Towards Understanding Learnability for Operating Systems in Smartphones

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Abstract:-Smartphones are grown very fast nowadays than in the past. People from different ages are using smartphones to surf the Internet, organized activities, paly games, etc. while different parties are competing to design more learnable applications suitable for all ages. A set of learnability features of the applications will be considered in the comparison between two common operating systems of smartphones through classifying different criteria into design approaches of user interfaces.The main purpose of this research is to investigate the learnability feature in smartphones considering different operating systems (mainly Android and iOS) to evaluate the ability of each system to improve the learnability for the users. In this paper, we will compare two common operating systems for smartphones applications in terms of their learnability.More specifically, we are not interested in improving the learnability of smartphones applications by designing a new user interface for one of the smartphones operating systems, but rather we aim to describe the characteristics of learnability in both operating systems.This research is focused on two types of learnability: basic learnability and advanced learnability.

I. INTRODUCTION

The development of smartphones applications has rapidly grown in an unusually short time. Smartphone is a portable phone that provides capability of connectivity and computing, as well as allowing users to install and use applications [6]. The developers can transform their ideas into real applications that have a wide range of domains such as education, medical, sport, etc.[4]. Smartphones applications do not need only an attractive user interface that looks good, but also good quality of smartphone applications should able to reduce physical and mental stress, shorten learning time, and help users to operate an application in consistent way [1].

Abundant platforms to create smartphones applications including Google's Android, Apple's iOS, BlackBerry, Nokia's Symbian OS, and Microsoft's Windows Mobile. However, the most common two operating systems in smartphones applications are Google's android and Apple's iOS[4].

There are a set of heuristic evaluation strategies should be considered when evaluating User Interface (UI) of smartphone applications. Some evaluation strategies are: 1) The perceptibility of the system status and appropriate feedback to keep users up-to-date with the progress of the system in a sensible time. 2) The mapping between real life conventions and system components to keep users familiar with the function of each tasks in natural and logical way. 3) The user control and freedom to enable users to do what they want to do in an uncontrolled context. 4) The consistency with standardized principles to design elements consistent with the same meaning for several conditions. 5) The prevention of errors to reduce overall time of learnability. 6) The principle of recognition not recall to design visible and recognizable options of elements and objects. 7) The efficiency and flexibility use to shorten the time by providing shortcuts and customized frequently used functions. 8) Help and assistance optionality to allow user rapidly fix errors by displaying a warning messages that show the error and its proper solution, as well as providing helping information properly documented easy to search and find [7].

More learnable application allows users to take less time to learn how to use and perform different tasks although they are not trained to use it and without using the documentation of that application [7]. In general, human perception gives us a realization of spatial memory of objects [5]. Learnability refers to the level of usability of an interface that enables end users to perform simple and complex functionalities without errors and in less time [1]. Learnability is one of the main critical elements of the usability; that contains other factors such as efficiency, satisfaction, memorability and performance [2].

Particularly, the lack of relevant technology experience and the slowness of an application are not considered here since

they are dependent to the human knowledge and the quality and power of a smartphone not operating system. The difficulty of learning to use technology is not concerned in this research, since it depends on a set of personality characteristics not on the design of an application. A set of learnability features of the applications will be considered in the comparison between two common operating systems of smartphones through classifying different criteria into design approaches of user interfaces.

The main purpose of this research is to investigate the learnability feature in smartphones considering different operating systems (mainly Android and iOS) to evaluate the ability of each system to improve the learnability for the users. In this paper, we will compare two common operating systems for smartphones applications in terms of their learnability. Particularly, this study helps developers to choose the best operating system or platform for developing application in terms of learnability issue.

In this paper, we are motivated to answer the following main questions regarding the design approaches and learnability criteria for smartphones operating systems:

- How Android and iOS smartphones operating systems improve the learnability of the applications for the users?
- What are the main factors that affect the learnability in two chosen smartphone operating systems?
- How to evaluate the applications of smartphones in regard of learnability for iOS and Android platforms?

II.   LITERATURE REVIEW

Multiple mobile applications were developed that operate on a specific number of operating systems. Some of them are cross platform applications that can operate on any operating system, while others may be platform dependent. However, every platform is independent and has its interaction philosophy to create mobile applications with interaction design.

