Culture in the design of mHealth UI: An effort to increase acceptance among culturally specific groups

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Abstract

Purpose - Designers of mobile applications have long understood the importance of users' preferences in making the user experience easier, convenient, and thereby valuable. The cultural aspects of groups of users are among the key features of users' design preferences, because each group's preferences depend on various features that are culturally compatible. The process of integrating culture into the design of a system has always been an important ingredient for an effective and interactive human computer interface. This study set out to investigate the design of a mobile health (mHealth) application UI-based on the Arabic culture. It was argued that integrating certain cultural values of specific groups of users into the design of the user interface (UI) would increase acceptance of the technology.

Design - A total of 135 users responded to an online survey about their acceptance of a culturally-designed mHealth.

Findings - The findings showed that culturally-based language, colours, layout, and images had a significant relationship with users' behavioural intention to use the culturally-based mHealth UI.

Value - This study consolidates the role of culture in the design of mobile applications for the Arabic culture in general. It encourages UI designers to implement the relevant cultural aspects while developing mobile applications.

1. Introduction

Mobile applications are widely used for various purposes. The application of mobile technology to healthcare has been determined as one factor influencing its growth prospects. This is due to the fact that mobile health (mHealth) technology can improve service productivity, efficiency, quality, cost burden, and communication. For instance, mHealth applications (apps) can help users in managing chronic diseases, electronic records, fitness, and wellness (Adepoju *et al.*, 2017; Bervell and Al-Samarraie, 2019; Henriquez-Camacho *et al.*, 2014). The number of available mHealth apps has increased by around 100 percent between 2013 and 2015 (Vignato *et al.*, 2018), to the extent that thousands of them are now available for users of all skill levels and health categories. With the rapid changes in mobile application development, mHealth applications are evolving to satisfy different users' needs. For example, the substantial increase in diabetes rates in recent years has necessitated the development of mHealth applications to address this health challenge and, in so doing, satisfy users' preferences and thus enhance their acceptance and usage. The idiosyncrasies of design preferences will likely influence the way a user interacts with mobile devices. This is where the role of culture can at most be a modest one in a complex web of interacting factors in the design of mHealth applications (Alsswey *et al.*, 2018a). In addition, modern technology is currently designed to satisfy its users' demands and preferences (Al-Samarraie *et al.*, 2019). Nisbett and Masuda (2003) agreed that members of a certain cultural group share similar ways of observing and processing information. This phenomenon can be found usually in the design of the interface of a web site with regard to the country of origin. For example, the design of

web sites in the Asian region involves colourful interfaces with cartoonish and animation elements, while European web sites present information in a straightforward and organized way (Reinecke *et al.*, 2010). The diversity in individuals' preferences (e.g., icons, navigational information, typefaces, and colours), therefore, is common within a given cultural group (Callahan, 2005). Barber and Badre (1998) and Callahan (2005) stated that different nationalities also differ in their design preferences and in their perception of usability. It is therefore important to localize the design for particular user groups, as well as in regard to their cultural identities.

The design of the user interface (UI) must be aligned to certain cultural aspects, which may influence users to resist or reject a system (Czaja *et al.*, 2019). Hence, a good understanding of cultural preferences and differences is vital for the success of any product, especially for the delivery of services to the end user in an acceptable way. It is argued that integrating certain cultural values of specific groups of users into the design of UI would increase their acceptance of the technology. Understanding the role of culture in users' acceptance of mHealth applications will support future design of new technology and their implementation in the Arab world. The remainder of this paper is structured as follows: Section 2 presents a comprehensive review of related bodies of literature. Section 3 presents the mHealth design-based culture. Section 4 discusses the research hypotheses. Section 5 presents the research methodology. Section 6 reports on the results of quantitative data. Section 7 discusses the findings of this work, as well as the practical and theoretical implications. Section 8 highlights the limitations and future research works. Finally, Section 9 presents the conclusion of the study.

2. Literature review

Culture is defined as a collective programming of the mind that distinguishes one group of people from another. This implies that people of different cultures have distinctive cognition patterns, perceptions, thinking styles, and values (Hofstede and Hofstede, 1991). Therefore, understanding how different cultural values would influence users' acceptance of technology is an essential aspect for system designers (Khaddam and Vanderdonckt, 2014; Kieser, 1994). Arab culture and Islamic beliefs are intensely intertwined. While Islam is the main religion in the Arab world, other religions and cultures are still accepted and treated with respect in Arab countries. Arab culture has its own customs, beliefs, and aspects that distinguish it from other cultures. Thus, everyday words, phrases, icons, images, and colors used in Western countries may not be suitable for use in the Arab world.

