several factors regulate a user's preferred font size.

In the student's studies, the text background was white by default. Consequently, the students preferred black font for reading Arabic text. Pure black text on a pure white background is known to enhance the readability of text, because black-on-white achieves

the highest possible contrast. However, what motivates the colour and font-size preferences of Arabic users can be further investigated in the future.

Female students preferred colours that are harmonious with the background, and tended to change their font colours accordingly. Despite the high diversity and multiplicity of choices, most of the applicants used a white background for text.

The extensive use of one colour could also adversely affect the overall perception of the interface design. The participating Jordanian designers considered that multiple colours would improve the usability of their design concepts. They responded that colour combinations are important while designing the programme, and (unless excessively applied) will produce a good-looking interface. It is important to understand that poor colour selection creates major reading difficulty (Rello, Kanvinde, & Baeza-Yates, 2012).

In this research, users were presented with six colours: black, green, blue, yellow, red and purple. Red was considered to most effectively draw the reader's attention to religious texts. Many previous studies confirm that colour flexibility facilitates readability, understanding, and comfort (Darroch, Goodman, Brewster, & Gray, 2005; Pijpker, 2013).

In fact, by the harmonious use and combination of colours, designers can attract the attention of users. For instance, many users are attracted to coloured buttons and bright, contrasting illustrations. Robust and distinctive text colours also draw attention, rousing users' curiosity in the application. This finding is consistent with Almakky, Sahandi, and Taylor (2015) and Prasanna, Yang, and King (2013), who claimed that appropriate colour properties could improve users' experience of a system.

Text alignment, which is closely affiliated with text in the educational system, was also investigated. When the text is properly aligned, the page is easily scanned and the user becomes more satisfied (Shillcock, 2013). Because the Arabic language is written and read from right to left, most users are expected to prefer the right alignment. Additionally, the user's selection will likely be influenced by Islamic culture, which is entirely right-oriented, and the right direction is recommended in religious textbooks. In our study, the students preferred either right or centre alignment.

In addition, the Arabic justification tool Kashida (Benatia, Elyaakoubi, & Lazrek, 2006) largely affects the text alignment. Kashida elongates some parts of the Arabic letters while keeping the body character rigid, allowing left-alignment of Arabic text at selected points on the line. Therefore, when the alignment preferences of the user differ from the original alignment of the written text, the readability may be affected.

Regarding the menu of the educational application, most of the male students preferred the expanding menu type, whereas females preferred the bottom menu. In general, the navigation menu should improve the usability of the system and accelerate the completion of tasks (B. M. Yu & Roh, 2002). Without a clear and smooth information path, the user may become lost in the application. Also, the designer should consider the menu placements (left, right, top or bottom) in the menu design. The ordering of items in the menu should follow the sequence in which the application is arranged, within the screen length and width constraints. These constraints influence the graphic and layout of the menu.

Most of our participating students were additionally concerned about the touch feedback. Students needed to locate the action that allowed them to complete their tasks. The Arabic interface designers advised the use of Google Android responsive interaction guidelines, which advocate illumination and dimming in response to touch, reinforcing the resulting gesturing behaviours (Android, 2014). This response eliminates potential errors when the user makes a decision but touches the wrong link or button. For correct selection and efficient task completion, students preferred a clear colour contrast between the different links and buttons of the application.

The researcher also examined the hypothesis that the UI preferences for tablet PCs significantly differ between Arabic men and women. Gender difference impact in many aspects on our life. In technology, the gender has impact on software design (S.-H. Cho & Hong, 2013; Oyibo et al., 2016)The literature provides ample support that men and women differ in their perceptions of UIs and in which UI features are attractive (Djamasbi et al., 2007a; Moss et al., 2006).

In conclusion, only the font type preferences differed significantly between males and

females. No statistical gender differences were found in font size, font colour, alignment, menu type, and button type. This somewhat surprising result might be attributable to the small number of participants. However, whereas some studies similarly found no statistical gender differences in preferred user interfaces (Blasius, 2001; J. E. Lee, Zarit, Rovine, Birditt, & Fingerman, 2016), other studies (Baker et al., 2007; Goh & Sun, 2014; C. C. Hsu, 2012; Morris et al., 2005; C.-M. Wang & Huang, 2015) found prevailing differences in male and female preferences for user interfaces. Such differences were linked to the individual's ability to understand the presentation, which seems to influence the overall navigation performance (Marcus, 2013; N. Yu & Kong, 2016).

The Jordanian male and female students frequently changed their UI preferences, suggesting that selecting the preferred setting is a difficult task for designers. Rather than applying a fixed setting, designers should allow users to change their preferences as desired. However, UI guidelines could be useful tools at the beginning of the design process. Later, designers could allow more freedom for the user to change their preferences and personalise their design.

**To what extent do the proposed design guidelines satisfy the designer needs?**

This question was shaped to assess the proposed guidelines from the previous early research stages. The UI design guidelines developed from the previous research questions were evaluated and refined in a qualitative Delphi study. Our refined guidelines were reviewed by the designers that were interviewed in the early research stage.

The present Delphi study establishes a unique collaboration between the designers as professionals involved in Arabic UI design. These results seem to be consistent with other research which claims to employee the experts from the same field (Embo, Helsloot, Michels, & Valcke, 2017)

The Delphi technique is iterated until a consensus is reached. According to Green, Jones, Hughes, and Williams (1999) the classic Delphi technique reaches a consensus after three or four rounds. In our Delphi study, two rounds were sufficient for drafting the UI guidelines. In the earlier study, the designers might have wanted to trial the guidelines

before further modification, which would require more Delphi iterations.

To understand the characteristics of users of educational tablet PCs, the researcher counselled designers and developers from different Jordanian companies. Overall, the designers were satisfied with the new version of the final guidelines. Their satisfaction can be attributed to various behavioural-related factors and design measures. According to Ivanov and Cyr (2014), design factors that satisfy users' needs can enhance the effective responses of users and subsequent quality evaluations of the product. As such, the proposed UI design guidelines can be thought to favour experts' expectations of the current market. Consistent with, Bhandari, Neben, Chang, and Chua (2017) stated that users' behaviour when operating an interactive interface is related to visibility rather than prior experience of the interface. Our findings also extend the view of C.-M. Wang and Huang (2015), who discussed the conservative role of thinking-aloud dialogue in formulating effective outcomes, and how effective arousal leads to user satisfaction. Hence, Jordanian designers and developers of educational applications are advised to follow the outcomes of this thesis. From a theoretical perspective, the proposed design guidelines based on user preferences can enhance an individual's experience of educational applications in a tablet PC. This is inferred from the literature, which highlights the need for developing design characteristics for mobile applications.

To our knowledge, the development and assessment of Arabic UI guidelines have not been reported in the interface design literature. The findings of this thesis are intended to improve the overall design experience of mobile designers and developers by highlighting the design elements that stimulate active learning and interaction.

## 9.3  Research Contributions and Implications

This thesis makes contributions to both theoretical and practical knowledge. Its main contribution is the set of UI guidelines, but the process by which these guidelines were developed is also novel, and may assist practitioners and academics wishing to develop other guidelines, particularly in an Arabic context. This process included the development and the use of AVID, and the methods used with the Arabic participants, which have

added value to the research. Each of these contributions is discussed below.

## 9.3.1    UI Guidelines

Motivated by the growing demand for Arabic UIs for mobile devices and tablet PC applications in the Arabian world, I sought to identify how designers and developers of Arabic educational applications can overcome the inherent difficulties in current design approaches.

UI guidelines generated in this thesis are intended to unify the design elements and help UI practitioners with their new designs. Consistency among the design elements is important because it instils trust between users and the application. The guidelines could be converted into design rules, which would be provided to all members as a reference to be referred or improved when designing future applications.

The proposed UI design guidelines for Jordanian companies could support and enhance the design of tablet PC applications in Arabic. When a company utilises a guideline as a core reference, a large amount of information is systematically arranged to enable several UI problems (such as consistency and user preference) to be solved concurrently. The UI guidelines offer both functional and visual consistency between and within applications (Quesenbery, 2001).

Designing an Arabic tablet PC or mobile application demands a solid understanding of all requirements that guarantee success of the designed application. If the application fails to satisfy the end users, it could likely fail altogether. Therefore, the designers should understand the users' preferences and establish design rules that are compatible with the particular requirements of each application.

Accordingly, not all of the proposed guidelines for Arabic UIs are functional for designing a particular Arabic tablet PC application. Therefore, designers and developers are responsible for selecting the UI guidelines that form the specific design rules for a given application.

The UI guidelines will also reduce the time (and hence the cost) of development, which is important from a practical perspective. The proposed guidelines could free designers from time-consuming mundane design processes, thereby improving the quality of Arabic user interfaces, and the user experiences for Arabic users.

In the Arabic world, connection between designers and engineers is a critical goal in the product development process of all companies. Therefore, the Arabic UI guidelines offered in this thesis could encourage designers and developers to disseminate new ideas regarding Arabic user preferences. Companies might also support their design teams with training and additional workshops on how and when to use the UI guidelines.

Moreover, these guidelines provide a shared communication language among the designers and the developers, allowing them to share their experiences and thereby link the design and development stages. This sharing could hasten the development time and maintain harmony between the code and the design over all tablet PC applications, which possibly will strengthen the UI usability of these applications.

Some Jordanian IT companies greatly appreciated the proposed design guidelines, and have already requested to adopt the final version of the UI guidelines in their next project. Furthermore, their feedback and comments on this version may well enable future improvement and enhancement of the guidelines (see Appendix M).

## 9.3.2    An approach to Developing the UI Guidelines

In this thesis, by collecting the contents from the end users, I proposed a technique that acquires the needs of Jordanian designers. The proposed development approach for Arabic UI guidelines is potentially applicable by designers and developers of Arabic tablet PC applications. The design elements and user preferences of Arabic UIs were identified in five main stages, as discussed below.

I.    **Stage A: Addressing the gap.**

As a teacher and designer, I believe that understanding the user preferences could improve

the quality of e-learning and enable students to focus on their tasks. The first step was to understand the problem. Informal discussion and a literature search pointed the direction of the following steps.

As tablet PCs become more ubiquitous, they will play an increasingly important role in school and university education (Li, Pow, Wong, & Fung, 2010). Tablet PCs are the newest electronic gadgets with potential learning support for students (Wise, Toto, & Lim, 2006).

II.   **Stage B: Confirm the gap and collect the target guideline requirements.**

To develop UI guidelines that will be used by Jordanian designers and developers, I queried representative designers and developers on their requirements and expectations. The success of any design depends on the skills and experiences of the participating experts (Dayton, 1991; Laurel, 1990; Norman, 1987; Rubinstein & Hersh, 1984; Wroblewski, 1991). Therefore, the researcher needs to understand and support the goals of these experts.

Consequently, my next step was to meet the Jordanian designers and developers and collect the requirements and content elements of the nascent UI guidelines. This step ensures that the guidelines reflect the designers' requirements (Gale, 1996). Several issues affecting the design of UI guidelines with Arabic contents were also discussed. Moreover, by querying how Jordanian companies process UI designs, I began to understand the activity by which these designers produce their designs.

The end user preferences, and their impact on good design practices, were also deemed important. The relevance of end user preferences has been recognised by most researchers. For instance, Norman (1990) claimed that the first question in the development process should be: Is the design user-centered? In this study, the end users were students using tablet PCs for educational purposes. Therefore, the proposed guidelines were designed to meet the needs of students. Addressing their preferences was considered an essential factor in my development of Arabic UI guidelines.

III.    **Stage C: Outline the students' study (collection of user UI preferences).**

After reviewing the literature, I selected the coaching thinking-aloud protocol for interviewing the study participants, which is popularly adopted by usability professionals in usability testing (Olmsted-Hawala, Murphy, Hawala, & Ashenfelter, 2010). Subsequently, the UI preferences of school and university students for Arabic PC tablet applications were collected and identified through the coaching thinking-aloud technique combined with the AVID system.

The AVID system was especially developed for the present study, and is newly available for collecting user preferences. It is important to understand that this research did not *test* the AVID system. Instead, the AVID provided a dynamic and highly individualised user interface, through which users could instantly visualise and try the applications. Consequently, the usefulness and efficiency of the selected UI can be assessed and reviewed directly by the user (students). However, when using AVID for the first time, the students exhibited careful, neutral communication behaviours. Over time, the students familiarised themselves with the system and expressed more positive behaviours.

During this stage, the end user becomes involved in the development process. Other researchers, such as Gale (1996) also reported that the assessment process could be considered from the users' perspective. Therefore, in this research, the UI guidelines for Arabic tablet PCs were designed within the Jordanian environment, and the thoughts of both designers and developers were communicated with the end-users.

The user preferences identified in this stage were reviewed to improve our understanding of the UI preferences of Arabic students. Tablet PC educational applications for Arabic students were then improved as described below.

IV.    **Stage D: Formulate the initial guidelines.**

This stage develops the initial Arabic UI guidelines for Jordanian designers and developers. These guidelines directly reflect the opinions of the students working on educational applications. Several design principles that improve the usability of the

application were also developed at this stage.

**Stage E: Evaluate and refine the guidelines.**

Using the Delphi technique, I refined and assessed the Arabic UI guideline and principles. The effectiveness of our guidelines is maximised by periodic assessment and adaptation. Evaluation revealed the weaknesses in the initial guidelines, and the final guidelines were satisfactorily rated by designers.

The proposed approach has several advantages. First, at the work level, it enabled the development of new Arabic UI guidelines. The design process considered the approaches and gaps found in the literature, and the requirements and goals of Arabic designers of UIs for PC applications. Second, the guidelines are based on user preferences and designer needs, so are easily editable and updatable when either of these bases changes. Several researchers (Gale, 1996; Gelb & Gardiner, 1997; Jounila, 2007) similarly confirmed that designed guidelines should be continuously updated and administrated. Finally, our UI guidelines were approved by expert Arabic designers and developers. In the final assessment, the experts reported that such guidelines would improve their design processes for Arabic tablet PC applications.

In this thesis, the design was accomplished by identifying and integrating the broader needs of users (students) and designers. Tablet PC designers used the UI design guidelines to enhance the quality of their output, and to raise the satisfaction level of their clients.

## 9.4 Limitations

This thesis was limited to the design of Arabic educational applications for tablet PCs. Moreover, the design and consideration of evaluation of the guidelines were limited to the Jordanian community. Most previous studies of Arabic UIs have focused on cultural differences in the Arabic world (Marcus et al., 2011; Rashed & Santos, 2013), but not within the context of this thesis. However, the present thesis was limited to specific demographic characteristics (namely, age and gender). Our research findings were derived from Jordanian users. Among the Arabic cultures, Jordan ranks average in open-

mindedness. Some Arabic cultures have strict limitations, while others are open-minded and culturally tolerant.

A main limitation of this thesis is the lack of guideline assessment criteria, which are necessary for ensuring the effectiveness of the final UI guidelines. This should be the first step before building (developing) the guidelines. The participants in the schools and university studies were instructed to use the AVID in the default orientation of tablet applications (that is, the landscape orientation). Moreover, the user was allowed to change only the font type, size, colour, and alignments. These limitations should be removed in the next version, expanding the freedom of use. The resulting form this thesis study could help UI designers to design new tablet PC applications for Arabic users. However, a model that facilitates sharing of knowledge and experience by design practitioners is difficult to develop, and was not addressed in this study. Besides being conducted in only two Jordanian cities, this thesis was limited in observational scope. The user's UI preferences when interacting with a tablet PC were inferred from only six UI design elements.

Owing to the selected approach, the design guidelines were based on the preferences of a small group of study participants. Therefore, the guidelines may not be generalisable to other Arabian countries. The findings need to be confirmed and validated in a larger user population or even other Young Jordanian.

## 9.5  Future work

Various research endeavours will assist the further refining of the guidelines, their takeup, and their development process. These endeavours, and other research foci and questions, are outlined below.

### 9.5.1 UI guidelines

In addition, when culture is considered in design research and practice, both objective and subjective cultures are embedded in the UI design. Research into cultural influences on

interface design has advanced rapidly in recent years, because culture plays a controversial role in HCI (M. N. Burns et al., 2013; Duncker et al., 2013; Orji & Mandryk, 2014; Suadamara, Werner, & Hunger, 2011). Because design guidelines vary across cultures, the researcher here argues the importance of the cultural dimension when designing Arabic UI guidelines for tablet device applications.

### 9.5.1.1    The Guidelines Assessment Criteria

In a future study, the Technology Acceptance Model (TAM) could identify the determinants affecting behavioural intentions, which should be incorporated in our guidelines. The TAM "is an information systems theory that models how users come to accept and use technology" (Surendran, 2012, p. 175). Developed by Davis (1989), it studies an individual's acceptance and adoption of technology and ISs, and explains the behaviour of computer usage. In developing countries, the adoption and use of technology are influenced by cultural and lingual differences. Culture, society, and language have also influenced the adoption of UI guidelines in Jordan. Nevertheless, these issues have not been explored in a deep, practical study. How language and culture affect UI guidelines adoption in Jordan requires further research. Furthermore, according to an investigative Jordanian study, the TAM is valueless in Jordan unless extended to accommodate specific issues (Al-Khasawneh & Maher, 2010).

### 9.5.1.2    Assessment of User Experiences of Apps Developed Using the Guidelines

Tablet PCs will likely become increasingly useful tools in education. The appearance and UI elements of educational applications should be controllable to the particular needs of individual users. Therefore, by understanding the UI preferences of Arabic users, I should able to assist the educational purposes of this group.

Guideline assessment criteria are necessary for evaluating the research results, but their development can be fraught with difficulties. According to my research findings, the outlined guidelines are suitable for Jordanian designers and developers of Arabic tablet PC educational applications for the Jordan Ministry of Education. The readability and

legibility of the Arabic text in the designed applications could be evaluated by usability testing. Also, the effectiveness of the guidelines could be determined from students' evaluations of the application, and the marks and feedback on students' work from teachers/lecturers.

The UI is a critical part of the learning experience. Thus, the learning content and UI presentation crucially affect the effectiveness of the e-learning. I hope that our guidelines could assist users to locate the content and navigate between pages, and thereby select good learning decisions. Using our UI guidelines makes the designers sure the UI elements are consistent throughout the tablet PC application. The UI elements should be I harmony and feel consistent at every touch point in the application.

Efficiency can be defined as the accuracy and speed with which a user completes system tasks (Quesenbery, 2001). When learners understand the relationships among the component options of a UI, their learning efficiency improves. Although our guidelines mainly suggest the UI preferences (for example, font type and size) of users to designers, I anticipate that users can also apply them to accelerate their reading and learning.

### 9.5.1.3    Development and use of UIs in the field.

The proposed guidelines must be usable in real-life design tasks. Currently, I am constructing a website from which Jordanian designers and developers can access my guidelines, then evaluate and improve them.

The New Zealand Association of Optometrists has confirmed a high demand for eye health care in New Zealand. Among the more than one million New Zealanders undergoing eye examinations each year, 60% (on average) are prescribed with eyeglasses or contact lenses. Moreover, around 20% of children have blurry vision which, if left untreated, may affect their play, study, use of computers and smart technology, and texting. The AVID could identify the UI preferences of people with vision problems, such as colour blindness and low vision. It is possible that AVID could help researchers to develop UI guidelines for visually impaired users.

### 9.5.1.4 Designing for Reflection on Experience

User experience and the role of UI usability is increasingly important in design(McCarthy & Wright, 2004). Reflection on experience has the potential to improve the learning and practice (Sas & Dix, 2009) through sharing understanding between individuals and groups.