The first version of Android was released in 2008, while the present version is Android 5 (also called Lollipop) [11]. The first version of iOS was released in 2007, while the present version is iOS 8 [11]. As known, iOS and android are the two most common smartphone operating systems and they are the first options while developers want to develop smartphone application [7]. Learnability is one of the main measures used to determine the Usability, which falls under the human computer interaction field of research. Furthermore, it is an ongoing discussion due to the many interfaces frequently developed for devices [12].In the following subsection, I provide several related works to my study ordered from the newest to the oldest.

Wukkadada et al, 2015, [10],have compared between iPhone and android operating systems with respect to various issues such as customer concerns and developer knowledge. The key comparison criteria considered memory randomization, built in antivirus, and data storage format. The results of the paper have confirmed that iOS limits the used hardware which cannot be easily obtained. This issue motivates customers to prefer Android operating system which is much cheaper and even freeware. On the other hand, iOS error reporting is better than Android. Therefore, error reporting helps users for more experience inn learnable interfaces.

Barea et al., 2013, [3], have compared the discriminations between the two common operating systems of smartphones, android and iPhone in terms of the interaction philosophy. Three possible cross platform approaches were discussed for consistency purpose and marketing objective. The results showed many differences among the design approaches and interaction ways and decisions. iOS has more constrained interaction design than Android ones. For this reason, Android has better interaction design than iOS that enables Android to be further extended due to the usability features, platform conventions, and user satisfaction and acceptance.

Phillips et al., 2011, [8], have considered the technique of knowledge production of the operating systems such as the possibility of open source and accessible infrastructure of surveillance. The results of the study have proved the capacity of google to become a typical mass media corporation by predicting the political and cultural consequences in the process of making profits. The authors expect that the surveillance of google products mainly android operating system in the cloud is much larger than other products. This refers to the easily to download, understand, remember, and learn.

Goadrich & Rogers, 2011, [4], presented a brief description of Android and iPhone operating systems through making a comparison between them in terms of their performance, growth, and platform. In addition, several support features in each operating system such as security, usability, as well as other advantages and disadvantages were discussed. The main goal of the paper was not to determine the winner between two operating systems but rather to specify which is the best one from the perspective of our favour.

The study of [11] has compared between the interface design of top three mobile operating systems considering human computer interaction principles. The study has conducted a quantitative experiment by distributing a questionnaire to ask the participants to perform some ordinary tasks on three different platforms. The results proved that Android was the best in terms of interaction design, whereas other platforms such as iOS and windows phone were the worst. The

discussion presented in the study has confirmed that novice users do not prefer to use iOS interface design.

III. DISCUSSION

We are focused into two types of learnability: basic learnability and advanced learnability. We are intended in investigating learnability feature of smartphones applications and studying the main differences between two mentioned above operating systems. Hence, we are not interested to improve the learnability of smartphones applications by designing a new user interface for one of smartphones operating systems, but rather we aim to describe the characteristics of learnability in both operating systems.

Form development perspective, the computers used to develop iOS applications should be powerful and restricted to running on Macintosh OS since the size of smartphones applications are small in general. In contrast, Android OS is not restricted to the operating system of the computer used to develop an application; it can be developed on a computer running Linux systems, Mac OS and Windows. This feature gives Android applications more flexibility to develop using most operating systems without any specialized hardware and requirements [4].From usability and learnability perspectives, one of the most crucial factors of the learnability is the time take in understanding the functionality of each element in an application, so less time indicates more efficiency [7].

Basic Learnability Features	Advanced Learnability Features
- Simple enough - Easy to understand - Easy to learn - Easy to remember - Small icon used - Natural page flow - Visible navigation - Interactive contents - Progress and status of system - Description of each element - Meaningful warning messages - Teach user how to fix errors - Consistency of content - Familiar layout	- Use visual design and behavioral design. - Show all information needed to complete process. - Enable users to make decisions. - Responsibility control of the user actions. - Keep user aware and informed with the accurate status. - Tested by color blond individuals. - Top level consistency, platform consistency. - Easier and faster interaction. - Splash screens, feel single app, and visualized design elements. - Small visible structures including buttons, symbols, scroll bars, icons, etc. - The location of elements. - Interpretation of user behavior - Discoverability - Allow undo option. - Understandable, self-consistent, and stable - The inclusion of metaphors to enable users to rapidlytrigger their memories. - high contrast readable text. - using keywords to form unique button labels, menus. - Make balance between easy to use and easy to install.