Several previous studies have been conducted on cross-cultural UI design to investigate the influence of integrating cultural values in the design of the interface on users' use of the technology. For example, Khushman *et al.* (2009) stated that the interface design of e-business web sites, which involves high power distance, high collectivism, low masculinity, and high uncertainty avoidance, is not optimally relevant to the Arab culture. This is where some researchers (e.g., Tolba, 2003) emphasize the need for understanding the role of culture in shaping the human-computer interaction (HCI) field, in which users from different cultures with various preferences for interface design may tend to process different acceptance criteria. In addition, Kyriakoullis and Zaphiris (2016) stated that addressing certain cultural aspects in the design of a system is fundamental to its success and acceptance. Ansari and Riasi (2016) found that investigating the cultural influence on customers' perceptions is important because cultural aspects can have a remarkable impact on consumers' decisions to buy or not to buy a product. The results of these studies

confirm that considering cultural differences in the design of UIs could expand individuals' acceptance and satisfaction with the system. Moreover, Marcus and Hamoodi (2009) discussed other issues related to the effect of culture (Jordan, Egypt, and the United Arab Emirates) in the design of Arabic web sites. The authors found that Arabic sites are poorly designed to reflect users' cultural profiles. Although Khushman *et al.* (2009) and Tolba (2003) have reported the effect of culture in the design of Arab web sites, there seem to be no studies reporting the role of culture in the design of mobile UI for Arab users.

A number of studies have been conducted to examine the impact of cultural differences on individuals' use of technology. For example, Evers and Day (1997) examined the differences in interface acceptance for Indonesian and Chinese users on the basis of cultural differences in terms of system usage. The authors found that although the interface designed for Indonesian users was difficult to use by Chinese users, they were still able to work with it, whereas Indonesian users favoured an interface that is relevant to their characteristics. This result is due to the higher uncertainty avoidance of users from the Indonesian culture than that of the Chinese culture. Therefore, the interfaces should be compatible with various cultures, and acceptable to the specific cultural attribute (Hsiao *et al.*, 2017; Van Biljon and Kotzé, 2008). In addition, Reinecke (2010) stated that some UI components could be mapped to suit certain cultural dimensions, especially when it comes to developing an interface to complement the norms and trends of a particular culture. Several researchers (e.g., Al-Samarraie *et al.*, 2019; Cyr, 2013; Cyr *et al.*, 2010; Salinas, 2002) have explored how different culturally-specific design attributes, such as icons, colours, language, and images, may potentially influence users' interaction with the system. In supporting this, Chen and Tsai (2007) reported that Chinese and other Asians use different design of icons in mobile UI design. For example, Chinese culture uses Glassware icons to examine the quality of the UI as compared to the use of more complex images by other Asians. Based on these observations, it can be anticipated that examining the role of the design of an interface to influence users' acceptance of technology is important.

3. mHealth UI design-based culture

In this study, an mHealth application was specially developed for Arab users based on the cultural guideline proposed by Alsswey *et al.* (2018b), in an attempt to examine its acceptance among Arab users. In the context of this study, the use of mHealth UI features was mainly to enable users to manage their medication information, such as quantity, time, dosage, type of medicine, and guidelines regarding medication. In addition, the application delivered common healthcare information (e.g., reasons and signs of particular diseases common in the Arab world). Figure 1 shows the design of mHealth UI.

Figure 1. The mHealth UI design

The UI design of this app was based on the Arabic culture aspects; namely, language, colour, images, layout, and typeface to help Arab people learn about several health-related aspects. In designing the UI, the formal Arabic language (Fusha) was applied to guarantee that the information in the UI was simple, clear, and appropriate to Arab users. This study also used three colours (blue, green, and black) that are commonly used to represent Arab culture. For example, it is anticipated that green is used to represent Islamic beliefs; black is associated with a specific period in the Islamic era, and blue represents the sky and sea. In addition, the colours red and yellow were employed in the UI design because they are used frequently in the Arab world to increase users' attention towards products and increase their interaction with the display (Marcus and Hamoodi, 2009; Mushtaha and De Troyer, 2012). In addition, a font size of 12pt and 14pt, as well as font type of "الرقعة" were employed in the design of mHealth UI to display the text along with the use of buttons and icons. With regard to the layout, the text and other UI design elements in mHealth were aligned from right to left to reflect Arabic cultural preferences. The reasons behind using these formats in the UI design were to make the reading and understanding processes as relevant as possible to Arab users (Azmi and Alsaiari, 2010). This study also used images that were commonly used in the daily life of Arab users. For more information about the design of the UI, see Alsswey and Al-Samarraie (2019).

