Another perspective of computer interface usability: not "easy to use" but "thinking to use"

Masanori Mizuno and Kiyofumi Motoyama, Nagoya University, Japan

Abstract (EN)

The history of computer interface shows us a different perspective about usability: Usability means not "easy to use", but "thinking to use". To make this clear, this paper first focuses on two important persons involved in developing the computer interface; Douglas Engelbart and Alan Kay. Next, the Star information system, announced by Xerox, is considered in order to explore why the paradigm discussed in this paper occurred. Engelbart was influenced by B.L.Whorf and explored the relationship between body sense and language. To investigate this relationship, he sought to connect "action" and "looking" via the computer screen. Therefore, Engelbart and his group invented the mouse as a pointing device that translates "action" into images on the computer screen for "looking". In this "action" - image - "looking" circular process, Engelbart wanted to allow new ways of thinking by using a computer. On the other hand, Alan Kay coined the slogan, "Doing with images makes symbols" to develop a different computer interface from Engelbart. Kay were affected by J. Bruner and focused on the link between "image" and "looking" as a thinking process. His overlapping window system was invented to fulfill Kay's intention. He wanted to make a strong relationship between "image" and "looking" in order to build a fantasy on the computer screen via controlling images. This requires the user to construct his/her own way of visual thinking way. Engelbart and Kay didn't intend to develop "easy to use" interfaces but "thinking to use" interfaces, capable of amplifying the human intellect. However, the basic elements that they invented for the computer interface contribute to developing "easy to use" interfaces and gave birth to the Star workstation. The concept of Star changed the meaning of usability to 'easy to use without thinking'. However, we must revisit Engelbart and Kay's ideas in order to open new possibility for the human-machine symbiosis.

Keywords: Computer interface, Usability, GUI, NLS, Alto, Star

Zusammenfassung (DE)

Aus der Geschichte der Bedieneroberfläche geht eine ganz andere Perspektive der Benutzerfreundlichkeit hervor. Und zwar bedeutet Benutzerfreundlichkeit nicht "leicht zu bedienen", sondern "denkend zu bedienen ". Um dies zu veranschaulichen, befasst sich diese Abhandlung zunächst mit Douglas Engelbart und Alan Kay, zwei wichtige Personen, die an der Entwicklung der Bedieneroberfläche mitgewirkt haben. Daran schließt sich eine Untersuchung des von Xerox angekündigten Star-Informationssystems an, um herauszufinden, wie es zu dem hier besprochenen Paradigma kam. Engelbart, unter dem Einfluss von B.L.Whorf, untersuchte die Beziehung zwischen Sinnesempfindung und Sprache. Zu diesem Zweck suchte er über den Computerbildschirm eine Verbindung zwischen "Handlung" und "Anschauen" herzustellen. Dies machte Engelbart und seine Gruppe zu den Erfindern der Maus als ein Zeigegerät, das "Handlung"

in Bilder zum "Anschauen" auf dem Computerbildschirm umwandelt. Mit diesem Zyklus "Handlung" - Bild - "Anschauen" wollte Engelbart durch den Gebrauch des Computers neue Denkweisen zulassen. Alan Kay seinerseits verfolgte unter dem Slogan "Doing with images makes symbols (Eine Benutzerschnittstelle sollte Synergien aus bildlichen und symbolischen Schemata gewinnen.)" einen von Engelbart unterschiedlichen Weg zur Bedieneroberfläche. Kay, unter dem Einfluss von J. Bruner, konzentrierte sich auf den die Verbindung zwischen "Bild" und "Anschauen" herstellenden Denkprozess. Sein sich überschneidendes Fenstersystem sollte Kays Absicht realisieren. Er wollte eine starke Beziehung zwischen "Bild" and "Anschauen" herstellen, um durch die Manipulierung von Bildern ein Fantasiebild auf dem Computerbildschirm aufzubauen. Dazu muss der Benutzer sein eigenes visuelles Denken entwickeln. Die Absicht von Engelbart und Kay war nicht, "leicht zu bedienende " Schnittstellen zu entwickeln sondern "denkend zu bedienende", die dazu fähig sind, den menschlichen Intellekt zu erweitern. Die Grundelemente ihrer Erfindung für die Bedieneroberfläche haben jedoch zur Entwicklung von "leicht bedienbaren" Schnittstellen geführt und so die Star-Workstation hervorgebracht. Das Star-Konzept hat der Benutzerfreundlichkeit die Bedeutung 'leicht bedienbar ohne zu denken' zugeordnet. Wir sollten uns jedoch erneut auf die Ideen von Engelbart und Kay besinnen, um neue Möglichkeiten für die Symbiose zwischen Mensch und Maschine zu eröffnen.

