A Short Report about Usability

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Abstract
In this paper a general overview of the concept of usability in interfaces of machinery is given, with a special focus on computer software. Amongst other things ulterior motives and the benefits of usable interface design are explicated. Moreover the concepts described are exemplified by their usage in Web design.

Introduction
We encounter the concepts of usability every day in many different ways – either applied, usually resulting in our lives being simplified without noticing, or unconsciously neglected, causing us to be confused or even annoyed. Every object – from every-day things like doorknobs to highly complex devices such as computers and their software – must offer people obvious ways to use it. The simpler and more intuitive a device's interface, the more usable it is.

What Is Usability?
In very general terms usability comprises everything that is connected with the intuitive and efficient handling of respectively interaction with human-made devices. As a consequence, usability is an interdisciplinary field, coalescing industrial design, psychology, physiology and ergonomics ("human factors"), and – as an important part – user testing and evaluation [2, 14, 21].

The International Organization for Standardization ISO tries to define usability as follows (ISO 9241):

"[Usability refers to] the effectiveness, efficiency and satisfaction with which specified users achieve specified goals in particular environments." [15]

ISO mentions two crucial criteria for assessing usability subjectively and objectively: efficiency and satisfaction. Both are related to the user's sensation when operating a certain product or device. Though, the objective result and the time invested are of interest as well. However, the users' satisfaction normally stands in the foreground, because this can make all the difference between a successful and profitable product, and one that is not [10].

Beyond that, according to Jakob Nielsen, usability is defined by the following 5 quality components [14]:

- *Learnability:* How fast can users learn working with a certain interface and how easy is it for them to do more or less complex tasks when working with the interface for the very first time?
- *Efficiency:* How fast are users in accomplishing different tasks once they have internalized the functionality of the interface design?
- *Memorability:* When users have not worked with the interface for a longer time, how much of its functionality do they remember and how fast can they regain their proficiency?
- *Errors:* Do users make many errors when working with the interface? Are those severe errors and can they easily cope with them?
- *Satisfaction:* How satisfied are users after working with the interface concerning the time they had to invest? Was the interface pleasant to use?

However, usability is hard to define precisely, and so every expert suggests another conception. Whitney Quesenbery, for example, characterizes usability using "5Es". According to her, usable products have to be effective, efficient, engaging, error tolerant and easy to learn [17]. Alan Dix lays stress on learnability, flexibility and robustness [2].

From the user's point of view one can summarize all that in a short phrase, which can also be seen as a guiding principle when developing usable products:

"Don't make me think!" [7]

The term "usability" was coined in the late 1980s, when John Whiteside (Digital Equipment Corporation) and John Bennett (IBM) published several articles about usability engineering. Their papers dealt with a new approach to product design, stressing the importance of usable design and user testing to enhance the products' quality and the users' productivity [4].

Before proceeding further, I'd like to annotate the following: Nowadays the computer is a universal tool for working with all types of media. In order to facilitate handling those far-reaching possibilities, especially for laymen, the concepts of usability are essential when developing modern GUIs (Graphical User Interfaces). Therefore usability is one of the fundaments of HCI studies (Human-Computer Interaction) [2]. For this reason I will hence focus on usability of software and websites.

Advantages of Optimized Usability

Until now we merely concentrated on how users profit from usable products. Actually these advantages are the basis of the above definition, since the concept of usability literally only makes sense if users are involved. Facilitated learning, increased productivity and efficiency, less frustration – these effects are decisive for users' satisfaction [3, 20].

Out of that, however, a number of benefits arise for companies that develop products with optimized usability:

- Increased sales and thus higher revenues
- Reduced costs for development, maintenance and user support
- Enhanced loyalty of costumers
- Image improvement (of company and product)

Additionally, if a company itself utilizes software with optimized interfaces, increased efficiency, higher productivity and reduced training time of employees inure to the company's own benefit [2, 3, 20].

Not wrongly, good usability is nowadays often regarded as a sign of quality. Of course, improving a product's user-friendliness costs more money at first - just like any other measures to enhance product quality. The above-mentioned benefits prevail by far, though. For this reason, investment in usability is a relatively facile yet intelligent business action [18, 20]. Roger Pressman illustrates this fact in a very simple way:

"Every $1 invested in user-centered design returns between $2 and $100." [16]

Designing User-Centered Interfaces

As the previous paragraph shows, usability should be considered as an essential component of a high quality product. Therefore, we must ask ourselves the question how to create usable, user-centered interfaces.

In his collection of usability maxims, Arnold Lund gives probably the easiest answer to this question:

"Know thy user, and YOU are not thy user." [8]

Hence user testing and research is the crucial method for optimizing a product's usability, as long as the users are chosen wisely to be representative for the product's target audience [14]. As user testing is explicated in the next chapter, I will not go into detail at this point.

In the process of interface development and testing, the concept of iterative design plays a major role. This term describes a cyclic step-by-step procedure with alternating sequences of prototype creation and user testing. After each iteration, the results of the last test analysis get incorporated into the design, ensuring that the interface's user-friendliness is improved steadily. By that approach, usability problems can be identified and fixed at an early stage or at least before the final release of the product [8, 11, 12, 17].

In order to be at all able to design a functional prototype for an interface, however, designers need some basic rules to follow. For this purpose, as mentioned above, Arnold Lund has put together a number of practical, self-explanatory and slightly facetious maxims, of which I want to list a few to give an overview [8]:

- *Keep it simple.*
- *Things that look the same should act the same.*
- *Every action should have a reaction.*
- *Consistency, consistency, consistency.*
- *Keep it neat. Keep it organized.*

Following these maxims, one approach to prototyping could be parallel design: At the same time, several groups of designers work out an interface independently, having in common solely a basic set of requirements. These designs are then merged into one, comprising the best ideas and concepts of each of them. The merging step can optionally be done via user testing. After that, the design process continues with the above-mentioned iterative design to further optimize the interface prototype. *Figure 1* shows this process of designing and testing [1, 12].