4. Theoretical background and model

Several theories have been adapted to investigate users' acceptance of technology. The technology acceptance model (TAM) and the unified theory of acceptance and use of technology (UTAUT) have been widely used by previous studies to investigate user acceptance behaviour towards technology and information systems. Basically, TAM is a new version of the reasoned action theory which suggests that system use can be evaluated by the intention of use. It is composed of two factors relevant to computer use behaviour; namely, perceived usefulness and perceived ease of use. Additional research was carried out by other researchers, and a new model of technology adoption was developed; namely, UTAUT. Researchers have employed and tested the UTAUT model to understand users' behaviour towards technology adoption in different contexts, such as online banking adoption (Tan *et al.*, 2010) and electronic learning (e-learning) (Chiu and Wang, 2008). The UTAUT model was also applied in different cultural contexts. For example, Im *et al.* (2011) compared users' acceptance of MP3 players and Internet banking technologies in Korea and the United States. Lim *et al.* (2010) employed the UTAUT model in three culturally different groups: United States, Australia, and Malaysia. Due to the sensitive nature of health data (Agarwal *et al.*, 2010), this study applied UTAUT to investigate Arab users' intentions to adopt a culturally acceptable mHealth UI design. Figure 2 shows the research model of this study.
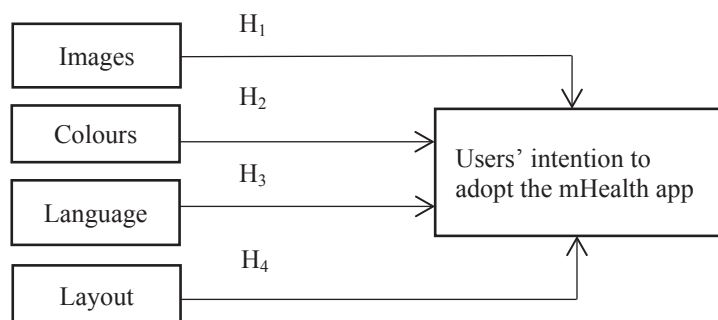
Figure 2. Research model

4.1 Hypotheses development
Mobile phones are becoming an important part of our daily lives and are the most disseminated and used devices in the world (Parasuraman *et al.*, 2017). Today, end users interact using mobile applications in different ways depending on their cultural and personal preferences, such as language, religion, habits, and customs (Hu *et al.*, 2018; Khaddam and Vanderdonckt, 2014). Thus, this study examined the relationships between these preferences in a mobile context.

4.1.1 Images
Images are considered to be vital design elements in the creation of interactive and visual environments. Images contribute to the overall graphical and aesthetic appearance of the interface and enhance the user's experience of the system (Bonnardel *et al.*, 2011; Garrett, 2010). In some cases, the choice of images' contents may be offensive to other cultures (Ross and Gao, 2016). For example, images of comic characters are used in Japan in illustrating their ideas and sharing their knowledge. However, in many European cultures, using drawn characters is not preferred for corporate use (Makkonen, 2012). From a semiological view, images and symbols are more than mere objects; they represent certain cultural values and convey social relationships. In general, images referred to as cultural artefacts contain ideologies and values, and convey "their maker's ethos" (Salinas, 2002). In this regard, it can be said that viewers of images are not passive, rather they actively participate in constructing and assigning cultural meanings to images. This led Bansal and Zahedi (2006) to propose that web site images contain cultural artefacts that have social values and subtle cultural messages. The authors found that web images provided support for the existence of cultural signifiers in the design of UI. Meanwhile, images in the interface are usually based on the cultural values and practices extant in each society (Cyr *et al.*, 2009, 2010). Thus, the relationship between culturally-based images and users' intention to adopt technology is proposed:

> **H₁** Culturally-based images have a significant relationship with users' intention to adopt the mHealth app.

