

Intuitive use in design guidelines

Can intuitive use be applied to a product?

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ABSTRACT

Several design guidelines recommend to design for intuitive use and marketing often advertises products as intuitive in use – but what does it mean for a design to be intuitive? One design guideline that embraces intuitive use is described by the principles of universal design. The third principle says that the design should strive for ‘Simple and intuitive use’ regardless of experience and cognitive abilities. This article will examine the concept of intuitive use and address the case of an automatic toilet door system that, even though universally designed, seems to be confusing to many users. From the literature, the focus will lie on the concepts of affordance and familiarity, due to its relation to intuition. The case is further used to evaluate these concepts and to see if principle three of universal design is possible to fulfill. The article concludes that the principle is a good reminder of an important concept; however, the design process needs supplements from other design literature to fulfill the principle.

KEYWORDS: Affordance, Familiarity, Intuitive use

1. INTRODUCTION

For many years design guidelines, including the seven principles of universal design, have recommended products and interfaces to be created with the intention of being intuitive in use [1]. Universal design defines Intuitive use as the ‘use of the design is easy to understand, regardless of the user’s experience, knowledge, language skills, or current concentration level’ [2]. Yet this definition of intuitive use is unclear on why it happens and how it works. Molly Story, one of the developers of the principles of universal design has expressed that ‘we have not done any deep research in this area’ and ‘the concept (of intuitive use) makes so much sense to me I never questioned it’ [3].

By definition, intuition is something that does not require conscious thought. [1]The term intuitive means having the ability to understand or know something without any direct evidence or reasoning process. [4] But simply using this definition in a design process cannot work as a complete instruction on how to execute the design. Further the definition does not say anything about what intuitive use is built upon, and therefor nothing about how it can be applied to a design process.

1.1 The methods used in this article

The methods used in this article is an extensive literature review, initially on the usability perspective, user-centered design and HCI (Human Computer Interaction). The objective was to get an understanding of how products could be

easy to use and comprehensible. This literature led the author towards the investigation of intuitive use, where especially three authors were prominent, Blackler, Popovic and Mahar. In advance, a case from universal design was discovered that appeared to be difficult in terms of intuitive use, and this case was later analyzed bearing the literature on intuitive use in mind.

1.2 The goal of this article

As indicated in the introduction, this article will explore one of the most fundamental aspects of interaction design, namely that it should be intuitive in use. The goal of the article is to examine the concept of intuitive use, to evaluate if it is possible to apply such a concept to a design guideline such as the universal design principles. The findings will be used to evaluate how the locking system in the case can be improved.

1.3 The structure of this article

The paper starts by introducing universal design, and a case about an automatic train toilet, which seems to be confusing to several users although being a product of universal design. In the principles of universal design, one will find intuitive use to be a desire although not explained. Next, literature from other design areas regarding comprehensible design is briefly addressed. From this, two frequent concepts related to intuitive use appear namely affordance and familiarity. The article will give an account of these two concepts, evaluate them, and discuss in light of the toilet door case. The findings will be used to evaluate if it is possible to use the concept of intuitive use as it is in the universal design principles. Thereafter comes a conclusion.

2. UNIVERSAL DESIGN

The term universal design describes the concept of designing all products and spaces to be aesthetic and usable to the greatest extent of people, regardless of age, ability, or status in life. The philosophy is to make things safer, easier and

more convenient for everyone [5]. The term evolved from Accessible design, which operates with the idea of a divided population, that is the able and the disabled. Whereas accessible design only focuses on designing for the disabled group, universal design goes further by recognizing a wide spectrum of human abilities. Everyone, even the most abled-bodied person will pass through childhood, periods of temporary illness, injury and old age. Universal design philosophy takes into account both physical, perceptual and cognitive abilities in the design process. The idea is that by designing for human diversity, there can be created things and spaces that will be better for everyone.

2.1 Universal design principles

The seven principles of universal design were developed at the North Carolina State University in 1997 by a team of architects, product designers, engineers and environmental design researchers [6]. The group was led by the late Ronald Mace, who first invented the term Universal design. The purpose of the principles is to guide the design process, to evaluate existing or new designs of environments, products or communications, and to teach students and practitioners [2].

Principle one: Equitable Use

The design is useful and marketable to people with diverse abilities

Principle two: Flexibility in Use

The design accommodates a wide range of individual preferences and abilities.

