Universal Access: The "Universal" Is Not as It Seems

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Abstract. The quest for universal access, still today is faced with the expectation of a minimal knowledge of the use of interactive equipment in order to establish successful communication between these equipments and users. We propose to broaden the discussion on ways to include those unfamiliar with the use of computers, the internet and interactive devices, people with little education and/or illiterate, while not excluding those already accustomed to the use of information technologies. We are not unaware of the undeniable fact that the search for a fully universal interaction is utopian, however, we try to explain the problem here and provoke discussion about the concept of universality.

Keywords: universality, interactive systems, interface, usability.

1 Introduction

The general idea of the concept interaction is to establish a mediator language between two distinct players where messaging can happen so that participants can understand and be understood in action. Following this concept, the Human-Computer Interaction (HCI) searches since its inception, sets mediation languages between two actors: the human being and the computer. We have as the beginnings of HCI the need to allow people who did not participate in the computers construction could operate them to process data and get the desired results. Since then, the search of mediator language between machines and people evolved a lot, today it has very different forms of interaction and uses various types of software and hardware for this purpose. The technology advancement in itself and its reach in different social circles and services offered to the population caused a growing number of people who needed access to computer services. This increase of the computer technology search is democratic, that is, everyone needs to access its services and there is no distinction between its users that may have different characteristics and are classified in many different ways (by age, social class, educational level, expertise level, etc.).

From these events have emerged software engineering studies that no longer prioritized the applications functional aspect and computer systems, or process models of software production and tried to give greater emphasis to the specific needs of people who would use the system in question (Pressmann, 2009).

From the concern in creating systems that meet beyond the features that were proposed but were also visually interesting and brought satisfaction to the user in its use, it comes the concept of usability. This concept, in the context of computing devices,

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cares how a system is pleasant to use, easy to learn and to remember its manner of use. Preece (2011, 18) sets targets that serve as guides for the design and evaluation of interactive systems: usability goals - that deal with features related to interactive devices - and the goals arising from the user experience - focusing the awakening in the user certain reactions to the use of interactive device.

According to Preece (2011, 10) the interaction design, seeking for aligning itself more and more to the end user needs, dialogues with various disciplines in many different areas of expertise (graphic design, information systems, ergonomics, software engineering, psychology, social sciences, etc.). In this context, the organization aspect of information within the device also changed the studies field called Information Architecture (IA) and brings several contributions regarding the expansion of human capabilities in discovering and locating information. Based on Agner (2009, 90), "the focus of IA is the design of structures (information environments) that give users the necessary resources to transform their needs into actions and to reach their goals successfully."

In this concepts mixture that raised the user to another level of importance within the design of an interactive device, there is the issue of access to information for people with special needs. For this line of thought was given the name of universal access, which promotes the use of various forms of interaction combined into a single interactive device so that it can comply with various purposes and needs. For example, for users with mobility impairments, were created ergonomically different devices and that meet them, enabling their access to information contained in the device; for users with difficulties related to vision, systems that suit, as the use of different fonts size in web pages, deployable through the use of Cascading Style Sheets (CSS), or the use of audio description.

The search for universal access can greatly increase the systems complexity, since in the same system are contemplated several different forms of interaction and, consequently, different languages mediating between the user and the interactive device.

Nevertheless, we can state that the use of audio-descriptive systems, ergonomic changes and even the employment of motion recognition systems or voice still does not come in a significant number, the universal access, because when it is heard about universal access, in general, it is thought, or in providing access to populations where technology is not present yet, or in terms of interface, in objectifying up access (to contents) of users regardless of their physical-motor and perceptual , cultural and / or social abilities.

However, although there is a concern with these users' limitations of the devices it is still expected that those have minimal knowledge of the use of interactive devices in order to establish a successful communication between actors.

We then consider an interface that, ideally, reaches a broader universe of users, including the unfamiliar with the use of computers, the internet and interactive devices, people with little education and / or illiterate, and that the same time, we do not delete those already accustomed to the use of information technology.

