A COMPARISON BETWEEN THE THREE TERMS; UNIVERSAL DESIGN, INCLUSIVE DESIGN AND DESIGN FOR ALL

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ABSTRACT

This article examines the different terms of “universal design”, “inclusive design” and "design for all". For many people the different terms are just the same way of designing products and buildings for a broader part of the populations, but with different names. The article will explore the origin of the three terms, their definitions and if there are any methods connected to each term. In the end they will be discussed and compared. This article finds that there are some differences between the three terms concerning method and geographical use, but still most people consider them as equal.

KEYWORDS: Universal design, Inclusive design, Design for all

1. INTRODUCTION

According to the Assembly of European Region the amount of disabled people in Europe is estimated to be between 10 and 15% [1]. This, and the fact that the average age of the population increases, makes the need of user friendly and accessible buildings and products more necessary. By the year 2060, the amount of the population above 65 years in Europe will be 29,5%, compared to 17,4% in 2010. [2] This development will just continue during the years, which will lead to a population where the needs of user friendly products and buildings will be important because of the lack of younger people to help the disabled and the elderly. In addition to this, designing for a broader population will usually result in a better product for the whole population.[3]
other adults to take care of us. As we grow older, we might get sick or injured for some time, which will make us temporary disabled. When we get children ourselves, the need of carrying the child in one arm, will leave us with just the other one left to use. When we are out walking with our child, the stroller might prevent us from accessing buildings and shops that we normally go to. As the age increases and we get older, we will need help for most of our tasks and daily routines. Based on this, there are many ways of designing products so that as many people as possible can use them, without the help of others. When doing a quick search on the internet, expressions as "universal design", "inclusive design", "design for all", "ability-based design", "lifespan design", "transgenerational design" and "accessibility" are just some of the expressions that at first glance seems to be used for more or less the same design approach. This can be confusing to the reader, and the questions that remains are; do these expressions mean the same, or are there some significant difference attached to expression that demands to be used before the product/building can be called by this expression?

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Table 1: Overview over the most used terms in the Scopus database. "All" indicates that the searches did not have any constrictions, while the other search focused on the title, abstract and keywords of the articles.

To get at better overview of the terms used in scientific articles a table has been made for the most used expressions (Table 1). Based on the results here one can see that the search with "accessibility" got the most results. Because accessibility can be connected with a lot of other terms, like databases and internet structures rather than just design, it has not been explored further on in this article. In total, universal design, inclusive design and design for all got significantly more results that the three other terms in total. Among these three universal design got over double the amount of results compared to inclusive design and design for all. This shows that universal design is the term most used, but does not give any reasons why. Based on this it is interesting to explore the differences, if there are any, between the terms.

2. GOAL OF PAPER

This paper will examine three of the most used expressions in terms of designing for a broader part of the population being; “universal design”, “inclusive design” and “design for all”. The goal of this paper is to examine the background and the definitions of the expressions and to consider whether or not they have the same meaning. In the case where the expressions do not mean the same, the article will discuss the differences and when to use which expression.

3. STRUCTURE OF PAPER

The paper will start by exploring the different terms of universal design, inclusive design and design for all. It will also explore how the terms came to life and what they represent. The results from these explorations will be analyzed, compared and discussed before the conclusion in the last part of the article.

4. INTRODUCTION

Before the three expressions are being explored further on, it is important to explain how the design of products for people with usability
challenges has been earlier on. In many cases people with some kind of disability have had the possibility of using a regular product bought in any store. It is just in the cases where this product becomes unusable for the person because of a disability, the alternative has been to develop a product specially customized for people with this sort of disability. As Thimbleby wrote "badly designed systems handicap all users".[4] The development of a product based on the lack of an ability is seen as a niche product and this product usually has a top to bottom approach. This means that the disability is the starting point and the product is being developed according to this. While designing for the broader part of the population seeks to produce products that will fit most of the users without concerning the need of additional assistive. This is called a bottom to top approach.

In the following parts the three expressions of universal design, inclusive design and design for all will be explored further on.

