Measuring the Effectiveness of Designing End-User Interfaces Using Design Theories

Completed Research

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Abstract

Software systems could be the most important technology present in almost every human task, which is intended to enhance performance. Humans interact with software systems using a computer interface. However, many developers have not been exposed to courses on Human-Computer Interaction, they sometimes, develop software using their own preferences based on their skills and abilities and do not consult theories that could help them create ad-hoc interfaces. This issue is very important specially when the intended end-user has no enough experience in using technology. A study was performed to identify what are the main attributes that an application for managing crops must have. Two different HCI interfaces versions were developed and tested by using interface development principles. Results allowed developers to identify which features are better in each version so that the final version can be developed and expected the better outcomes for end-users. Results should be taken cautiously.

Keywords

Graphical user interface, end-user, application development, software quality, information systems.

Introduction

More and more frequently, humanity faces new problems. Many of them are inherited from very old inattention, bad decisions, or simply irresponsibility of our ancestors. The increase in the birth rate, the inefficient food production and the high contamination of soil, air and water are three of the most serious, which are closely linked. Research and recent technological developments have tried to contribute ingeniously, efficient and economic solutions to these problems. The World Bank reports that "the world will need to produce 50% more food to feed the projected population of 9,000 million people by 2050. However, climate change could reduce crops by more than 25%. Land, biodiversity, oceans, forests and other forms of natural capital are being depleted at an unprecedented rate unless we change the way we grow food and manage our natural capital, food security will remain at risk, especially for the poorest " (Fukase and Martin 2017). Latin America countries have special interest in addressing these issues because such problems are largely present in these countries. We believe that a prototype that contributes to alleviate the problem of food production issue is in great need. This could help meet a basic principle that "each person on the planet has a safe, nutritious, and affordable daily diet" (WBG 2016).

Information systems (IS) is probably the most influential technology nowadays. Burton-Jones and Grange (2012) argue that IS must be used effectively so that end-users are able to obtain maximum benefits from them and very frequently this simply does not happens. In addition, mention that "despite a great deal of research on when and why systems are used, very little research has examined what effective system use involves and what drives it" (p. 632).

Many software systems developers have never taken a Human Computer Interaction (HCI) course because most developers are trained in Computer Science and Engineering degree programs, most of which do not offer such type of courses. For example, in Mexico, IS development is normally taught in Engineering programs and up until recently these programs did not typically offer HCI courses. Computer Science programs at some of the most well-known institutions in the United States (e.g. Yale University, Cal Tech, among others) did not offer an HCI class in 2016-2017. However, we believe that interface design is a necessary component of effective systems development. Although curriculum changes may address this problem for the next generation of systems developers educated in Mexico and elsewhere, the lack of knowledge of interface design for current developers remains a problem. For example, we talked with managers of three Mexican software development organizations who asked for advice on interface design. They stated that their software developers create application interfaces based mainly on their own preferences rather than those of their end-users.

As a first step, we identify a set of 11 recommended guidelines in existing literature (Blair-Early and Zender (2008). Then, a single team that was trained in using such HCI guidelines developed two different versions of a software application for cropping management. The purpose of this paper is to report the results of a study that users evaluate such versions in order to identify the best design for each guideline. The paper concludes with an assessment of those features based on the guidelines, and a discussion of limitations and future research ideas

Literature Review

Agriculture and Humanity

Since the start of humanity one of the main tasks that dedicated a lot of time was to obtain food. Initially, they collected and hunted their food, causing a nomadic life, which was full of uncertainty. Thanks to their intelligence and ability to learn, humans, step by step, acquired experience and knowledge related to how to cultivate plants and raise animals for their consumption as food; therefore, generating agriculture and livestock. By ensuring their own food production without relying exclusively on nature; thus, humans initiated civilization. Upon settling, humans entered an exponential growth through time. With this, increasing in equal or greater measure the needs of habitation, as well as food production, where the last is the most important for their subsistence. At the beginning it started only with a few plants such as wheat and barley, although it is possible that it was developed independently and simultaneously in different parts of the planet. passing this basic activity was developed and refined to feed an increasingly large population.