This concern becomes even more significant when we analyzed a global indices extract of absolute, functional and technological illiteracy. We focus then on the development of interactive devices that can be called universal with more validity considering that even an interactive system has audio description, which in turn aims

to facilitate its use by the visually impaired people, its effective functioning does not preclude the need for this user to have knowledge of interactive computer systems, and thus it becomes exclusionary to a portion of users who does not own this prior training. For this perspective are mutually exclusionary in the same way systems using interactive technology resources supported in natural language or in picking up movements of the user, that, although they have conceptual simplicity of operation, need to practice in interactive devices and often of the reading capacity of their contents. This concern becomes relevant when analyzing the data provided by the IBGE (Brazilian Institute of Geography and Statistics) of the 2010 Census where the Brazilian population of 13,933,173 inhabitants has a rate of 9.6% of people over 15 years who cannot read and write, totaling over 1,300,000 inhabitants. The region of highest rate, the Northeast, has a rate of 19.1% and in cities that have 5000 to 10,000 inhabitants in this region, this rate reaches 29.6% of people who do not read or write. (IBGE, 2012). This picture becomes even more interesting when we know that, according to the UNDP (United Nations Development Programme), Brazil ranks among 187 countries, placing 84th in the HDI (Human Development Index). These data show that thinking only in people with physical or sensory difficulties, excludes a large portion of the world population that also needs (and has the right of) access to information and interaction.

2 Proposal

The proposal is to produce an interactive system that complies with a larger portion of the population, seeking to create models for persons who do not have experience in these systems or who do not have sufficient training to understand or read texts. As a whole, the interface should be inviting, encouraging the user to experience, to interact with its content. The whole process should be guided by mnemonic information that create analogies with the tasks to be performed, metaphors with elements of the real world and, in cases whose needed actions are less intuitive, ie, are not likely to be perceived by themselves, small animations can explain to the user what to do. To contemplate such functionalities and features, we can make use of usability techniques, information architecture and game design to develop a suitable environment to our expectations.

Both the devices as gaming is desirable that the experience provided is meaningful and enjoyable. Meaningful, in order to make sense for their user, namely, it must seem consistent within its own proposal, otherwise may alienate those who do not understand the meaning of the actions they perform. Some concepts of game development have equivalents in the field of usability.

The concept of learning curve, for example, is correlated to the concepts of learnability. The learning curve takes into account the speed with which the player feels comfortable with the game controls, and the learnability concerns about the user's ease to learn how to use a particular software. Both depend on the user to understand the operation of the system, in other words, its intelligibility.

The games, usually, keep increasing the difficulty degree of the actions that the player must accomplish over time, starting with simple actions whose difficulty grows as the player will get used to the development of the previous action. Another concern is the reuse of actions, similar contexts that can be solved with similar actions.

In the games or in any other type of interactive system, it is important that its structure guides the user, both in the sense of letting you know where you are within the data set from that system, and in the sense of giving feedback to their actions. When the user acts within the environment is important that he realizes that his actions influence this structure and what are the consequences of these actions, receiving positive or negative feedbacks to their movements, including helping you to understand the rules and operation of the device through the discovery of what he is allowed and what is denied.

We bring so from the game universe, the concept of rules as being the ones responsible for determining what can or cannot be done and what happens as a result of the choices, guiding the user action in order to produce significant results within each application in particular. As in the games, the rules must be clear and unambiguous so that their understanding contributes for the user can increase his repertoire and skills while giving him a pleasurable and meaningful experience.

Although the concerns about a pleasurable experience are eminently linked to games, they must not be altogether discarded when there is a concern in meeting the user of a given device, whereas other questions to be analyzed, in terms of usability, is the attractiveness, that is, how attractive is that application to the user. Furthermore, we must consider that the playful aspect of the game is admittedly a learning powerful tool.

"The games can be used for a variety of purposes within the context of learning. One of the very important basic uses is the ability to build up self-confidence. Another one is the increased motivation." (Fernandes, 1995).

The feedback information from user actions, contextualizing him within the interactive system and explaining the results of his actions are important for the user to define his next step. The way as the actions are developed can be understood in terms of mechanics. The game mechanics are characterized by a set of available elements for interaction and modification of the gamestate, they regulate the actual interaction with the game and are shaped by the player's action who changes the game state, proposing a continuous challenge in pursuit of his goal. Thus, the mechanics should be characterized by the choice options available to the user and their multiple possible outcomes. Salen & Zimmerman (2003, p.63-64) describe the anatomy of a choice from five questions.