5. UNIVERSAL DESIGN

5.1 Background

There were a lot of changes in the United States of America in the 20th century which started the development of what we today know as "universal design". In the middle of the 1950's there were many war veterans from the two world wars, with severe injuries that kept them from living a normal life. It was also around this time the penicillin was introduced to the people and the recovery from diseases, which earlier on were lethal, increased. Because of this people started to live longer and the need of products and buildings that were developed for elderly and disabled increased. The new laws that prohibited “discrimination against people with disabilities and provided access to education, places of public accommodation, telecommunication, and transportation.” [5] were pushed through by the Disability Rights Movement in 1973. This meant that the civil rights of people with disabilities were protected by law. The Rehabilitation Act of 1973 (Section 504) made it illegal to discriminate on the basis of disabilities and applied to federal agencies, federal contractors, public universities and any other institution that would receive federal funds.

Other Acts also had an impact on what would later be known as “universal design”, like the Education For All Handicapped Children Act (later known as Individuals with Disabilities Education Act. IDEA) that came in 1975. This act would guarantee that all children had the right to attend and access public education. Also the Americans with disabilities Act (ADA) from 1990 had sufficient impact on the American disability history. This act said that no one could be discriminated by their disability in employment, services rendered by the state, places of public accommodation, transportation and telecommunications services. [6]

According to the Center of Universal Design at North Carolina State University [5], the term “universal design” originated from the late Ronald Mace. At the age of 10, Ronald Mace got polio and was from that time on chained to his wheel chair. By the help of his parents, his family and his ability to build the things he needed on a daily basis, he could finish elementary school, high school and college. He was interested in architecture and wanted to start at the School of Design at North Carolina State University (NCSU). Because of his disabilities, the dean did not think he would make it through the program, and advised him not to apply. He did anyway, and finished after living with his mother in a trailer for six years, since the dormitories were not accessible for him. After this Mace has been involved in several other organizations that help disabled people, like for instance the Barrier Free Environments. He has even been honored by the former President Clinton in 1992 for his “work promoting the dignity, equality, independence, and employment of people with disabilities.” [5]
5.2 The principles of universal design

The definition of “universal design” that was used by Mace was "the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design" [7].

Universal design also focus on exterior spaces and buildings, which can be seen in another, more general, quote by Mace: "Universal design means simply designing all products, buildings and exterior spaces to be usable by all people to the greatest extent possible." [3]

Based on the definition of universal design, a group of product designers, architects, engineers and environmental design researches formed the seven principles of universal design. This was done in 1992 and was led by Ronald Mace. The seven principles all have some guidelines, and these can be read at the web-page of NCSU [5]. The shortened list can be seen in Table 2.

Steinfeld (who participated in writing the 7 principles of universal design) and Maisel (2012), sited in Steinfeld and Smith [8], suggest "8 goals of universal design" as a method to "provide a framework for measuring the achievement of universal design". They also point out that these goals are compatible and can be mapped on the 7 principles of universal design. These 8 goals of universal design are also used at the webpage of Global Universal Design Commission and can be seen below. [9]

The 8 goals of universal design

Body fit - accommodating a wide a range of body sizes and abilities

Comfort - keeping demands within desirable limits of body function and perception

Awareness – ensuring that critical information for use is easily perceived

Understanding – making methods of operation and use intuitive, clear and unambiguous

Wellness - contributing to health promotion, avoidance of disease and protection from hazards

Social integration – treating all groups with dignity and respect

Personalization – incorporating opportunities for personalization

regardless of ambient conditions or the user’s sensory abilities.

5. Tolerance for Error
- The design minimizes hazards and the adverse consequences of accidental or unintended actions.

6. Low Physical Effort
- The design can be used efficiently and comfortably and with a minimum of fatigue.

7. Size and Space for Approach and Use
- Appropriate size and space is provided for approach, reach, manipulation, and use regardless of user’s body size, posture, or mobility.