Design practitioners have stressed that design work should have a voice and have a say(Simonsen & Robertson, 2012).

Therefore several methods have been developed to facilitate work between developers, designers and users (Bakke & Bratteteig, 2015; Bratteteig, Bødker, Dittrich, & Mogensen, 2012).

### 9.5.1.5 Further Development of the Guidelines.

As mentioned in the literature, some researchers prefer brainstorming with designer practitioners. I believe in the usefulness of this approach in different environments. For instance, understanding the design methodology and the special features of Arabic users is challenging for novice designers, who also lack experience in Arabic designing. Guidelines are difficult to apply in such situations. However, the brainstorming method could be combined with our design steps to enhance the quality of the proposed guidelines.

Additional knowledge of designers and developers, from which I could further build and refine the guidelines, could be gained from focus groups, interviewing, brainstorming, surveys, and case studies.

### 9.5.1.6 Extending the Scope of the Study.

Our research identified the user preferences for educational tablet PCs. The user preferences for business and productivity, health and fitness could be identified similarly.

The initial design guidelines specified the type, size and colour of the font, the menu type, text alignment and button type that were preferred by students in school and university studies. Important aspects of these preferences (gender differences and sensibilities around religious symbols) were also discovered. Future research could cover all user

interface elements in the UI design.

## 9.5.2    Refining AVID

The AVID captures the user preferences by a usability approach. The following features can be added to AVID:

- Selectable menu and button type
- Portrait mode

A future researcher could develop the AVID idea and extend its scope to other fields, such as health and entertainment. The present AVID was designed in an Arabic context and assumes the Arabic culture. If one is mindful of cultural differences, one can transfer the AVID to European settings.

By employing artificial intelligence methods such as machine learning and deep neural networks, AVID could learn from the user and the UI can adapt to an individual user's behaviour. In future research, the AVID could predict the user preferences from the demographic information of the user group. User preference learning by AVID could also be achieved through MOCCA, which can adapt to new UIs and learn new rules by observing the users' interaction with the system. Under MOCCA, the UI improves over time (Bernstein & Reinecke, 2013; Reinecke, Minder, & Bernstein, 2011).

A typical recommender system suggests items that improve the decision-making of users, and thereby improves the efficiency of task completion (Burke, 2007; Ricci, Rokach, & Shapira, 2011). Recommender systems understand the news we prefer to read, the books we prefer to buy, and other personal-life preferences. The items in a recommended system (such as songs and books) are quite specific  (Ricci et al., 2011). Therefore, when designing a graphical user interface, the basic recommendation technique should provide useful suggestions and effective item lists. For this purpose, it should generate all customised recommendations.

A recommender system provides personalised suggestions created by various users, and non-personalised suggestions that are recommended overall (such as the top ten songs or

the top ten movies). An adaptive recommendation engine requires three matching-based algorithms; the categorising algorithm, the recommending algorithm, and the adapting algorithm.

The categorising algorithm identifies user preferences based on the actual context of use. The recommending algorithm enables or disables the recommended preferences based on a prediction, which depends on the semantic objects and the historical use of the prior system. The adapting algorithm determines the desirable adaptive interaction that enhances the model.

A personalised recommender for graphical UIs offers suitable graphics items (e.g., font, colours) inferred from the user preferences and constraints. Implicit preferences are collected (inferred) when the user interacts with the interface (e.g., when the user changes the size of the existing font by zooming in or out).

To provide users with graphical interfaces that suit their needs, the system must refer to the demographic information of the user, which is obtained from the user registration form. The characteristics required in the user classification (gender and age) are also obtained from demographic information. This classification system has been adopted in the initial GUIs assigned to each user.

## 9.5.3 How is Knowledge and Information Shared among Arabic UI Designers?

How Arabic designers exchange their knowledge of design issues is also worthy of future investigation. Knowledge exchange leads designers towards the correct decision. For this purpose, one could focus on decision-making in design, which is itself a conceptually challenging topic. Deciding the changes to be made crucially affects the design result. One aim of my website is to admit the ideas and examples of expert designers, thereby improving the utility of the present guidelines.

Finally, our studies generated a number of further research questions. Some of these

questions are listed below:

- How can designers select the relevant guidelines? (see Section 9.2.1)
- How can the connection between design and engineering be further enhanced and developed?
- Can the guidelines potentially assist the connection between design and engineering? How can Arabic designers apply our guidelines to develop usable and useful tablet PC applications?
- To what extent do Arabic tablet PC applications design with our UI guidelines support Arabic-speaking students?
- How will cultural factors change the contents of the UI guidelines?

The above research questions could be investigated by a range of methods and approaches; for example, a case study followed by surveys and interviews. To test the usability of an application designed by our guidelines, we could apply the GUI usability checklist for tablet applications developed by Henrik Xu.

## 9.6  Summary

The contributions of this thesis are both theoretical and practical. It is hoped, and anticipated, that the thesis could benefit Jordanian IT companies, Arabic research, and design practitioners and academics. Partial publication of this work in journals and conferences inspires confidence in this goal.

The researcher anticipates that as the UI design elements in our research become better appreciated, designers and developers could apply them to achieve the educational goals of their applications. Moreover, a greater appreciation of the different design factors and how they influence and relate to each other could be of considerable assistance. This thesis formulated some initial design guidelines for Arabic educational tablet PCs, which have not been previously proposed. These guidelines were deemed necessary for helping designers and developers to enhance the quality of Arabic UIs for educational applications, thereby promoting fast and efficient learning. Here, I provided guidelines for six design elements, and investigated how the UI preferences of young Jordanian

students. The UI preferences for Arabic tablet PC educational applications significantly differed between males and females. This thesis is hoped to provide the necessary elements that designers and developers should consider when designing educational applications for tablet PCs. It also enriches our current understanding of the available UI design guidelines for Arabic users.

I hope to see technology work for the people, particularly students and teachers. Learning is very important to myself, my family and my communities. I have a vision that modern devices can be designed to suit Arabic speakers. Through the research components in this thesis, I have learned much and gained valuable experience. I am very keen to continue my research, to further develop my confidence and competence, and to lead practical research that could benefit people.

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# APPENDIXES

# Appendix A

Consent Form

For use when interviews are involved.

*Project title:* **Interface Guidelines for Arabic Applications on Tablet PCs**

*Project Supervisor:* **Dave Parry**

*Researcher:* **Ahmed Alsadi**

- I have read and understood the information provided about this research project in the Information Sheet dated 14 /10 /2014.
- I have had an opportunity to ask questions and to have them answered.
- I understand that notes will be taken during the interviews and that they will also be audio-taped and transcribed.
- I understand that I may withdraw myself or any information that I have provided for this project at any time prior to completion of data collection, without being disadvantaged in any way.
- If I withdraw, I understand that all relevant information including tapes and transcripts, or parts thereof, will be destroyed.
- I agree to take part in this research.
- I wish to receive a copy of the report from the research (please tick one):
  Yes     No


Participant's signature:

......................................................………………………………….………………

………

Participant's name:

.............................…………………………………………………………
………

Participant's Contact Details (if appropriate):

………………………………………………………………………………..

………………………………………………………………………………..

………………………………………………………………………………..

………………………………………………………………………………..

Date :

*Approved by the Auckland University of Technology Ethics Committee on* 18
November 2014

*AUTEC Reference number* **14/345**

| استمارة الموافقة | AUT UNIVERSITY TE WĀNANGA ARONUI O TAMAKI MAKAU RAU |
| --- | --- |

عنوان المشروع: دليل المصمم للكمبيوتر اللوحي للواجهات العربية

مشروع المشرف ديف بيري

الباحث احمد السعدي

16/08/2014 لقد قرأت وفهمت جميع المعلومات المقدمة حول هذا المشروع البحثي في ورقة المعلومات المؤرخة

وقد أتيحت لي فرصة لطرح الأسئلة والتي تم الاجابة عنها فيما يتعلق بالدراسة.

أنا اعلم أنه سيتم تدوين الملاحظات أثناء المقابلات، وأنه سوف يتم كتابتها خطيا وتسجيلها على شريط رقمي.
وسوف يتم استخدامها لاغراض بحثية فقط.

أنا اعلم أنني قادر على الانسحاب بنفسي من هذا البحث أو الغاء اي معلومات قدمت لهذا المشروع في أي وقت قبل
الانتهاء من عملية جمع البيانات، دون التأثير على شخصي باي شكل من الاشكال.

أنا اعلم أن جميع المعلومات ذات الصلة بما في ذلك الأشرطة والنصوص، أو أجزاء منها، سيتم حذفها والتخلص
بشكل سليم منها بعد الانتهاء من عملية التحليل والنشر.

أنا أوافق على المشاركة في هذا البحث

إذا كنت ترغب في الحصول على نسخة من التقرير من البحث يرجى كتابة بريدك الالكتروني ومعلومات الاتصال.

توقيع المشارك:
.............................................................................................................

اسم المشارك:
.............................................................................................................

معلومات الاتصال:

.............................................................................................................

.............................................................................................................

.............................................................................................................

التاريخ: تم الموافقة عليها من قبل جامعة أوكلاند للتكنولوجيا ـلجنة الأخلاقيات ـبتاريخ  2014/11/18  و الرقم المرجعي  **14/345**

التاريخ: تم الموافقة عليها من قبل جامعة أوكلاند للتكنولوجيا ـلجنة الأخلاقيات ـبتاريخ  2014/11/18  و الرقم المرجعي  **14/345**

# Appendix B

**Demographic Information Questionnaire**

*(Please note, your information will **not** be sold or given to outside entities.  It is for internal use only.)*

1.  Name_____ (Your name will not be used in any public files.  All public research reports will use pseudonyms.  I only ask your name in case you have any follow up questions)

2.  Gender:    Female     Male

3.  Age Group:    16-18    19-25      26-36   > 36

4.  Have you use a Tablet PC before?
    Yes     No

5.  How often you used tablet PC:

6.  Please specify the extent of your use of the Tablet PC? (Select all that apply) :
Educational                          Games          social network and chat
        Shopping

    Video and Entertainment            Other please specify…………

# Appendix C

## The government letter

بسم الله الرحمن الرحيم

وزارة التربية والتعليم
مديرية التربية والتعليم لواء قصبة اربد

الرقــــم .......... ١٢ / ٧
التاريـخ .......... ١٤٢٥ /٥ /٢٠
الموافــق .......... ٢١ /٢ /١

مدير مدرسة اربد الثانوية للبنين المحترم،،،
مديرة مدرسة اربد الثانوية للبنات المحترمة،،،،

الموضوع / البحث التربوي

السلام عليكم ورحمة الله وبركاته،،،،

يقوم الطالب احمد عبدالكريم السعدي بإجراء دراسة بعنوان " تصميم وتحليل الواجهات التطبيقية للكمبيوتر اللوحي " ,
وذلك استكمالا لمتطلبات الحصول على درجة الدكتوراه من جامعة (AUT) في نيوزلندا ويحتاج ذلك إلى تطبيق استبانه على
عينة من طلبة مدرستكم.

أرجو التكرم بتسهيل مهمة الطالب المذكور وتقديم المساعدة الممكنة له.

مدير التربية والتعليم

الدكتور
يسرى جاد الله خصاونة
مدير الشؤون الإدارية والمالية

نسخة للسيد / مدير الشؤون التعليمية والفنية
نسخة للسيد / ر.ق. الإشراف والإسناد التربوي

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# Appendix D

**AUTEC**

**SECRETARIAT**
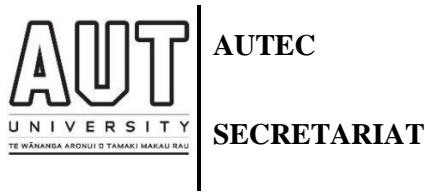
18 November 2014

Faculty of Design and Creative Technologies

Dear Dave

Re Ethics Application:   **14/345 Interface guidelines for Arabic applications on tablet PC's**

Thank you for providing evidence as requested, which satisfies the points raised by the Auckland University of Technology Ethics Committee (AUTEC).

Your ethics application has been approved for three years until 18 November 2017.

As part of the ethics approval process, you are required to submit the following to AUTEC:

- A brief annual progress report using form EA2, which is available online through http://www.aut.ac.nz/researchethics.  When necessary this form may also be used to request an extension of the approval at least one month prior to its expiry on 18 November 2017;
- A brief report on the status of the project using form EA3, which is available online through http://www.aut.ac.nz/researchethics.  This report is to be submitted either when the approval expires on 18 November 2017 or on completion of the project.

It is a condition of approval that AUTEC is notified of any adverse events or if the research does not commence.  AUTEC approval needs to be sought for any alteration to the research, including any alteration of or addition to any documents that are provided to participants.  You are responsible for ensuring that research undertaken under this approval occurs within the parameters outlined in the approved application.

AUTEC grants ethical approval only. If you require management approval from an institution or organisation for your research, then you will need to obtain this. If your research is undertaken within a jurisdiction outside New Zealand, you will need to make the arrangements necessary to meet the legal and ethical requirements that apply there.

To enable us to provide you with efficient service, please use the application number and study title in all correspondence with us. If you have any enquiries about this application, or anything else, please do contact us at ethics@aut.ac.nz.

All the very best with your research,

Kate O'Connor

Executive Secretary

**Auckland University of Technology Ethics Committee**

# Appendix E

**Participant Information Sheet**

**Date Information Sheet Produced:**

06/11/2014

**Project Title**

Interface Guidelines for Arabic Applications on Tablet PCs.

**An Invitation**

Hello, I am Ahmed Al-Sadi. I am studying at AUT University, New Zealand for PhD. This research will be a part of my PhD study (computer and information systems).

**What is the purpose of this research?**

This research will contribute significantly to helping designers and developers in Jordan, in the following manner:

In regard to visual design guidelines and principles for this domain, Arabic application designer and developers may gain maximum benefits from using visual interface design guidelines. Also, it may become possible for software designers to create more effective software for an Arabic tablet PC interface. This study will enhance the usability of an Arabic-interface educational tablet PC application, by using suggested visual design guidelines and principles, and will also identify effective methods for assessing an Arabic-interface tablet PC application. We anticipate that guidelines and principles for educational applications will be transferable, applicable, and useful in the Arabic-speaking world. Arabic is the native language of over 400 million speakers (Swamy,

2009) , located primarily in the Middle East and North Africa and gulf countries , also Arabic is used by Muslims to read "Quran "the holy book of Islam.

**How was I identified and why am I being invited to participate in this research?**

You have been chosen because you are an Arabic student at school or University in Jordan.

**What will happen in this research?**

You will be invited to participate based on convenience, I will give a quick welcome and information about the test. In addition, I will give you an idea about thinking aloud technique.

The next step will be to explain the testing environment and the equipment to be used. Prior to beginning the test, you will read and sign a letter of consent, and fill out the demographic questionnaire.

When you feel ready, testing will begin, this will include Audio and screen capture recordings for tablet PC.

You shall be under no pressure throughout the entire session as this research is focusing on your experience of using the software and device, not your individual performance. All data collected will be only accessible for the researcher and his supervisor. Your identity will be anonymous in the written report.

Your participation is fully voluntary. You may withdraw yourself at any time during data collection and all data will be destroyed.

**What are the discomforts and risks?**

None, this study designed to keep you fully comfortable.

**How will these discomforts and risks be alleviated?**

You may get bored while the doing the task, you can have a friend present during the session. All sessions will be done in lab room in governmental and private universities or schools with big glass window. This study is designed to keep you fully comfortable.

**What are the benefits?**

● To identify visual design preferences that needs to be offered to users (Swipe layout, Font size, font colour etc.).

● To identify the impact of user gender and age that might affect user visual design preferences while using an adaptive educational Arabic tablet PC interface.

● To design UI principles and practical guidelines for educational Arabic tablet PC application.

**What compensation is available for injury or negligence?**

None, this study designed to keep you fully comfortable and safe.

**How will my privacy be protected?**

The researcher and teacher/lecturer will assure the confidentiality of the participants. When writing up the report, real names will not be used. All the data collected will be securely stored and is only accessible for the researcher and his supervisor.

**What are the costs of participating in this research?**

Every session of testing (coaching thinking aloud) will be short (approximately 30-45 minutes). You will participate in one sessions. Moreover, there is 15 minutes of preparation and introduction before the session.

**How do I agree to participate in this research?**

Please complete the consent form and return it within a week.

**Will I receive feedback on the results of this research?**

The results and discussion sections will be sent to you either electronically or by post upon request. Summary of findings will be shared and disseminated with the participants

as they are produced during the research in form of scholarly articles (conference or journal papers and thesis) to the participants wishing to receive such feedback.

**What do I do if I have concerns about this research?**

Concerns regarding the conduct of the research should be notified to the Executive Secretary of AUTEC, Kate O'Connor, *ethics@aut.ac.nz* , 0064 921 9999 ext 6038.

**Whom do I contact for further information about this research?**

Project researcher and supervisor contact details*:*

| Researcher: Ahmed Alsadi | Supervisor: Dave Parry |
|---|---|
| email address aalsadi@aut.ac.nz | dparry@aut.ac.nz |

**Approved by the Auckland University of Technology Ethics Committee on** *type the date final ethics approval was granted***, AUTEC Reference number** *type the reference number***.**

ورقة المعلومات للمستخدم

تاريخ المعلومات:

2014/06/11

عنوان المشروع

إرشادات واجهة للتطبيقات العربية على أجهزة الكمبيوتر اللوحي.

دعوة

السلام عليكم ورحمة الله وبركاته .

اسمي احمد السعدي , هذا البحث والذي هو جزء من تكملة دراسة الدكتورة في قسم (الحاسب و نظم المعلومات ) في جامعة أوكلاند للتكنولوجيا . ابحث عن اهمية تصميم الواجهات التطبيقية للحواسب اللوحية هذا البحث سوف تسهم إسهاما كبيرا في المعرفة القائمة.

فيما يتعلق المبادئ التوجيهية ومبادئ التصميم المرئي هذا المجال، يمكن للمستخدمين الحصول العربية أقصى قدر من المنافع من استخدام تطبيق أجهزة الكمبيوتر اللوحي. أيضا، فإنه قد يصبح من الممكن لمصممي البرمجيات لخلق برامج أكثر فعالية لواجهة الكمبيوتر اللوحي العربية. وهذه الدراسة لتعزيز قابليتها للتطبيق على القطاع التعليمي بالعربية ، وذلك باستخدام المبادئ التوجيهية التصميم المرئي المقترحة والمبادئ ، وأيضا سوف تحدد طرق فعالة لتقييم تطبيق أجهزة الكمبيوتر اللوحي واجهة العربية. نتوقع أن المبادئ التوجيهية والمبادئ للتطبيقات التعليمية سوف تكون قابلة للتحويل، المعمول به، ومفيد في العالم الناطق بالعربية.

يتضمن مشروع البحث اولا تعبئة استبيان المعلومات الاساسية . ايضا اذا كانت لديك الرغبه في المشاركه في موضوع البحث ما عليك الا ان تبدي الرغبة في بارسال بريد الكتروني او الاتصال على الارقام في الاسفل للمقابلة الشخصية التي ستكون باللغه العربية. اتمنى ماسوف نتعلمه من هذا البحث يكون له الفائدة في الحاضر والمستقبل لي وللطلاب العرب.