1. The first question approaches the context in which the choice is made, and it is concerned with the state (of the game) before the player has the choice.
2. The second asks how the choice is transmitted.
3. The next question focuses on how the player (user, in case of this system) makes the choice, concerned with the ways in which they are given the opportunities for action.
4. The result of choice and how it will affect future choices is at the heart of the fourth question. "This element of the anatomy of a choice speaks to the outcome of a player action, identifying how a simple choice impacts larger events within the game world."
5. The last question seeks to understand how the outcome of the choice is transmitted. This result will provide the context for the next choice, sending us back to the first step.

The more information the users has, the more informed his decision will be, which will result in smarter or more elegant choicest, besides it will provide him a greater sense of control over his progress. So, the system meaning emerges through this relationship that is established between the user action (due to his choice) and the result of this.

2.1 System Requirements Definition

To think an interactive system, we will use software engineering artifacts to systematize our creation. Initially, we thought the needs of the system in question comprehensively, which is pictured below in scope.

> It is an interactive system generic, namely, which initially has no particular function except to promote the exchange of information between a user and a system. This system will be offered in a format that does not increase the complexity in its use: a hardware with touch screen would be more appropriate. The form of communication used by the iPad's appears to be quite suitable for use as touch screens and, in the first interaction, the only option with the device turned off is a button front, which simplifies to the maximum the initial step of the interactive process. The audience considered as users of such system is composed of people who have no formal schooling, thus it rules out the possibility of interaction through text. The end users also have no experience with interactive systems. Ideally the proposal is that the portrayed user receives the system in a device and be able to communicate and develop interaction with it even without any external help.

From the stated scope, we can define a list of system requirements:

"a format which does not increase its complexity":

- must be developed in a portable platform tactile interaction, based on the simplified operation of the iPad

"must not have text interaction":

- use of shapes and colors to portray the system functions.
- use of animation to explain more complex functions.

"able to communicate and develop interaction without external assistance":

- use of metaphors with elements of the real world.
- analogies to represent the functions performed in the system.
- constant feedback of user actions (tactile, auditory and visual).
- organize tasks in order to reduce the time he takes to learn how to use the system.

Analyzing these requirements, we can trace the interaction design goals of our system (PREECE, 2011, pg. 18) to be satisfied the necessary specificities to accomplish the project.

Table 1. Usability Goals and expected solutions

Goal	Expected Solution
Efficiency	• The system will perform the function which it is intended, in the case of our project, its goal is not defined yet.
Effectiveness	• The system will have fewer levels of interaction to simplify its operation. • In a few interactions he must offer the result of a task; • Its interface must be clear and with large size icons enough to facilitate its operation.
Security	• The system must communicate constantly with the user through symbols and visual, tactile and sound signs, denoting the result of an action or the path to the next action; • The organization of information will be designed so that the user feels comfortable and secure in his actions.
Usefulness	• Our system has no specific function, but it will demonstrate the operation of an interactive system broader with respect to users who may operate it.
Learnability	• The system will bring visual, audible and tactile elements to establish a language through comprehensible signs to the less skilled users, allowing its operation be learned with little difficulty; • The use of game design techniques for the difficulties levels organization must provide a gradual and permanent learning.
Memorability	• This goal must be achieved by the simplicity of its operation.

Regarding the resulting goals from the user experience, it is expected that this system is:

- **Satisfactory:** providing training for operation of an interactive system for a class of users with very little experience in process
- **Friendly**, fun and aesthetically appreciable: its interface of easy understanding must exploit to the full graphical capabilities of the device, providing an interesting sensory experience to the user.
- **Emotionally** appropriate: feelings such as fear, uncertainty and unpleasant surprises will be avoided to the maximum seeking emotional comfort needed for the user to operate the system as a whole.

