Ethical concerns regarding the use of Intelligent User Interfaces

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Abstract - *Intelligent user interfaces have progressed in many ways throughout the years. Interfaces are implemented to help with everyday tasks and applications. However, there are many ethical concerns regarding the use of intelligent user interfaces. People are concerned with privacy as in many cases such intelligence have to collect personal and non-personal information to complete an accurate profile of the user. In this paper we will discuss some of the uses of intelligent user interfaces, advantages and disadvantages and ethical concerns related to its use.*

Keywords: Intelligent user interface, artificial intelligence, ambient intelligence

1. Introduction

Intelligent user interfaces are interfaces that include some aspect of artificial intelligence. They are implemented to create a more cohesive communication between the computer and its user and adapt based on user's preferences. They can respond to a user's gestures, key strokes, and preferences through various online content. They gather this information using aspects of psychology, cognitive science or computer graphics to create a more interactive and personalized experience for the users [Tavani 2011].

Ambient intelligence describe technological environments that preform daily tasks by responding to the presence of people. They rely on intelligent user interfaces to reach its full potential. Ambient intelligence runs in the background and is not seen or detected by the user. Profiling becomes possible when intelligent user interfaces are implemented in an ambient intelligent environment. Profiling is the ability to personalize and automatically adapt to a person's behavior patterns making the more usable and useful. Most people are unaware that this technology is used in many things that they use on a daily basis [Tavani 2011].

Researchers dealing with the concept of pervasive computing are able to provide smart products that communicate unobtrusively. Ambient Intelligence refers to convergence of two factors that include ubiquitous and pervasive computing. On the other hand, bioinformatics refers to convergence of both information technology and biotechnology. Finally, Nano-computing refers to convergence of computing and nanotechnology [Seelman 2008].

Ubiquitous communication ensures communication through various interlinked computing equipment such as wireless local area networks, and radio frequency Identifications. The concept of pervasive computing is made possible with the use of enhanced intelligent users interfaces. Intelligent user interfaces ensure that there is enhanced interaction among people through better intuitive ways. Such interfaces can sense and relate to a person, situation, context, or the environment as compared to the traditional interfaces that only performed basic functions [Jutai et al. 2005].

Ambient intelligence helps people to live and work in environments that respond to their interactions in intelligent ways. Intelligent user interfaces utilizes artificial intelligence and concepts of being a personal assistant. The idea is to have interfaces that can be personalized and can adapt to users and their preferences. Usually users may not be even aware of the existence of intelligent user interfaces in their normal day to day interactions (which is what a natural user interface strives for). They are also may not be aware that we are surrounded with hundreds of intelligent networked computers that may sense the presence of the user and are aware of their personality, and needs [Tavani 2011].

An Intelligent User Interface connects between a personal and the system he/she is using. Such interface should make this interaction easier, and not be a burden placed on them especially if they need to learn to use this interface. Adapting to the user is done by using techniques from artificial intelligence to perform reasoning and learning. This can be done by performing user modeling and recognition. To be most effective, the interface allows the system's user interaction be adapted to different usages. It should utilize user modelling which allows a systems to retain information about a user. It should also utilize natural language technologies which lets a system either create or interpret text or speech in a system. Utilizing dialogue modelling allows a system to maintain a natural course of interaction using a user's primary language. Explanation generation allows a system to explain to the user its end results. Sometimes machines may have to learn and foresee

future situations; therefore, the interface should be able to acquire dynamic information and use it with already acquired knowledge and provide seamlessly experience to the users. Current Intelligent interfaces replaces pointing and clicking with speaking or swiping. In addition, such interfaces should be developed in a way can be used by young and old, the tech whiz and not, and by the casual user or a person in an emergency [Laster 2001].

Currently, there are many examples of intelligent user interfaces, and some are more successful than others. For example, there are the adaptive and collaborative interfaces, affective interfaces, agent-based interfaces, model-based interfaces, and natural language interfaces [Leake 2004].

To summarize, not all intelligent systems use intelligent user interfaces. The intelligent interfaces usually use a set of techniques such as user adaptivity, user modelling, natural language technology, dialogue modelling, and explanation generation. Even if a technology uses these techniques, "an intelligent interface must utilize technology to make an improvement: the resulting interface should be better than any other solution, not just different and technically more advanced" [Ehlert 2003].