During the times dominated by the Romans, cereals, legumes and vegetables were added to the list of crops. In addition, techniques such as Roman plough and furrow were used, that is, cropping was performed using technology increasingly. Technological innovations continued in the Middle Ages such as the introduction of the wheeled plough, hydraulic and wind mills, among others, which allowed to increase performance and to produce larger crops. Later, in the Modern era the variety of crops was diversified enormously due to the exchange of seeds between the American continent with the European as well with the rest of the world. With the arrival of the greenhouse in 1850 an alternative was created in the production of crops, which allows to isolate the crops from pests and climate changes, in addition controlling temperature, humidity and other external factors. This was a great innovation with which it is possible to recreate crops of a certain type of climate from different regions.

As the time passed, agriculture continued its tendency of creating and using techniques and technologies in order to enhance cropping. With the initiatives created during the Green Revolution (or Third Agricultural Revolution) cropping continued its tendency; which caused a qualitative jump in technify crops around the world; using the best techniques and technology available such as high-performance seeds, among others. Such performance enhancement was archived by using fertilizers, pesticides, intensive irrigation, agrochemicals and agricultural machinery. However, these advancements increasing pollution, soil and water contamination, diminishing soils quality because of the effects of chemicals in the local biodiversity. As time passed, new crop optimization methods were in high demand, availability of land for crops, and climate issues arose; therefore, new technologies were created for solving these problems. Traditional agricultural methods face several problems such as rain scarcity, flooding, soil exhaustion, among others. In summary, it is important to create innovative ways of cropping that impact environment at a minimal rate. Thus, technology can be a very helpful tool in solving those critical issues.

Techniques and Technology in Agriculture

One of the innovations (or improvements) related to cropping has been: hydroponics; in which the roots of the crops receive the nutrients through a chemical solution, allowing them to grow in an inert medium, such as washed sand, gravel or perlite, among others. A more advanced and technologically more demanding technique is aeroponics, in this technique, plants can be grown in a fog environment without making use of soil. In this alternative, the cost of water and nutrients is much lower, however, the installation cost is higher and requires constant supervision; such high cost can be recovered as more harvests are obtained; therefore, in the long term it could be cheaper.

Existing literature (Castelló Ferrer, et al., 2017) mentions that in the upcoming decades it will be necessary to greatly increase food production in order to meet food needs so that population growth cab be feed. Countries, research organizations, as well as individuals have tried to solve this problem, some achieving better success than the others. Additionally, private and public organizations are interested in producing fertilizers and chemical components to be used in innovatively in agriculture (Castelló Ferrer, et al., 2017).

Technology could be used to mitigate the problem by using it in innovative ways for food production. For example, using a personal computer by a family for food production (Castelló Ferrer, et al., 2017), green architecture has been included in urban buildings as an additional component (Specht, et al., 2014), controlled environments in vertical agriculture installed in buildings (Despommier 2011), controlling crop environment in order to improve production compared to the open option (Story, et al., 2010), use of sensors to take care of the quality of the agriculture environment (Aqeel-ur-Rehman, et al., 2014; Díaz, et al., 2011), among others. It is important to mention that technology has helped to solve food production problem but has not solved it yet.

Developing countries face two big problems: food production and access to technologies for doing it. Therefore, it is extremely important to develop/enhance cheap and efficient technologies that increase performance, which can be implemented/installed easily, at a low cost, and can be used by almost any person. Maybe this would help to enhance cropping performance.

Existing Technologies.