3 Testing the Assumptions

The hypothesis treated here is that it is possible to transform applications and interactive devices so that they can serve a larger number of users, including those who are illiterate. To meet this goal, we will use signs, colors and action feedbacks that guide the user to accomplish a given task. The experiment consists of applications that will run on

a tablet. Each application brings in a progressive manner, the use of visual aids that help to fulfill a simple task. Moreover, it stores data covertly from user as solution time, mistakes and successes during the development of each step. For the experiment, we attempt to portray a sample of heterogeneous population, consisting of people from various levels of education, gender and age. In order to seek this population should be visited universities, banks, employment agencies, parks and popular markets, in which volunteers who can devote a portion of their time to the test development would be approached. The test uses four applications and each of them will be shown to a distinct group of volunteers. All applications interfaces have three circles, and each one of them is in a color and also there is a background in a fourth color. The volunteer must be enlightened by the following text on screens 1, 2 and 3. "You need to touch the tablet in a sequence of circles which we expect you fulfill and for that you have three touches."

3.1 Screen 1: Gray Shades

On this screen are shown three circles of equal size, aligned and with different gray shades on a quarter gray shade. It is hoped that volunteers touch within the circle on the left, in the middle and on the right in this order, what action would be considered correct. However it is not expected that most of the volunteers fulfill this action order.

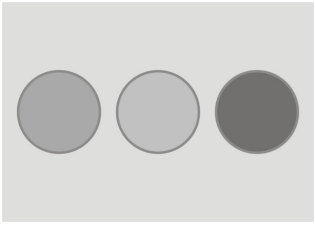

Fig. 1. Colors and Shapes Screen 1 of the experiment

3.2 Screen 2: Colors of Light

On this screen are shown three circles of equal size, aligned, the one on the left is green, the middle yellow and the third red, both of them on a blue background. These colors by themselves are a metaphor to traffic lights, which already indicate a possible order of action (there are no lights in the sequence green-red-yellow, for example).

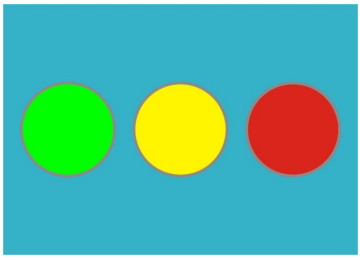

Fig. 2. Colors and Shapes Screen 2 of the experiment

The volunteers are supposed to touch the green circle firstly, then the yellow and finally the red one. It is expected that the number of volunteers who perform the action in the desired sequence is considerably larger than the ones from screen 1.

3.3 Screen 3: Colors and Indicator Light

On this screen the colors and the circles layout are identical to those applied on Screen 2. Furthermore, the circles to be clicked by the volunteer receive a highlight with a background 'light' indicating that it is correct at that time. The volunteers are supposed to touch the green circle firstly, then yellow and finally red in the same way as it is indicated by the backlight. The indicator light only will change for the next circle indicating the next one if the volunteer has performed the step correctly, but it remains in the circle which he should have touched until he finishes his chances of touch. It is expected that the number of volunteers that perform the action in the desired sequence is close to all the respondents.

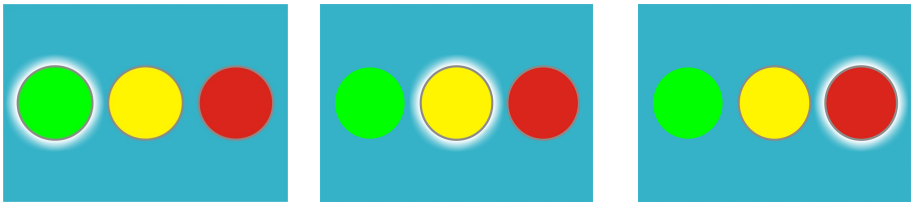

Fig. 3. Colors and Shapes Screen 3 of the experiment, with a color indicator light to meet the desired sequence. If the volunteer is wrong, the light continues until he performs correctly or his chances have finished.

3.4 Screen 4: Color, Light and Feedback

In this test, the volunteer must be enlightened by the following text: "You must touch on the circles in an order you are supposed to fulfill."