Schlüsselwörter: Bedieneroberfläche, Benutzerfreundlichkeit, GUI, NLS, Alto, Star

Résumé (FR)

L'histoire de l'interface d'ordinateur nous montre un différent aspect de la facilité d'utilisation: facilité d'utilisation ne signifie pas « facile à utiliser », mais « réfléchir en utilisant ». Afin de clarifier cette définition, cet article se focalise, premièrement, sur deux personnalités importantes impliquées dans le développement de l'interface d'ordinateur: Douglas Engelbart et Alan Kay. Ensuite, une analyse est elaborée sur le système informatique Star, introduit par Xerox, pour examiner les causes du paradigme discuté dans cet article. Engelbart a été influencé par B.L.Whorf et a étudié le rapport entre les sens des humains et les langages. Pour étudier ce rapport, il a cherché à relier l' « action » et la « vue » par l'intermédiaire de l'écran d'ordinateur. Par conséquent, Engelbart et son équipe ont inventé la souris comme dispositif de pointage qui traduit l' « action » en image sur l'écran d'ordinateur pour la « vue ». Dans ce processus circulaire « action »-image-« vue », Engelbart a voulu introduire une nouvelle manière de pensée en utilisant un ordinateur. D'autre part, Alan Kay, auteur du slogan « Doing with images makes symbols», qui peut être traduit comme « se servir d'images pour concretiser la pensée », s'est inspiré de ce slogan pour développer une interface d'ordinateur différente de celle de Engelbart. Kay, influencé par J. Bruner, s'est concentré sur le lien entre l' « image » et la « vue » comme processus de pensée. Pour atteindre son objectif, Kay a inventé le système de fenêtre de recouvrement. Il voulait établir un rapport profond entre l' « image » et la « vue » afin de créer une fantaisie sur l'écran d'ordinateur en contrôlant les images. Ceci obligerait l'utilisateur à former sa propre manière de pensée visuelle. Engelbart et Kay n'avaient pas l'intention de développer des interfaces « facile à utiliser » mais des interfaces à « réfléchir en utilisant » capables d'amplifier les capacités de l'intellect humain. Cependant, les éléments de base qu'ils ont inventés pour l'interface d'ordinateur ont contribué à développer des interfaces « facile à utliser » et ont donné naissance au poste de travail Star. Le concept du poste de travail Star a suscité l'interpretation « utiliser facilement sans réfléchir » à la facilité d'utilisation. Cependant, nous devons redécouvrir les conceptions de Engelbart et de Kay afin de créer de nouvelles possibilités pour la symbiose homme-machine.

Mots clés: Interface d'ordinateur, facilité d'utilisation, interface utilisateur graphique (IUG), NLS, Alto, Star

I. Introduction

The history of computer interface shows us a different perspective regarding usability: Usability means not "easy to use", but "thinking to use". At first, usability meant "thinking to use," but something changed in the history of computer interface design; now usability is analogous to "easy to use". To make the paradigm change clear, this paper first focuses on two persons involved in developing the computer interface- Douglas Engelbart and Alan kay. Engelbart invented the mouse, Kay, the overlapping window system, both of which are essential to the computer interface. I want to consider their possible intentions for the ultimate computer interface while inventing their own systems. Next, in order to explore why the paradigm change happened, I will consider the Star information system developed by Xerox.

