

Improvements in Computer Interfaces and User Experiences

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Abstract

What can make a great user-focused interface? What are the tools and methods that create these well-made personalized interfaces? There are a plethora of methods that incorporate user behavior and models that display what actions the user will take next. There are tools that blend these concepts to create an interface personalized for the user. As designers, we must clarify ways to develop usable, personalized designs for the user and incorporate their personality and their actions into the interface. Personal interactions with an interface are important and the user should always have likeability towards their device.

Introduction

Developing an interface is more than putting buttons, menus, borders, and other items randomly around a background; it is about putting those items in the correct place for the user to understand and be comfortable with. Firstly, human-to-human interactions (HHI) have been an important step in understanding human-to-computer interactions (HCI) since HCI accomplishes the human to interact with the computer as it does with a human. Many mental models and psychology studies have proven successes in connecting users with their computers. The future of interface design boils down to creating artificial intelligence monitoring user interactions and extracting all data obtained from the user to use in the interface. Some organizations have learned from such ideas, and they are developing interfaces designed specifically for their workers. As conclusion, HCI methods for interface designs have been a key step in understanding how to create interfaces designed directly for the user.

Background

What makes a great interface design and how is it done? Designing an interface is more than adding menus on display, adding taskbars, buttons, or navigation, no... it is about understanding the user and evolving with the user's tastes and personality. Before human-to-computer interactions (HCI) was widely taught, developing an interface, and suiting a person's needs was not as important as how functional the interface can be. HCI deals with the study of people, computer technology, and techniques, all of which influence each other (Guney, 2009). HCI is derived from human-to-human interactions (HHI) since before you can understand how a

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person connects with their computer, it is better to first know how they interact with a person.

The key to interface design is to incorporate the user's knowledge and behavior into the design.

One important aspect to be attentive to is usability. Usability will define how easily the interface can be used as intended by the user (Guney, 2009). To understand if the system is usable for the user, the system needs to analyze the user's needs and gather data from what actions are taken. The system should be able to access any visual design, interaction design, and functionality in the system, as well as understand the user's context and store gathered data from the user. HCI researchers must design instructional structures frequently called self-learning systems, of human activity and use the structures to design newer interfaces (Guney, 2009).

The process in which the interface collects data from the user is quite simple and it is done quickly. Feedback is taken from the user such as visual (movements on a screen, typing, taking a picture), verbal (text, voice), or tactile. For example, tactile feedback would be like if a phone vibrates to let you know of notification, or for verbal, talking to the machine and it talks back. Feedback contains indirect information that supports continuous reflections on the ongoing actions of the user (Schar, 2000). Cognitive feedback is involved in all interactions within a system in which the users can observe the consequences of their actions (Schar, 2000).

Whenever a computer gives a response to the feedback, it should give an approach (how to do the task), give motivation (encourage to complete the task), and create a connection with the user (understand the user's mental state). In turn, the presence of information from the system causes users to focus their attention on the ongoing actions they are performing (Schar, 2000) and essentially ignore what the system is giving. When interfaces use proper models to understand the user, the interfaces should begin to increase task load and result in a better understanding of the system for the user.

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Interface design must also consider the abilities and cultures of users, derived from their behaviors, not just their feedback to the interface. Using dynamic techniques and methods can enhance the users' experience to a greater extent than basic approaches to interface design. Everything must be accommodated such as age, intellect, skill, health, emotional status, and mental status of the user to fully connect the user and their device. There must be a balance between the demands of the interface and the user. There needs to be a certain amount of interaction from the user, the user will need to express their actions thoroughly to the interface, and the user will need to choose a proper environment for the interface to be in. The interface will need to deliver and process efficiently after actions are executed and the technology using the interface should be constantly updated. The certain design components for a user interface would include:

- safety & security of the interface
- the overall effectiveness of the interface
- the efficiency and functionality of the interface
- the entertainment from the interface
- the ease of learning the interface.

Organizations around the world are currently improving their technology and adding features to their technology that makes the interface more efficient for their workers and simple to work with. Nowadays, some organizations keep track of their employee's offline habits to understand them at a personal level, to essentially micromanage them and keep them efficient on the job. Intelligent interfaces are starting to arrive that may make micromanaging employees and other organizational tasks much easier. Intelligent interfaces in organizations may even mitigate

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risks in applications prone to security attacks. Of course, there will be risks behind these kinds of interfaces such as ethical risks like discrimination through biometric data, also privacy and security risks can play an important role too. Luckily, regulation on intelligent interfaces is a bit shaky currently, but with enough support, more organizations will be able to use these interfaces to better organize and keep efficient. Some educational institutions had used intelligent interfaces within studies, and they have found the use of them is simpler, more motivation is made to the interface, greater attention towards it was noted, and it provided a better experience than traditional interfaces.