This screen has the same components of the screen 3 but, when the volunteer performs the sequence correctly, it appears on the screen a sign indicating correctness ("V") for about three seconds and it displays the light in the next circle to be touched. If the volunteer misses the sequence circle, the application displays an error indicating signal (red "X") and the indicator light continues to shine in the circle which is expected to be touched. At this stage, the volunteer can touch and miss (make right) as many times as necessary to accomplish the task. He is supposed to touch it in the same sequence shown on screen 3 (green, yellow and red), also his understanding about "V" indicates correctness and "X" indicates error, knowing now if he hit or missed the expected sequence. It is expected that in this test there is a minimum number of volunteers who miss the sequence.

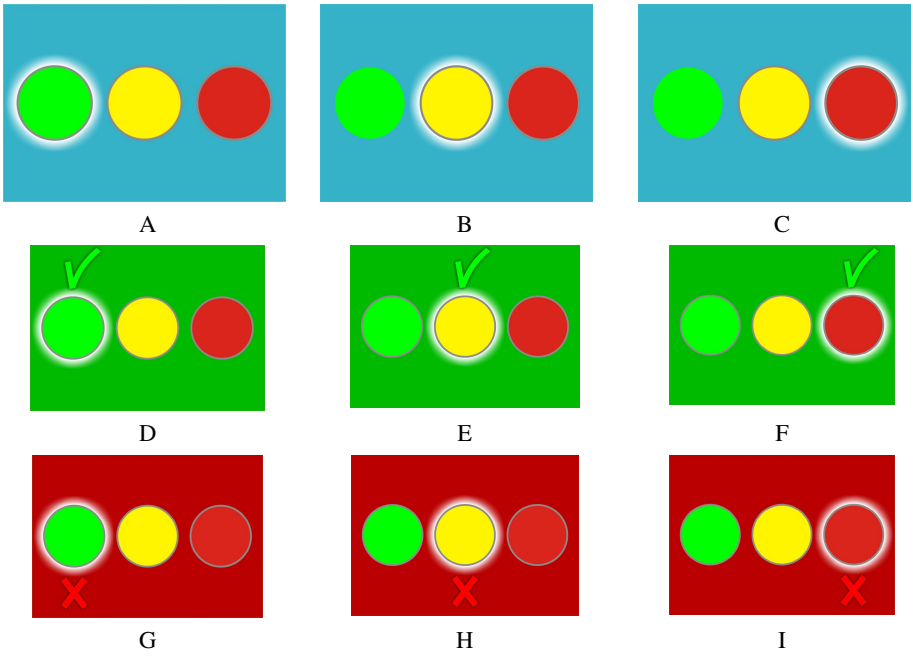

Fig. 4. Shapes and colors of the screen 4 of the experiment, with one color indicator light to accomplish the desired sequence (A, B and C). If the volunteer is successful, the light remains in the right circle, so the background turns green momentarily and a "V" appears as a form of feedback for the correct action (D, E and F) and then it returns to the home screen (A, B or C). If the volunteer is unsuccessful at the sequence, the light continues at the correct circle, then the background turns red momentarily and an "F" appears as a form of feedback for the wrong action (G, H and I), then returns to the home screen (A , B or C).

As noted, for comparison purposes, each screen will be shown to a distinct group of volunteers, in order to neutralize the learning factor that would result the screens demonstration in the sequence. It is hoped that this experience show quantitatively the direct relation between the amount of hits and the amount of tips and action feedback, demonstrating thereby that when more information is passed to the system user, the greater is his ability to correct responses, regardless of his education degree, age or gender.

In the future, this experience can be applied in other countries in order to verify if such interaction assumptions discussed in this text also work in other cultures, and if they do not work, investigate what are the reasons for failure.

4 Final Comments

It is undeniable that the search for a fully universal interaction is utopian, however, these new proposed challenges show also that the current exploitation of universality is far from meeting its concept.

This proposal, equally far from resolving this issue definitively, seeks to clarify the issue and provoke discussion about the concept of universality, since, although there is a concern (important and relevant) to include those with special needs, there is still exclusion of people with little or no knowledge of computing systems in devices developing often even proclaimed as "intuitive" and "natural."

And despite undeniable progress in achieving an increasingly larger number of people, a lot still needs to be done so that all people can exercise their right of access to information and interaction.

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