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ما هو الغرض من هذا البحث؟

هذا البحث سوف يسهم إسهاما كبيرا في تصميم واجهة المستخدم باللغة العربية والتنمية لقطاع تكنولوجيا المعلومات والتعليم، وتحديدا في الأردن، على النحو التالي

فيما يتعلق في المبادئ التوجيهية ومبادئ التصميم المرئي لهذا المجال، فان مصممي ومطوري التطبيقات للواجهات العربية، سوف يستفيدون أقصى قدر من المنافع من استخدام المبادئ التوجيهية لتصميم واجهات بصرية للمستخدم العربي. أيضا، قد يصبح من الممكن للمصممين ابتكار برامج أكثر فعالية لواجهة للكمبيوتر اللوحي.

هذه الدراسة تعزز مستوى قابلية الاستخدام للتطبيق للبرامج التعليمية للواجهة العربية، من خلال استخدام إرشادات التصميم المرئي المقترحة من قبل هذا البحث. بالإضافة إلى ذلك، فإنه سيتم تحديد طرق فعالة لتقييم واجهة تطبيقات الكمبيوتر اللوحي العربية. نتوقع أن المبادئ التوجيهية والمبادئ للتطبيقات التعليمية سوف تكون قابلة للاستخدام على مستوى واسع ومفيد في العالم الناطق بالعربية. اللغة العربية هي اللغة الأم لأكثر من 400 مليون شخص في الشرق الأوسط وشمال أفريقيا، ودول الخليج. علاوة على ذلك، اللغة العربية هي لغة القرآن الكريم.

كيف تم اختياري لهذه الدعوة؟

لقد تم اختيارك لأنك طالب ناطق باللغة العربية ومن الأردن.  وترغب بالمشاركة لإثراء المحتوى الرقمي العربي.

ماذا سيحدث في هذا البحث؟

يتم استدعاء المشاركين على أساس تكفل الراحة وحسن التعامل. يقدم الباحث ترحيب سريع ومعلومات عن الاختبار وهدف الاختبار، ومن ثم إعطاء المستخدمين فكرة عامة حول المشاركة والحقوق. وستكون الخطوة التالية هي شرح بيئة الاختبار والمعدات المستخدمة.

قبل بداية الاختبار، يجب قراءة وتوقيع خطاب الموافقة، ومن ثم ملء الاستبيان. عندما يشعر المشارك في الاختبار انه على استعداد، سوف يبدأ الاختبار. سوف يتم تسجيل جميع الاختبارات باستخدام برامج لتسجيل البيانات عن شاشة المستخدم.

يجب ان لا تكون تحت اي ضغط. تستطع ترك الاختبار باي وقت وهذا لن يكون له اي انطباع سلبي.

جميع البيانات التي تم جمعها لا يستطيع اي أحد الوصول إليها إلا الباحث والمشرف العام على البحث. سوف تكون هويتك مجهولة في التقرير المكتوب.

لعرض نتائج البحث

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مشاركة طوعية تماما. تستطيع الانسحاب في أي وقت خلال جمع البيانات وسيتم إتلاف كافة البيانات إذا طلب ذلك.

ما هي الفوائد المترتبة على الباحث؟

• تحديد تفضيلات التصميم البصرية التي تقدم للمستخدمين في البرامج العربية (حجم الخط، لون الخط الخ)

• تحديد أثر الجنس والعمر للمستخدم و التي قد تؤثر على تفضيلات المستخدم للتصميم المرئي أثناء استخدام الواجهات العربية.

• تصميم دليل لمصمم التطبيقات العربية

كيف ستتم حماية خصوصيتي؟

ان الباحث يؤكد على سرية بيانات المشاركين. عند الكتابة عن التقرير، ولن تستخدم الأسماء الحقيقية في جميع البيانات التي سوف يتم جمعها حيث سيتم تخزينها بشكل آمن ويمكن الوصول اليها فقط من قبل الباحث والمشرف العام على البحث.

كيف أوافق على المشاركة في هذا البحث؟

يرجى ملء استمارة الموافقة وإعادتها خلال أسبوع

هل يمكنني معرفة على نتائج هذا البحث؟

سوف يتم إرسال النتائج لك إلكترونيا عن طريق البريد الالكتروني عند الطلب.

ماذا أفعل إذا كان لدي مخاوف من هذا البحث؟

ينبغي إخطار المخاوف بشأن سير الأبحاث إلى الأمين التنفيذي للAUTEC، كيت أوكونور،

[ethics@aut.ac.nz](mailto:ethics@aut.ac.nz)

هاتف 0064 921 9999  تحويلة 6038.

يمكنني الاتصال للحصول على مزيد من المعلومات حول هذا البحث؟

| الباحث احمد السعدي | المشرف ديف بيري |
|---|---|

| dparry@aut.ac.nz | aalsadi@aut.ac.nz |
|---|---|

التي وافقت عليها جامعة أوكلاند للتكنولوجيا جنة الأخلاقيات في نوع منحت الموافقة النهائية موعد الأخلاق،

**AUTEC** الرقم المرجعي اكتب رقم المرجع. الرقم المرجعي

# Appendix F

## Final Interviews Questions

Date:

Participant's #:

Interview Type:  Single               Group


**Part 1 Designers and Developers Role Issues**

1.      What type of App(s) do you create in your company?

2.      What are your profession or role in the organization / team? Any issue with your role?

**Part 2 Usability testing**

3.      What kind of usability test your company used?

4.      At which stages of web development life cycle you use UEM?

5.      What are the usability methods you used to test the Arabic UI?

6.      If you face any usability problem what you usually do?

**Part 3 UI guidelines**

7.      Did you use any design guidelines in your recent projects?

8.      What kind of User Interface Guidelines your company used?

9.      Do you think Arabic design interface different from another interface design

such as English interface?

10.    What is Arabic UI guideline should include for improving UI design for mobile and tablet PC? Please see the following table

| # | Guideline elements | | Details |
|---|---|---|---|
| 1 | Spacing | | Many novice designers underestimate the need for white space. Where on mobile and tablet PC space is very critical due the limited screen size |
| 2 | UI Elements | Typograph | Need to define the typefaces to use: font's type, size and colour |
| | | Colour | Always include colour palettes and what the colours should be used for. Semantics and the meaning of colours in Arab culture. |
| | | Layouts and Navigation | While the design comes with two diminutions, (landscape and Portrait orientation) this best practices of promoting consistency and readability. Navigation bars make it easy to explore and switch between, three main attributes, which are usage, colour and space |
| | | Button | Very important to keep the consistency where it could be customizable background and it could be title or icon. |
| | | Icons And Symbols | Defining size and spacing and where to use icons is another great way to promote consistency (in addition to symbol meaning and how) |
| | | Branding | To keep consistent between all applications and pages |
| | | Toasts | A toast provides simple feedback about an operation in a small popup. |
| | | Animation | Animation can convey status, provide feedback, enhance the sense of direct manipulation, and help users visualize the results of their actions. |
| | | Style and themes | The main style of the application |
| 3 | General UI | | The main UI design principles to advice designers and developers. |

| | | | |
|---|---|---|---|
| | principles | | |
| **4** | Touchscreen gesture references | | Include all possible movements and figure interaction with screen |

**Part 4 knowledge sharing**

11.　　Please could you tell me what you do if you face design problem and you can't find the answer via the internet?

12.　　How do you share your knowledge of design with your colleagues?

13.　　What kind of guideline format you prefer to use and why?

**Part 5 Closing question**

14.　　Do you like to add anything else?

# Appendix G

**Designers and Developers Questionnaire**

**Part 1: Some info about yourself**

1. Name: _____

2. Your email …………………………..

3. Age Group:   18-24    25-34    35-44    45-55    over 55

4. What is your home country?

Jordan                              Other please specify ………

5. Your gender?

A.    Male                              B.  Female

6. Your educational background?

    A.    No Degree

    B.    Student

    C.    Undergraduate / Bachelor's Degree

D.      Post graduate / Master's, Doctoral Degree

7.  How many years of experience in Mobile/ Tablet PC Application Development/ Design do you have?

    A.      Less than one year
    B.      2-4 years
    C.      5-8 years
    D.      More than 8 years

8.  Your experience in

    A.      Jordan
    B.      Arabic County please specify………….
    C.      Other County please specify …………………………

9.  Why do you develop Apps, what is the main goal for you or your organization?

    A.      Promote or extend a non-mobile product
    B.      Have fun or build things
    C.      Generate direct revenue
    D.      Monetize digital content
    E.      Generate revenue via contract / commissioned app development
    F.      Gain experience
    G.      Increase organizational efficiency / reduce costs

**Part 2:  Some info about your working experience and conditions**

10. How many years have you been involved on mobile Apps / websites / software in general?

| | 0 | <1year | 1-2 years | 3-5 years | 6-9 years | 10+ years |
|---|---|---|---|---|---|---|
| Mobile /Tablet Apps | | | | | | |
| Websites | | | | | | |
| Software | | | | | | |

11. Your profession or role in the organization / team?
   A.    Developer
   B.    Designer
   C.    UX Designer
   D.    UI Designer
   E.    Product Manager
   F.    Team Lead
   G.    Analyst
   H.    Management
   I.    All the above

**Part 3: some info about the App development process**

12. Which platforms are you developing for?

Android                            B. Bada                            C. BlackBerry

D. Firefox OS          E. iOS          F. Symbian

G. Windows Phone

13. What programming languages do you use to develop your App(s)?

C / C++                    C# / VB.NET          Java

JavaScript          HTML5                    Objective-C / Cocoa

Python          Ruby          Other ………………..

14. Which audience your App(s) target?

    A. Not sure          B. Professional users          C.
    Consumers
        D.    Enterprises          E. Students

15. What type of App(s) do you create?

Games                    Media (News, Sports, Weather,
Magazines)

Business & Productivity                    Communications & Social
Networking

Music & Video                    Maps & Navigation

Entertainment                    Health and Fitness

Education & Reference                    Utilities

Enterprise                    Other ………………

16. Where do you release your App(s)?

I have not published an App yet                                    Apple App Store

BlackBerry App World                                               Google Play

Microsoft Marketplace                                              Nokia Store

GetJar                                                             Amazon

17. Dos your company develop any application with Arabic interface

•       Yes

•       No

18. Do you Use any Usability principals or guidelines?

•       Yes

•       No

19. What kind of usability test your company used?

1-      Think aloud protocol (Participants in testing express their thoughts on the application while executing set tasks_

2-      Remote Usability testing (The experimenter does not directly observe the users while they use the application though activity may be recorded for subsequent viewing)

3-      Focus groups (A moderator guides an interview with a group of users of the application)

4-      Interviews (The users are interviewed to find out about their experience and expectations)

5-      Cognitive walkthrough (A team of evaluators walk through the application discussing usability issues through the use of a paper prototype or a working prototype)

6-      Pluralistic walkthrough (A team of users, usability engineers and product developers review the usability of the paper prototype of the application)

7-      Heuristic evaluation (is a usability engineering method for finding and assessing usability problems in a user interface design as part of an iterative design process. It involves having a small set of evaluators examining the interface and using recognized usability principles (the "heuristics"). It is the most popular of the usability inspection methods, as it is quick, cheap, and easy. )

8-      Questionnaires/Surveys (Surveys have the advantages of being inexpensive, require no testing equipment, and results reflect the users' opinions. When written carefully and given to actual users who have experience with the product and knowledge of design, surveys provide useful feedback on the strong and weak areas of the usability of a design.)

20. At which stages of web development life cycle you use UEMs? Tick all appropriate

A.    Analysis
B.    Design
C.    Coding
D.    Testing

21. Who evaluates the usability of application user interface in your company?

A.     Developers

B.     Testers

C.     Usability Experts

D.     Project Manager

E.     If others specify

22. Do you Use any User Interface guidelines/ Style guide?

- Yes

- No

23. What kind of User Interface Guidelines your company used?

A.     GNOME

B.     Apple

C.     Android

D.     Microsoft

24. List some different user interface guidelines and rules may you use?

A.     Standards: international and national standards aimed to standardize the use of technology and make using technology easier to use by setting out design rules, international standard organization (ISO) is one of the best known examples.

B.     Collections of rules: A sets of rules for optimizing developing user interface , these include  general rules such as Nielsen's usability heuristics, and

a specific rules for certain field  for instant, mobile applications and golden rules of web design.

C.      User interface pattern: a recurring solution that solves common design problems. Design patterns are standard reference points for the experienced user interface designer. There are a huge number of good patterns available in GUI field.

D.      Platform style guides: these guidelines are recommended look and feel of an application for a specific operating system. Aims to ensure all UI elements are used consistently. Apple human interface guideline and Microsoft windows user experience interaction guidelines as example.

E.      Corporate style guides:  Applicable to look and feel and corporate design with a variety of applications expected from an enterprise to meet regulations. A distinction must be made between the guidelines for the system of applications and internal corporate guidelines for applications and products for external clients.

F.      Project style guides: also called a personal guideline, it is used to ensure the consistency of the interface.


Do you accept me to contact you for further discussion?

•       Yes


•       No


**That's it! Thanks for taking part.**

# Appendix H

Arabic slang word

| Terminology | Meaning in Arabic | signal | Meaning in English |
|---|---|---|---|
| طقع | ممتاز | + | Perfect |
| أبصر | لا اعرف | +- | I do not know |
| بتخزي | سيء | - | Ugly |
| بتسطل | جميل | + | Awesome |
| بصرصع | مزعج | - | Noisy, annoying |
| حزلوط | مزري | - | Bad |
| شقفه | جميل | + | Beautiful |
| إمبولم | زعلان | - | Sad |
| إمقرقد | ضعيف | - | Slim |
| تشعتل | صعب | - | Hard to achieve |
| تشلتشة | الوضع اصبح غير منتظم اي ان الامور تداخلت في بعضها | - | Mishmash |
| خريستو | رائع | + | Awesome |
| خيخة | رجل ضعيف | - | Poor Man |
| زلمة | رجل | * | Man |
| زنخ | سيىء | - | Vapid |
| زنون | رائع | + | Awesome |
| غاد | هناك | * | there |
| غوله | بشع | - | Ugly |
| كبست معي | اصررت اصرارا | - | Insisted |

| | | | |
|---|---|---|---|
| يا طخه يا إكسر مخه | يقال في موقف يكون فيه الخيارين أو الحدثين الواحد فيهما أسوأ من الأخر. | - | Both choices bad |
| يلعن روم | سيء وعصبي | - | Angry and bad |
| ابيش | لا يوجد | - | Nothing |
| اجبد | اشر او ابداء | * | Hit, Good, Start |
| الشنتير | بمعنى الكبير (الناضج والواعي الذي لم يعد طفلا) | * | Adult |
| الطنجير | غبي | - | Stupid |
| جاب | اعطى | * | Get |
| جخة | ممتاز | + | Awesome |
| سواليف حصيده | كلام فارغ | - | Nonsense |
| سوالف طرمه | على الفاضي | - | Nonsense |
| طبرة | غبي | - | Stupid |
| فاخر على الاخر | افضل شيء | + | The best of best |
| طعا وقايمة | بدون تنظيم | - | haphazard |
| فستق فاظي | بدون فايدة | - | Nonsense |
| فلته | ذكي | + | Clover |
| فياعة | عصري | + | Modern |
| لاسع | غبي او المتهور | - | Stupid |
| لخمه | غبي | - | haphazard |
| لى اللة | ممتاز | + | Awesome |
| هشت | كذب | - | Not true |

# Appendix I

**The first draft of the Arabic UI preferences guidelines.**



دليل التصميم للتطبيقات التعليمية للكمبيوتر اللوحي

مرحبا بكم في الكمبيوتر اللوحي واجهة عربية تصميم، مكانك لتعلم كيفية تصميم التطبيقات التعليمية استثنائية للكومبيوتر اللوحي **Tablet PC**

اعداد: احمد السعدي

اشراف: **Dave Parry**

هذا العمل برعاية

**المقدمة:**

قد يفاجأ البعض، ممن يعتقدون أن تصميم واجهة المستخدم هو أمر سهل وممتع، أغلب المبرمجين لا يحبّذون برمجة واجهة المستخدم، ولم يتمكنوا من معرفة الحلول التي تجعل برمجة واجهة المستخدم UI سهلة وبسيطة وممتعة جداً.

لعل خوف المبرمجين من برمجة تصميم الواجهة يأتي من خوفهم من عمل تصميم واجهة مستخدم، لاعتقادهم أن تصميم واجهة المستخدم مشابه لتصميم الصور والرسوم، فهم يرون أنفسهم منطقيين وتحليليين، ولكن ضعافاً من الناحية الفنية. والحقيقة أن تصميم واجهة المستخدم هو سهل وعقلاني في آن واحد، وليس بالمسألة الغامضة التي تتطلب شهادة اختصاص في الفنون، فهناك طريقة عقلانية ومنهجية للتفكير في واجهة المستخدم، تتضمن بعض القواعد المنطقية البسيطة التي يمكن تطبيقها في أي مكان من واجهة المستخدم التي تعمل عليها.

بوجهٍ عام ، واجهة المستخدم الناجحة هي التي تولد إحساساً للمستخدم بأنه يسيطر على بيئة البرنامج، فيتصرف البرنامج تماماً كما اعتقد المستخدم سلفاً، والقواعد الأخرى للتصميم الجيد هي مجرد بديهيات لا أكثر .

تعتبر واجهة المستخدم من أهم أجزاء البرنامج ويحتاج تصميم الواجهة للكثير من الوقت حتى تكون النتيجة جيدة وذلك لأن واجهة المستخدم هي حلقة الوصل بين المستخدم والوظيفة المرجوة من البرنامج ولان هذه الواجهة سوف يتعامل معها المستخدم كل الوقت فيجب على المصمم تصميم هذه الواجهة لأريحية المستخدم وليس على هوى المصمم.

من المعلوم أن واجهة المستخدم لأي برنامج هي مفتاح النجاح له حيث أن واجهة المستخدم هي أول ما يرى من البرنامج وهي الجزء المحسوس منه فإن كانت واجهة المستخدم مميزة فإنها تمهد الطريق للبرنامج ليحظى بالقبول. فواجهة المستخدم تسهل عملية التواصل مع البرنامج ففي واجهة المستخدم الرسومية نجد الاعتماد على الرموز والنقر بزر الفأرة بعكس ما هو موجود في واجهة المستخدم الكتابية بحيث يجب على المستخدم إدخال أوامر للبرنامج بحيث ينفذ ما يطلب من البرنامج بحسب الأوامر وهذا يتطلب من المستخدم حفظ هذه الأوامر حتى يستطيع استخدام البرنامج. كما ذكرنا فإن واجهة المستخدم هي وسيلة للتواصل مع البرنامج فهي تساعد المستخدم على إدخال البيانات أو الأوامر المطلوبة وتعرض له النتائج بطريقة يفهمها لذلك يجب أن تكون مصممة بحيث لا تضع لبس للمستخدم في حاله الإدخال أو العرض.

**لماذا تحتاج هذا الدليل**

تجربة الاستخدام لا تعتمد على النصائح والمبادئ بقدر اعتمادها على مقابلة المستخدمين الحقيقيين وجها لوجه، ومعرفة مشاكلهم وتصميم حلول بناءً على ملاحظتك لهم، الشكل التالي يوضح تلك المسائلة



صورة رقم 1 : توضيح المبادئ ("Culture and Religion", 2015)

يمكن تشبيه المصطلحات التالية ( قابلية الاستخدام Usability – واجهة الاستخدام User Interface – المحتوى Content – تجربة الاستخدام User Experience ) ب وجبة بيتزا ! ...