There are already some technologies that are being used in food production. All of them trying to solve the problem of producing food by controlling important aspects such as: climate, cropping, pest control, among others. Some that are reported are: use of wireless sensors (Díaz, et al., 2011) which were used for the grape production and to improve the quality of wine; these sensors measured soil humidity, temperature and luminosity; however, results are only limited to the wine industry. Aqeel-ur-Rehman, et al. (2014) found that the use of wireless sensors is complex to implement and requires a lot of technical support, it is expensive and there is no a generalized solution. Computational vision was used for the production of lettuce in greenhouses (Story, et al., 2010), which proved to be a very good solution although the algorithms have yet to be improved and had a high cost. Urban vertical greenhouses (Despommier 2011; Specht, et al., 2014) allow to have control over climatic and pests' aspects that affect food production, reduces the cost of transport and risk of contamination, although large spaces and investments are required. Use of robots in food production developed by MIT and detailed by Castelló Ferrer, et al. (2017), this is a very costly solution. A small controlled environment for agriculture with the use of new technologies to create a that allows enhancing the productivity of agriculture in spaces ranging from a small farm or garden to a single plant within a home (Lameski, et al. 2017), but requires extensive use in order to achieve optimal performance. Finally, the use of a personal computer for family food production (Castelló Ferrer, et al., 2017), which is a novel system but uses technology that may not be accessible to everyone since the components are not easily found in developing countries as well as the associated costs.

Technologies in Food Production

It is important to mention that implementing a technology solution is not for everyone. Therefore, adding an Information Systems (IS) for monitoring and controlling such technology would enhance the chances of success for people that is not technology savvy. Thus, technology use hazards can be minimized. IS are software that allows humans to interact with hardware and displays information easy to read, easy to understand, and easy to interact. Hence, humans can make better decisions, corrective and preventive actions, stay in control of the technology, and to obtain information regarding the current state of crops.

However, an IS that allows all of the above demands a perfect set of interfaces. A very good interface is the one that takes into account end-user demographics such as: age, schooling, age, and other aspects (e.g. disabilities) that target humans might have.

Human-Computer Interaction

The process of visual communication plays an important role in the design of interfaces for IS, since it guarantees compliance with the goal of informing on time and with the correct information. Within this process, the design is aesthetically effective and attractive to the target audience, as well as the readability and functionality of the messages that wish to be communicated.

Interfaces

Blair-Early and Zender (2008) argue that an interface is the first product or service that an end-user touches to interact with an IS. An interface is the visible part of the systems that contains elements to facilitate the interaction (Mazumder, 2014) with a computer. In addition, it is in charge of connecting humans with computing resources such as: operating systems, applications, and data. Individual preferences have an impact on how each person prefers to interact with an IS. "In many cases, the way we access and use, and even the degree to which we rely on technology, may be vastly different from generation to generation" (Blair-Early & Zender, 2008, p. 85). Interfaces have an impact for people to increase productivity (Orubeondo & Mitchell, 2000). Therefore, interface design should include human factors principles (Staggers & Kobus, 2000) so that end-users' acceptance and use might be enhanced.

Design Guidelines

It is well known that software is an intangible product; thus, its quality depends the most on the perception of each end-user. For the present study, the principles proposed by Blair-Early and Zender (2008) to design the training content of the interface were chosen. While many researchers, consultants and organizations have proposed many other guidelines for interface design (Apple_Inc, 2018; Constantine, 1999; Nielsen, 2013; Sollenberger, 2018; Ta'eed, 2008; usability.gov, 2018), it was partial to the fact that Blair-Early and Zender used the Design research to develop its principles. Furthermore, in a continuum from general to specific, it was found that the principles of Blair-Early and Zender were in the middle range. Moreover, we found that there is a high correlation between the various sets of principles studied, which provided nominal validity for the use of the chosen set. Following is Blair-Early and Zender's list of nine principles and how they were implemented in the design of the training.

