Historical Effects of Electronic Interfaces

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Definitions

Human Computer Interaction (HCI) is the relationship between computers and people.
An **electronic interface** is the group of controls and functions that a person uses to interact with an electronic device.
Electronic interface limitations are the parameters of interactions a person can make with the machine through the interface (ex. limitations of a keyboard are defined by what keys are on the board).
Hacker culture is a group of individuals that find clever ways to overcome software limitations.
Cognitive scaffolding is knowledge defined by one group that another individual, or group, can use to build onto that field of information.
Command Line Interface (CLI) is a computer interface that relies on a keyboard for input.
Graphic User Interface (GUI) is an electronic interface based on icons and graphics.
Peripheral hardware is an electronic device networked to the main processing unit.
The **mouse** is hardware networked to the main processor that acts as a navigation tool within the software.

Motivation

The majority of modern society's personal and professional interactions happen through electronic interfaces [II]. Because our interactions are framed by electronic interface limitations it is important to know where these boundaries lie, and what enhancements are delivered by this focus. By investigating key historical developments in this field, I expect to gain insight into social behaviors. I expect to find that as electronic interfaces have developed to be more responsive to nonverbal human communication, usability and significance is enhanced for the user.

Introduction

Computers and electronic technology began with heavy task loads and demanded sophisticated understanding of the technology to benefit from them. Early efforts required large manual calculations that would be applied to existing electronic interfaces of punch cards and vaccuum tubes. These primary methods for computer usage required large amounts of time and

patience. Computers took up large amounts of physical space to house the various electronic parts. Each program took a team that would engineer it from scratch. These electronic interface limitations played a big role in who used these machines, and how they were thought to be useful. Computer science wasn't known to have the applications it has today.

The development of interface technology has reduced the time and understanding required to capitalize on modern electronic marvels. This research investigates what effects major developments had on society, and what that may mean for future developments.

Methodologies

I examine common obstacles and values of early culture that lead to the innovation of the mouse and GUIs, which are our primary electronic interface. This backdrop provides context as to why early interfaces developed in their distinct manner, and how later generations built from them. These points remain significant in modern electronic development, and are fundamental to current technology leaders.

By investigating the development of the 'mouse,' GUI, and the Altair 8800, through the access and demand of these technologies, effects on society reveal surfacing individual behaviors. Specifically, how society viewed the use of computers before and after contributions made by Douglas Engelbart and his team. His breakthroughs and publications defined new perspectives on the use of electronic technology, and how people could interact with computers.

By Engelbart leading his team through research into his vision, he groomed them to carry his technologies into lead developments at Xerox Palo Alto Research Center (PARC), which released the Xerox Alto. This computer was the first to base its interface on GUIs and the mouse. Comparing the public response to Engelbart's oN-Line System and the Xerox Alto, we start to see a value in electronic interface limitations.

Another value surfacing at this time came from "Hacker" culture, revealed by the commercialization of the Altair 8800. Access to hardware became more publicly retrievable and traceable, making this a key turning point in history for electronic interfaces. The demand and significance for these simple electronic kits was highly underestimated, with key developments stemming from their access.

Observations

Hacker culture valued freedom of information, prioritizing performance and capability over authorization [VI]. This principle developed cognitive scaffolding that surfaced programs to create programs, as to not re-invent the wheel each time electronics were used. This amplified operators' capability and elevated HCI, inviting more research to the field.

In 1962, Douglas Engelbart (scientist at Stanford Research Institute), published "Augmenting Human Intellect: A Conceptual Framework." He targeted "increasing the capability of man to approach a complex problem situation… speedier solutions… and finding solutions to problems that before seemed insoluable." He recognized, "the complexity of [man's] problems grows still faster, and the urgency with which solutions must be found becomes steadily greater." This concept laid out methods to provide "minute-by-minute services of a digital computer equipped with computer-driven… display, and developing the new methods of thinking and working that allow the human to capitalize upon the computer's help" [I]. He described an architect using this system, the computer as his "clerk," to analyze specifications on the building and produce solutions that could be shared with builders, engineers, and peers.

Comparing these descriptions with modern HCI we can easily draw lines to Engelbart's influence. His concepts developed the backbone of how we think of computers as an extension

of human capability. By investing in his vision, him and his team developed major components to HCI and defined new boundaries that modern programs emerge from.

Four components he focused on were artifacts, language, methodology, and training. His influence on these elements shaped the workspace of the modern computer desktop, as we think of it. Artifacts such as the mouse, screen, keyboard, and printer are standard periphal hardware used to conduct contemporary business. Contributions in language, such as text editing and GUIs, are essential to HCI. The methodologies in which we organize our lives are very much based on the technology we access. Finally, training optimizes an individual's ability to exercise the prior three [I].

These components were organized into a "Two-Domain System" which relied on the only physical elements, the human and the artifacts. The success of the system was dependent on the capabilities of these two elements. Leading us to the original electronic interface.