Table 2: The 7 principles of universal design

<table>
<thead>
<tr>
<th>THE 7 PRINCIPLES OF UNIVERSAL DESIGN</th>
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<tbody>
<tr>
<td>1. Equitable use</td>
<td>The design is useful and marketable to people with diverse abilities.</td>
</tr>
<tr>
<td>2. Flexibility in Use</td>
<td>The design accommodates a wide range of individual preferences and abilities.</td>
</tr>
<tr>
<td>3. Simple and Intuitive Use</td>
<td>Use of the design is easy to understand, regardless of the user’s experience, knowledge, language skills, or current concentration level.</td>
</tr>
<tr>
<td>4. Perceptible Information</td>
<td>The design communicates necessary information effectively to the user,</td>
</tr>
<tr>
<td>5. Tolerance for Error</td>
<td>The design minimizes hazards and the adverse consequences of accidental or unintended actions.</td>
</tr>
<tr>
<td>6. Low Physical Effort</td>
<td>The design can be used efficiently and comfortably and with a minimum of fatigue.</td>
</tr>
<tr>
<td>7. Size and Space for Approach and Use</td>
<td>Appropriate size and space is provided for approach, reach, manipulation, and use regardless of user’s body size, posture, or mobility.</td>
</tr>
</tbody>
</table>
choice and the expression of individual preferences

Appropriateness – respecting and reinforcing cultural values and the social and environmental context of any design project.

There has not been found other articles about universal design that does not refer to either Ronald Mace or North Carolina State University, in the research of this article.

6. INCLUSIVE DESIGN

6.1 Background

According to Plos et al [10] the term inclusive design “arose in the UK from collaboration between companies, designers, researchers and teachers.” This can also be verified by the article of Elokla, Yoshitsugu and Yasuyuki from the Kyushu University [11] that concluded that the term “inclusive design” is mostly used in Europe and primarily in the UK. Dong and Clarkson [12] use the definition that; "designers, manufacturers and service providers ensure that their products and services address the needs of the widest possible audience".

The British Standard Institute has a slightly different definition and defines inclusive design to be; "The design of mainstream products and/or services that are accessible to, and usable by, as many people as reasonably possible (...) without the need for special adaptation or specialized design." (British Standard 7000-6:2005).

The OCAD University in Canada are more detailed in their definition and defines inclusive design to be “design that is inclusive of the full range of human diversity with respect to ability, language, culture, gender, age and other forms of human difference.” [13] They say it can be compared to universal design, but also has some distinctions in the definition. The University of Cambridge never defines inclusive design but still has developed a guide for designing inclusively [14] and state the inclusive design principles to be as follows:

1. Repeat to refine
   Successive cycles of exploration, creation and evaluation should generate a clearer understanding of the needs, better solutions to meet these needs, and stronger evidence that the needs are met.

2. Test early and test often.
   Perform quick tests with rough prototypes, early enough in the process that meaningful change is still possible.

3. Strive for simplicity.
   Simplicity is powerful but elusive, it requires a clear and succinct vision of what the product is about. Ask "can you do it with less?".

4. It is normal to be different.
   In addition, it’s normal to want different things and do things in different ways. Understand diversity amongst your customers. Understanding disability is only one part of understanding diversity.

5. Consider the whole user journey.
   Satisfying user goals involves designing for end-to-end journeys that takes place in real-world contexts.

6. Detail matters.
   Dig deeper to uncover and address the things that people really do, really want, and really need.

7. More than just users.
   Consider the needs of stakeholders such as regulators, shareholders, manufacturers, retailers, purchasers, installers, supporters, and maintainers.

   It’s easy to get stuck in thinking that the way things have been done is the only way they could be done. List your assumptions and ask “why?”
9. Let ideas breathe. 
*Give wacky ideas the chance to become great ideas.*

10. Prove it. 
*Complement opinions with evidence.*

11. Wear different hats. 
*Be creative, be critical and know when to switch.*

As can be seen, the definition of inclusive design varies, and there is no general definition.

### 6.2 The inclusive design cube

A lot of people have come to know universal design as design for the disabled, and the OCAD University tries to underline that inclusive design do not specializes on the disabled, but could also be used by this group. When universal design makes “one size fits all”-products, inclusive design is rather trying to make the products so that they can be fitted or adapt to suit as many people as possible, called inclusive design space, using a bottom-up approach (see Figure 2). [14]

The inclusive design approach also includes a method called the inclusive design cube, which comes from the older pyramid design approach. This method divides the whole population into three different stages: the fully capable group, the group with reduced strength and mobility and the severely impaired (see Figure 2). It believes that if a designer uses a target group which is placed higher than the lowest level (fully capable group), the levels underneath will be automatically taken into account. So the goal is to design for a group as high as possible in the pyramid, then the people who are categorized in lower levels are automatically included as well.