4.1.2 Colour
Colour is one of the most important and influential components in UI design due to its importance in conveying cultural messages and other important display-related aspects, such as clarity, attraction, attention, and aesthetics (Kaya and Epps, 2004). For example, Arab culture has a strong association to green, black, and blue colours. Thus, the choice of colour would considerably impact the preference and choice of users with regard to the task itself. In addition, colour can be used to communicate specific meanings and feelings, whereby different cultures tend to use relevant colours in their designs. Qingbin (2009) stated that colours used by companies may directly be associated with the norms and culture of its customers. This led some researchers, such as Dias *et al.* (2010), to explore the potential of colour and its cultural meanings expressed in common sense knowledge as a potential solution to recurring problems of lack of motivation. Dias *et al.* (2010) found that culturally-based colours can influence the way a user perceives the design of UI artefacts. Based on these, it can be said that colours have different meanings and implications towards culture which may differently influence people's acceptance of modern technology (Aslam, 2006; Dhou, 2019). According to Nezhad and Kavehnezhad (2013), providing a cultural

understanding of individuals' preferences for certain colours can help marketers identify the most appropriate colours for a product. The authors concluded that culturally-based colours can be used to increase the purchase intention of customers. Thus, the following hypothesis is formed:

H₂ Culturally-based colours have a significant relationship with users' intention to adopt the mHealth app.

4.1.3 Language

The Arabic language is one of the key design features that has a strong influence on individuals' use of technology. Moreover, using the formal language in the UI design may play an important role in reducing confusion and stress among users when interacting with information and communication technology systems. A review of the literature showed different studies that have investigated the use of formal language in UI design. For example, Medhi *et al.* (2011) indicated that the usability of an interface design can be improved when the designer or developer considers the native language of the users. Nantel and Glaser (2008) stated that there is limited evidence about the link between the usability of UI and the linguistic background of its designers. Thus, using native and formal language for users is a vital factor to the success of a system. According to Hoft (1996), culture can be represented in terms of text orientation, metaphor, date and number formats, page layout, colour, and language. Devlin (2007) stated that language and culture may have an influence on the individual's experience of a system and, therefore, they should not be examined separately as they are intertwined. This has been further supported by Petrie *et al.* (2009), which reported that language and culture can shape users' preferences for the navigation layout of web sites. The relationship between culture and language has been highly linked to the usability of a web site (Llanos and Muñoz, 2007). In addition, it is likely that perceived usability may increase when the interface is conceived in the native language of the user (Moura *et al.*, 2016; Nantel and Glaser, 2008). Hence, this study hypothesized the following:

H₃ Culturally-based language has a significant relationship with users' intention to adopt the mHealth app.

4.1.4 Layout

The UI can be designed to further accommodate certain needs of the users and ensure that it incorporates the required components that are clear to understand and easy to access and use. Therefore, ensuring a convenient UI layout for users is important. The design of a layout allows users to feel more comfortable and enables them to quickly perform their tasks. However, the design layout of most mobile applications is arranged from left to right, which is not appropriate for use by Arab users. There are several studies that have emphasized the role of layout in UI design. For example, Ross and Gao (2016) stated that following specific cultural guidelines in the design of an interface would increase users' recognition. In addition, the use of cultural layout in the design of multimedia systems may trigger users' interest to use a system (Cipolla-Ficarra *et al.*, 2008). A review of the literature (e.g., Callahan, 2005; Lachner *et al.*, 2018) showed that culturally sensitive user interface design can generally represent distinct cultural dimensions that may improve users' experience and, as a result, their preferences. Hence, this study hypothesized that:

H₄ Culturally-based layout has a significant relationship with users' intention to adopt the mHealth app.

5. Methods

5.1 Sampling

In this study, Arab users with various experiences and qualifications were the main population. They were 18 years old or older with at least one year of experience in using mobile applications. This study used a convenience sampling technique by floating questionnaires to the people who were easily accessible. Individuals were approached in public areas (e.g., public hospitals, clinics, and university campuses) and were asked to participate in the study. The reason for recruiting participants from these areas is that these types of organizations have more interest in using health-related applications than others. For example, when there is no close substitute on which to base the use of the provided technology, users' motivation to participate may be low. Written informed consent was obtained from all participants. Random sampling was not used in this study due to time constraints and the practical difficulties of identifying culturally-specific users (Arab users). A total of 160 questionnaires were distributed but a total of 147 questionnaires were received from the identified respondents, which represent 91.9 percent of the total responses. Twelve out of the 147 questionnaires were incomplete, leaving 135 questionnaires for analysis purposes. In this study, the data was numeric and thus analysed using SPSS software.