Principle three: Simple and Intuitive Use

Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level.

Principle four: Perceptible Information

The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.

Principle five: Tolerance for Error

The design minimizes hazards and the adverse consequences of accidental or unintended actions.

Principle six: Low Physical Effort

The design can be used efficiently and comfortably and with a minimum of fatigue.

Principle seven: Size and Space for Approach and Use Appropriate size and space is provided for approach, reach, manipulation, and use regardless of the user's body size, posture, or mobility.

2.2 Case: Toilet door locks on trains

From 2012 and onwards, The Norwegian state railways (NSB) has put in to service about 70 new regional trains from Stadler. The trains are overall designed with focus on universal design [7]. For instance, all entrances allows step-free access, and are equipped with running boards in two levels to facilitate entry and exit at low platforms. One of the entrances are fitted with wheelchair lifts, and the seats allocated to passengers who depend on wheelchairs are integrated in the ordinary compartments. The trains are designed with large and clear information displays, good solutions for bicycles, strollers and luggage, they have large open lobbies and good seating comfort. Also all the toilets are designed with emphasis on universal design to ease accessibility.

Recent design of cubicles on trains in general, not just on Stadler trains, has introduced a three stage electronic door locking system [8]. Many people are struggling to operate this locking system, although many instructions are provided both in form of icons, flashing lights, Braille and sometimes even writing in different languages. The doors still cause confusion, resulting in people using the toilet behind an unlocked door. This again has led to both embarrassing and distressing situations for the users.

The difficulties with this particular locking system is a very interesting case study on intuitive use, since it is hard to avoid a trip to the toilet during a long train ride. Hence many people will have to face the interaction whether they like it or not. A visit to the toilet is a very vulnerable situation, and to maintain the dignity of the users one of the most important aspects is being able to lock the door. Not all users succeed in doing so.

There are no statistics regarding the misunderstanding of the interaction. However, Aftenposten did an observation of the phenomena in 2012 [9]. They discovered that on a train ride between Oslo and Skien 4 out of 9 people misinterpreted the doors, and apparently used the toilet unlocked. Twice during the observation, next person in line opened the door.



Figure 1: Illustration of the pushbuttons of the locking system.

In figure 1 there is an illustration of the pushbuttons of the locking system. The proposed interaction of the doors involves pushing the green flashing middle button to close the door, followed by activating a red flashing button with a key symbol to lock it. When the lock is activated the flashing stops, but the light is still red. As soon as the door is locked, the opening button flashes green to indicate the next interaction of the system. The buttons are located on the wall in hip height.

2.3 The principles of universal design in relation to the case

At first glance, the locking system seems self-explanatory. Nevertheless, many people fail to lock the door, which implies that there is something wrong with the design of the interaction. Fiendish locking mechanisms make people feel uneasy about using public toilets [10]. Some people are frightened by the automatic element, fearing they may be locked in or exposed [11]. This fear can make the anticipated intuitive interaction less intuitive.

The problem may lie in the interpretation of the principles of universal design. How can something be designed to be simple and intuitive in use as in principle three, still cause so much frustration? Is the information perceptible enough to fulfill principle four about communicating necessary information effectively to the user? Moreover, does the interaction really minimize unintended actions as recommended in principle five?

As mentioned in the introduction, one of the developers of the principles of universal design expressed that the concept of intuitive use made so much sense that it was never really questioned [3].

The problem with the automatic door locks shows that it is not easy to fulfill the universal design principles. Even though the idea of intuitive use seems fundamental, being able to apply the concept to a design requires further investigation of the mechanisms behind intuitive use. This exploration may be based on other design discipline's approaches to make design comprehensible.

3. INTUITIVE USE

Intuitive use is a term widely mentioned in product reviews and advertising. One can assume that it implies use without instruction, but it is not clear why and how this occur. Intuitive use of products has been mentioned, but not elaborated, by a variety of authors [2] [12] [13].

According to Blackler *et. al.* very little work has been done in the area of understanding intuitive use.

On the other hand, concepts similar to intuitive use is taken into account in various design literature. For instance, user-centered design (UCD) aims at anticipating final use during the design process by involving people who are considered potential future users [14] [15]. In some approaches to user-centered design, the goal is to understand how a given design is interpreted in order to make the intended interpretation into the one most likely to happen. This approach can be related to the idea of intuitive use, since the focus is to determine whether a product is easy to understand and easy to use.

