

Consideraciones en el Desarrollo de Interfaces Naturales Gestuales

Considerations on the Development of Natural Interfaces Gestures

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Resumen

La relación hombre-máquina es un tema evaluado desde el inicio del desarrollo de la tecnología, motivo de estudio que pretende facilitar el uso de los dispositivos y mejorar la comunicación que se da con ellos. El desarrollo y la integración de diferentes tecnologías han permitido que se genere un cambio en la interacción con estos dispositivos creando una interacción diferente. Aunque queda en manos del analista-desarrollador de la aplicación la responsabilidad de determinar la distribución en pantalla de los diferentes elementos es evidente el desconocimiento en lo que se refiere a las normas y estudios que facilitan la creación de interfaces eficientes y ergonómicas. En el campo de la robótica, los estudios acerca de la relación e interacción hombre-máquina facilitan la creación de tecnologías, las cuales pueden ser aplicadas para “humanizar” la parte mecánica y electrónica, y en esta área han sido de bastante ayuda las interfaces naturales.

Durante la revisión bibliográfica se analizaron las variables en el esfuerzo que se da entre la interacción del ser humano con computadores, tablets, entre otros, con la utilización de interfaces gráficas y naturales que, mediante un correcto diseño, permiten maximizar el rendimiento en el uso de dispositivos apuntadores y otros con funciones similares; la información extractada sugiere que en el diseño de interfaces naturales se continúa utilizando el mismo tipo de interfaz realizada en desarrollos bajo interfaces

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gráficas, pero independiente del tipo de interfaz es vigente la preocupación por el aumento de enfermedades generadas por el uso y abuso de la tecnología y la forma en que interactuamos con ella; también deja en evidencia que las Interfaces Naturales de Usuario -NUI- aún continúan en investigación la generación de directrices de diseño para la nascente interacción natural y que todavía hay parte de su potencial por descubrir.

Palabras clave: HCI, usabilidad, ergonomía, interfaces naturales, ley de Fitts.

Palabras clave adicionales: wavi xtation®, microsoft Kinect®, pointing techniques, diseño de interfaces, interacción de usuario.

Abstract

Human-Computer devices interaction is a subject which has been researched from the beginning of technological development. The purpose of this aims to investigate the use of technology and improve human interaction with it. The development and integration of different types of technologies has generated a change in the interaction between humans and computers.

Even though is assign directly to application developer analyst who has the responsibility to determine the distribution of different elements on the screen. However it is clear lack of knowledge in regard to the rules and studies facilities the creation of efficient and ergonomic interfaces. In the field of robotics it studies about Human-Computer Interaction, facilitate the creation of technologies which can be applied to “humanize” the hardware, and in this area has been quite helpful for natural interfaces.

During the review of the literature, the variables that exerted an influence were analyzed in an effort to understand the interaction humans and computers, tablets (among others) and the use of graphics and natural interfaces that through proper design, allows you to maximize the performance of pointers and other devices with similar functions. After reviewing the results of the research, the conclusion is that neither the old nor the new interfaces uses a viable alternative to facilitate human interaction with technology. They still remains the worry about increasing diseases generated by the use and abuse of technology and the way we interact with it; also makes it is clear that the Natural User Interfaces - NUI - research is still generating design guidelines for the nascent, natural interaction and is still the potential to discover more.

Keywords: HCI, usability, ergonomoy, natural interfaces, Fitts Law.

Additional keywords: wavi xtation®, microsoft Kinect®, pointing techniques, interfaces design, user interaction.

1. Introduction

The Graphical User Interface has been researched for last years, it had been identified the most efficient practices for development of a computer program, but some years ago the paradigm had been changed, again, highlight another crisis software because of the faster hardware development [1].

Complexity human interactions such as looking, gestures, signs and even the accent are used for communication. Body language gives information consciously and unconsciously, but how identifies and make use of it to communicating between us and the machines?

For humans is simple to translate this actions into something useful, but take this to computer code or language programming for any device such as computer, smartphone or tablets turn into a complex project and is essential use another programming techniques such as neural networks to calculate and predict movement and interaction without SDK using [2-3].

The interesting on the Natural User Interfaces based on the capacity which it gives to machines, through this techniques to identify and understand us, using the same mechanism we use to communicate naturally between humans, the capability to listen and identify the real world with its shape, color and textures could become one of the first states of consciousness achieved in machines [4-5].