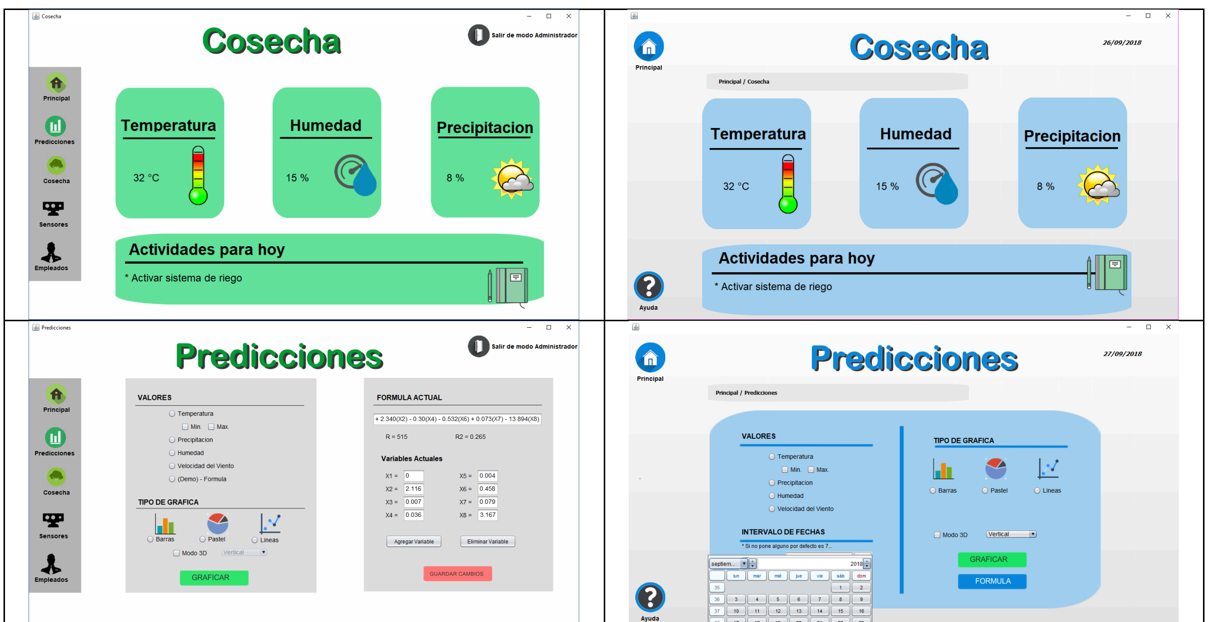
- *Obvious Starting Point*. Any interface should show perfectly where the end-user can start interacting with the system through the interface. Therefore, it is important that end users must know how to start interaction with the content without hesitation. Every new interface demands a learning process; thus, it is important that end-users understand perfectly where to start so that they will be able to find patterns among details. Hence, the end-user must know where to begin the learning process. Some features that can be used to call the end-user attention include such as size, value, hue, orientation, shape, enclosure, blurriness, and movement, of which movement is the most basic pre-attentive identified feature (Blair-Early & Zender, 2008). These features should be applied because they immediately will be easily noticed by end-users from the rest of the interface content. It is important that a visual presentation has a focal point, which is called the center of interest or point of emphasis. This focal point intends to catch the viewer's attention and persuades the viewer to follow the visual message further (Chang et al., 2002; Chang & Nesbitt, 2005).