2. Examples of Uses

Currently, intelligent user interfaces can be found in and used by numerous devices. Traditionally interfaces were controlled by the computers keyboard, mouse, and monitor. Now, intelligent user interfaces are able to determine information about the user without receiving typed commands. Websites and search engines use this form of technology in order to create a better experience for its users. For example, advertisements are chosen depending on what the user views and what they click on while they are browsing through websites and using search engines such as Google. Cell phone companies started using intelligent user interfaces to design new and improved smart phones. Some smart phones now have the technology to make changes based on the user's eye movements. They are able to automatically scroll down as the user reads. Smart phones have many ways to monitor and make changes to the settings based on the surrounding environment. The phone's screen can become brighter or dimmer based on the brightness of the sun or lights. [Ehlert 2003]

Companies are trying to create tutoring systems that provide online learning content [Guerra et al. 2016] that utilizes intelligent user interfaces that would provide a better more personalized experience then if they were to hire a human tutor. An intelligent tutor is "a program that aims to give a personalized "education" to a user in a specific domain of knowledge" [Shute and Psotka 1994]. Tutoring programs are designed to detect strong and weak points in the user's subject. For example, if the program detects that the student is having trouble with a specific subject or area, the system will provide more practice problems and examples that involve that area. These tutoring programs are essential to online schools and degrees. Turing systems can also help with everyday life of people of all ages. The tutor program infer the user's understanding of the domain through analyzing the user's performance on test problems. The tutoring system provides active advice by intervening, and suggesting alternative courses of actions, or passively, by answering explicit users queries [Ehlert 2003].

Recommendation systems also use intelligent user interfaces. For example, Netflix looks at movies and television shows that the user has watched, and recommends new shows that the user may like based on their previously viewed programs. This recommendation list has helped many people find shows and movies they may not have considered without them being recommended to them [Ehlert 2003]. In general, to allow users to navigate content, an intelligent television uses intelligent interfaces [Sirpal, 2016].

Intelligent user interfaces are also used to filter information. Especially when surfing the internet. The user's search results are selected based on their search and browsing history. Other viewer's preferences are also taken into consideration when selecting information. Some systems consider similar users with similar interests and searches and recommend accordingly [Tavani 2011]. This is also important when dealing with data collection, as the system is logging what a user is reading or accessing and then provide websites or articles for the user to read based on their interests. Many companies are putting more time and effort into adaptive technologies.

There are many practical uses for Intelligent User Interfaces as seen with the refrigerator. This said there are three major overarching categories of IUI's that can be talked about. These are system functionality, user, and wants and needs. A IUI that focuses on system functionality "might have some knowledge of how to get around the system, or tasks a user would want to do. With this information, the system can present its interface in an intelligent manner, making navigation and operation more intuitive to the user."[Ehlert 2003] A great example of this is Apples Siri. This program allows users to ask the phone how to do things, to do things for them, or allows them to skip past the interface itself directly to the information they were wanting.

3. Advantages

Intelligent user interfaces are the key to have a more personalized experience when using technology. It simplifies the process of finding information and give users access to advertisements that would be of interest to them. For example, students may benefit from online tutoring programs [Ehlert 2003]. They can also help users find information about their surroundings and environment.

Newer smart phones may provide a street view of local shops or emergency services and give directions, distances and phone numbers, when one is lost in a city. Some of them are always connected and waiting for our voice commands and requests [Orland 2013].

Such systems also can be set up to take into consideration an individual's habits, preferences and ways of working. Using such information, the system can provide personalized interaction methods that are best for a user. It can also aid with filtering problems and information over-load since searching is usually a tedious and time consuming task. An intelligent interface can reduce the quantity of information to look at. Also, by filtering out irrelevant information, the interface can reduce the user's cognitive load. Sometimes , the system can also help find useful information one may not have been aware of [Alvarez-Cortes et al. 2009].

Other intelligent user interfaces can help a user learn a new software and can teach the user how to use its features. Such a feature is usually available with videogame introductions. In other examples, an intelligent user interface monitor a user's actions or tasks performed and try to understand the context and recognize his/her attempt, and finally deal with the execution of that task, allowing the user to focus its attention to others tasks [Alvarez-Cortes et al. 2009].