Intelligent interfaces are starting to grow traction in the technology market and it's only going to get bigger. The most popular intelligent interfaces nowadays are primarily voice-activated ones such as Amazon Alexa or Google Home (Cook, 70-71). There is a multitude of current and upcoming intelligent interfaces like emotion recognition, eye tracking, bioacoustics sensing, muscle-computer interfaces, volumetric displays, exoskeleton and gait analysis, and plenty more (Cook, 71-72). Bioacoustics sensing is the use of the skin input of a device, muscle-computer interfaces monitor muscle activity, volumetric displays are three-dimensional holograms, and exoskeleton and gait analysis are measuring overall skeletal activity to transfer to robotics. These interfaces though need great bandwidth to run them and for the system to run properly. With all the data being sent and received, a strong internet is greatly required to run systems/interfaces like these. Cloud computing and incorporation into the Internet of Things (IoT) also are a necessity for creating these kinds of interfaces because they use a lot of data that gets transferred in and out of its system and the internet will provide knowledge the system needs.

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To conclude, in the years 2019 to 2022, there had been more studies and more improvements toward smarter and more user-friendly interfaces than in most years. Artificial intelligence is reaching the point where can create words from what the user says, it can create programs within a programming language without any user interference, it can develop images, and it is even able to understand human language. With these technological advancements, interface designs won't be too far away from incorporating most, if not all, aspects of an interface to be connected with artificial intelligence, becoming an intelligent interface. Once intelligent interfaces make surface and more interfaces become automated towards the user's needs, then hopefully organizations around the world look to make it a universal necessity to have interfaces like that.

Future Goals

For future goals of this paper and research, I plan to occasionally review the work I have done this semester and build off the final part of my paper which is finding the perfect intelligent interface and diving into how it works. The primary goal of my research is to fully understand the user and their interactions with a machine; to understand whatever data the machine collects from those interactions and develop from that. I hope in the future, other Juniata College students take interest in AI-driven interfaces and HCI since I believe it's an important step in technology. As of now, many big and small companies have ambitious plans for intelligent interfaces and hopefully goals in mind that will be released to the public.

Conclusion

Developing a well-made interface comes down to the following: HCI models for the interface, system-ready software for task completion, and structured resources for the system.

The design of an interface will depend on the mode of interaction with the user, the intention and motivation of the user, the cultural background of the user, the learning curve the user undergoes, and the technology that is servicing the interface. In the future, we hope to have universal designs that are interfaces made for all and stop the digital divide between bad and good interfaces.

Bibliography

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This article talks about how to design interfaces that are inclusive to users that are elderly and disabled. The article dives into simulations that reflect problems related to the demographic and models are created to help understand those problems.

Cook, A., Berman, J., Dajee, J., & Eggebrecht, R. (2019). *Intelligent Interfaces*. Deloitte. <https://www2.deloitte.com/content/dam/Deloitte/uk/Documents/technology/deloitte-uk-tech-trends-2019-chapter5-intelligent-interfaces.pdf>

This article discusses intelligent interfaces that are used as of today and that may be used in the future.

Guney, Z. (2019). *Considerations for human–computer interaction: user interface design variables and visual learning in IDT*. Cypriot Journal of Educational Sciences. <https://files.eric.ed.gov/fulltext/EJ1240368.pdf>

The article mainly discusses studies between HCI in educational technology. Dives into computer-human interface studies that determine how to make technology more usable by people.

Hsu, T.-Y., Breure, L., Shadiev, R., Hwang, W.-Y., Huang, Y.-M., Anderson, C., Morris, R. J., Ulvund, F., Boonstra, O., Cronin, J. G. R., Bincsik, M., Maezaki, S., & Hattori, K. (n.d.). *A computer-assisted instruction system with a vision-based interactive interface for Children: International Journal of Humanities and Arts Computing: Vol 6, no 1-2*. International Journal of Humanities and Arts Computing. <https://www.eupublishing.com/doi/full/10.3366/ijhac.2012.0047>

This article discusses a computer-assisted instruction system used for game design for students.

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Johnson, S., & Iziev, N. (2022, April 15). *A.I. is mastering language. should we trust what it says?* The New York Times. <https://www.nytimes.com/2022/04/15/magazine/ai-language.html>

This article talks about artificial intelligence becoming smart enough to start understanding language and creating from the language it learns.

Miraz, M. H., Ali, M., & Excell, P. S. (2021, February 3). *Adaptive user interfaces and universal usability through plasticity of User Interface Design*. Computer Science Review. <https://www.sciencedirect.com/science/article/pii/S1574013721000034>

The article proceeds to discuss the use of machine learning algorithms as key when bounding datasets; the goal is to be able to get accurate user preference models, which are built upon by human interaction.

Samuel, S. (2022, April 14). *A new AI draws delightful and not-so-delightful images*. Vox. <https://www.vox.com/future-perfect/23023538/ai-dalle-2-openai-bias-gpt-3-incentives>

The article speaks on artificial intelligence able to create images and icons from various databases, from what a user types.

Schar, S. G. (2000). *Interaction for computer-aided learning*. IMEJ. <http://www.imej.wfu.edu/articles/2000/1/03/index.asp>

This article talks on how certain aspects of user interface affect the cognitive process related to learning and problem solving.

Vincent, J. (2022, February 2). *Deepmind says its new AI coding engine is as good as an average human programmer*. The Verge. , from <https://www.theverge.com/2022/2/2/22914085/alphacode-ai-coding-program-automatic-deepmind-codeforce>

This article is related to AI-assisted programming within the coding interface. Discusses on The DeepMind AI system, AlphaCode has been shown to even beat the most average programmers in programming.