الدقيق، الجبن، الطماطم ... الخ هو المحتوى Content

ان نعد عجينة بيتزا هشه ورقيقة، بحيث تكون سهلة التقطيع ... هو ما يمثل قابلية الاستخدام Usability

ان نعد طاولة الطعام ونرتبها بعدد الحاضرين، وان نضع المقبلات والعصائر فى اماكنها ... هو ما يمثل واجهة الاستخدام User Interface

اعددنا بيتزا رائعه، حلوة المذاق، جهزنا طاولة الطعام ، الان حان وقت الحصاد/الأكل ما رأيك ببعض الموسيقى، والشموع ؟ ... هذا كله هو ما يمثل تجربة المستخدم User Experience

تجربة الاستخدام تعنى بما يدركه المستخدم، انفعالاته وعواطفه التى تتولد اثناء تفاعله مع الموقع/البرنامج/التطبيق/النظام. قد يكون الموقع سهل الاستخدام، وتصميمه رائع، ولكن الموظف المسؤول عن الدعم

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الفنى او خدمة العملاء يسيئ التعامل مع العملاء او لا يرد على استفسارات المستخدمين بلغة واضحه، هل تعتقد ان تجربة الاستخدام لم تتأثر ؟!("Culture and Religion", 2015)

المصطلحين "قابلية الاستخدام Usability" و "تجربة الاستخدام User Experience" متشابهيين، ولكنهما ليسا متطابقين، فالثاني يشمل الاول ... وكي نستطيع التفريق جيداً بينهما يجب ان نتخلص من هذه المعتقدات:-

اولا اعتقادنا ان اي شيء سهل الاستخدام يحقق تجربة استخدام جيدة هو اعتقاد خاطيء

ثانيا نعتقد ان الشيء الجميل هو شيء سهل الاستخدام اوبديهي ان يسهل على الناس استخدامه ومع ذلك لا ننكر ابدا ان الاشياء الجميلة اكثر قابلية للاستخدام ولكن علينا ان لا نغفل العوامل الاخرى

ثالثا تجربة الاستخدام هى جزء من العملية الكلية لتصميم موقع الويب وهذا خاطيءوالصحيح ان تجربة الاستخدام هي عملية التصميم للويب وليست جزء منها.

رابعا ما يقوله جاكوب نيلسون هو دستور مقدس يجب ان انفذه بغض النظر عن النتيجه ! .... الصحيح هو ان تجربة الاستخدام لا تعتمد على النصائح والمبادئ بقدر اعتمادها على مقابلة المستخدمين الحقيقيين وجها لوجه، ومعرفة مشاكلهم وتصميم حلول بناءً على ملاحظتك لهم، مختبرات جاكوب نيلسون لم تختبر كل المستخدمين فى العالم، وابحاثها علي عينات محددة وفي مناطق محددة بثقافات محددة، على الرغم من ذلك ما يتوصل اليه الباحثون يجب ان نلتفت له ونضعه بالحسبان بشئ من التوازن عندما نهندس تجربة الاستخدام(Nielsen, 1993).

خامسا تصميم تجربة الاستخدام " شئ مكلف جداً" ... كل دولار تنفقة على تحسين تجربة الاستخدام لموقعك سيساوى 6$ ارباح وولاء لزبائنك، البعض يمتنع عن تطبيق تجربة الاستخدام وتحسينها لانها مكلفه، فى الحقيقة تحقيق تجربة الاستخدام يمكن ان يتم من خلال ورقة ملاحظات و5 مستخدمين تختبر عليهم المهام والموقع، لا نطلب منك ان تحقق تجربة الاستخدام بشكل كامل من البداية، اجعلها تتم علي خطوات، استمع للمستخدمين وطور موقعك علي مراحل مشموله بتحسينات فى تجربة الاستخدام. الاستماع للمستخدمين لن يكلف شئ !

سادسا تجربة الاستخدام هى شئ خاص بالبرمجيات فقط ! ... تجربة الاستخدام هى فى كل شئ يتعامل معه الانسان في حياته اليوميه، ماكينة الصراف الالى، ماكينة القهوة، اجهزة التحكم بالسيارة ... كل ما يتفاعل معه الانسان يجب ان يهتم بتحسين تجربة المستخدم.

**نصائح عامة**

كيف يمكنني معرفة نموذج المستخدم User Model؟

بدايةً اعرف من هو مستخدمك

لتتمكن من تحديد المستخدم، قم باختبار بسيط يتضمن اختياراً عشوائياً لخمسة أشخاص أو أقل ضمن مكتبك، أو من عائلتك أو أصدقائك، ثمُ اسألهم بعض الأسئلة، مثل:

-   ما هو هدف المستخدم؟
-   ما هي مهارات وتجارب المستخدم؟
-   ماذا يريد المستخدم؟

إذا كان العمل الذي تريد صنعه يخص برنامجاً كبيراً أو نظام تشغيل، يمكنك أن تقسم المستخدمين إلى فئات مثل (خبير-غير خبير، صغير-كبير)، وهناك وسيلة أخرى هي الاتصال بمستخدمين فعليين ومناقشة عملية التطوير مباشرة مع المطورين.

يجب أن يكون التطبيق التعليمي مفيد. وينبغي أن يكون واجهة تطبيق سهلة الاستخدام، وأنه من المهم أن يكون من السهل البدء في استخدامه. ومع ذلك، فإنه يجب أن يكون ذا معنى للطلاب من خلال الجمال البصري والرؤى الشخصية، الخ

من خلال الدراستين التي أجريت في الأردن للطلاب في كل من المدارس الثانوية وطلاب المرحلة الجامعية، كانت هناك فروق ذات دلالة إحصائية في تفضيلات بين الذكور والإناث. ولذلك نصحنا المصممين للنظر في النصائح التالية.

<u>التصميم لأقصى قدر من وضوح</u>

جعل الخط واضح ومقروء، في التطبيق التربوي فمن المهم أن يكون الخطوط واضحة جدا وقابلة للقراءة.

<u>ضبط حروف الكلمات بالحركات واضافةعلامات الترقيم</u>

في النص العربي وخصوصا في النص الديني، وأظهرت دراساتنا أن الطلاب يوصون باستخدام علامات الترقيم والحركات لضبط الحروف والتي من شأنها أن تجعل القراءة أكثر سهولة بالنسبة لهم.

<u>استخدام ألوان التباين العالي</u>

الطلاب العرب يفضلون الخطوط السوداء ولكن كما هو معروف في بعض الأحيان المصممين تغيير لون الخطوط لأسباب معينة قد يحتاجونها. لذلك، ننصح باستخدام الألوان عالية التباين مثل اللون الأزرق مع خلفية رمادية.

<u>صفحات ميتة او مفقودة</u>

يرغب الطلاب عادة في الحصول على المعلومات في أقل عدد من الخطوات الممكنة. ان مصمم التطبيق ينبغي أن يقلل من الخطوات ، بالإضافة إلى توفير واستخدام الإيماءات بطريقة ذكية لمساعدة المستخدم في الوصل الى هدفه في التطبيق.

<u>البساطة والثبات</u>

الطلاب العرب يفضل تصميم بسيط جدا ، اكد الطلاب أن التصميم يجب أن يكون على دراية ومنطقي مع ما يعرفونه. يجب على المصمم بناء التطبيق المتسق وبسيطة مع أقصى قدر من وظائف وضوح.

<u>لا تستخدم مناطق صغيرة للنقر</u>

تصميم وصلات وأزرار لمساعدة المستخدم للوصول إلى المعلومات بطريقة سهلة. ولذلك، ينبغي للتصميم أن يكون من السهل للنقر وجود مساحة كافية للنقر.

<u>تنظيم المحتوى بشكل جيد</u>

الكمبيوتر اللوحي هو جهاز متعدد اللمس، وعادة ما يأتي مع الكاميرا، والميكروفونات، ويتراوح حجم الشاشة 7 حتي 13،3 بوصة. ويرغب الطلاب عادة في رؤية كل شيء منظم، لذلك علينا كمصممين أن نفكر في كل شيء قبل أن نبدأ التصميم. عندما نبدأ في التفكير في التطبيق، التخطيط هو الشيء الضروري كتحديد ما سيقوم التطبيق القيام به، والذين هم من مستخدمي الرئيسي، والتفكير حيث يمكن استخدامه. من المهم لتنظيم المحتوى وتحديد نموذج الملاحة في التطبيق باستخدام هندسة المعلومات.

<u>النظر في خصائص المستخدم (العمر والجنس(</u>

كان واحدا من أهم نتائج هذه الدراسة حيث أن دراسات أجريت على حد سواء في المدارس و الجامعات الأردنية أن هناك فروق ذات دلالة إحصائية بين الذكور والإناث. ولذلك على المصمم ان ياخذ بعين الاعتباره\ه العوامل .

**دليل اللغة (الطباعة)***Typography* **في الكومبيوتر اللوحي**

اللغة العربية هي لغة ثنائية الاتجاه، حيث يتم عرض النص والقراءة من اليمين إلى اليسار، مع أرقام عرض من اليسار إلى اليمين. بالإضافة إلى ذلك، الحروف العربية تحتل مساحات مختلفة من الحروف الإنجليزية، وهذا يتوقف على ما إذا كان يتم إرفاق رسالة إلى حرف آخر أم لا (Alsumait، العصيمي، وAlFedaghi، 2009). اللغة

العربية لها خصائص فريدة من نوعها، كما قد استشهد في العديد من الدراسات (أحمد السعدي وآخرون، 2014؛ الغامدي، Aldabbas، الشهري، وNusir، 2012؛ Hemayssi وآخرون، 2005.) كما يلي:

• الكتابة من اليمين إلى اليسار، لذلك ينبغي من أي تطبيق أو موقع تمكين الشخصيات التي تقدم في هذا الاتجاه. يتم محاذاة القوائم وفقا لذلك، نقطية، المسافات البادئة الفقرة، والقوائم إلى اليمين.

• الترتيب الأبجدي باللغة العربية، مما يؤثر ظائف البند النوع، عرض الاختصارات، والاختصارات غير موجودة في اللغة العربية يجب أن تقود المصمم لتحديد فترة ولاية كاملة قبل الترجمة.

• الكلمات العربية تحتل مساحة أكبر أفقيا و، مع مجموعة محرف المختار، أربع نقاط أكبر من الخطوط الإنجليزية.

• في العربية، خطابات تغير شكل وفقا لموقع الصورة الرمزية، وهذا هو، سواء كان في البداية، الوسط أو نهاية الكلمة. هذا يغير إيقاع الصاعدين والنازلين، والخطوط العربية تتطلب البنط الأسود لزيادة الوضوح.

في هذه الدليل سوف نركز على حجم ونوع الخط المستخدم في الكومبيوتر الوحي للطلاب الذكور والاناث في كلتا المرحلتين الجامعية والمدرسية.

يعتبر خط الشعار هو الفصل بين ما إذا كان تصميمك احترافي أم لا ، فكثير من المصممين يواجهون صعوبة كبيرة في إيجاد الخط المناسب لتصميمهم . سوف نستعرض اولا نوع الخط

استخدام خط النسخ للطلاب الذكور والاناث في الذين تقل اعمارهم عن 18 والخط الفارسي الفارسي للذين 19-24



وهذا وان الدراسة التي اجريت بالاردن قي بينت ان
استخدام حجم خط 12 نقطة هو افضل خيار للطلاب الذكور والاناث


**دليل التصميم *Layout* في الكومبيوتر اللوحي**

تعد المحاذاة من العناصر المهمة في التصميم ,قرب أو بعد عناصر واجهة الموقع من بعضها البعض، يرسل رسالة ضمنية للمستخدم مفادها أن العناصر القريبة من بعضها تندرج تحت تصنيف واحد والبعيدة عن بعضها تندرج تحت تصنيف آخر مختلف .... وهكذا، المحاذاة أيضاً تعني وضع كل عنصر من عناصر التصميم في مكانه الصحيح.

اظهرت هذه الدراسة ان جميع الطلاب الذكور

<u>استخدم المحاذة الى جهة اليمين</u>

اما بالنسبة للطالبات الاناث فقد اظهرت هذه الدراسة ان

<u>استخدم المحاذة الى الوسط في حالة ان المستخدم كان انثى</u>

**دليل الالوان الكومبيوتر اللوحي**

الألوان تؤثر بقوة تصميم واجهة، وتختلف معانيها تبعا للثقافة. أظهر الحلاق وبدر (2001) أن المواقع الحكومية في جميع البلدان (مع بعض الاستثناءات) بما في ذلك المملكة العربية السعودية، واستخدام ألوان أعلامها الوطنية في عناصر تصميم واجهة مثل الخلفية، والحدود، والصور، والارتباطات التشعبية. الحلاق وبدر (2001) المدرجة عدة ألوان، واضح الدلالات في مختلف الثقافات. على سبيل المثال، الأحمر هو رمز للسعادة في الصين، بينما في الولايات المتحدة الأمريكية وهو ما يعني خطر. وبالإضافة إلى ذلك، تظهر (2001) بحوث سيمون أن الآسيويين تفضل "الألوان الزاهية أقل"، في حين أن الأوروبيين والأمريكيين الشماليين يفضلون الألوان أفتح أو أكثر إشراقا وعدد أكبر من الصور، من أجل أن يظهر أكثر حداثة. لذلك، والألوان هي عامل إضافي في توقعات المستخدمين بشأن الملاحة، والمحتوى، وصلات، والرضا العام.

استخدامك للألوان بطريقة صحيحة سيسهل كثيراً على المستخدم في التنقل بين المعلومات التي تعرضها على البرنامج. يجب ان تستخدم الالوان بشكل صحيح بحيث تكون مفهومة لدى المستخدم.colour
الألوان لها تأثيرات نفسية مختلفة على المستخدم مثلاً اللون الاحمر في الغالب يشير الى العداء او الخطر. بالنسبة للقراء فقد اظهرت هذه الدراسة ان

<u>استخدم لون خط اسود مع خلفية بيضاء لضمان افضل قراءةافضل</u>

**دليل الرموز الدينية  Religion *samples*  في الكومبيوتر اللوحي**

أثناء عملية الترجمة، ويجب أن يترجم النص إلى اللغة العربية. السهم الرموز الحفاظ على اتجاهها الصحيح عند تغيير اتجاه النص من اليمين إلى اليسار. رموز الحيوان تختلف في المعنى، على سبيل المثال، ينبغي تجنب الخنازير في الثقافة الإسلامية لأنه ضمنا قذارة. لذلك، لتجنب الارتباك الثقافي، ينبغي أن يكون تصميم معظم الرموز النص.

الدين هو الجزء الرئيسي من الثقافات العربية. وخاصة في الأردن. غالبية الأردنيين هم من المسلمين أن حوالي 92٪ منهم مسلمين وهو السنة. في حين أن المسيحية تمثل 6٪ من مجموع السكان، ومعظم المسيحيين من

الأرثوذكس أو الكاثوليك. ويعيش الناس في التسامح مع الانفتاح وقبول الآخر. وبالتالي فعلى تصميم أي تطبيق واجهة المستخدم العربية أن تأخذ بعين الاعتبار المستخدمين واحترام ثقافتهم.

الرموز تختلف في المعنى بين المجتمعات الدينية، على سبيل المثال، ينبغي تجنب الخنازير في الثقافة الإسلامية لأنها سوف تتداخل مع العقوبات الدينية لمفهوم "التلوث / النقاء".

حاولت دراستنا فهم فكر الطلبة الأردنيين العربية رموز الجانب الديني. سألنا سؤالا مباشرا من خلال التجارب في الجلسات "هل لديك أي لون أو رمز يمثل أي معنى ديني بالنسبة لك". حتى اننا لم نطلب من الطالب التعريف عن دينه

يمكننا تلخيص إجابات الطلاب عن طريق ما يلي.

تجنب استخدام أي صور أو رموز تحمل أي دلالات جنسية

لا تستخدم صورة من الحيوانات التي تحمل معنى غير مرغوب فيه في الإسلام

استخدام أحمر للإشارة إلى اسم الله وموضوع الأخضر في النص الديني

استخدم الخطوط واضحة ونصوص دينية كبيرة، وتجنب الخطوط المزركشة

استخدام الرموز الدينية مثل المآذن هلال من المسجد

# دليل تصميم التطبيقات التعليمية للكمبيوتر اللوحي

اعداد: احمد السعدي

اشراف: **Dave Parry**

هذا العمل برعاية

مرحبا بكم في دليل تصميم واجهة عربية للكمبيوتر اللوحي، وكيفية تصميم تطبيقات تعليمية استثنائية للكومبيوتر اللوحي **Tablet PC**

# الفهرس

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## المقدمة:

بالرغم من ان تصميم واجهة المستخدم هو امر سهل وممتع، الا ان الاعتقاد السائد لدى المبرمجين انه امر صعب ومعقد. حيث ان أغلب المبرمجين يتجنبون برمجة واجهة المستخدم، وذألك نتيجة لعدم معرفتهم للعوامل التي تساعد في جعل واجهة المستخدم المصمم سهل وبسيط وممتع جدا للمستخدم.

إضافة لما سبق، يعتقد المبرمجين أن تصميم واجهة المستخدم امر مشابه لتصميم الصور والرسوم. ومع ذالك يجدون انفسهم ضعافا من الناحية الفنية ، و أنهم أكثر مهارة كمنطقيين وتحليلين. ان تصميم واجهة المستخدم هو أمر سهل وعقلاني في آن واحد وليس بالمسألة الغامضة التي تتطلب شهادة اختصاص في الفنون. و بالتالي على المبرمج اتباع طرق عقلانية ومنهجية للتفكير في واجهة المستخدم، والتي تتضمن بعض القواعد المنطقية البسيطة التي يمكن تطبيقها في أي مكان من واجهة المستخدم التي يقوم بتصميمها.

بوجهٍ عام ، واجهة المستخدم الناجحة هي التي تولد إحساساً للمستخدم بأنه يسيطر على بيئة البرنامج، فيتصرف البرنامج تماماً كما اعتقد المستخدم سلفاً. ولذالك هناك بعض القوعد المتبعه التي تساعد المبرمجين والمصممين على حد سوء في تصميم واجهة مستخدم ممتعه وسهلة في نفس الوقت. حيث أنه تعتبر واجهة المستخدم من أهم أجزاء البرنامج ويحتاج تصميم الواجهة للكثير من الوقت حتى تكون النتيجة جيدة، وذلك لأن واجهة المستخدم هي حلقة الوصل بين المستخدم والوظيفة المرجوة من البرنامج ، حيث سوف يتعامل معها المستخدم كل الوقت فيجب على المصمم تصميم هذه الواجهة لأريحية المستخدم وليس على هوى المصمم.

تعتبر الحواسيب اللوحية أداة مناسبة للأغراض التعليمية ولاستراتيجيات التعليم ومنهجياته. حيث يستطيع كل طالب استخدمها في الدراسة والاستعاضه بها عن الكتب المدرسية نتيجة لكونها أكثر تفاعلية ومرونة وخفيفة الوزن. ولذالك فان واجهة المستخدم لأي برنامج تعليمي هي مفتاح النجاح له ، حيث أن واجهة المستخدم هي أول ما يرى من البرنامج وهي الجزء المحسوس منه ،فإن كانت واجهة المستخدم لتطبيقات التعليمية مميزة فإنها تمهد الطريق للبرنامج ليحظى بالقبول. حيث ان

واجهة المستخدم تسهل عملية التواصل مع البرنامج وتبني جسور الثقة بين المستخدم من جهة وبين البرنامج من جهة أخرى.

و بالتالي فان نجاح تطبيقات التعليم الإلكتروني ، لا يقوم فقط على محتوى المعلومات التي تقدمها هذه التطبيقات ، و انما أيضا على مراعاة كيفية عرض هذه المعلومات، و اعتبار حجم الشاشة بالإضافة الى العديد من العومل التي تؤثر على تصميم هذه التطبيقات ، ومنها ان واجهة المستخدم في الكمبيوتر اللوحي تعتمد على الرموز والنقر باستخدام اليد بعكس ما هو موجود في واجهة المستخدم في الحواسيب التقليديه بحيث يجب على المستخدم استخدام الفأرة.