2. Background

One of the first ways of Human- Machine Interfaces or CHI was through the CLI or command line interfaces and it was used by who were training, you must remember the instructions with parameters and correct syntax, with no natural interface requiring knowledge and expertise. With the GUI, a real-world graphics in the electronic -virtual- pointing devices and supported representations, some things made easy to use, but still do not take advantage of the graphical user interfaces or WYSIWYG concept [6-7], then, we were taken to tactile devices with functions that must search to reach out an advantage of these accesses, when we used to play suddenly we can shake and tilt the interface or even increase our reality or connecting to our brain directly, appearing devices ranging fusing new concepts and take us a step further.

In another hand, Fitts' Law is a model to account time it takes to pointing something, based on the size and distance of the target object; and applying the concept in computer sciences: Fitts' Law and variations of it are used to model the time it takes to use a mice and other input devices to click on controls on a screen ^{[8][14]}.

$$T = a + b \text{Log}_2\left(\frac{A}{W} + c\right) \quad (1)$$

Where:

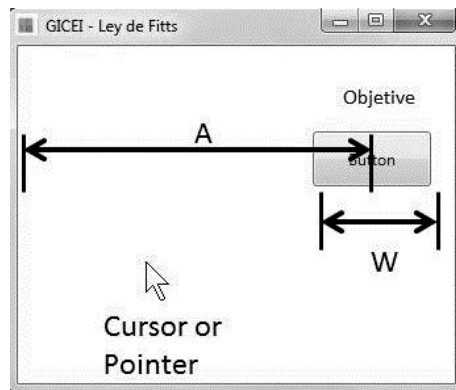
T: is the average time taken to complete the movement.

A: is the distance from the starting point to the center of the target.

W: is the width of the target measured along the axis of motion.

a y *b*: empirical constants, which depend on the test.

FIGURE 1. FITTS' LAW.



3. Definition

Adaptability and nature is defined as that which is natural for those who use it, whether it is natural for the programmer to type, it will be natural to use the keyboard ^[15]. The definition of Natural User Interface is based on humans we can interact with devices by the same way we do with other humans, speech and gestures, this kind of applications is given through the merge of available technology and decreasing the use of input devices such as keyboard, mouse, light pen and joystick avoiding direct contact of the user with the physical device for application usage, and thanks to the

research and development in recent years in the areas of voice recognition, handwriting recognition, screen “touch” and “multitouch” Motion Recognition, Visual Recognition, among others [16].

During Natural Interfaces development the concepts and uses of usability as ISO defined persist. Usability.

“Usability is measured by the extent to which the intended goals of use of the overall system are achieved (effectiveness); the resources that have to be expended to achieve the intended goals (efficiency); and the extent to which the user finds the overall system acceptable (satisfaction)” [17-20].

4. Comparison between GUI and NUI

Again, emphasized that the parallel lies in the methods of data capture and entry and their equivalents in both interfaces and not entirely on the mechanism of presentation and representation, where the convergence of the same methods of access and interaction objects because it shows the development of graphical user interfaces remains the keyboard and mouse devices used, with some adjustments become more ergonomic, which compared to a natural interface gestures shows a reduction in the effort and displacement by the user to achieve the goal. This, in terms of Fitts' Law does not apply directly to the concept: Time it takes to aim target a visual objective is relation between distance and how big the object is [21-23].

When implementing based on NUI applications, we should remember that the constant factor a and b , which is evaluated is different as, the time it takes move the entire arm to describe a movement only when we move the wrist to move the mouse, that's the difference factor.

The distance to move relate to the end of my hand cursor will generate greater movement for clicking certain object making our T (time to complete the movement) using interface NUI is greater than using a GUI, and although there is the same distance in pixels between the source and the target pointer button, the movement will be greater in NUI. In this light, it is not advisable to design applications with windows and buttons NUI based applications, exist another techniques that minimize the displacement but for applications intended to training the physical condition can be very useful, it is so different use in desktop applications.

TABLE 1. Interface development and body damage

Interface	Concept	Body damage
CLI: Command Line Interface.	Using the keyboard with a high degree of knowledge of command and effort to type movements.	Wrist pain associated with wrong posture.
GUI: Graphical User Interface ^[25]	Developed by Xerox and standardized by Apple and Microsoft, allows the development of the WYSIWYG philosophy, where pointing device developed by Stanford was assumed as the main device. Most widely used ^[29] .	Moving the mouse generates the carpal tunnel
TUI: Touch devices and multi-touch ^[28] .	Kinesthesia and technology Intuitive.	Condition affecting the tendons on the thumb side of your wrist.
Wii, iPhone and other mobiles	It was integrated to TUI, Using gyroscope, to make sense of location devices. Requires prior training (wii)	Few cases reported because of drop up control, consequence of do not tie control to the wrist.
Virtual Reality and Augmented Reality ^[31] .	Device such as Google Glasses First devices of this kind can cause numerous problems such as neck pain because of the device's weight, but google has solved part of this problem.	Dizziness.
NUI: Natural User Interface ^[36] .	Infrared cameras and devices combine several technologies as Smart TV, Kinect, Intel Perceptual Computing, PlayStation Move motion-control, among others. In this kind of interface, breaks the need of physical contact for its operation.	Not reported
Biological Interfaces – Neural Interface Technology ^[46]	Reading the movements of the muscles controlling interfaces or direct connection between the brain and the action of the device. Still in development, with some cases of partial success, available in the market.	Using devices to read brain waves can cause headache.