II. Engelbart: the somesthetical and structural thinking

Engelbart (1962) was influenced by B.L.Whorf and wrote the Neo-Whorfian hypothesis: "Both the language used by a culture, and the capability for effective intellectual activity are directly affected during their evolution by the means by which individuals control the external manipulation of symbols." Engelbart thought of the computer as a new device of "Automated external symbol manipulation." Further, the human beings would be augmented by using the computer properly. Engelbart believed that our way of thinking would change if our action changed. T. Bardini (2000) points out that Engelbart wanted to evolve the human way of thinking somesthetically with the electronic brain. According to the Neo-Whorfian hypothesis, he invented the mouse and chord keyset to control images on the computer screen. Moreover, Engelbart thought that a display system was needed to control the external manipulation of symbols. Engelbart (1962) wrote that:

> To help us get better comprehension of the structure of an argument, we can also call forth a schematic or graphical display. Once the antecedent consequent links have been established, the computer can automatically construct such a display for us.

This statement implied that he hoped to connect "action" with "looking" by attaching the computer to a visual display screen. Whorf's reasoning follows (1956):

> It would seem as if kinesthesia, or the sensing of muscular movement, though arising before language, should be made more highly conscious by linguistic use of imaginary space and metaphorical images of motion.

Engelbart wanted to display "metaphorical images of motion," generated by using the mouse and chord keyset into the computer screen, to augment our "linguistic use of imaginary space." In fact, Engelbart demonstrated this connection effectively with his system, oN Line System (NLS) in 1968. He made a feedback circuit between "action" and "looking" via the computer screen. This showed that the user was always aware of his/her "action" with the mouse and chord keyset in the process of understanding what he/she was "looking" at on the computer screen. In short, the user must always connect his/her "action" and "looking" to interpret images on the display while manipulating the computer. At the same time, NLS made the user aware of his/her own body action when he/she interpreted images. Moreover, the user could control his/her thinking more structurally because his/her ideas were projected into the computer screen and the computer showed their relationship clearly like in hypertext. Engelbart wanted to make the symbiotic unit by connecting the human's somesthetical factor with the computer's structural factor. It meant that to the using computer improved not only the manner in which one controlled symbols, but also one's way of somesthetical and structural thinking.

III. Alan Kay: the visual way of thinking

Alan Kay (1990) coined the slogan, "Doing with images makes symbols" to develop a different computer interface from Engelbart. Kay was affected by J. Bruner and focused on a link between images and looking as a thinking process. Bruner (1966) said:

> What comes out of this picture, rough though I have sketched it, is a view of human beings who have developed three parallel systems for processing information and for representing it --- one through manipulation and action, one through perceptual organization and imagery, and one through symbolic apparatus. It is not that these are "stage" in any sense; they are rather emphases in development.

Alan Kay invented a system of overlapping window as an intuitive way to use a computer to fulfill his "Doing with images makes symbols" goal. To change between computer modes or applications, the user need only bring the desired window to the top of the stack. Kay (1990) said:

> An intuitive way to use the windows was to activate the window that the mouse was in and bring it to the "top." This interaction was modeless in a special sense of the word. The active window constituted a mode to be sure --- one window might hold a painting kit, another might hold text --- but one could get to the next window to do something in without any special termination.

Kay made the user focus on looking at images on the screen in order to control the computer. The user, upon walking into an illusion, enclosed by many images, forgets his/her own body that actually manipulated the mouse. Kay constructed a strong relationship between "image" and "looking" by virtually eliminating the sense of body. The

use then doesn't need to be aware of their own "action" in order to change modes- a requirement of Engelbart's system- the user simply looks at images on the display to control the computer.