Other uses may involve informing the user of detailed and personal information about their environment. Such examples include informing the user about or even controlling climate that measures air quality, moisture in the air, and allergens especially those with medical problems [Tavani 2011].

4. Disadvantages

While intelligent user interfaces can be very helpful and beneficial, they can be a burden. When the user is given information that should be geared towards what they want, the results could be completely off. Users are usually are provided with information that has the same content or opinion. This will cause pigeon holes in the information. This is because the user is basing his/her beliefs and reference information on the information provided and is not aware of all aspects or sides of other information that is still available online [Ehlert 2003].

It is not easy to design Intelligent User Interfaces or programs that are able to act and give a personal, individual experience each time. Programmers have to avoid scripting scenarios, and instead set up programs that adapt and act on their own according to a given scenario. Programs that are scripted have to follow a direct flow chart or steps. However, if a program is set as a free agent, it is able to adapt to different situations and is able to 'converse' with a user, as opposed to following a set 'script' [Andre and Rist 2001].

Technology, is also, not advanced enough to be used efficiently and can end up causing more problems especially when movement of parts is involved. Sometimes, gathered information about the user is not correct and does not represent the user but a single instance of his/her behavior that may not occur again. This can lead to creating incorrect inferences about the user, his/her actions, or the situation. These incorrect inferences may require the user to perform or be involved in corrective actions [Tavani 2011].

Many users are naïve with regard to setting up their privacy options or are unaware of breaches. Many users don't update their software regularly and don't have current security checking software installed. This privacy related issues can be abused easily. If the intelligent user interface was not correctly set up, the system can get hijacked. In other instances, it may allow some parties to spread misinformation and control what people see and do. Some think that virtually anything said, done, and sometimes felt can be digitized, stored, and later on retrieved. Sometimes collected information can be used for denying some people from legal benefits such as health insurance [Tavani 2011].

Another concern is that although it is easy to build an intelligent user interface in theory it is actually quite hard to scale up and make it work at a larger scale. Artificially based intelligent systems have been typically developed by academia which develops and tests a limited number of devices that is addressing a specific problem and then those systems cannot be scaled up to the cover more functionalities or be used on a larger scale [Hook 2000].

Another disadvantage is that people can become technologically dependent on the intelligent user interfaces. This is a problem because even though they can relieve humans from worrying about performing many routine tasks, that are sometimes tedious and boring, it is mainly relieving us of cognitive effort that enables us to be fulfilled and flourish as humans. There are also worries that if humans depend heavily on such devices and they go down, we will not be able to perform our daily tasks. Similar to many businesses depending on grocery stores, if the grocery's store system goes down, all other businesses need to wait until it is back up [Tavani 2011].

5. Ethical Concerns

The use of intelligent user interfaces raises many ethical concerns. Many believe that the gathered information violates their privacy. For example, profiling is viewed as a major invasion of the user's privacy. This is because the information is collected and then used to create a profile of the person. This profile is then used to recommend what information is presented to the user. As these systems are working in the background without the knowledge of the

user, it is hard to detect them. This is why some people are concerned that their personal information; such as, credit card numbers, bank information, and social security number may be also collected without their knowledge [Ehlert 2003].

Other ethical concerns include freedom and autonomy, privacy, and technological dependency. Many question whether human autonomy and freedom will be preserved with the use of Ambient intelligent. Some believe that humans will be able to have better control in the environment as they are able to interact more by the aid of technology that is responsive to their needs. However, other believe that it is not the humans who are gaining much control of the environment; rather such control is delegated to the machines. There is therefore the belief that the machines have robed humans the right and privilege to experience life first hand. Ambient intelligent can make human's life more controllable in three main dimensions: it can respond quickly to the needs of the users. It can also react quickly to the intentions of the users, as well as their actions. It can also provide users with personal information in a detailed manner [Jutai 2005].

In addition, there are other ways where Ambient intelligent can diminish the level of control that humans have enjoyed over their environment. For example, smart objects can make wrong inferences about a user's intentions, actions, or situation which can compromise the user's ability to remain in control over their environment [Jutai 2005]. There is also the possibility that in some instances, smart objectives may require user's corrective actions which denies the user's distinct role of making decisions on various circumstances in the environment. In rare occasions, the smart object may advance the needs and interests of other parties other than the user. In addition, there is the possibility that the smart object may lack the capacity to address human challenges over the environment.