5. VUI

Most people prefer to use the keyboard instead dictate to the computer or just move the mouse even knowing since Windows 7 released and with the right software, most prior to this, it is possible to do it using voice commands. Its accuracy has improved over time; proof is the accuracy in cellphone having also used by some users. Same is inconvenient if you always use it because aside from bothering someone, it bothers talking to machines.

Working with VUI (Voice User Interface), should only works in places that are below 65 db ambient noise and used commands should sound different between them, being carefully not base the entire interaction on this interface kind.

Devices supporting this NUI technology, built-in multi-array of 4 microphones allowing them take the sound and filter it with ambient noise suppression and even to identify the source the sound spatially, providing better sound quality than a comparable single microphone and is much more convenient to use than a headset.

This is one of the more mature technologies that make the sum of NUI with the development of speech recognition is not currently required training tasks to recognize a specific user, it is now more widespread [24-26]. However there is no doubt about training for the machine helps improve accuracy substantially even above 80%.

6. Experiences with adaptation and Natural Interfaces

During partial developments made was identified that when gestures are used, the algorithm may have some low levels of recognition and delay when they are sampling in Computer introduces a delay in performing any type NUI application, since the Microsoft Xbox[®] console to be dedicated to gaming machine has a high performance, while the computer will always be a multipurpose machine that can do a lot of things but do not specified in a task with high performance, in addition, based on neural networks and database search in the SDK for detecting algorithms player gestures cause these delays in the interaction.

The model formula is based Fitts' Law initially to a single dimension, through GUI research [27-29] taking it to two dimensions, but with the development of NUI it is increased to three dimensions growing the care to have with the design of NUI interfaces.

7. Final Comments

The larger an item is, and the closer it is to your cursor, the easier it is to click on (1).

The most of developers still thinking in designing with buttons, textbox, sliders, and other kind of GUI elements, and this must be reconsidered and turn into new interactive interfaces allowing minimized (body's movement) and use another methods such as distance between parts of the body to control characteristics in the system. The Graphical User Interface has an important develop but the way of registration with natural interfaces still keep making use of GUI, controls such representation mechanism implicit on interaction and visualization because is necessary a feedback such as monitor, glasses as google, once again using buttons, sliders and other graphical components more stylized but the same interaction as GUI does - touch, slide and drag - supported by the new paradigm, they are on research of another way of interaction becoming less displacement and ergonomic, so designing Natural Interfaces much be more than use an Windows Form based Application. When we design a Natural User Interface we must use another interaction type to give an option to the interacting user not depend on just one recognizing method, using Voice User Interface and Gesture Recognize as a second option, when one fails the other works or even enable the pointing device to click on graphical interface, the precision on this methods is not 100 percent effective. There's might exists a way to feedback the user about sensor senses, showing in a bottom of screen online video from the VGA camera and IR camera and if it's possible, confirm user commands to avoid misunderstandings.

Programming alone it is an exhausted work, you will have to stand up every time you want to test the lines of code you just write each time, so, if you are alone, focus on what you want to test.

Some add-ons such applications add quite interesting functionalities to bring the mouse pointer to the button that is highlighted (on focus) in the active window, this kind of development significantly reduce the movement by the user to access the options presented application. Similarly functionalities activated the center button of the mouse contextual menus with functions such as close a window, control panel and other shortcuts and hotkeys.

During the readings it finds that exists software that allow to take advantage of tracking the Natural Interfaces Gestures using any of the hardware available in market, even can run in another OS platforms such as Linux, Mac OS® or MS-Windows®. Some testing was made using OpenNI and Mi-

Microsoft Kinect for Windows SDK 1.8, Windows 7 Operating System, and they have a lot of differences; with OpenNI we obtain portability to Linux and Mac, but Microsoft does not support, like fingers tracking were impossible with the version 1 of the device.

Natural interfaces designed based on the same philosophy of buttons and GUI interaction, added more effort by the user to achieve their goal. So what is your success? Lies in the possibilities of interaction and recognition of gestures, signs and movement of wrist and fingers, face recognition, computer and performing arts, gameplay, and a great opportunity to enhance the capacity of devices that understand and recognize us.

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