5.2 Data collection and analysis

A quantitative method was used in this study to examine users' acceptance of the mHealth UI design-based culture. Precisely, this study investigated the influence of four cultural aspects – images, colours, language, and layout – on users' adoption of the mHealth app. A questionnaire was used to gather data from 135 participants. In this study, the Pearson correlation coefficients test was used to assess the relationship between the study variables. In addition, multiple linear regression analysis was also used to verify the correlation between users' perceptions of the mHealth UI design-based culture. The results from performing these tests were used to construct the model and find the significant association between the study variables.

5.3 Instrument and reliability

The questionnaire for this study was adapted from Chin *et al*. (1988) with some modification to fit the context of this study. Since all the respondents were native Arabic speakers, the questionnaire was first scanned by an English-language expert and then translated into the Arabic language by an Arabic-language expert. The questionnaire consisted of two sections. Section one emphasized the demographic characteristics of the participants (e.g., age, gender, experience in using mobile applications, and educational qualifications). Section two was designed to elicit responses on items related to the adoption of the mHealth app UI. All items of the questionnaire were measured at five levels of a Likert-type scale. Participants were asked to choose from the following; 1 = SD (Strongly disagree), 2 = D (Disagree), 3 = N (Not sure), 4 = A (Agree), and 5 = SA (Strongly agree). To improve the validity of the content of the questionnaire, a pilot study was conducted with 42 users experienced in using mobile applications before the formal data collection. Based on their feedback, the questionnaire was found to be readable and intelligible. In addition, the reliability of the questionnaire was also measured in order to confirm the consistency of the items for each construct (Drost, 2011). In this study, Cronbach's alpha of 0.7 and above was used to test the items for each factor. As depicted in Table I, the Cronbach's alpha value for all items were larger than 0.70, thus suggesting an acceptable reliability (van Griethuijsen *et al.*, 2015).

Table I. The reliability results

Factor	Items	Cronbach's alpha
Language	3	0.860
Colours	4	0.786
Images	5	0.721
Layout	5	0.762
BI	4	0.725

6. Results

6.1 Demographics

The demography of the participants for this study was analysed using simple descriptive statistics. The age range of respondents was between 18-23 years (n: 78; 57.8%). However, a few of them (n: 9; 6.7%) were between 36-41 years old. Seven respondents were 42 years or above. As for the participants' gender distribution, the majority of the participants were males (64.4%) while females represented 35.6 percent. In terms of education level, most of the respondents had a bachelor's degree level certificate (n: 106; 78.5%). A few of them had a master's degree (n: 19; 14.1%) and a Ph.D. (n: 10; 7.4%). As for the respondents' experience in using mobile apps, the majority of them had between one to three years of experience. The lowest category was those with ten or more years (n: 12; 8.9%) of experience.

6.2 Correlation analysis

The correlation coefficients between the cultural design elements and the users' intention were calculated. Pearson's correlation analysis was used in this study due to its suitability in estimating the linear relationship between variables (Ahlgren *et al*., 2003). Table II shows the correlation results.

Table II. Correlation results of this study

Factors	BI	Language	Layout	Colour	Image
BI	1	.68**	.57**	.53**	.51**
Language		1	.72**	.23**	.41**
Layout			1	.49**	.46**
Colours				1	.63**
Images					1

Table III depicts that the correlations between factors, language, colours, images, and layout were significant. According to the Pearson correlation values, 1 to 0.3 represents weak correlation; 0.3 to 0.5 moderate correlation; and 0.5 to 1.0 strong correlation (Field, 2013). Based on Table II, it can be said that there is a strong correlation between culturally-based language and users' behavioural intention to use the mHealth app ($r = 0.68^{**}$, $p < 0.01$), followed by culturally-based layout ($r = 0.57^{**}$, $p < 0.01$), colours ($r = 0.53^{**}$, $p < 0.01$), and images ($r = 0.51^{**}$, $p < 0.01$), respectively. Moreover, the results also showed a strong correlation between culturally-based language and layout ($r = 0.72^{**}$, $p < 0.01$); and a moderate correlation between culturally-based language and images ($r = 0.41^{**}$, $p < 0.01$). However, the relationship between culturally-based language and colours was weak ($r = 0.23^{**}$, $p < 0.01$). The same was true for the relationship between culturally-based

layout of the UI towards mHealth and choice of culturally-based colours ($r = 0.29**$, $p < 0.01$). The relation between culturally-based layout and images was moderate ($r = 0.46**$, $p < 0.01$). Finally, the relationship between culturally-based colours and images was significantly strong ($r = 0.63**$, $p < 0.01$).