و بناء على ما سبق، يجب ان يكون المصمم على دراية ومعرفة تامة باحتياجات المستخدم وتوقعاته لمحتوي أي تطبيق او موقع الكتروني ، ولذالك يجب على المصمم معاينة التطبيق اوالموقع المصمم والتحقق من تحقيقه لأهداف المنشودة وتوافقه مع احتياجات المستخدم وتوقعاته. اذا بشكل عام يجب ان يكون التطبيق التعليمي الجديد الذي نصممه للكمبيوتر اللوحي سهل الاستعمال، وعملية تحميل وتنزيل البيانات من خلاله تتم في وقت قصير ، بالإضافة الى يجب احتواءه على معلومات قيمة بحيث يستطيع الطالب ان يحصل على هذه المعلومات والموارد بطريقة سهلة وواضحة وتحوز على رضاه.

# لماذا تحتاج هذا الدليل

هذا الدليل يقدم مجموعه من المقترحات لتحسين جودة التطبيقات التعليمية للطلاب من خلال : نوع الخطوط، حجم الخطوط، لون الخطوط، المحاذاة، نوع الازار والرموز الدينة.

ان هذا الدليل تم من خلال دراسة علمية مع كبرى شركات التقنيات المعلوماتية الأردنية، ومشتق كذلك من خلال الادلة الارشادية ذات الصلة والمستوحاة من الخصوصيات والثوابت المعتمدة في العالم العربي.

وعليه، ان هذا الدليل سوف يقوم بتقديم مجموعة من المفاهيم العامة الأساسيه لتصميم وجهات المستخدم للتطبيقات التعليميه العربية للكمبيوتر اللوحي، بالاضافه الى طرح بعض المقترحات التي نرجوا من خلالها ان يتم تبادل الخبرات وإيجاد أفضل الواجهات للمستخدم العربي.

وكما ذكر سابقا، ان تصميم التطبيق التعليمي يجب أن يكون مفيد وذو واجهة تطبيق سهلة الاستخدام. بالإضافة الى أهمية كونه ذا معنى للطلاب من خلال الجمال البصري والرؤى الشخصية، الخ. ولتوثيق أهمية هذه النقاط في نجاح التطبيق التعليمي العربي للكمبيوتر اللوحي وللحصول على مقترحات أخرى، تم اجراء دراستين في الأردن ، احداهما لطلاب المدارس في المرحلة الثانوية من كلى الجنسين، والأخرى لطلاب الجامعات وأيضا من كلى الجنسين.

حيث تم عرض على الطلاب واجهة تطبيق تعليمي باللغه العربية لكمبيوتر لوحي.  وقد احتوى هذا التطبيق على عناصر التطبيق التعليمي العربية الأساسية ( لون ونوع خط وحجم الخط والمحاذاة و الرموز الدينية) و كانت هذه عناصرة قابلة لتغير ضمن خيارات متعددة وذالك لملائمة اختلاف رغبات المستخدمين ( الطلاب) . ومن خلال هاتين الدراستين تم استنتاج فروق ذات دلالة إحصائية في التفضيلات بين الذكور والإناث. وعلية تم استنتاج النصائح و النقاط المهمة التالية التي يجب على المصممين أخذها بعين الاعتبار اثناء تصميم أي تطبيق لوحي باللغة العربية.

استخدام المبادئ التوجيهية توفر التصميم الخاص بك والشركة لنمط متسق، واجهة المستخدم أكثر مهنية والمواد التعليمية، وسهلة لتعلم واجهة المستخدم.

● متسقة ـ تسمح إرشادات الاستخدام لمقدمي المحتوى بإنتاج المواد التي تتبع نمطا موحدا.

● احترافية ـ تساعد الأساليب والمبادئ التوجيهية المتسقة للاستخدام على إنتاج مستندات أكثر احترافية ونص واجهة المستخدم.

● سهلة لتعلم ـ يمكن للمستخدمين تعلم النظام بشكل أسرع وأكثر كفاءة إذا كان كل واجهة المستخدم واجهة المستخدم والوثائق استخدام نفس المصطلحات.

هذا الدليل هو للمستخدمين الذين يبنون التطبيقات، وكتابة أدلة المستخدم، وبرامج تدريب المنتج، وأي مواد تعليمية أو مرجعية، بما في ذلك:

● مطوري واجهة المستخدم

● مصممين واجهة المستخدم

● المهنيين تجربة المستخدم

● المحررين والمراجعين

● مدراء المنتجات

## قواعد تصميم عامة

نستعرض بعض القواعد الأساسية لتصميم , حيث ان هذه القواعد متبعه ومعمول بها من اغلب المصممين . القوعد الأساسية التي سوف نستعرضها مستخلصة من اهم باحثين في مجال تميم الوجهات ( جكوب نيلسون وبن شندرمان)



- **التصميم لأقصى قدر من وضوح**

يجب على المصمم جعل الخط واضح ومقروء في التطبيق التربوي، حيث انه من المهم أن تكون الخطوط واضحة جدا وقابلة للقراءة.

ان اختلاف حجم الخط بالنسبة لنوعه يمثل تحدي للمصمم، لذالك يجب على المصمم اختيار حجم الخط ليكون متوافق مع نوع الخط، حيث أن كل خط يأخذ حيز مختلف بالشاشة ولو كان حجم الخط نفسه.



اختلاف نوع الخط وتاثيره على حجم الخط

المثال اعلاه يبين كيفية اختلاف نوع الخط وتأثيره على حجم الخط.

أي نص يحتاج إلى معيار يحدد التدرج في طرح فكرة المقالة، فكل مقالة تدور حول فكرة محددة وبالتالي النص يجب أن يكون محدد في تدرجه لطرح هذه الفكرة بشكل منطقي. بالاضافة لمعيار التدرج،النص يجب أن يكون منسقاً تنسيقاً ملائما لهذا التدرج، فيتم تنسيق عناوين الفقرات كلها بلون وحجم واحد، العناوين الفرعية بلون وحجم واحد ... الخ. ان التسلسل الهرمي للنص يساعد القاريء على سرعة الالمام بكل محتوى الفقرة أو المقالة.

● ضبط حروف الكلمات بالحركات واضافةعلامات الترقيم

تبرز أهمية وضع الحركات و علامات الترقيم كثير في النص العربي وخصوصا في النص الديني. وأظهرت دراساتنا أن جميع الطلاب يوصون باستخدام علامات الترقيم والحركات لضبط الحروف والتي من شأنها أن تجعل القراءة أكثر سهولة بالنسبة لهم.

| وإذ ابتلى إبراهيم ربه بكلمات and ابْتَلَى إِبْرَاهِيمَ رَبُّهُ بِكَلِمَاتٍ |

اثر التشكيل على دقة القراءة

وعليه، فانه من المهم على المصمم معرفة اين يجب ادراج التشكيل وكيفية تاثيره على تصميم البرنامج حيث ان التشكيل عامل مهم في قراءة أي تطبيق تعليمي باللغة العربية.

● استخدام ألوان التباين العالي

بينت الدراسة ان معظم الطلاب العرب يفضلون اللون الأسود للخط، ولكن كما هو معروف في بعض الأحيان يقوم المصممين بتغيير لون الخطوط لأسباب معينة قد يحتاجونها. لذلك، ننصح باستخدام الألوان عالية التباين مثل اللون الأزرق مع خلفية رمادية.

| وإذ ابتلى ابراهيم ربه بكلمات |

تباين لون الخط

عملية تباين الالون عملية جدا مهمة ،حيث ان اختيار لون الخلفية هو جزء مهم بالتصميم . فلا يجب اختيار اي لون للخط لا يتباين مع لون الخلفية وبالتالي يقلل من وضوح الكلمات اثناء القراءة.

- صفحات ميتة او مفقودة

يرغب الطلاب عادة في الحصول على المعلومات من خلال أقل عدد ممكن من الخطوات. و بالتالي ينبغي على مصمم التطبيق أن يقلل من الخطوات المتبعة داخل التطبيق من قبل المستخدم، بالإضافة إلى توفير واستخدام الإيماءات بطريقة ذكية لمساعدة المستخدم في الوصول الى هدفه في التطبيق. حيث ان الطالب سوف يقوم باغلاق التطبيق في حالة وصوله الى صفحة لا تمكنه من الرجوع الى الصفحة السابقة او الى الشاشة الرئيسية.
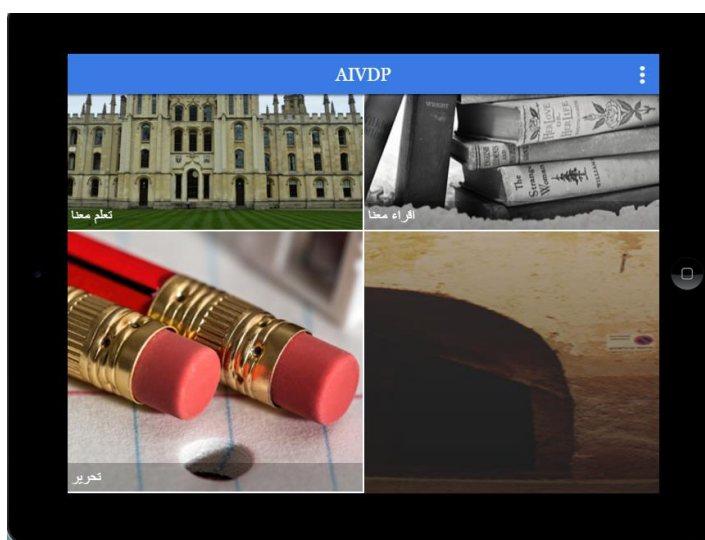


- البساطة والثبات

الطلاب العرب يفضل تصميم بسيط جدا، حيث أكد معظم الطلاب أن تصميم التطبيق يجب أن يكون على دراية ومنطقي مع ما يعرفونه بحيث يجب على المصمم بناء تطبيق متسق وبسيطة مع أقصى قدر من وظائف وضوح.
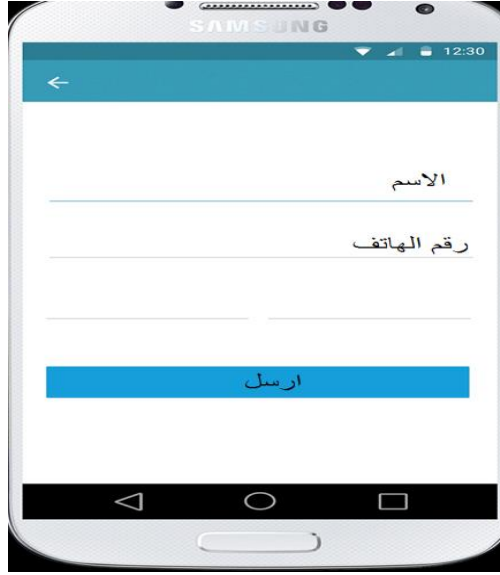
● لا تستخدم مناطق صغيرة للنقر

على المصمم تصميم وصلات وأزرار لمساعدة المستخدم للوصول إلى المعلومات بطريقة سهلة. ولذلك، ينبغي للتصميم أن يكون سهل للنقر وجود مساحة كافية للنقر.

● تنظيم المحتوى بشكل جيد

الكمبيوتر اللوحي هو جهاز متعدد اللمس، وعادة ما يأتي مع الكاميرا والميكروفون، ويتراوح حجم الشاشة من 7 الى 13,3 بوصة. وبالتالي ان على المصمم التفكير في كل هذه الميزات قبل أن يبدأ بتصميم أي تطبيق وذالك لتخطيط التطبيق بما يتناسب مع ميزات الكمبيوتر اللوحي من اجل تحقيق الغاية من هذا التطبيق وتلبية احتياجات المستخدم الرئيسي لهذا التطبيق. و بالتالي فان تنظيم المحتوى وتحديد نموذج القوائم في التطبيق يساعد في تلبية حاجة المستخدم ( الطالب) في رؤية كل شيء منظم وواضح داخل التطبيق التعليمي للكمبيوتر اللوحي.

● النظر في خصائص المستخدم (العمر والجنس)

كان واحدا من أهم نتائج الدراستين. حيث تم استنتاج وجود فروق ذات دلالة إحصائية بين الذكور والإناث. ولذلك على المصمم ان ياخذها بعين الاعتبار. وفيما يلي شرح لتفضيلات التي تم استنتاجها من كلى الدراستين:

دليل اللغة (الطباعة) في الكومبيوتر اللوحي

اللغة العربية هي لغة ثنائية الاتجاه، حيث يتم عرض النص والقراءة من اليمين إلى اليسار، بينما الأرقام يتم عرضها من اليسار إلى اليمين. بالإضافة إلى ذلك، الحروف العربية تحتل مساحات مختلفة مقارنة مع الاحرف الإنجليزية، وتختلف المساحة حسب موقع الحرف بالكلمة و إمكانية ادماجه إلى حرف آخر أم لا (Alsumait، العصيمي، و AlFedaghi، 2009).

ولتلخيص خصائص اللغة العربية التي تتميز بها عن اللغات الأخرى و أهميتها اثناء تصميم أي تطبيق تعليمي عربي خاص بالكمبيوتر اللوحي، تم الاستشهاد بالعديد من الدراسات (أحمد السعدي وآخرون، 2014؛ الغامدي، Aldabbas، الشهري، و Nusir، 2012؛ Hemayssi وآخرون، 2005.) وتم تلخيصها بما يلي:

• الكتابة من اليمين إلى اليسار، لذلك ينبغي من أي تطبيق تمكين ا التي تقدم في هذا الاتجاه. يتم محاذاة القوائم وفقا لذلك، نقطية، المسافات البادئة الفقرة، والقوائم إلى اليمين.

•الترتيب الأبجدي باللغة العربية، مما يؤثر ظائف البند النوع، عرض الاختصارات، والاختصارات غير موجودة في اللغة العربية يجب أن تقود المصمم لتحديد فترة ولاية كاملة قبل الترجمة.

• الكلمات العربية تحتل مساحة أكبر أفقيا و، مع مجموعة محرف المختار، أربع نقاط أكبر من الخطوط الإنجليزية.

• في العربية، خطابات تغير شكل وفقا لموقع الصورة الرمزية، وهذا هو، سواء كان في البداية، الوسط أو نهاية الكلمة. هذا يغير إيقاع الصاعدين والنازلين، والخطوط العربية تتطلب البنط الأسود لزيادة الوضوح.

في هذه الدليل سوف نركز على حجم ونوع الخط المستخدم في الكومبيوتر الوحي للطلاب الذكور والاناث في كلتا المرحلتين الجامعية والمدرسية.

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لَا مَلْجَأَ مِنَ ٱللَّهِ إِلَّا إِلَيْهِ

يعتبر خط المستخدم في تصميم أي تطبيق باللغة العربية هو الفصل بين ما إذا كان التصميم احترافي أم لا ، فكثير من المصممين يواجهون صعوبة كبيرة في إيجاد الخط المناسب لتصميمهم . وقد بينت نتائج الدراستين اللتين اجريتين بالأردن انه يفضل :

> *استخدام خط النسخ للطلاب الذكور والاناث الذين تقل اعمارهم عن 18 والخط الفارسي الفارسي للذين*
> *تتراوح أعمارهم بين 19-24*

وهذا وان الدراسة التي اجريت بالاردن قي بينت ان

> *استخدام حجم خط14 نقطة هو افضل خيار للطلاب الذكور والاناث*

عند استخدام اللغة العربية و عكس الاتجاهات اما يختفي جزء من الصور في الزوايا او اسفل الادوات المجاورة لها او فوقها فيتم استخدام خاصية الScale ب1 او اكثر حسب الحاجة بكسل للاحداثيات (X,Y) لحل المشكلة

| En : | AR : |
|---|---|
| .img-icons {<br><br>   display: inline-block; | .img-icons {<br><br>   display: inline-block; |

```
transform: scale(1,1);                    transform: scale(-1,1);

-webkit-transform: scale(1,1);            -webkit-transform: scale(-1,1);

-moz-transform: scale(1,1);               -moz-transform: scale(-1,1);

-o-transform: scale(1,1);                 -o-transform: scale(-1,1);

}                                         }
```

# دليل الالوان (الكومبيوتر اللوحي)

الألوان تؤثر بقوة على تصميم واجهة التطبيقات، وتختلف معانيها تبعا للثقافة والدلالات. أظهر الدراسة التي اجراها الحلاق وبدر (2001) أن المواقع الحكومية في جميع البلدان (مع بعض الاستثناءات) بما في ذلك المملكة العربية السعودية تستخدم ألوان أعلامها الوطنية في عناصر تصميم الواجهة مثل الخلفية، والحدود، والصور، والارتباطات التشعبية. على سبيل المثال، الأحمر هو رمز للسعادة في الصين، بينما في الولايات المتحدة الأمريكية وهو ما يعني خطر. وبالإضافة إلى ذلك، تظهر (2001) بحوث سيمون أن الآسيويين لا يفضلون استخدام الأوان الزاهيه في تصميم ، في حين أن الأوروبيين والأمريكيين الشماليين يفضلون الألوان أفتح أو أكثر إشراقا وعدد أكبر من الصور، من أجل أن يظهر أكثر حداثة. لذلك، والألوان هي عامل إضافي في توقعات المستخدمين بشأن القوائم، والمحتوى، وصلات، والرضا العام.

يجب أن يكون هناك تباين لوني بين النص و الخلفية التي كتب عليها، وضعت منظمة W3C معايير لقابلية الوصول للمحتوى على الويب سميت WCAG 2.0 ، وفيها وضعت معادلة لإختيار ألوان النصوص والخلفيات لتوفر تباين يعطي للنص قابلية أكثر للقراءة، بعض المواقع حولت هذه المعادلات إلى أدوات يمكن لمصممي المواقع استخدامها بشكل مباشر ، هذه المعادلة توفر للمصمم أكثر درجات التباين وصولاً لجميع المستخدمين بما فيهم المصابيين بعمى الالوان أو من يستخدمون شاشات باللونين الابيض والاسود، أما النصوص التي لا توفر درجة عالية من التباين بينها وبين الخلفية ستتسبب في جعل عملية القراءة مؤلمة لعين المستخدم وبطيئة في نفس الوقت.

استخدامك للألوان بطريقة صحيحة سيسهل كثيراً على المستخدم في التنقل بين المعلومات التي تعرضها على البرنامج، لذالك يجب ان تستخدم الالوان بشكل صحيح بحيث تكون مفهومة لدى للمستخدم. فالألوان لها تأثيرات نفسية مختلفة على المستخدم مثلاً اللون الاحمر في الغالب يشير الى العداء او الخطر. بالنسبة للقراء فقد اظهرت هذه الدراسة ان

| *استخدم لون خط اسود مع خلفية بيضاء لضمان افضل قراءة* |
|---|

# دليل المحاذاة التصميم في الكومبيوتر اللوحي

تعد المحاذة من العناصر المهمة في التصميم , حيث ان قرب أو بعد عناصر واجهة الموقع من بعضها البعض يرسل رسالة ضمنية للمستخدم مفادها أن العناصر القريبة من بعضها تندرج تحت تصنيف واحد والبعيدة عن بعضها تندرج تحت تصنيف آخر مختلف .... و هكذا، فالمحاذاة تضع كل عنصر من عناصر التصميم في مكانه الصحيح.