- *Clear Reverse: Design an Obvious Exit or Stop.* It is important for end-users to know how actions performed in an interface can be reversed, including how to end the session (Blair-Early & Zender, 2008). Thus, the reversal should be easy-to-perform and identifiable within the interface when such action is required. This attribute has to be included in such way that it is unambiguous for end-users so they easily to understand the message (Chang et al., 2002; Chang & Nesbitt, 2005). For example, using an open door icon feature common in operating systems (Blair-Early & Zender, 2008).
- *Consistency.* Achieving consistency leads to an increased performance, error reduction and less effort, which would facilitate for the end-user to learn how to use the interface (Blair-Early & Zender, 2008; Te'eni, Carey, & Zhang, 2007). Thus, having little surprise form on interface to the another helps end-users learn to operate the whole IS as well as similar applications. Therefore, interfaces should be design so that users are able to quickly identify the pattern between actions and effects (Blair-Early & Zender, 2008). Also, people distinguish the foreground from the background in a visual field. Two contrasting colors make the viewer perceive different things that are presented in the same interface (Chang et al., 2002; Chang & Nesbitt, 2005); in addition, a congruity exists among the elements in a particular design; they look like they belong together. It is important that related objects do appear within the same form, so that users will consider such objects to be related to the main visual design (Chang et al., 2002).
- *Observe Conventions.* Interfaces that identify and respect end-users' familiarity would more likely to increase performance. Developers must identify words, phrases, images, and conventions that users are familiar with (Blair-Early & Zender, 2008). It is important that convention do not violate social and cultural experiences (Blair-Early & Zender, 2008). In addition, some of these components are interpreted by users based on their own experience (Chang & Nesbitt, 2005). Thus, developers must be careful while including them in their designs so that they do not have a confusing meaning. For example, red color is commonly used to represent an alert; therefore, it should not be used just to highlight a word.
- *Feedback.* End users should receive feedback as they operate the system (Blair-Early & Zender, 2008). Also, the feedback should be as immediate as possible and related to the context that users are performing a particular task so that users are informed that their actions are having an effect on the system (Te'eni et al., 2007). Feedback should be presented in such way that it is uncluttered, unambiguous, and simple (Chang et al., 2002). In summary, feedback must be presented in the interface in such way that really helps and informs, and it can be distinguished from the rest of the interface's content.
- *Landmarks.* Interfaces must present information that suggests their location in the conceptual space of the interface (Blair-Early & Zender, 2008). Landmarks help users to know exactly what task are performing, and its overall relation with the system. This guideline helps users to build a mental model of their experience (Blair-Early & Zender, 2008). Users tend to complete missing parts, group disconnected, but related objects based on their own experience (Chang & Nesbitt, 2005). However, it is important that systems' interfaces would not really in users' ability to fill the gaps because this could lead to low performance, or a number of errors.
- *Proximity.* "A user should not have to traverse great physical, conceptual, or time spaces to perform similar actions or access related content" (Blair-Early & Zender, 2008, p. 101). In addition, they state that there are at least three types of proximity: a) space – a person's location memory associates content with a specific position on the interface with specific location; b) time – content is available on users' demand; and c) concept – items that related are grouped together. This principle suggests that items that are placed near each other with the intention of forming a functional group (Chang et al., 2002; Chang & Nesbitt, 2005). Therefore, it is important that interface designers create coherent and cohesive

groups of elements that are related so that users' mental load can be reduced. The Proximity feature is divided into 3 variables based on its corresponding categories (space, time, and content). Thus, we studied a total of 11 features.

- *Interface is Content/Aesthetics*. Content is accessed by users through an interface. In addition, it is very important that the interface should be aesthetic so that calls users' attention, not just a means to access content (Te'eni et al., 2007). A good interface should be indented to serve for accessing content, not the other way around (Blair-Early & Zender, 2008). Thus, it is important that designers create interfaces so that interaction is as direct with content as possible and avoids interfaces where the content interferes with the user (Te'eni et al., 2007). People tend to group elements is their attributes are perceived as related (Chang, Nesbitt, & Wilkins, 2007b). It is important that *visual* objects must appear complete and balanced because this creates a sense of visual 'weight' placed evenly (Chang et al., 2002; Chang & Nesbitt, 2005). It is important that interfaces should be fully perceived like a painting. Persons has the ability of ignoring irrelevant objects in an interface so it is important that in order to perceive an aesthetic design; also, elements will be grouped together if they can be interpreted as they are continuous (Chang, Nesbitt, & Wilkins, 2007a). Therefore, interfaces should persuade end-users to complete the whole visual screen (Chang et al., 2002; Chang & Nesbitt, 2005) in order to see the "complete painting" not just a small portion.
- *Help*. Errors are unavoidable and part of human activity (Te'eni et al., 2007), therefore it is important to include support source of last resort that is always available but subtle (Blair-Early & Zender, 2008). However, help must be only for the currently performed action, not as a help menu that users have to perform a search for what they need. The help message should be uncluttered, easy to read and understand (Chang et al., 2002; Chang & Nesbitt, 2005) and delivered in a very distinguishable fashion on the interface.

Figure 1 shows screenshots for each version so that the reader can see differences in how each guideline was applied in each version.