Table 1 shows some propositions of the author regarding basic and advanced learnability features of mobile operating systems. It contains a set of principles or rules that help developer or examiner in designing and evaluating the proper characteristics of smartphone applications either android or iOS.

Some of the measures of how much an application is learnable and functions of the learnability measurement (the level of the learnability) are [9]:

- Measures of how effective such as number of function learned and the percentage of users who successfully manage learning.
- Measures of how efficient such as time taken to explore, time taken to learn, time taken to re-learn, and the efficiency of learning (performance).
- Measures of how user is satisfied such as the use of a scale to rate the ease of learning.
- Other measures such as number of encountered errors, time to fix errors.

From the perspective of the author, user's satisfaction is dependent to the learnability feature since high learnability level of any application helps the user to quickly learn the functionality, aim, and how to use that application and then to be more satisfied. Hence, the ability of user to fix some errors or to recover from system crash lead to increase the probability of scaling learnability score or level.

Learnability can be measured through an establishment of an analysis considering different factors such as the level of competence, feedback from users, user help and assistance, user interface usability, the visibility and the location of icon (operation), prevention of errors, contrast in function, design standards, the sequence of tasks, the presentation of information, the coverage of system functionalities, the attractiveness and interactivity of content, the direction of the elements, the completeness of information, the clearness of an operation text, etc. [7].

In the following subsection, we provide a set of important learnability criteria that comprise the major components of learnable smartphones applications and affect the use of an application [6].

- Design space of improving the learnability.
- Permanency of learning support.
- Icons apply learnability support.
- Source of learning support.
- Changes in functionality.

Based up on, the design of smartphones applications should consider learnability features to support more enhanced usability. Thus, it helps in supporting many other measures like metaphors clarity and indication, icons and buttons interpretation, and functionality changes adaption. After this overlook about the learnability feature, we conclude the requirements for good learnable applications based on operating system or platform of smartphone, mainly iOS and Android in Table 2.

Criterion	Differences		Similarities
	Android	**IOS**	
Navigation	The action bar in Android is placed on the same location that the back button in the bottom part of the screen.	The navigation in iOS relies on the top-positioned navigation bar.	
	The action bar in Android holds a control to alternative views, action buttons like the search and the app icon.	The navigation bar in iOS holds a title for the current screen, the back button, and, buttons in its right part.	
Screenshot			

Screen logical regions	Both Android and iOS utilize the rest of the screen with different regions.		Both platforms have a status bar in the top position of the screen.
	The main action bar on top is only considered in Android. The content area utilizes the rest. Content area also may be further partitioned into several optional bars (upper,body, and lower bar). This enables to split action bar from the content bar and to optionally addore controls. Android also offers the possibility of a sliding drawer to show a menu hidden under the current view.	The rest in iOS is partitioned intothree bars: top area, the content area, and a tool area. Top area holds the navigation bar, whereas tool area may hold a tab bar, a toolbar, or a segmented bar.	
Settings	The most general approach set up optionsdiffer from one platform to another. These differences strongly affect the expectations of users from the functionality of each item that might be changed perapp settings.		
	Only one type of setting is considered by Android. Standardly, settings of the app are located inside the app itself. The name of button is "settings" that islocated inside the action bar.	In iOS, app settings differ than app preferences; App settings can be reached from system settings that are not changed frequently; while App preferences are configured from inside the app and optionally can be changed on regular basis.	
	Android design, the other way around is adapted harder than iOS.	The diversity of elements and options of interaction design in iOSis narrower than Android.	

Based on Table 2, it seems that there are many differences between two most common operating systems of smartphones, namely iOS and Android. Therefore, the differences distinguish one system from the other in terms of learnability feature. Subsequently, the operating system with less time to remember and less time for thinking provide more popularity and demand by customers or users of that operating system. Lastly, more points of learnability go beyond Android operating system, which has an easy to use interface, familiar layout, logical organization, and reasonable real-world connection to icons and labels.

IV. CONCLUSION

A set of learnability features of the applications were considered in the comparison of two common operating systems of smartphones namely IOS and android. The study included a classification of different criteria mapped into design approaches of user interfaces.The main purpose of this research was to investigate the learnability feature in smartphones considering two mentioned operating systems to evaluate the ability of each system to improve both basic and advanced learnability for users. We compared two common operating systems for smartphones applications in terms of their learnability. In conclusion, iOS platform is more learnable than Android due to the many features introduced by iOS operating system such as variety of options, consistency in design, and support of higher security.

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