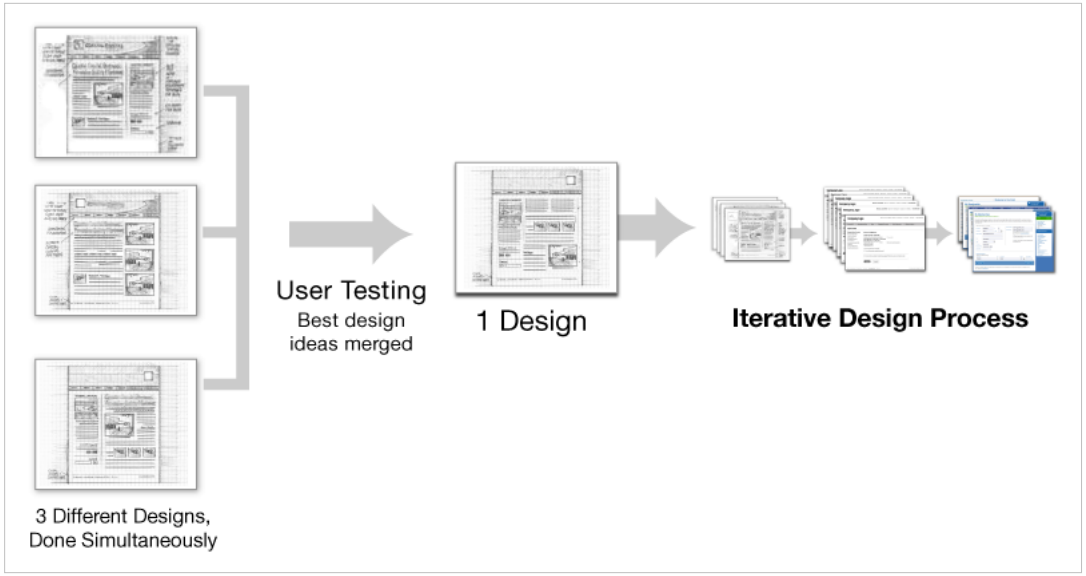

Figure 1. Interface design step-by-step: At first parallel design, then user testing to help merging the created designs into one, and after that iterative design. The number of designs in the parallel design process can differ from 3, of course. Though, according to Jakob Nielsen, who also created this figure, the ideal number is between 3 and 5 [12].

Usability Evaluation and User Testing

As shown in the previous chapter, user testing is virtually indispensable when designing usable interfaces. Although usability experts have developed various methods to assess user interfaces without actually testing them, no theoretical evaluation done by experts can replace a real user test. Just for completeness I want to name some of these methods, which are summarized under the term "Usability Inspection" [13]:

- *Pluralistic walkthrough*: Experts and users discuss different using scenarios together and try to find optimizations.
- *Cognitive walkthrough*: Experts emulate the user's thoughts when solving problems concerning the interface.
- *Heuristic evaluation*: Usability experts check if the interaction of the interface with the user (e.g. dialogue boxes) follows standard principles.

But let's come back to the actual topic of this chapter, user testing. When an interface prototype is ready to test, the first task is to find representative users. Representative in so far as it usually makes no sense to let a certain system be tested by users who would never use it in real life. In most cases it is sufficient to test with only 5 users – at least when the project is still in development process. When running smaller tests, it is possible to do more of them and refine the interface design in-between (see "iterative design") [14, 19].

The chosen users are then confronted with the interface and asked to perform certain tasks, which should be representative as well in order to avoid warped test results [14].

The most important part is observing the users' actions without influencing them, for example by helping them or drawing their attention to a special feature of the interface. Potential weaknesses of the current design can then be detected directly, because most likely these are the parts where users are having difficulties. The data collected in this step is quantitative data, which means that the user's accuracy, speed and recollection are measured as well as the number of errors [6, 14].

After that, qualitative data can be gathered, too. The users are asked different questions concerning their satisfaction with the interface design and its handling. One thing is to be noted here, however, and one cannot put it any better than Jakob Nielson [6, 14]:

"Shut up and let the users do the talking." [14]

Applying Usability Concepts in Web Design

The best example for the practical application of usability concepts is Web design. Websites virtually only consist of an interface with information embedded. Furthermore Web designers have absolutely no restrictions when creating a website design – principally everything is possible [5].

However, designing a usable website is a great challenge. The average visitor scans the homepage of a website for just a few seconds before leaving again. Therefore, a website hast to be clearly structured, easy to use and must set obvious priorities to enable users to see at a glance what the site offers [5, 14].

To achieve this, Web designers have to optimize every point of the following list [9]:

- Accessibility
- Identity
- Navigation
- Content

People don't want to read tutorials on how to use a website – if it is not pleasant to use or if users suddenly get lost on a site, there are hundreds of other websites offering similar information but providing better usability. Understandably, users do not have any tolerance when facing a difficulty on a website. Indeed, Web design is a permanent struggle of implementing usability concepts best [5, 14].[1]

Conclusion

As we have seen, usability is an important aspect of the computer age. For the computer a cornucopia of software exists and the Internet offers us millions of websites that all contend for the favor of users. However, it is hard to achieve market advantages without a user-friendly interface. Therefore, it's worthwhile to internalize the concepts of usability - not least to facilitate the users' – our – lives.

[1] Besides, this explains the frequent redesign of many websites within just a few years.

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