Donald Norman also addresses Human-centered design, which is quite similar to UCD [16]. It circles around the understanding of people's needs, mainly through observations as people might be unaware of their true needs. Like in UCD, extensive testing is done to ensure the design meets the intended need.

In Human Computer Interaction (HCI) the concept of affordance is a hot topic [17]. Although the term affordance is used in different ways within the HCI literature, understanding the term appears essential to anyone who aims to design intuitive products.

The most profound research on the term intuitive use is done by Blackler, Popovic, Mahar and coauthors through experimental work in recent years. The authors have concluded that intuitive use is highly related to prior experience and familiarity with similar products or situations [3] [18] [19] [20] [21] [22] [23]. In this paper, their work on intuitive use related to familiarity, and the HCI literatures approach to affordance have been found to be interesting topics to follow up on. Affordance as a concept was selected due to the similarities of what one would want to achieve in a design process regarding intuitive use. Familiarity was selected due to being one of the

only concepts to directly address the term intuitive use.

3.1 Affordances

The term affordances was originally introduced by the psychologist James J. Gibson in the late 1970s [24]. Gibson argued that affordances are ‘action possibilities’ latent in the environment, objectively measurable, and independent of the individual’s ability to recognize them, but always in relation to the actor and therefore dependent on their capabilities.

However, in 1988, Donald Norman adopted the concept of affordances for the design of common objects and both implicitly and explicitly adjusted the meaning given by Gibson [25]. In the first edition of ‘The psychology of everyday things’, Norman defines affordances as ‘the perceived and actual properties of the thing, primarily those fundamental properties that determine just how the thing could possibly be used (e.g. a chair affords sitting; glass affords seeing through, breaking; wood affords solidity, opacity, support, carving)’. Norman argues that affordances provide people with clues on how to operate a device.

Norman’s definition spread quickly in the HCI community, but some ambiguities have led to widely varying usage in the HCI literature. For instance designers using the word to describe where actions should take place in an interface [16]. In his later work, Norman tries to clarify his original definition of affordance. He argues that the term affordance refers to the relationship between the properties of a physical object and the capabilities of any interacting agent. An affordance is not a property in itself. He also states that the word affordance in his early work should be replaced with the phrase ‘perceived affordance’. Norman disagrees with Gibson in the declaration that affordances needs no interpretation. He argues that affordances exists even if they are not visible, but visible affordances helps the designers to provide clues to the operation of things [16]. Perceived affordances help people figure out what actions are possible

without the need for labels, instructions or asking for help.

In the context of industrial design, affordance is understood as a three-way relationship among users, objects, and actions [26]. The concept is attractive to many designers because it helps them shift their focus from users’ mind to their action. Affordances is used as a framework to explain how the potentiality of a product directly will affect a user’s action.

3.2 Difficulties with affordances

Affordances becomes a complex concept when things found in daily use such as switches, knobs, and buttons work differently (but look similar) in different parts of the world [27]. Donald Norman claims that, when simple things need pictures, labels, or instructions, the design has already failed [16]. Still, the design also seem to fail when the users’ culture and the context of use is ignored.

A study done by Oshlyansky *et. al.* shows that US and UK citizens disagree on the affordance of a light switch [27]. The study showed that UK participants thought the down position of a light switch indicated that it was on; for their US counterparts it meant off. This indicates that affordances needs to be discussed with respect to both culture and context, and that it does not necessarily give a clue on how to operate something.

Another example on difficulties with affordances is found in the notion of which arrow to push in order to continue a digital slideshow [16]. Donald Norman discovered that the understanding of forward and backward in a presentation depended on which nation you asked. This depended on what those asked perceived as the moving object. Is it the slides that moves towards the audience? Or is it the audience that moves through the slideshow? Here, understanding the culture of the users seems essential.

Another good example on how complex affordances can be are found in the article *Affordance as context* by Phil Turner [28]. An American tourist failed to open the door of an old British slam-door train. The tourist was unfamiliar with the design of the doors, and the interior did not offer a simple affordance of depressing a handle and pushing open. However, the exterior did and the clue was to lean outside through the window and do the operation from there. This example introduces the factor of familiarity when it comes to affordances, and shows that there is a link between the two concepts.