Focused research on these components developed a powerful station to render solutions that enhanced interactions with others. Applying advancements in these four components, the modern desktop emerged with key interfaces, the mouse and GUIs. Engelbart organized a public display, the first of its kind, to demonstrate his system in hopes to raise awareness and gain more interest from fellow engineers.

In 1968, "The Mother of all Demos" was projected on a screen and recorded for the public to witness Engelbart's system. The mouse, GUIs, and text editing were introduced to fellow engineers and scientists. Engelbart's vision materialized for all to share.

The Mouse

The prototype mouse started as a small wooden box with three buttons and two perpendicular tracks with a cable connecting to the main unit. The story goes that engineers thought it looked like a mouse, and the name stuck, although even Engelbart humorously apologized for not having a more sophisticated name for his profound device [M.o.a.D.].

This tool was a cheap replacement for light pens, which developed around 1954 [IX]. It offered direct manipulation of on display objects, where before whole units would have to be removed and input correctly. This mobility offered accessibility to text editing, and phrase selection within documents. It offered a pointer to capatilize on the menu and icon technology circulating in the field. Most of all, it channeled major functions into hand-eye coordination, which unfamiliar users could master quickly.

Although groundbreaking, these advancements could not gain the attention needed for Engelbart's complete vision, resulting in a transition of his team and technology to Xerox PARC in the early 1970s. With this technology under new direction Xerox began focusing on a more easy to use system with less emphasis on addressing "human intellect" and more on a physical product. This resulted in the first computer system based on the mouse and GUI interface system, released as the Xerox Alto in 1972.

GUIs

GUIs have changed communication more than any other invention in the past 50 years. [III]. The human ability to process information through images and icons expedites HCI and opens new frontiers of interactions. While Engelbart harnessed GUIs for navigation through the system, developments at Xerox were including windows, menus, radio buttons, and check boxes

[VI]. This model was lead by Alan Kay, who's goals differed from Engelbart's, but technology remained. From this, development started to shift from being solely a product for complex and highly sophisticated computations, to a use electronics to address common everyday obstacles.

The mouse, keyboard, and GUIs became the primary interface for HCI. The method of exchange became an acronym known as WIMP for windows, icons, menus, pointing device. This interface worked well for less knowledgeable computer operators, by relying on hand-eye coordination. Prior to GUIs, the command line interface was the main method for inputing and retrieving data. Commands and programs took much more education to find solutions through the tool. Using familiar images for simple functions, and multiple tiles for separate applications, HCI was becoming identified as a tool for quality lifestyles like architects, designers, and builders.

The Altair 8800

In 1975, the newly developed Altair 8800, from MITS, made a large impact on hackers and electronic hobbyists [IV]. Commercialized as a self-assembly electronic kit in Popular Electronics, hobbyists and hackers quickly took advantage of the affordable option for a simple computer processor. Hobbyists used this main unit to run programs for peripharal hardware they found importance in. The demand for these products expressed a comprehension of the public to prompt more production from companies.

The first to realize the true value of the Altair 8800 were hobbyists with skills in soldering and electrical repair on non-computational electronics such as radios, calculators, and TV keyboards (which were different than the computer keyboards we have today). These were basically technicians and people with a personal interest in tinkering with electronics. Some did have higher education skills, but the true demographic for this product was just above the high

school education level. They're curiosity drove them to see the frontier in computer programming, but the hardware was just out of reach. The Altair 8800 bridged that gap [IV].

Most importantly, the Altair 8800 pioneered the platform for consumer based electronics [IV]. Bill Gates created the computer language, "Basic," using the Altair. As we know his efforts developed into Microsoft software. New public access stimulated innovation through clubs and activities aimed at pushing the limits to what could be done with computer electronics. Enthusiasts could share programs, and trade parts to discover new solutions to their projects. The Homebrew Computer Club was one of these clubs, and included some of the biggest influences to our modern market like Steve Wozniak, cofounder of Apple.

Conclusion

To identify influences that formed our current behaviors, and frames the way we think of computers, this study has examined Engelbart's contributions, the mouse, GUIs, and the Altair 8800. These influences have converged with public demand to precipitate electronic interfaces with a mass understanding of how to operate and capitalize on computer technology. From a passionate vision of computer aided society, Engelbart scouted a frontier with depths we are yet to discover. With a hacker society willing to share information, ideas, and solutions, developments emerged from exhausting research. The mouse enabled control over computer operations through hand-eye coordination, opening a channel for greater masses to utilize the power of electronics. GUIs have become a powerful communication tool that increases efficiency and decreases task load. The Altair 8800 gave early innovators their starts to our two major systems in HCI, Microsoft and Apple.

Through these trends we can see a simplification of the electronic interface and usability. We can see that interfaces have reached toward human communication, offering familiar

interactions that new users can associate with, from outside the electronics field. Even now, touch and motion activated interfaces continue to make interactions more intuitive. The more user-friendly devices have come out on top, in the competition for innovative electronic technology.

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