With regard to privacy and surveillance, Ambient intelligent has four unique features that cannot be found on other famous computing applications. They include ubiquity, sensing, invisibility, and memory application. Since such devices are inserted invisibly in ambient intelligent surroundings, it increases the possibility of invading privacy. This is because there is a high possibility that the users will not realize their presence, as such, it is possible to disseminate and collect personal data [Nahrsted and Chu 2008]. Sensing devices, which are interlinked with the integrated user interface, are so sensitive that they are able to sense emotions emanating from human. Such emotions include stress, fear, and excitement and have the capacity to maintain records of collected data.

The greater the capabilities of technologies nowadays, as well as, the possibility of the presence of compromised privacy make individuals unsure about whether their presence is being recorded. The fact that people actions are being monitored and recorded means that they cannot be sure of what the future holds for them or in which context such private information will be used. Some believe that when personal information is being accessed, it should be with their informed consent because it is a violation of their fundamental rights and privileges as an individual. There is a need for the stakeholders in the information sector to come up with regulations that safeguards the interest of the society. For example, there should be place measures that ensure that privacy and confidentiality of the public. This is especially when human nowadays rely heavily on cyber technology that relies on the convergence of wireless technologies, the internet, and advanced electronics [Nahrsted and Chu 2008].

Other ethical issues include Privacy and surveillance threats. For example, the interface of Xbox One can be used to spy on its users. It comes with a Kinect (a camera and microphone array) that when launched, it is supposed to be always on. This feature was supposed to help the end user sign their apps, control their system with voice or gesture, and enable them to launch or accept a Skype call. Users became concerned that they could be hacked or spied on and that their personal and biometric information that is stored for the Xbox fitness game or recognition system that is stored on Microsoft's cloud servers would be attacked [Orland 2013].

Edward Snowden NSA leaks are another example where users are concerned about how much of their personal data and browsing is being monitored by the government. There is also the idea that researchers are planning to go beyond taps and keystrokes, and to use the accelerometers and gyroscopes in smartphones to determine a user's gait, and analyze which apps are opened and at what times of day and at which locations [Stromberg 2013]. Although such information may be gathered for good reasons by the intelligent user interface, others may use them for other reasons such as sending you annoying add to stalking or blackmailing. That is why some believe that these ethical concerns can be addressed by having total transparency. Meaning that, the user should be informed about any information that will not be kept private and might be shared.

Many systems that utilize a user model forces users to accept that the system will keep a representation or patterns of their behavior. Some intelligent user interface systems require that users share their preferences with a user community. For example, Netflix gets its recommendations by checking other users that have watched a particular film that the user has watched, and recommends other films that the other users have also watched. Another example is Doppelgänger which allowed people to create personalized news papers so that they could view the news that interested them. This system allowed people to copy the personalized newspapers of others. The difference between both systems is that Netflix was anonymous, however, Doppelgänger, displayed actual names instead of being anonymous [Hook 2000].

Another concern with the use of intelligent user interfaces is trust. This occurs whenever systems start doing things automatically for users which may not always be what the user wants. This will cause a problem because if the users do not trust a system, they will not use it. This would be a problem if, for example, the system starts sorting mail, filtering news, retrieving information from the web, selling and buying goods, etc., [Hook 2000].

6. Conclusion

While the use of intelligent user interfaces will always raise ethical concerns, many will continue to enjoy the ease that they create. Tutoring programs, intelligent search filtering, and cell phone technology are just a few of the ways that intelligent user interfaces are being implemented.

Many people are connected and are using computer systems or smart-phones and as these systems become more complex and feature-rich, it is important that the way we interface with them keeps up with these changes. It not convenient if our interaction with devices is complicated as the tasks they perform. Interfaces need to be able to deal with huge amount of information, be helpful and be personalized to the end user while trying to complete a task [Virvou and Kabassi 2002].

It is important to understand that humans are relying heavily on the tasks performed by electronics, machines and computers. It is important for the user to have the tools that would help him/her decide when and what is considered safe in relation to what is being controlled or accessed via the interfaces. The users should feel safe while having such interfaces controlling or accessing their sensitive information.

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