تستخدم المحاذاة لتحسين هيكلة التصميم حيث تساعد المصممين في تحديد وضعية العناصر وسد الفجوات وكيفية التفاعل بينهم كما تساعد المستخدم ايضًا في خلق علاقات بين العناصر ومن ثم يتولد انطباع جيد لدى المستخدم .

لكن تذكر عدم اتباع منهجية معينة وعدم الحد من إبداعك ف ليس كل شئ بحاجة للمحاذاة وأحيانًا ستلجأ إلى دمج المحاذات لتحقق الهدف بطريقة أسرع.

اظهرت هذه الدراسة ان جميع الطلاب الذكور

| *استخدم المحاذاة الى جهة اليمين للطلاب الذكور* |
|---|

اما بالنسبة للطالبات الاناث فقد اظهرت هذه الدراسة ان

| *استخدم المحاذاة الى الوسط في حالة ان المستخدم كان انثى* |
|---|

# دليل القوائم والتنقل في الكومبيوتر اللوحي

القوائم هو جزء مهم من كل واجهة المستخدم، سواء كان لموقع الكتروني أو لتطبيقات الجوال. هذا و قد يأتي في أشكال كثيرة وأساليب مختلفة، أفقية، عمودية، ربما أضيق الحدود أو عالية مفصلة ورسوم بيانية. ربما الأهم من وجود القوائم التي تبدو جيدة هو أن يكون واحد هو أن بديهية ويمكن الوصول إليها بسهولة. القوائم المحمول يجمع بين فكرة سهولة الاستخدام مع واحد الجمالية وتحقق نتائج مذهلة حقا، ويجعلك ترغب في استخدام ونقدر واجهة المستخدم القائمة، وليس فقط جعله وسيلة لتحقيق الغاية. بالنسبة للمبتدئين، والفرق واضح بين تصميم المحمول وسطح المكتب هو حجم الشاشة. شاشات المحمول هي أصغر، لذلك كل أجزاء من الشاشة تصبح أكثر قيمة. لهذا السبب، ينبغي أن تكون نظم القوائم المتنقلة الحد الأدنى: محتوى الموقع يحتاج إلى الوقوف الأمامي والوسط، في حين يشعر القوائم غير مرئية تقريبا.

ولكن لمصممي يفكرون في طرق جديدة لتقليل عناصر التحكم في التنقل، والحلول في بعض الأحيان مربكة ويساء فهمها. لهذا السبب يجب أن القوائم المحمول أيضا أن تكون متماسكة. كما جاء في التفاعل تصميم أفضل الممارسات، استخدام الدوال المناسبة (مثل الاستعارات البصرية الصحيحة) بحيث القوائم لا يتطلب أي تفسير.

القوائم من اهم العناصر في اي تطبيق. وقد اظهرت الدراسة التي اجريت بالاردن ان الطلاب يفضلون نوعين محديدن من القوائم

| *وهي الاسفل بالنسة للاناث والسحب للخارج للذكور.* |
|---|



عند الكتابة في MENU بجميع اشكالها بالعربي اغلب الحروف تاخذ حجم اكبر من الحروف الاتينية كمثال

حرف السين بالعربي بالمقارنة بحرف ال i  فيتم تغيير نوع و حجم الخط بالعربي لتقريبه الى الحجم الانجليزي

| EN : | AR: |
|---|---|
| ```<br>.Menu:link {<br><br>    font-family:MS Sans Serif;<br><br>    font-size:10px;<br><br>}<br>``` | ```<br>.Menu:link {<br><br>    font-family:Times New Roman<br>    (Arabic) ,Sans Serif;<br><br>    font-size:12px;<br><br>}<br>``` |

## دليل الازرار في الكومبيوتر اللوحي

أزرار عادية، العنصر اليومية من تصميم التفاعل. على الرغم من هذا، لأن أزرار تشكل عنصرا حيويا في خلق تدفق التخاطب السلس في الويب والتطبيقات، فإنه يستحق الالتفات الى هذه أفضل الممارسات الأساسية للأزرار. كما أننا سوف يذهب أكثر أنواع زر وتنص - المعلومات الهامة التي تحتاج إلى معرفته لإنشاء أزرار الفعالة التي تعمل على تحسين تجربة المستخدم.

• هل أزرار واجهة مستخدم مرئية ومميزة من المكونات غير التفاعلية في واجهة المستخدم؟ وأزرار واجهة مستخدم بسيطة بما فيه الكفاية والتعرف على فهم الغرض منه؟
• هل هناك علامة على نجاح أو فشل عندما تفاعلت مع زر؟
• هل أزرار واجهة مستخدم وضعه بشكل صحيح أن لا يكون مخطئا لخدمة وظائف أخرى
• هل أزرار واجهة مستخدم واضحة وموجزة؟

## دليل الرموز الدينية  في الكومبيوتر اللوحي

الصورة خير من ألف كلمة, تعد الصور والرموز من إحد أهم وسائل الإيضاح في التعليم . فالصورة تتكلم و ترسخ في عقل الطالب . و هناك نوعان من الصّور او الرموز : الصّور والرموز الكتابية و صور من واقع حياة التلاميذ , و الصّور الكتابية تُظهر مشاهد مستوحاة من القصص الكتابية , أو من أزمنة الكتاب الدينة , أما الصور الأخرى فهي تظهر أشياء من حياتو واقع التلاميذ في الوقت الحالي و التي تتطابق مع حياتهم اليومية و التي يجب تغييرها أو تعديلها , بناءاً علي ما شاهدوه في الصّور الكتابية .

رموز الحيوان تختلف في المعنى، على سبيل المثال، ينبغي تجنب الخنازير في الثقافة الإسلامية لأنه ضمنا قذارة. لذلك، لتجنب الارتباك الثقافي، ينبغي أن يكون تصميم معظم الرموز النص. الدين هو الجزء الرئيسي من الثقافات العربية. وخاصة في الأردن. غالبية الأردنيين هم من المسلمين أن حوالي 92٪ منهم مسلمين وهو السنة. في حين أن المسيحية تمثل 6٪ من مجموع السكان، ومعظم المسيحيين من الأرثوذكس أو الكاثوليك. ويعيش الناس في التسامح مع الانفتاح وقبول الآخر. وبالتالي فعلى تصميم أي تطبيق واجهة المستخدم العربية أن تأخذ بعين الاعتبار المستخدمين واحترام ثقافتهم.

الرموز تختلف في المعنى بين المجتمعات الدينية، على سبيل المثال، ينبغي تجنب الخنازير في الثقافة الإسلامية لأنها سوف تتداخل مع العقوبات الدينية لمفهوم "التلوث / النقاء". حاولت دراستنا فهم فكر الطلبة الأردنيين العربية رموز الجانب الديني. سألنا سؤالا مباشرا من خلال التجارب في الجلسات "هل لديك أي لون أو رمز يمثل أي معنى ديني بالنسبة لك". حتى اننا لم نطلب من الطالب التعريف عن دينه

يمكننا تلخيص إجابات الطلاب عن طريق ما يلي.

1. **تجنب استخدام أي صور أو رموز تحمل أي دلالات جنسية**

2. **لا تستخدم صورة من الحيوانات التى تحمل معنى غير مرغوب فيه فى الإسلام**



3. **استخدام أحمر للإشارة إلى اسم الله وموضوع الأخضر فى النص الدينى**
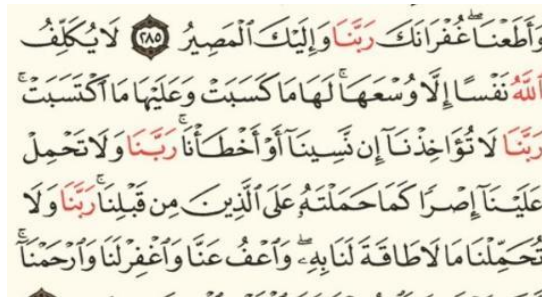


4. **استخدم الخطوط واضحة ونصوص دينية كبيرة، وتجنب الخطوط المزركشة**



5. **استعن بالدليل لفهم استخدام الرموز الدينية**

| الرمز | الديانة | المعنى |
|---|---|---|

| | | |
|---|---|---|
| اسم " الله " هو اشهر دلالة للاسلام | الاسلام |  |
| النجمة والهلال هو رمز المعروفة التي تستخدم لتمثيل الإسلام. الرمز هو غير مسلم في الأصل، كان رمز تعدد اعتمدت خلال انتشار الإسلام، وتستخدم حتى اليوم في مثار للجدل في بعض الأحيان في العالم الإسلامي. كثيرا ما يقال إن الهلال والنجمة لتكون الرموز الإسلامية، ولكن يقول المؤرخون أنها كانت شارة الإمبراطورية العثمانية، وليس من الإسلام ككل. | الاسلام |  |
| يتم استخدام بسيطة نجمة تسعة وأشار عموما البهائيين باعتباره رمزا من ايمانهم. الرقم "تسعة" مهم للبهائيين لعدة أسباب. | البهائية |  |
| عجلة دارما هو واحد من أهم رموز البوذية الدينية. ويرمز إلى بوذا تحريك العجلة الحقيقة أو القانون. تشير العجلة إلى القصة أنه بعد فترة وجيزة حقق بوذا | البوذية |  |

| | | |
|---|---|---|
| التنوير، وجاء براهما نزل من السماء، وطلبت من بوذا لتعليم من خلال تقديم له Dharmachakra. | | |
| رمز الصليب، والتي هي اليوم واحدة من الرموز الدينية المعترف بها على نطاق واسع في العالم هو أقرب رمز مسيحي مستخدم. بمعنى أكثر واوسع أنه يرمز إلى الدين المسيحي. وبشكل أكثر تحديدا، لأنها تمثل وتحيي ذكرى وفاة المسيح. | المسيحية | ✝ |
| كان السمك أول استخدام معروف كرمز ديني المسيحي في وقت ما خلال القرون الثلاثة الأولى للميلاد. بدأ المسيحيون باستخدام الكلمة اليونانية ل "الأسماك" باعتبارها الجناس الناقص / اختصار ل "الابن يسوع المسيح الله، المنقذ". | المسيحية | ⌢⌣ |
| وأم هي واحدة من الرموز الدينية أهم عند الهندوس. وهي مكونة من ثلاثة أحرف اللغة السنسكريتية. والتي تمثل العديد من الثلاثيات هامة: العوالم الثلاثة | الهندوسية | ॐ |

| | | |
|---|---|---|
| | | من الأرض، والغلاف الجوي، والسماء. الآلهة الهندوسية الرئيسية الثلاثة. |
|  | الهندوسية | رمز الصليب المعقوف التي تبدو وكأنها الشعار النازي، يحمل أهمية دينية كبيرة لالهندوس. الصليب المعقوف هو شخصية التصويرية في شكل صليب مع فروع عازمة على زوايا قائمة وتواجه في اتجاه عقارب الساعة. ينبع SWASTIKA كلمة من اللغة السنسكريتية وهي لغة هندية قديمة وتعني "يجري سعيدة". |
|  | اليهودية | والنجمة السداسية داود، وهذه هي رمز ديني اشتهر من الدين اليهودي.. النجم ديفيد هي رمز جديد نسبيا من اليهودية وأصبحت شعبية فقط في السنوات ال 200 الماضية. ومن اسمه بعد الملك داود، الذي يحكي أسطورة كان لنا درعا مع هذا النجم على ذلك. |

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| | اليهودية | الشمعدان هو أقدم رمز ديني من الدين اليهودي. وهو سبعة تشعبت حامل شمعة. |
|---|---|---|
| | السيخ | يتكون الرمز الديني السيخ خاص تتكون من ثلاث صور: وكاندا، وهو سلاح ذو حدين. ويمثل هذا الاعتقاد في إله واحد. وChakkar، مثل كارا هو دائرة تمثل الله دون بداية أو نهاية وتذكير السيخ على البقاء في الحكم بما أنزل الله. اثنين kirpans عبرت تمثل السلطة الروحية والسلطة السياسية. |
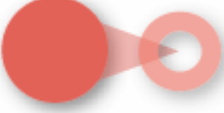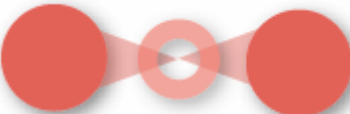
جدول رقم 1 : الرموز الدينة

## دليل الحركات في الكومبيوتر اللوحي

إذا كان لديك شاشة تعمل باللمس فمن الطبيعي ان يقوم المستخدم بالتعامل مع هذه الشاشة من خلال حركات يوائم بها مع واحد او اثنين او أكثر من اصابعه. وهي أسهل من استخدام الفارة او لوحة المفاتيح.

ان شاشة الحاسوب اللوحي هي متعددة اللمس، بمعني انها تستجيب لنقطتين لمس او أكثر. وهنا يجب ان يراعي المصمم ما هي الحركات الممكنة التي يمكن ان يوفرها للمستخدم وكذلك توقع حركات

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المستخدم وتوظيفها لكي تخدم التطبيق.

| مثال الوصف | طريقة العمل | الاسم | الرمز |
|---|---|---|---|
| لتشغيل او التنقل | الضغط والافلات السريع | الضغط لمرة واحدة | |
| لكشف قائمة مخفية | الضغط والانتظار في نفس المكان | الضغط المطول | |
| للتحديد | الضغط مرتين بنفس المكان | الضغط مرتين | |
| لنقل اي كائن. او لتعبئة مكان | الضغط بمكان وسحب الاصبع من غير الافلات | الضغط والسحب | |
| لعمل تكبير او التصغير | الضغط بمكانين والتجمع بمكان او العكس | القرصة | |
| للتحديد | الضغط بعدة اماكن والافلات | الضغط باماكن مختلفة | |

<u>بعض المفاهيم</u>

هناك لبس في عدة مصطلحات (قابلية الاستخدام Usability – , واجهة الاستخدام User Interface – , المحتوى  Content – , تجربة الاستخدام User Experience ) يسمعها المصمم ونعتقد انه من الضروري لنا ان نوضح هذه المطلحات قبل البدىء في استعراض هذا الدليل.  الشكل التالي يوضح تلك المسائلة



صورة رقم 1 : توضيح المبادئ ("Culture and Religion", 2015)

يمكن تشبيه المصطلحات التالية قابلية الاستخدام Usability – واجهة الاستخدام User Interface – المحتوى Content  – تجربة الاستخدام User Experience ب وجبة بيتزا ! … الدقيق، الجبن، الطماطم … الخ هو المحتوى Content

ان نعد عجينة بيتزا هشه ورقيقة، بحيث تكون سهلة التقطيع … هو ما يمثل قابلية الاستخدام Usability

ان نعد طاولة الطعام ونرتبها بعدد الحاضرين، وان نضع المقبلات والعصائر فى اماكنها … هو ما يمثل واجهة الاستخدام User Interface

اعددنا بيتزا رائعه، حلوة المذاق، جهزنا طاولة الطعام ، الان حان وقت الحصاد/الأكل ما رأيك ببعض الموسيقى، والشموع ؟ ... هذا كله هو ما يمثل تجربة المستخدم User Experience تجربة الاستخدام تعنى بما يدركه المستخدم، انفعالاته وعواطفه التى تتولد اثناء تفاعله مع الموقع/البرنامج/التطبيق/النظام. قد يكون التطبيق سهل الاستخدام، وتصميمه رائع، ولكن لدى المستخدم تجربة سيئة !!!

المصطلحين "قابلية الاستخدام Usability" و "تجربة الاستخدام User Experience" متشابهيين، ولكنهما ليسا متطابقين، فالثاني يشمل الاول ... وكي نستطيع التفريق جيداً بينهما يجب ان نتخلص من هذه المعتقدات:ـ

اولا اعتقادنا ان اي شيء سهل الاستخدام يحقق تجربة استخدام جيدة هو اعتقاد خاطيء

ثانيا نعتقد ان الشيء الجميل هو شيء سهل الاستخدام اوبديهي ان يسهل على الناس استخدامه ومع ذلك لا ننكر ابدا ان الاشياء الجميلة اكثر قابلية للاستخدام ولكن علينا ان لا نغفل العوامل الاخرى

ثالثا تجربة الاستخدام هى جزء من العملية الكلية لتصميم موقع الويب وهذا خاطيءوالصحيح ان تجربة الاستخدام هي عملية التصميم للتطبيق وليست جزء منها.

رابعا ما يقوله جاكوب نيلسون هو دستور مقدس يجب ان انفذه بغض النظر عن النتيجه ! .... الصحيح هو ان تجربة الاستخدام لا تعتمد على النصائح والمبادئ بقدر اعتمادها على مقابلة المستخدمين الحقيقيين وجها لوجه، ومعرفة مشاكلهم وتصميم حلول بناءً على ملاحظتك لهم، مختبرات جاكوب نيلسون لم تختبر كل المستخدمين فى العالم، وابحاثها علي عينات محددة وفي مناطق بثقافات محددة، على الرغم من ذلك ما يتوصل اليه الباحثون يجب ان نلتفت له ونضعه بالحسبان بشئ من التوازن عندما نهندس تجربة الاستخدام(Nielsen, 1993).


احدى الاعتقادات الخاطئة عن تجربة الاستخدام هو اننا كمصممين ومهندسين لخبرة المستخدم نعتقد ان المستخدم الغير خبير غبى ! وهذا غير صحيح، نحن لا نقيس مستوى الـ IQ للمستخدمين، ولا يجب ان نفعل ذلك، من الممكن ان يستخدم الموقع مستخدم حاصل على ماجستير او دكتوراه او مستوى ذكاءه اعلى – وربما هم النسبة الاكبر من المستخدمين – وبالتالى فان استخدامه سيطور ولن يبقى على حاله، لانه اقدر على استيعاب الواجهه ربما اكثر من صانعها.

# Appendix K

Jordanian company Arabic UI guidelines requested.


Dear Ahmed Alsadi,

I am Mr. Jbreel Ahmad, development team leader in Protech company. Thank you for updating us with your research study results.

Actually, our company is now working on developing a several tablet PC applications for some private Jordanian schools.

Therefore, we are interested in your research study results, and our company would like to adopt your user interface guidelines in the next project if you agreed.  We are looking forward to receiving your approval regarding our request by reply our email attached with the final version of your Arabic user interface guidelines.

Also, please let me know if there is a fee for using this work in this manner. If you have any additional questions or require further clarification, please, do not hesitate to call me or send me an email.


Thank you very much for taking the time to consider our request.