Furthermore, Kay (1990) wrote that "The slogan also implies --- as did Bruner --- that one should start with --- be grounded in --- the concrete 'Doing with Images,' and be carried into the more abstract 'makes Symbols. (Sic)" Here, controlling images on the computer screen became the system of symbol whereby one controls the computer itself. The bitmap screen made the overlapping window system possible to run on Alto- the first personal computer developed by the Xerox Palo Alto Research Center. The bitmap screen connected the bits of computer memory and the pixels of the display directly; the user could therefore control the computer by controlling the images on the screen. Kay's idea of the computer as "fantasy amplifier" may have a relationship with these technological innovations. H. Rheingold (1985) recorded Kay's words, "We can't exist without fantasy because it is part of being a human. A fantasy is a simpler, more controllable world". Kay might have considered that "a simpler, more controllable" fantasy world would have great power, because the best point of computers was their ability to simulate. The fantasy that the user generated was displayed on the computer screen faithfully, and the user could direct the precise images in order to control the computer. Finally, the user could watch the computer's response in images, which amplified the user's fantasy on the screen, and illuminated the underlying principal of the world. This means that a user could construct "a simpler, more controllable world" through images as a tool or application he/she needed to solve his/her own problems in, and understand the outside world. This was a kind of perfectly rational world, like which a man watched in the camera obscura (Crary, 1992). Therefore, Kay had to cut out body-consciousness in order to allow for the user to construct his/her own visual way of thinking.

IV. Star: the paradigm change

Now, we are deceived by friendly icons. These icons don’t request that the user consider what they are doing because there is one presupposition: 'it is very easy for the user to understand the meanings of images without learning'. After Engelbart and Kay, Xerox announced the 8010 Star information System in 1981. Star had a bitmap screen, windows system, mouse, and icons, all of which Engelbart and Kay are greatly concerned with. The engineers of Star adopted a desktop metaphor for the users to understand how to use the computer easily. The computer screen also displayed icons of familiar office objects. Only the requirement of the user was locating an icon on the screen and pointing to it with the mouse. Moreover, the engineers said (1982) "A well-designed system makes everything relevant to a task visible on the screen," and:

> When everything being dealt with in a computer system is visible, the display screen relieves the load on the short-term memory by acting as a sort of "visual cache." Thinking becomes easier and more productive. A well-designed computer system can actually improve the quality of your thinking. In addition, visual communication is often

more efficient than linear communication; a picture is worth a thousand words.

In this statement, it became clear that the designers of Star thought of the computer screen as a "visual cache" for helping the user's short-term memory. This perspective lacks opportunities for the augmentation or amplification of human intelligence. Engelbart and Kay wanted to use the computer as thinking tool. Therefore, they considered a user-computer thinking process circuit, allowing the user to build his/her own world. Engelbart read Whorf's linguistics and Kay read Bruner's developmental psychology in order to investigate how the human make own mental world. However, the designers of Star focused on cognitive psychology and the images on the screen became a visual stimulus to invoke the user's actions.

Star did not succeed commercially, but its interface philosophy has had great influence on the design of subsequent computer systems. As a result, many computer engineers now believe that showing information via images is good for the user and equals usability. Star provided the user with a kind of relationship between stimulus and response not unlike the Pavlov's dog. There is a Pavlovian relationship when many people use the word, "usability" now. This "usability" means "easy to use" without the need for thinking. This idea conceals the fact that usability has another meaning, "thinking to use."

V. Coda

After Star, the idea of usability as "easy to use" became dominant in the computer industry. Apple's Macintosh has had great influence. However, this direction encourages the relationship between stimulus and response. There is no interactive communication, because there is no room for the user to think about what he/she is doing. We must revisit Engelbart and Kay's idea of usability as "thinking to use" in order to open new possibilities between the humans and computers, and to restore real interactive communication. Then and only then, will we achieve the human-machine symbiosis.

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