Version 1 | Version 2

Figure 1. Side-to-Side Screenshots for Each Version

MATERIALS AND METHODS

Measurement Instrument Development

An evaluation questionnaire was created based on existing literature. In order to validate such instrument, a pilot study was conducted in a 30-minute session. A total of 35 students from a bachelor's degree program were invited to participate and 28 did. The instrument consists of 11 groups of questions related to the studied variables and two questions regarding demographics (age and gender). Moreover, since all of the subjects were enrolled in the same semester of a Computer Systems Engineering bachelor's degree program, it is assumed that they are equally technologically-savvy. Questions related to IS features have a Likert scale that ranges from 1) Completely agree to 7) Completely disagree. Each question was evaluated using dispersion analysis to determine if answers behaved in a normal-like fashion. All of them were normal. In addition, no issues were found in wording or grammar.

Data Collection

Two periods of evaluation of the application were developed taking into consideration two groups of 30 students each, one with knowledge in the software development's area, and the other, without any knowledge. In both evaluation periods, the participants were the same. The process of applying the test lasted for both groups, and on both occasions, a total of 40 minutes that began with an explanation of the purpose and the process to be performed (5 minutes of time), followed by a stage of free use of the interface by the participants (15 minutes of time), ending with the answer of a questionnaire to know the system interface's effectiveness (20 minutes of time).

During the application of the first evaluation period, results were obtained of the effectiveness of the interface that allowed to make pertinent modifications thinking about a following evaluation process. In the second evaluation period, the modified interface was presented, and the process described in the previous paragraph was performed, in order to know the effectiveness of the interface with the changes reported in the first period.

Results

Version One Demographic Analysis. Participants are distributed as follows: Evaluated the first version. 33 are Male and 29 Females; 30 are in ICTs related field and 32 from business programs; 9.6% consider having Moderated experience using ICTs, 53.8% Adequate, and 36.5% Plenty; 2% use an iPod or similar device for connecting to the Internet, 5% use a Tablet, 11% use a PC, 44% use a Laptop, and 79% use a Smartphone. On average, participants use a computer 11.18 hours per week at Home, 2.74 hours at Work, 6.53 hours at School, .08 hours in an Internet Café, and .37 hours in some Other place. Finally, on average, connects to the Internet 20.21 hours per week at Home, 2.32 hours at Work, 7.31 hours at School, .55 hours in an Internet Café, and .71 hours in some Other place.

Version Two Demographic Analysis. Participants are distributed as follows: Evaluated the first version. 26 are Male and 26 Females; 19 are in ICTs related field and 33 from business programs; 1.6% consider having Few experience using ICTs, 11.3% Moderated, 54.8% Adequate, and 32.3% Plenty; 2% use an iPod or similar device for connecting to the Internet, 2% use Other device, 4% use a Tablet, 13% use a PC, 40% use a Laptop, and 83% use a Smartphone. On average, participants use a computer 13.62 hours per week at Home, 1.27 hours at Work, 4.67 hours at School, .12 hours in an Internet Café, and .71 hours in some Other place. Finally, on average, connects to the Internet 18.94 hours per week at Home, 1.42 hours at Work, 6.10 hours at School, .10 hours in an Internet Café, and .62 hours in some Other place.

		Obvious Starting Point	Reverse	Consistency	Conventions	Feedback	Landmarks	Proximity in Space	Proximity in Time	Proximity in Content	Aesthetics	Help
N	Valid	62	62	62	62	62	62	62	62	62	62	62
	Lost	0	0	0	0	0	0	0	0	0	0	0
Mean		2.00	2.35	3.32	1.71	2.15	2.08	2.42	1.98	1.84	2.08	2.18
Median		2.00	2.00	3.00	1.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Mode		2	2	2	1	2	1	2	1	1	2	2
Standard Deviation		1.103	.993	1.667	.948	.989	1.135	1.153	1.109	.927	.911	1.033
Skewness		1.552	.573	.387	1.936	.959	1.158	1.165	1.823	1.098	1.317	1.016