**Best Regards**




**Jbreel Ahmad**

Development Team Leader

**Tel.**    (+962-6)   5519 558

**Fax.**   (+962-6)   5549 558

**Mobile.** (+962-79)  6353 504

# Appendix L

| | Company Name | Commercial Name | Tel | Fax | Website |
|---|---|---|---|---|---|
| 1 | Silicon Valley For Electronic Solutions | Silicon Valley | 96265853092 | 96265853089 | www.esolutionsv.com |
| 2 | Itmam Computing Solutions | ICSME | 96265532644 | 96265536244 | www.icsme.com |
| 3 | Engineering Sense for Technology | Engineering Sense | 96265159906 | 96265159908 | www.engsense.com |
| 4 | Phoenic for Telecom Solution Development | Telephoenic | 962799441001 | 96265162163 | www.telephoenic.com |
| 5 | Hybrid Solutions For Computer | Hybrid Solutions | 96265151601 | 96265151601 | www.hybrid-solutions.com |
| 6 | Secured Services Systems | SSS Process | 96265857553 | 96265856526 | www.sssprocess.com |
| 7 | Information Technology Planet | ITP | 96265517731 | 96265517741 | www.itp.com.jo |
| 8 | Allied Applications Group - AA Group | AA Group | 96265413170 | 96265413170 | www.aagroup-co.com |
| 9 | Pencilo L.LC | Pencilo | 96265530131 | 96265510709 | www.pencilo.com |
| 10 | Sima Programming | Sima | 96264620415 | 96264620415 | NA |
| 11 | Kindi Software Solution | Kindi Soft | 96265333821 | 96265333824 | www.kindi.com |
| 12 | REALSOFT Advanced Applications | RealSoft | 96265160484 | 96265160485 | www.realsoft-me.com |
| 13 | Seneca Associates LTD | Seneca | 96265549411 | 96265549410 | www.senecaltd.com |
| 14 | Al-Rajeh for Computer Technology | Al Rajeh | 962795878472 | 96253748961 | www.rct-jo.com |
| 15 | Shomali Infotec Center | Shomali | 96265562015 | 96265562032 | NA |
| 16 | JValley Software Solutions | Jvalley | 96265866707 | 96265866706 | www.JValley.net |
| 17 | Integrated Technology Group | ITG | 96264618133 | 96264618115 | www.itgsolutions.com |
| 18 | MATRIX BUSINESS TECHNOLOGY | MATRIX | 96265532981 | 962565532781 | www.tditco.com |
| 19 | AL-DAD FOR INFORMATION TECHNOLOGY | Al Dad | 96265333512 | 96265333512 | www.ddadit.com |
| 20 | Estarta Solutions | Estarta | 96265330751 | 96265330752 | www.estartasolutions.com |
| 21 | Macro Applications | Macro Apps | 96265825078 | 96265825079 | www.macroapps.com |

| 22 | Moon Computer Systems | Moon | 962777416913 | 962777416913 | www.moonnetworks.com |
|---|---|---|---|---|---|
| 23 | Hakaya Technologies Company | Hakaya | 96265607930 | 96265607930 | www.hakayastudio.com |
| 24 | Sermon Business Solutions | Sermon | 96265345371 | 96265346071 | www.sermonsolutions.net |
| 25 | Promise for digital solutions | Promise | 962779903521 | 962779903521 | www.promise-solutions.com |
| 26 | Eskadenia Software | Eskadenia | 96265510717 | 96265510719 | www.eskadenia.com |
| 27 | Leading Point Software LTD | Leading Point | 96265349980 | 96265349180 | www.leading-point.com |
| 28 | Simtix | Simtix | 96265650511 | 96265650719 | www.simtix.com |
| 29 | CONTRIBUTOR FOR SOFTWARE | Contributor | 962797655443 | 962797655443 | NA |
| 30 | BT APPLIED TECHNOLOGY | BT Applied | 96265620022 | 96265620028 | www.btat.com |
| 31 | Softile Solutions | Softile | 96265694900 | 96265694900 | www.softilesolutions.com |
| 32 | United Business Applications | UBA | 96265652002 | 96265659009 | www.uba.com.jo |
| 33 | Orientek | Orientek | 96265885185 | 96265885175 | www.orientek.jo |
| 34 | ITAC | ITAC | 96265535205 | 96265535806 | www.itacsoft.com |
| 35 | Communities Tech | Communities Tech | 96265814605 | 96265814723 | www.communitiestech.com |
| 36 | TechnoSys Group | TechnoSys | 96265538110 | 96265538039 | www.technohome.net |
| 37 | Omniyat for IT and Business Management Solutions | Omniyat | 96265517778 | 96265517778 | www.omniyatbit.com |
| 38 | Ocean Soft | Ocean Soft | 96265667092 | 96265670183 | www.theoceansoft.com |
| 39 | H3O Systems | H3O Systems | 96265861199 | 96265827599 | www.h3osystems.com |
| 40 | Final-Solutions | Final-Solutions | 96265827751 | 96265827761 | www.fs.jo |
| 41 | Modern Systems & Computer Trade | Modern Systems | 96265829404 | 96265829405 | www.modernsystemsco.com |
| 42 | Iniment | Iniment | 96265828528 | 96265858007 | www.iniment-me.com |
| 43 | Habash information technology | Habash | 962797313060 | 962797313060 | NA |
| 44 | MIG for Technology Solutions L.T.D. | MIG | 96265865001 | 96265868796 | NA |
| 45 | SoftAct | SoftAct | 96265357667 | 96265347490 | www.softact.com |
| 46 | Al Hudhud | Al Hudhud | 962797721545 | 962797721545 | NA |
| 47 | Mobisoft | Mobisoft | 96264621256 | 96264621257 | www.mobisoft-me.com |

| 48 | DigitMore Solutions | DigitMore | 96264655584 | 96264655584 | www.digit-more.com |
|----|---------------------|-----------|-------------|-------------|---------------------|
| 49 | VitalTronix | VitalTronix | 96265805460 | 96265805462 | www.vitaltronix.com |
| 50 | LEGEND INTEGRATED SOLUTIONS COMPANY LIMITED | Legend | 96265412577 | 96265412578 | NA |
| 51 | General Computers & Electronics Co. | GCE | 96265513879 | 96265513509 | www.gce.com.jo |
| 52 | Delta Informatics | Delta | 96265160371 | 96265160372 | www.deltainf.com |
| 53 | Bentley Systems | Bentley | 96265679300 | 96265679300 | NA |
| 54 | Information & Graphics Systems Consultants L.LC. | InfoGraph | 96265603546 | 96265602891 | www.infograph.com.jo |
| 55 | Alhanaa Total Solutions | HTSOffshore | 962796555111 | 962796555111 | www.htsoffshore.com |
| 56 | Sokoon AlQamar For Information Technology | Sokoon AlQamar | 96265060696 | 96265061669 | www.sokoonalqamar.net |
| 57 | Mastership Information Systems | Mastership | 96264384363 | 96264384363 | www.mastership.com |
| 58 | Acorna Solutions | Acrona | 96265150661 | 96265150680 | www.acornasolutions.com |
| 59 | Scientific for Computers & Systems | SCS | 96265504058 | 96265504057 | NA |
| 60 | Information Systems Solutions Provider ISSP | ISSP | 962777495041 | 962777495041 | www.isspsoft.com |
| 61 | Savvytek | Savvytek | 96265816650 | 96265816640 | www.savvytek.com |
| 62 | ALRAYA SOFTWARE INDUSTRY COMPANY LIMITED | Raya | 96265151731 | 96265151831 | www.rayasolutions.com |
| 63 | Insight Group | Insight Group | 96264631310 | 96264631310 | www.insight.com.jo |
| 64 | Rabbitech | Rabbitech | 962795065031 | 962795065031 | NA |
| 65 | Shnoudi Trading Co. | STC | 96265516388 | 96265520801 | www.shnoudi.com |
| 66 | EBECS | EBECS | 96265548297 | 96265548297 | www.ebecs.com |
| 67 | Adaptive TechSoft | ATS | 96265162001 | 96265162005 | www.ats-ware.com |
| 68 | Manafsoft | Manafsoft | 96265853366 | 96265824149 | www.manafsoft.com |
| 69 | Specialized Technical Services | STS | 96265802626 | 96265829213 | www.sts.com.jo |
| 70 | ISoft | ISoft | 962779383578 | 962779383578 | www.isoft.ae |
| 71 | Brick2Click | Brick2Click | 962776666759 | 962776666759 | www.brick2click.com |
| 72 | Software House for business Development | AMOX | 96265639658 | 96265639359 | NA |
| 73 | Meayar IT | Meayar | 96264012660 | 96264006125 | www.meayar.com |

| 74 | Acasya Systems Development | Acasya | 96265341090 | 96265341091 | NA |
|----|----------------------------|--------|-------------|-------------|-----|
| 75 | CSC Beyond | CSC | 96264646660 | 96264646660 | www.cscbeyond.com |
| 76 | PACT | PACT | 96265658262 | 96265696827 | www.pactelecom.com |
| 77 | Technology Labs for Software Industry | TekLabs | 96265655310 | 96265655311 | www.teklabz.com |
| 78 | Pioneers Information Technologies Co.LT | PioTech | 96265516115 | 96265523249 | www.pio-tech.com |
| 79 | Ideal Society Center | Ideal Society | 96264777155 | 96264777199 | www.isc-jo.com |
| 80 | SAHER SOFT EST. | Saher Soft | 96264635565 | 96264635565 | NA |
| 81 | Dima Solutions | Dima | 96265561234 | 96265561233 | www.dima.com.jo |
| 82 | Jordan Company for Managing & Tracking Vehicles | Trak-Link | 96265412281 | 96265412282 | www.trak-link.com |
| 83 | CR2 | CR2 | 96265163122 | 96265163122 | www.cr2.com |
| 84 | ITABSOLUTE | ITABSOLUTE | 96265656113 | 96265656113 | www.it-absolute.com |
| 85 | Access to Arabia | Access2Arabia | 96265686588 | 96265650261 | www.access2arabia.com |
| 86 | Evanteck | Evanteck | 96265662241 | 96265662241 | NA |
| 87 | Scope Information System | ScopeME | 96265544157 | 96265544158 | www.scopeme.com |
| 88 | Alnassah Software Solutions | Alnassah | 96265335152 | 96265335031 | NA |
| 89 | NewERA for Computer Systems | NewERA | 96265560776 | 96265560778 | www.newera-jo.com |
| 90 | Vtech Systems | VTech | 96264616764 | 96264616764 | www.vtech-sys.com |
| 91 | Al-Daman for Information Technology | NetProcess | 96265512049 | 96265512046 | www.net-process.com |
| 92 | E-FILE | E-FILE | 96265655327 | 96265655328 | www.infiniteecm.com |
| 93 | Continuity Software and Information Technology | CSIT JO | 962796487691 | NA | www.csitjo.com |
| 94 | AL MUNTHAR Intentional Computers | Al Munthar | 962795542936 | 962795542936 | NA |

# UI GUIDELINES FOR ARABIC EDUCATIONAL APPLICATIONS TABLET PC

**Prepared by: Ahmed Al-Sa'di**

**Supervision: Dave Parry**

**This work is sponsored**

# Contents

# INTRODUCTION

The most important drives of this study are to comprehend better and conceivably enhance accessible for Arabic tablet PC interface design by designing an Arabic UI guideline. The design is progressively more a complex endeavour in which experts may gain access to research. The methods by which design research can be arranged and imparted to groups of practice defers, but guideline sets which concentrate on Arabic tablet PC interface configuration permit complex and multidisciplinary research to be dispersed to specialists.

This work will start to support Arabic UI designers for tablet PC in an educational context by developing initial UI guidelines and highlights some issue regards Arabic UI design. The contribution and the significance of this study added to existing knowledge, particularly for learners in Jordan, in the following manner:

Regarding UI design guidelines and principles for this domain, Arabic users may gain the maximum benefits from using a tablet PC application. Also, it may become possible for software designers to create more efficient software for an Arabic tablet PC interface. This study will enhance the usability of an Arabic-interface educational tablet PC application, by using the suggested UI design guidelines and principles and adopting identified effective methods for assessing an Arabic-interface tablet PC application.

People today are surrounded by technology, computers, mobile and tablet PC. They are able to communicate to each other, entertainment, learning and further goals. These new technologies take big parts of our lives through how to search and share the information (Klyuev & Oleshchuk, 2011).

Interaction design emphases on human behaviour and activities and provides an organised structure for the behaviours of the products and services they interact with when a user interacts or communicates with those products and services (Huang & Deng, 2008). By having a comprehensive knowledge of the goals, routines, needs and experience of the user, interaction design attempts to ensure that users can perform the right action at the right time (Gube, 2010).

One of the most important factors that determine the success of any tablet PC applications is its user interface design. User experience design mainly includes a sequence of interactions between a system and a user with the application through the UI. Therefore, it is important to understand UI and UI elements.

UI Preferences enable users to control and adjust UI features, such as display colour, font size and font type. Miñón and Abascal (2012) discussed an approach that introduces a layer of abstraction between the user interface description and its physical form; abstract interface elements can be transformed into varying concrete and individualised forms,

resulting in a generic user interface.

Users are accustomed to interacting with interface elements in a certain way, and this requires consistency and predictability in options and layout to facilitate completion, efficiency and satisfaction related to the tasks performed. The UI design focuses on the aesthetics of applications or websites by implementing strategies, guidelines and principles regarding colours, fonts, and images, for the purpose of building user confidence and increasing comfort in the use of these applications (usability.gov, 2006).

To increase the usability of UI design elements in computer applications, four elements must be taken into consideration; UI preferences, the user who will interact with this interface (user characteristics), computer technology and capability, and the interaction between the user and the interface through the computer devices (task) (Leavitt & Shneiderman, 2006).

This information will have a significant role in designing the Arabic UI guidelines for Jordanian designers and developers, through including what Jordanian high schools and universities students with an age range of (16-24) prefer in the Arabic UI design elements for tablet PC, and the highlighted impact of gender.

# WHY WE NEED THIS UI GUIDELINE

This guide offers a number of suggestions to improve the quality of educational applications for students through UI princples that fit for arabic community, UI elments we collected direct form end user (type of font type, size, colour, alignment, menu type and button type), religious symbols meaning, touchscreen gesture reference and explanation to some confusing concepts.

This guide was made through a scientific study conducted with the Jordanian young students. It was also extracted from other relevant guides taken from the specialities and constants used in the Arab world.

The design of the educational application has to be useful with an easy-to-use application interface. It is also important for it to be meaningful to the students through visual beauty and personal insights, etc. To ensure the importance of these points in the success of the Arab educational application for the tablet and to obtain other suggestions, two studies were conducted in Jordan, one was for the high school students of both sexes, and the other one was for the university students also for both sexes.

The Arabic educational application interface was shown to the students on tablets. This application had the basic Arabic educational application elements (type, size and colour of fonts, alignment, type of buttons and religious symbols). These elements were editable with multiple options to suit the preferences of the users (students). And through these two studies, differences of statistical significance were concluded in the preferences of males and females. The following tips and important points were concluded which have to be taken into consideration by the designers while designing any tablet application in Arabic.

Using guidelines provide your design and company for a consistent style, more professional user interface and educational materials, and an easy-to-learn user interface.

- **Consistent** - Usage guidelines allow content providers to produce materials that follow a uniform style.
- **Professional** - Consistent style and usage guidelines help produce more professional-looking documents and user interface text.
- **Easy-to-Learn** - Users can learn the system faster and more efficiently if all customer-facing user interface text and documents use the same terminology.

This guide is for users who build applications, write user manuals, product training programs, and any instructional or reference materials, including:

- UI Developers
- UI Designers
- User Experience Professionals

- Technical Writers
- Editors and Proofreaders
- Product Managers

# GENERAL PRINCIPLES



Many researchers have provided a user interface design principles in order to improve easy of us in HCI system (Han, Yun, Kwahk, & Hong, 2001).  Because of the UI principles give the designer a rational behind each design guidelines, we need to identify the principles which are applicable to the Arabic tablet PC UI.  We have conducted two studies with the Arabic tablet PC end user. Arabic users shared with us their preferred UI for educational tablet PCs. Also, they raised several key points for Arabic UI tablet PCs. In this section, we discussed these issues and gave some examples.

According to our studies, along with literature review, the following are the principles that we can summarise as the basic concepts for UI guidelines for Arabic educational tablet PC applications, some of which issues we discovered in our experiment and supported by literature studies.

## Design for maximum legibility

There are several other aspects of UI that impact on legibility. If we have to choose one combination of font size, colour, type and alignment for both genders, then the most preferred combination is Al-Nasikh 14- point black.



بسم الله الرحمن الرحيم    بسم الله الرحمن الرحيم
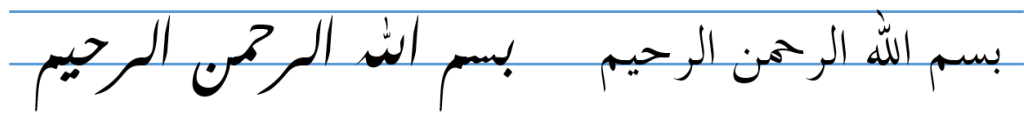
Figure 1: How font type effect the

The spacing between words and characters (kerning) is important in Arabic. The distance between the lines is one of the most important factors in the increasing readability, and the distance between words per line must be logical and suitable for reading. If the spaces are less than what they should be, this will cause confusion while reading, at the same time. If they are bigger than what they should be, this will negatively affect the user, who will think it is a different paragraph.

The text layout affects readability. In Latin script text is justified by expanding or contracting the space between letters. In Arabic script, it is done by stretching the letters themselves, which is called Kashida, see figure 2 for example.

| ( وإذ ابتلى إبراهيم ربـــــه بكلمات فأتمهن قال إني جاعلك للنــاس | ( وإذ ابتلى إبراهيم ربه بكلمات فأتمهن قال إني جاعلك للناس |
|---|---|
| إماما قال ومن ذريتي قال لا ينال عهدي الظـــــالمين ( 124 ) ) | إماما قال ومن ذريتي قال لا ينال عهدي الظالمين ( 124 ) ) |

Figure 2: Example of Arabic Justifying (Kashida)

## Add vocalisation marks

The experiment showed that there is a necessity to add vocalisation marks, which are placed on the top or below the Arabic character; these are usually used in an educational or religious text to remove and prevent confusion.

Figure 3 shows using vocalisation marks helps to have a clear reading with full meaning, since sometimes the meaning may be changed by the marks, for example two sentences in Arabic with the same pronunciation, but when we put the vocalisation marks in, the meaning is changed. Therefore, there is a need to add vocalisation marks onto the text to enhance reading for students, in addition to reducing reading mistakes.

ابْتَلَى إِبْرَاهِيمَ رَبُّهُ بِكَلِمَاتٍ and وإذ ابتلى إبراهيم ربه بكلمات

Figure 3: Vocalisation marks example.

## Use the right colours in the right places

Use colours to mark a particular word that the students should concentrate on, such as the use of a red font colour referring to the name of Allah (God) as shown in figure 4. According to our study, Arabic students preferred black fonts with a white background. However, sometimes designers change the font colour for specific reasons.

يُخَادِعُونَ اللَّهَ وَالَّذِينَ آمَنُوا وَمَا يَخْدَعُونَ إِلَّا أَنْفُسَهُمْ

Figure 4: Using a red font colour to refer to Allah's name

Contrast, the different degree of text colour from the background, scored dramatically by highlighting the text and startling the reader's eye if there is a problem while reading the content. Contrast is one of the most important things that the designer must take into account to make the text readable.

We found that most of the students expressed disappointment in designers who used

bright colours in the text to attract the user's attention; for example, one male participant said:

The designer must take into consideration users with colour blindness, who cannot distinguish between degrees of the same colours. For example; red and green are the most common colours when the patient cannot differentiate between the degree of red or green and sees them both as blue.

## Significance of the Importance

One of the lessons we designed was having religious texts coloured red for Allah's name in Arabic "الله" and green for the Prophets name. Most of our participants like to have words coloured in the text to help them to focus and make it easy to find information.

Colours have a semantic side for users and how they think about them. Word colour is an important point that designer should take into account, especially in the Arabic language and more specifically for religious texts to attract the user's attention to that point. So the importance of colours is in pointing to the connotation of the text. For example, the name of Allah (God) in the Holy Quran and the most religious books has a red font colour.

## Consider user characteristics factors (age and gender)

One of the main outcomes of this study was that both studies were done in Jordanian schools and universities, and showed that there were significant differences between males and females. Therefore, the designer should take into account these factors.