3.3 Familiarity and prior experience

Raskin suggests to replace the word intuitive with the word familiar [29]. Familiarity is a readiness to handle things, and has been developed from the earliest years. According to Turner the psychological basis of familiarity may be more fully understood as a change in perception rather than the creation of knowledge [1].

The link between intuition and previous experience is generally not recognized, and many assume intuition is instinctive or innate [18]. However, an individual's experience gradually increases over time. An infant's intuition will mostly consist of instinctive responses to stimuli, but an adult will include more learned responses as their intuition develop through the years.

Experience is closely related to familiarity. Lawry *et. al.* uses the definition of familiarity as well-known and experience defined as 'having become skillful or knowledgeable from extensive participation or observation' [19]. Gefen describes familiarity as 'understanding, often based on previous interactions, experiences, and learning of what, why, where and when others do what they do' [30]. In relation to interfaces, he argues that familiarity is an awareness based on experience.

All new products make some reference to previous generations of products in some way, shape or form, and users generally rely on their experience with previous products when

interacting with a new one [19]. Products that require new user knowledge, rather than utilizing existing knowledge may face difficulties in use, understanding, and learnability. It is suggested that as the newness or unfamiliarity of a product increases, so too does the complexity of the designing required to make the interface intuitive to use [21].

3.4 Learned intuitive use

Some products we find intuitive in use today, are actually learned through instructions or instruction manuals a long time ago, and then the knowledge is passed down to newer generations of users through observation [29]. It is claimed that the use of a computer mouse is intuitive, however Raskin argues that the intuitiveness in this case is examined incorrectly.

Raskin uses the example of when he first introduced the computer mouse to a computer-literate, who had never seen a mouse, nor any advertising or literature about it [29]. He told the person it was 'a mouse', and that it was used to operate the computer program. The computer-literate picked up the mouse and tried to move it in the air, discovered the ball on the bottom, held the mouse upside down, and continued to turn the ball. In the upside down position, the mouse wouldn't work. After shaking it, and making numerous attempts to operate it, the test-person gave up and asked for instructions. The computer-literate was familiar with joysticks to operate a computer program. When pointed out that the cursor moved on the screen when the mouse was moved on the desk, and that the raised area on top was a push-button, the computer-literate could immediately use the mouse without any more instructions. The familiarity was there.

Blackler *et. al.* also experimented with familiarity and learned intuitive use. One of their experiments was to have people operate a Fuji 4700 digital camera [18]. This camera had a wide range of features, some unique to the model, and other features that should be familiar to user who had used similar digital products. They found that

participants with relevant past experience used the new camera faster and more intuitively. They also found that so called expert users of digital cameras, who had limited experience with other digital products, completed the tasks slower than beginners with more experience from other digital products. From the findings the authors suggest that relevant past experience is transferable between products, and probably also between contexts.

3.5 Principles of intuitive use

Blackler, Popovic and Mahar have through their research on familiarity developed three principles [23] for applying intuitive use to a design:

Principle one

Use familiar symbols and/or words for well-known functions, put them in a familiar or expected position and make the function comparable with similar functions users have seen before.

Principle two

Make it obvious what less well-known functions will do by using familiar things as metaphors to demonstrate their function.

Principle three

Increase consistency so that function, location and appearance of features are consistent between different parts of the design and throughout each part.

4. INVESTIGATION OF AFFORDANCE AND FAMILIARITY ON THE LOCK

To test the concepts of affordance and familiarity in lights of the universal designed toilet doors, the author of this article conducted a survey. The survey tested conventions of the locking button both in and out of context.

When asked out of context what a red flashing push-button meant, five out of nine people said danger or warning, and that the button should not be pushed unnecessarily. Only two out of nine wanted to push the button in this setting.

When the key icon was introduced to the same red flashing button, seven out of nine said the door was already locked. Only one out of nine people meant a red flashing button with a key icon was intended to lock something.

When the author introduced the case, and told them that the button belonged to a toilet door on a train, four out of nine people recognized it. Three of the four said that even though they had encountered the toilet doors multiple times, they still had to think while operating them.

5. DISCUSSION

5.1 Evaluation of the literature

It is said that intuition is something that develops over time through experience and learned responses. This seems to be the essence of familiarity. The author's impression is that both affordance and familiarity attempts to get the user to successfully comprehend, therefore the concepts may not be so different after all. Even Norman argues that affordance needs interpretation [16], hence the concept of familiarity can seem embedded in his definition of affordance. Although Blackler, Popovic and Mahar have identified intuitive use of products as a rather unexplored field of study, it seems other design areas use other terms and concepts to explain similar mechanisms.