6.3 Factors affecting users' adoption of mHealth

To determine the factors influencing Arab users' adoption of mHealth in this study, stepwise multiple regression was applied. Multiple linear regression is commonly used to model the relationship between two or more variables and a response variable in which every value of the independent variable is associated with a value of the dependent variable. The appropriateness of the regression analysis was evaluated to guarantee that there was no violation of the assumptions of multicollinearity, normality, and outliers. All responses were found to be normally distributed and no extreme outliers were detected. The multicollinearity test, according to Kock (2016), was tested using the variance inflation factor (VIF) values. Consequently, VIF values below 3.0 shows no multicollinearity. According to the findings of this study, all VIF values for the relationships between the variables ranged between 1.66 to 2.25, which are below the 3.0 threshold (Kock, 2016). Table III depicts the VIF values.

Table III. Multicollinearity VIF statistics

	Tolerance	VIF
Images	.51	1.95
Colours	.60	1.66
Layout	.44	2.25
Language	.47	2.13

The multiple regression test was lastly employed to test for predictive significance between the dependent and independent variables. The findings of the stepwise regression are shown in Table IV.

Table IV. Results of the multiple linear regression analysis

Hypotheses		Unstandardized coefficients		Standardized coefficients	t	p	Results
		B	Std.Error	Beta (β)			
H_1	Images→ BI	0.55	0.13	0.38	4.52	0.000	Supported
H_2	Colours→ BI	0.38	0.07	0.44	8.35	0.000	Supported
H_3	Layout→ BI	0.73	0.02	0.55	9.31	0.000	Supported
H_4	Language→ BI	0.59	0.06	0.66	7.42	0.000	Supported

Table IV shows the regression coefficients values using a stepwise regression method. The findings depicted that the behavioural intention of Arab users was

significantly associated with culturally-based images ($\beta = 0.38$, $p < 0.05$), colours ($\beta = 0.44$, $p < 0.05$), layout ($\beta = 0.55$, $p < 0.05$), and language ($\beta = 0.66$, $p < 0.05$). Evidently, culturally-based language was the strongest predictor affecting users' behavioural intention to use mHealth.

7. Discussion

The results of this study showed that all constructs – namely, culturally-based images, language, colours, and layout – had a significant relationship with users' behavioural intention to use mHealth. The finding of this study showed that the culturally-based language was one of the main design elements which had an influence on the design of the mHealth UI. This can be due to the importance of formal language in reducing confusion among users when interacting with the display (Khanum *et al.*, 2012). It is anticipated that designing an interface based on the cultural preferences of a certain group of users might increase people's acceptance of technology. This result is consistent with the findings of Medhi *et al.* (2011), who indicated that the usability of the UI increases when the native language of the users is considered in the design process.

The choice of colours had a significant relationship with users' intentions to use mHealth. Cultural colour preferences may vary among users from different cultural backgrounds (Dhou, 2018; Ruse *et al.*, 2019). A possible reason for this relationship is that the main design elements of the mHealth UI (e.g., buttons, images, labels, and icons) became more attractive and clearer for users when using colours that are relevant to their cultural values, hence making it easier for them to complete their tasks efficiently. In addition, understanding the use of certain colours can help UI designers to define and promote users' interaction with the interface (Kondratova and Goldfarb, 2011). This finding is in line with some previous studies, such as Čok and Duhovnik (2016), Walton *et al.* (2002), and Hasan *et al.* (2011). This led us to anticipate that using culturally-based colours in the design of the UI can help create a trademark and is also the simplest way to promote user interaction with the display.

Moreover, the results indicated that the layout of the mHealth UI had a significant relationship with users' intentions. This is related to the fact that the direction of reading and writing in the Arab world starts from right to left which influences the way users process information and make decisions. In addition to that, some habits, customs, and activities that derived from religion require people to start from right to left in most cases. This result is consistent with findings from other previous studies. For example, Ross and Gao (2016) stated that it is essential for the layout to follow a specific culture that is recognizable amongst other applications to allow a wide range of users to use the application. Also, this finding is supported by Hofstede (2001) in which he stated that Arab people prefer to complete their tasks in a simple manner and follow their traditional way of life.