## No dead end pages

Students struggle with some applications that do not have a homepage or a return button to the previous section; therefore, it is critical to provide students with information in the fewest possible steps. Designers should minimise the steps by planning tasks well, and use gestures in the right way.
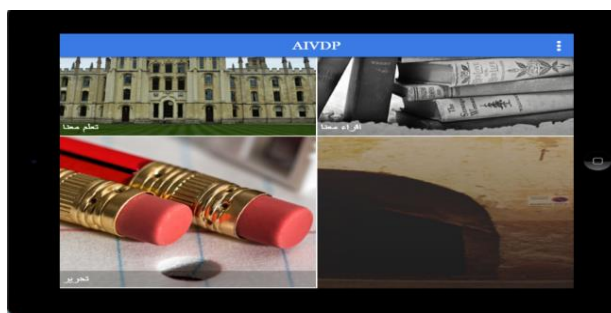


Figure 5: Example of empty and dead page.

# Simplicity and consistency

Arabic students preferred a simple design and few functions, and they emphasised that the design should be logical and familiar. The designer should build a consistent and simple application with maximum functionality and legibility.



Figure 6: Example of simple design

# Do not use tiny clickable areas

Links and buttons are designed to help the user to access the information in an easy way. Therefore, the design should be easy to tap and should have enough space to tap.

# Organise the content well

The tablet PC is a device equipped with multi-touch screens, often a camera, microphones and accelerometers. Usually, the screen size ranges from 7 to 13.3 inches. Students usually like to see everything organised, so designers should think about everything before they start designing. When they start thinking about the application, planning is essential to determine what the application will do and who the primary users are, and where they could use the application. It is important to organise the content and to define the application navigation model by using information architecture.



Figure 7: Example of content organization

# UI Preferences guideline



Arabic is a bi-directional language, in which text is presented and read from right to left, with numbers presenting from left to right. Additionally, Arabic letters occupy different spaces from English letters, depending on whether the letter is attached to other letters or not (Alsumait et al., 2009). To date, there is a lack of Arabic font variation for tablet PC, since the Arabic script is complex to design due to technical and design problems.

The Arabic language has unique characteristics as shown in figure 4, as has been cited in numerous studies (Alghamdi, Aldabbas, Alshehri, & Nusir, 2012; Chahine, 2016; Hemayssi, Sanchez, Moll, & Field, 2005). These characteristics are:

- Direction: writing flows from right to left, so any application or website should enable characters that present in this direction. Accordingly, bulleted lists, paragraph indentations, and menus are aligned to the right.
- Arabic alphabetical order: which affects sort item functions, displayed abbreviations, and acronyms not found in Arabic should lead the designer to specify the full term before translation.
- Arabic words occupy more space horizontally and set with a chosen typeface that is up to four points larger than English fonts.
- In Arabic, the letters change form according to the glyph location, that is, whether it is at the beginning, middle, or the end of the word. This alters the rhythm of ascenders and descenders, and Arabic fonts require bolding to increase legibility.
- Legibility at small sizes: Small or no inner forms tend to be confusing at low point sizes because the forms become incomprehensible and many characters begin to look similar or like ink blobs. Because of the dots and diacritic signs.
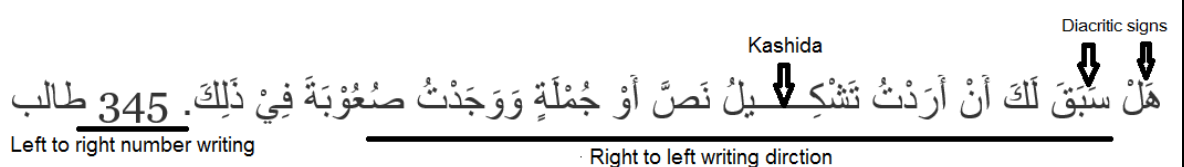
Figure 8: some of the unique characteristics of the Arabic language.

- Spacing problems: As we mentioned Arabic, the script is joined. Therefore, the spacing in Arabic is different from Latin.
- Diacritic signs also called vocalisation marks appear above or below the letters.

## 1. **Font type**

The correct font type choices contribute significantly to the users' acceptance of an application. Therefore, both school and the university studies were designed to find out the users' point of view about Arabic font types and what would they like or dislike in font type choices.

*Male students preferred Al-Naskh as the main font for reading Arabic text, whereas females preferred the Al-Farsi font.*

## 2. **Font Size**

The font sizes which the prototype presented were small (size 10), normal (size 12), big (size 14) and very big (size 16). The majority of students preferred a large size font (14-point). We also found that students preferred to change font size regularly based on font type and layout. This led us to affirm; give users features to change font size whenever they want.

*The majority of students preferred a large size font (14-point)*

Most of Arabic latter take more space than the other script, therefore we usually change the font type from Serif to Al-Naskh and we change the font size from 10 to 13 points .Also, and we set the font-weight to be thicker than the Latin script as shown in the following code.

| EN : | AR: |
|------|-----|
| span | span |
| { | { |

| | |
|---|---|
| ```
    font-family:Arial, Serif;

    font-size: 10px;

    font-weight: 100;



}
``` | ```
       font-family:Verdana, Al-Naskh
(Arabic), Arial Unicode
MS,Arial,Transparent,Sans Serif,Verdana,
Helvetica;

      font-size: 14px;

      font-weight:600;


}
``` |

## 3. Font Colour

In our study, we informed all the participants that the background of the text is white by default. However, the result showed that students preferred black font for reading Arabic text. Using pure black as the text colour on a pure white background is highly recommended in which most students felt the black font is best for readability.

Colour is one of the elements that plays a great role in the general appearance of any application and affects its aesthetic. Colour is also linked to the content and the character associated with the manufacturer.

> ***Black font on a white background was the most readable combination of colours for both genders***

## 4. Button Types

Commonly, students know that the action they need to do at the end of any application form is sent or submit. However, sometimes students become confused with several options and have to distinguish between them. Button design helps the user to know what action he or she should take; therefore, it is important to understand users' preferences about button types to help them to accomplish their goals.

Three types of the button were designed to know our participants' preferred buttons; there were coloured button, shaped button, and the typography (Text) button. After combining the two studies results it was found that all three types of buttons were preferred by both female and male students with small variations.

> ***All three types of buttons were preferred by both female and male students with small variations***

## 5. **Alignment**

The interface design for a tablet PC application is very different from the traditional PCs. It should support two design schemes (by orientation), where an adaptive layout is used to support the orientation and the different screen sizes.

Alignment of the text was also investigated as it goes hand-in-hand with text in the educational system. This is because alignment makes it easier for the user to scan a page and increases user satisfaction (Shillcock, 2013). The Arabic language is written and read from right to left. Therefore, it is expected that most users will prefer right alignment.

## 6. **Menu Types**

According to Galitz (2007), menus are used to indicate commands, properties that can be applied to an object, window and documents. Applications usually contain a large amount of information for students and perform a variety of functions; therefore, the menu is used to inform the users about the things that they can do. Menus affect students in the educational application, because they utilise the powerful capability of recognition rather than the weaker capability of recall. Designers provide the menu to remind the users about the available options that they may not be aware of or have forgotten.

Regards to the Menu Text Size and Style, most of the Arabic letters are larger than the Latin letters, such as the Arabic letter "(س) Sein" in comparison with the letter "I" " , this could affect the menu or buttons spaces. To solve this problem we used the following code

| EN : | AR: |
|---|---|
| ```
.Menu:link {

     font-family:MS Sans Serif;

     font-size:10px;

}
``` | ```
.Menu:link {

     font-family:Times Al-Naskh
     (Arabic) ,Sans Serif;

     font-size:14px;

}
``` |

# RELIGIOUS UI GUIDELINE

The picture is better than a thousand words, images and symbols are one of the most important means of illustration in education. The image speaks and solidifies in the student's mind. There are two types of pictures and symbols: pictures, biblical symbols and pictures from the reality of the lives of students, and the pictures of the scenes show scenes inspired by biblical stories or the times of the book of religion, and the other images are showing things from the life and reality of the students at the present time, Their daily lives, which must be changed or modified, based on what they saw in the written pictures.

Animal symbols differ in meaning, for example, pigs should be avoided in Islamic culture because it implies filth. Therefore, to avoid cultural confusion, most text symbols should be designed.

Religion is the main part of Arab cultures. Especially in Jordan. The majority of Jordanians are Muslims, about 92% of whom are Muslim, the Sunnis. While Christianity accounts for 6% of the total population, most Christians are Orthodox or Catholic. Therefore, the design of any application of the Arab user interface must take into account users and respect their culture.

Symbols vary in meaning among religious communities, for example, pigs should be avoided in Islamic culture because they will interfere with religious punishments for the concept of "pollution / purity".

Our study attempted to understand how Jordanian Arab students thought about the symbols of the religious side. We asked a direct question through the experiences in the sessions: "Do you have any colour or symbol that represents any religious meaning for you?" Therefore, we did not ask the student to make a definition of his religion. We can summarise students' answers by the following.
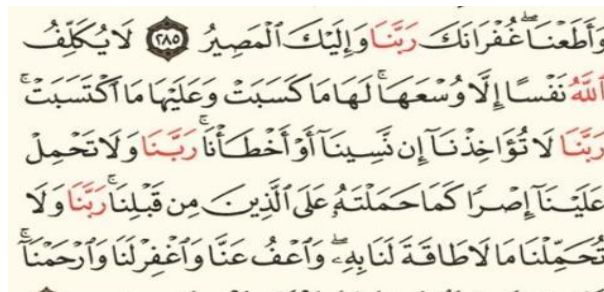
1. **Avoid using any images or symbols bearing any sexual connotations**



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2. **Do not use an image of animals that carry an unwanted meaning in Islam**



3. **Use red to refer to God's name and green theme in religious text**



4. **Use clear lines, large religious texts, and avoid embossed lines**

## 5. Use the evidence to understand the use of religious symbols

| Symbol | Religion | Meaning |
| --- | --- | --- |
| اَللّٰهُ | Islam | The name "Allah" is the most famous indication of Islam |
| | Islam | The star and the crescent is a well-known symbol to represent Islam. The symbol is not Islamic in origin, it was a symbol used while spreading of Islam, and it's still sometimes used today in the Islamic world in spite of it being controversial. It is said by many that the crescent and the star are Islamic symbols, but historians say that it was the Ottoman Empire's symbol and is not Islamic as a whole. |
| | Baha'i | A simple nine-sided star is used to point out Baha'is because it is considered as a symbol of their faith. The number "nine" is important for Baha'is for many reasons. |

| | Buddhism | Dharma Wheel is one of the most important Buddhism symbols. It symbolises Buddha is turning the real wheel or law. The wheel points out a story that Buddha achieved enlightening in a little time, and Brahma descended from the sky asking Buddha to teach by bringing Dharmachakra to him. |
|---|---|---|
| | Christianity | The symbol of the Cross, which is today one of the most well-known religious symbols used on a large scale in the world and it is the closest Christian symbol used, meaning it symbolises Christianity broadly and more specifically because it represents and keeps alive the memory of the death of the Christ. |
| | Christianity | The Fish was first known to be used as a Christian symbol within the first three centuries AD. The Christians started to use the Greek word for "Fish" which represented the short form of "Jesus Christ, Son of God, Saviour". |
| | Hinduism | Om is one of the most important symbols in Hinduism. It consists of three letters in the Sanskrit language that represents many important trips: The three worlds, Earth, Atmosphere,Sky and the three main Hindu gods. |

| | Hinduism | The crooked cross which looks like the symbol of Nazis holds a great religious importance for Hindus. The crooked cross is a graphical character in the form of a cross with branches bent on straight edges pointing clockwise. SWASTIKA is a Sanskrit language word; it is an ancient Indian language. It means "Put together well." |
|---|---|---|
| | Judaism | The six-sided David's star; it is a famous religious symbol for Judaism. David's star is a relatively new symbol of Judaism and has only gained popularity in the last 200 years. It was named after king David; legend says that he had armour with this star on it. |
| | Judaism | Menorah is the oldest religious symbol of Judaism. It consists of seven candles branching from one main candle holder. |
| | Sikhism | The Sikhism religious symbol consists of three parts: Khanda which is a two-sided weapon. This represents believing in one God. Chakkar, it's a circle representing God without beginning or end and reminding the Sikhs to continue ruling with God's rulings. Two Kirpans are representing the religious and political authority. |

# TOUCH GESTURE REFERENCE GUIDE

According to Shneiderman and Plaisant (2004) designing for an optimal UX requires understanding user behaviour and physical capability. The user needs to use his hand and fingers to tap on a tablet PC, which is a natural movement for the user. User touch has been mentioned in a range of research materials, including those of (Wroblewski, 2010), who suggests the following gestures:

- Single figure tab
- Single finger motion
- Single finger motion plus button presses
- Two finger motion (move in the same direction)
- Two finger motion (toward each other or away in opposite directions)
- Multiple finger motions (move in the same direction)
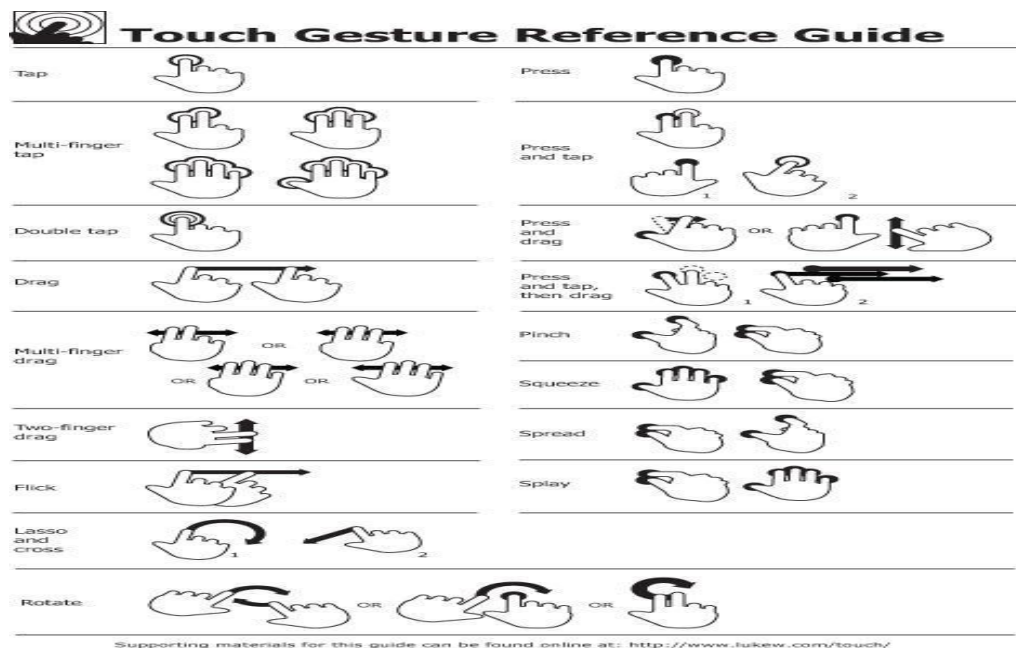- Multiple finger motions (toward each other or away in opposite directions)



Figure 9 : Touch gesture reference guide (Wroblewski, 2010).

# SOME CONCEPTS

There is a mix-up in many terms that the designer hears (Usability, User Interface, Content, User Experience) so we think that it is important to clarify these terms before demonstrating this guide. The following figure clarifies this matter:
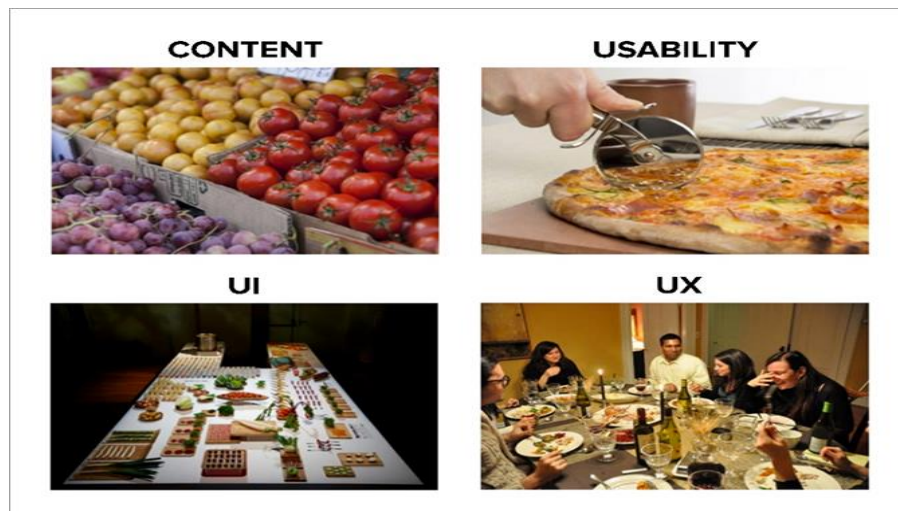


Figure 10: Usability, User Interface, Content, User Experience

The following terms: Usability, User Interface, Content and User Experience can be imagined as a meal of Pizza!

The flour, cheese, tomatoes...etc is the Content.

To prepare crispy thin dough that could easily be cut is represents the Usability.

To prepare a food table, arranging it by the number of attendants, and putting the appetisers and juice in their places, represents the User Interface.

We made an amazing Pizza that tastes good; we have prepared the food table, now is the

time of harvest/eating. Would you like some music and candles? All this represents the User Experience.

User Experience is concerned with what the user feels, his excitement and emotions that arise while interacting with the website/program/application/system. The application could be easy to use having an amazing design, but the user goes through a bad experience!!!

The terms "Usability" and "User Experience" are similar but not identical, because the second includes the first and in order to be able to differentiate well between them, we have to get rid of these beliefs:

Firstly, our belief that anything easy to use results in a good User Experience which is a false belief.

Secondly, the belief that a beautiful thing is easy to use or thinking that it's obvious that it will be easy for people to use. We do not deny at all that beautiful things are more usable but we should not ignore the other factors.

Thirdly, User Experience is a part of the whole procedure to design a website and this is wrong. The right thing is that User Experience is the procedure of designing the application not a part of it.

Fourthly, what Jacob Nielsen says is a holy script that we should follow regardless of the result…! The correct thing is that User Experience does not depend on advice and principles as much as it depending on meeting the real users face to face, knowing their problems and designing solutions based on your observations. Jacob Nielsen's laboratories did not test all the users in the world; its researches were conducted on specific groups in specific areas with specific cultures. In spite of that, we should still take into consideration what the researchers find in balance whenever we engineer User Experience (Nielsen, 1993).

# 1. **Usability**

The goal of UI is to produce a system with a high degree of usability (Rubin & Chisnell, 2008). Usability is considered one of the main factors that determine successful implementation. As defined by International Organization for Standardization (ISO 9241-11, ) the term usability refers to "the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use" (ISO 9241-11, 1998).

Usability, or ease of use, is one of the main features examined when assessing an interface. A high level of difficulty in using an interface is likely to force people to stop using it. Usability is essential throughout the software industry, because a user-oriented application design method brings business benefits, not only for users, who enjoy a high-quality application but also for the company producing and maintaining digital products (Sharp, Rogers, & Preece, 2007). Thus, usability is regarded as a central issue in designing human-computer interaction.

# 2. **UX**

The definition of user experience (UX) varies. The commonly adopted definition from researchers is that the term displays more implications than the helpfulness and utility of a product (Alben, 1996). It might be deeply affected by the 'user's internal state, the conceptual meanings, and perceptions of the product' (Väänänen-Vainio-Mattila, Roto, and Hassenzahl, 2008, p.1). UX also defined by ISO 9241-210 as "a person's perceptions and responses that result from the use or anticipated use of a product, system or service". Another definition from (Nielsen & Norman, 2014) "All aspects of the end user's interaction with the company, its services, and its products".