5.2 The toilet doors and affordance

Many people acknowledged that the button afforded to be pressed, but the red light made them think it was not to be pressed unnecessarily. It therefore does not seem like the problem of the locking system lies in the understanding of affordance. Even though affordances are complex and dependent on both culture and context, the perceived affordance of the three buttons are all alike. And people do not have any troubles with the open and close buttons.

5.3 The toilet doors and familiarity

From the analysis of the lock button, both in and out of context of use, the author found that the trouble with the locking button is likely to come from the familiarity to alarm/emergency buttons. In the context of trains, these buttons are often colored red. People are however familiar with the locking icon, but because of the color they assume it is automatically locked. Even though the users had encountered the locking system several times, many of them still had to relearn the interaction each time they used it. This may be because they have to readjust to the fact that they are allowed to push a red button.

5.4 Are the principles of intuitive use fulfilled in the door lock?

Principle one embraces the usage of existing features, labels or icons that users have seen before in similar products with the same function. The authors have stated that it is the simplest level of applying intuitive use [23]. The locking system is already using well-known open and close symbols, known from elevator doors etc. The locking symbol is also well-known as it resembles a key. It seems like this principle of intuitive use is fulfilled in the case.

Principle two involves the use of metaphors to make something entirely new more familiar by relating it to something already existing. The designers of the locking system have used the metaphor of the color red to show that the door is locked, however they have expected the users to understand that the flashing mode indicates that the door is unlocked. The connection to the interaction with the close button did apparently not work as a metaphor.

Principle three allows users to apply the same knowledge and metaphors across all parts of the interface. It seems like the designers have tried to do this by introducing flashing lights to the buttons that are next in line to use. This seem to have failed due to the red color. If the lock button flashed green, and changed to red after being

pressed principle three of intuitive use would perhaps be fulfilled.

5.5 Evaluation of the term intuitive use as a guideline in universal design

In the literature it is found that intuitive use is based on prior experience, learned responses, familiarity, perceived affordance, culture, and context and so on. The universal design principles apparently desires intuitive use to apply regardless of these findings. As in the, 'use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level'. This does not seem possible considering the findings in other design literature. If the part from 'regardless of...' is removed from the explanation of the principle, it might be easier to use the principle as a goal and rather show to the other design areas for guides to the design process.

6. CONCLUSION

In universal design, intuitive use means that the use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level. From the investigation of the case, the author of this paper concludes that the definition of intuitive use in principle three of universal design is not helpful as a guide to a design process, because it does not say anything about how it is done. Yet it is helpful as a reminder to a very important concept, the guidelines on how to execute the design can be supplemented with other literature. The part about a product being intuitive in use regardless of experience and cognitive abilities does not seem to apply, by understanding this it might be easier to design for the concept of intuitive use in the principles of universal design.

Most of the troubles with the automatic toilet doors seems to come from people's familiarity with emergency buttons. Apparently, people recognized the lock as a push-button, but still did not press it. It seems like a learned response not to push a red button unnecessarily. In addition it

seems like a convention that red means locked, whether the light is flashing or not. It appears to be the intention of the designer to guide the user to the right button by using flashing light. A flashing light will help people with for instance reduced vision or reduced cognitive ability to locate the buttons, as desired in universal design. However, using a red light instead of a safer green one may be the thing that cause trouble with the doors. The author concludes that if the key symbol was flashing green while unlocked, and lit up red as soon as it was locked it would be more similar to conventional locks where green means vacant and red means occupied.

It is also concluded that a product can be intuitive in use, but only if the designer understand that intuition is not necessarily just an instinctive or innate response.

6.1 Further work

Understanding affordance and familiarity appears to be a good starting point to fulfill the needs of intuitive use. The author of this article also suggests testing a design in light of these concepts both in and out of context, to reveal whether conventions are overlooked if the participants are faced with the whole system all at once.

More research on familiarity should be conducted, to see if the claim of a link between familiarity and intuitive use can be backed up. Research in this area is useful for design practice because intuitive use is an already frequently used term, but the mechanisms needs to be explained in order to be applied to a design and not just act as an ideal.

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