This study also found that the choice of images in the design of the mHealth UI had a significant relationship with users' intentions. A possible reason behind this relationship may be related to the fact that Arab users are used to symbolic and common Islamic images in their everyday practices. For instance, when it comes to the use of technology, users' history and their Islamic civilization can be reflected through the use of cultural images and symbols. This finding is in line with the work of Hofstede (2001) and Hall (1976) who have reported that Arab society as a social society, cares about reputation, dignity, shame, honour, and pessimism. In addition, this finding is supported by Benaida (2014), who conducted a study on the UI design

of Arabic web sites, which showed that Arab users gave higher attention to images that reflect their history and culture.

Furthermore, this study shows how culturally-based UI design can help promote users' behavioural intention to use technology. It is anticipated that the proposed UI design-based culture can inspire strategies for guidance to system designers. This includes consideration of the specific culturally-based design features that drive users' acceptance of mHealth apps. In addition, using relevant types of design elements (e.g., colours, layout, images, and language) can help, in a way, to make sense of the offered services, which can be directly linked to users' use of technology. For instance, when preferences for design features are met, users are likely to have greater confidence in using the technology. It is precisely the consideration of cultural images in the design of mHealth applications that shape the health behaviours of a specific culturally and linguistically distinct group. Meanwhile, when certain cultural preferences dominate the design of mHealth applications, individuals' decisions are likely to be guided by their immediate objective and the relevance of the design elements to the attainment of this objective.

The findings also offer some theoretical insights. For example, the use of certain cultural features in the design of UI has been studied in the fields of human-computer interaction, organizational behaviour, and information technology. However, a few studies investigated the association between culturally-based images, colours, language, and layout with users' acceptance of technology. For example, a few previous studies found that using the traditional Arabic language in the design of UI can improve the comprehension of heterophonic homographs by facilitating access to semantic representations (Al-Samarraie *et al.*, 2019). According to De Marsico and Levialdi (2004), the language used is a very important source for establishing textual links in order to meet users' expectations. The findings of the present study add to the evidence on the importance of cultural features in the design of mHealth applications. This includes providing reliable and valid measures of culturally-based design features for investigating users' intention to adopt the mHealth UI, and thus their acceptance of it within society. Based on the findings about the relationship between culturally-designed elements and individuals' intention to use mHealth, this paper adds to the existing technology acceptance literature (e.g., Choi *et al.*, 2018; Leung and Chen, 2019; Miao *et al.*, 2017) by investigating how preferences for colours, language, layout, and images are related to individuals' physical surroundings and experiences.

8. Limitations and future works

There are some limitations that need to be addressed in the future work. First, the sample and the data collected in this study was restricted to Arab users and Arab culture, therefore, the results cannot be generalized to other cultures and users. Second, the adapted UTAUT model was used in this study instead of the new version, which may expose new dimensions. Third, the cultural aspects of the UI design in this study were limited to the images, colours, language, and layout.

Based on these limitations, it is suggested that future studies should investigate the relationships between people's preferences to use certain design characteristics (e.g., symbols, icons, and font type) from a cultural perspective and their acceptance of mHealth applications. Future studies may also consider the use of other theoretical frameworks, such as UTAUT 2, to expand and strengthen the analytical and conceptual framework of this study. In addition, future studies may consider examining the moderator effects of certain demographic criteria, such as age, experience, background, and size, on their acceptance of cultural UI design. Specific

cultural dimensions such as the one identified by Hofstede (2001) and Hall (1976) can be used to categorize Arab users according to their cultural profiles. Finally, future works may also apply qualitative methods to explore other culturally-based patterns that could be linked to users' use of mobile apps.

9. Conclusion

Despite the rapid increase in mobile users in the world, users' interaction with mobile applications can still be influenced by various cultural preferences. This study attempted to investigate how mHealth UI design-based culture can affect people's acceptance of technology. The influence of culturally-designed elements, such as language, colours, images, and layout, on Arab users' intention to use mHealth was investigated. The findings showed that Arab users had a positive intention toward using mHealth designed in accordance with their cultural preferences and values. Findings from this study show the role of culture in enhancing users' acceptance of mHealth. It also encourages UI designers to implement the relevant cultural aspects while developing mobile applications.

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