Skewness Standard Error	.330	.304	.304	.304	.304	.304	.304	.304	.304	.304	.304
Kurtosis	2.934	-.284	-.726	5.748	.881	1.376	1.838	5.613	1.140	4.263	.979
Kurtosis Standard Error	.650	.599	.599	.599	.599	.599	.599	.599	.599	.599	.599
Minimum	1	1	1	1	1	1	1	1	1	1	1
Maximum	6	5	7	6	5	6	6	7	5	6	5

Table 1. Dispersion analysis for Version 1

		Obvious Starting Point	Reverse	Consistency	Conventions	Feedback	Landmarks	Proximity in Space	Proximity in Time	Proximity in Content	Aesthetics	Help
N	Valid	52	52	52	52	52	52	52	52	52	52	52
	Lost	0	0	0	0	0	0	0	0	0	0	0
Mean		2.00	2.00	2.37	1.73	1.87	1.83	2.00	2.02	1.83	1.83	1.69
Median		2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Mode		2	2	2	2	2	2	2	2	2	2	1
Standard Deviation		1.103	1.103	1.329	.717	.864	.901	.950	.970	.760	.857	.781
Skewness		1.552	1.552	1.162	.785	.838	1.358	1.143	1.608	.863	.931	.866
Skewness Standard Error		.330	.330	.330	.330	.330	.330	.330	.330	.330	.330	.330
Kurtosis		2.934	2.934	.864	.618	.186	2.336	1.966	4.584	.952	.420	.067
Kurtosis Standard Error		.650	.650	.650	.650	.650	.650	.650	.650	.650	.650	.650
Minimum		1	1	1	1	1	1	1	1	1	1	1
Maximum		6	6	6	4	4	5	5	6	4	4	4

Table 2. Dispersion analysis for Version 1

In order to identify which version is best suited for the intended end-users me make a head-to-head comparison. We use the mean as the comparison parameter. Table 3 shows that except two guidelines, Version has higher grades. Therefore, this will be the version to be deployed to end-users.

Guideline	Version 1	Version 2	Change (%)
Obvious Starting Point	2.00	2.00	0.00%
Reverse	2.35	2.00	14.89%
Consistency	3.32	2.37	28.61%
Conventions	1.71	1.73	-1.17%
Feedback	2.15	1.87	13.02%
Landmarks	2.08	1.83	12.02%
Proximity in Space	2.42	2.00	17.36%
Proximity in Time	1.98	2.02	-2.02%
Proximity in Content	1.84	1.83	0.54%
Aesthetics	2.08	1.83	12.02%
Help	2.18	1.69	22.48%

Table 3. Mean Value for Each guideline/Version

Conclusions

The results are a very good indication that by using research findings to design interface training, developers are able to provide an improved system to end users. In the present study, we used the design guidelines from past research (Blair-Early & Zender, 2008) as a means for designing interfaces for a purposely-developed application.

When having a broad type of individuals for a purposely-developed application, developers must be creative in identifying which are the main features of it. In addition, identifying end users' preferences is not an easy task. We believe that by using guidelines from existing literature and developing and testing at least two version of the interfaces would lead to better outcomes. In the present research we use this approach with great results. Developers who received training in designing interfaces would lead to end users perceived as of better quality. Therefore, developers and researchers are encouraged to explore further the used approach that this study presents.

Limitations and Future Research

While results are encouraging, the present study has some limitations. Although the number of subjects that qualified the interfaces was large, there is no empirical evidence that other sets of developers produce designs that lead to similar evaluations.

The study was conducted with young adults. Because of constraints required by the university, participants were not assigned randomly to groups; this could also have had an effect on outcomes.

The big picture of this study is that it provides evidence that systems developers who have not taken an HCI course benefit significantly from effectively designed HCI training. It is suggested that an HCI course can have a great impact. While the audience already understands the importance of HCI in the development of systems, it is hoped that this study and others will provide an even stronger conclusion about the importance of offering an HCI course to students who become developers of HCI systems and employers who hire these students.

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