The Inclusive Design Cube consists out of a 5 step design methodology, where the last step is a final evaluation visualized as a cube. The 5 steps, defined as levels, can be shown in Table 3. In level 5 the Inclusive Design Cube is presented. It is a box placed between three axes, which consist of cognitive ability, sensory ability and psychical ability as can be seen in Figure 3 on the next page. Using these three values, groups can be excluded, but the first three levels in the design methodology prevent the cube from shrinking. In Keates article from 2000 [16] the cube consists out of layers with different levels of disability severity, similar to the levels of the user pyramid design approach that can be seen in Figure 2. However in 2003 he reassessed his cube, so the designer is able to monitor its target population more clearly [17].

**The five step design method of the inclusive design cube**

**Level 1:** Problem Specification (specify problem, verify problem definition)  
**Level 2:** Visibility of system status (develop a minimal system of system status, verify user perception)  
**Level 3:** Matching system and real world (structure interaction to match with expectations, verify user understanding)  
**Level 4:** User freedom and control (develop quality of control and user input, verify user comfort)  
**Level 5:** Evaluation / Validation (evaluate system usability and accessibility, verify usability and accessibility)

**Table 3:** Keates S. (2000) *Towards a practical Inclusive Design approach, Cambridge, University of Cambridge, page 48*
The different layers, as can be seen in Figure 3, are divided into whole population, ideal population, negotiable maximum population and included population. These four layers represent four points in the design process where possibly some groups will be eliminated from the target group. These four evaluation points also have to be taken into account, so the final user can be properly defined. The different populations can be explained as follows:

**Whole population** is the part where you define for whom of the world’s population the design is meant for. If it is a ticket machine for the metro in a city, the whole population would be everyone who lives in or visits the city.

**The ideal population** is the biggest part of the population that at product could target under ideal conditions. This would mean the elimination of people who are disallowed by the law, safety considerations and severe lack of capability from using the product. For instance people who are blind, would not be in the ideal population for a car company.

**The negotiable maximum population** is the population that changes according to the requirements. Because the product is unlikely to exceed the requirements specification it is defined as “maximum”. In this part the inclusive design cube would be used, and the three axes as guide. “At what level of a given disability would make it impossible for a person to use the product.”

**The included population** is the populations that could actually use the product in the end.

The inclusive design cube is a way to eliminate different user groups, but at the same time give the developer a visualization of how to include groups that easily could fall out of the included population.

The development of inclusive design has been rather poor, but Reed and Monk wishes to develop "inclusive design" to "design for inclusion". They think the starting point in inclusive design should be the "social psychological and physical concerns and issues faced by particular groups (say the elderly) and allow them to inform "problem spaces". [18]

7. **DESIGN FOR ALL**

7.1 **Background**

According to Eloka, Yoshitsugu and Yasuyuki the term “design for all” is a term that is mostly used in Europe and Scandinavia. It originated from the 1950’s functionalism and the 1960’s ergonomic design. The term also has a background from the Swedish welfare system in the 1960 that gave name to “a society for all”, which was a reference to the general accessibility in the community. [19]

The EIDD Stockholm Declaration 2004 states that; “Design for All aims to enable all people to have equal opportunities to participate in every aspect of society. To achieve this, the built environment, everyday objects, services, culture and information – in short, everything that is designed and made by people to be used by people – must be accessible, convenient for everyone in society to use and responsive to evolving human diversity.” [19]
The EIDD stands for European Institute for Design and Disability and was founded in Dublin in 1993. The original aim was to “use design to achieve the inclusion of disabled people in society in European countries”, but with a name change in 2006 to EIDD – Design for All Europe now focus on enhancing the quality of life through Design for all. The EIDD – Design for All Europe is a federation with members in 23 European countries. [12]

At the webpage for the EIDD Sweden they divide the design process for design for all into six steps. These are as follows (shortened):

1. The starting point where the requirements and the time is being evaluated

2. Research which includes studies, dialogs with the target group and similar.

3. Concept and visualization. Here the research is being used to develop concepts that will be tested.

4. Evaluation and choosing a concept. The concepts are being tested against each other and the marked and the best one is chosen.

5. Adjustments and finishing. In this part the concept is being presented, tested and evaluated before it gets manufactured.

6. Monitoring and evaluation. The finished product is being evaluated and changes for later versions are being developed. [13]

The EIDD – Design for All Europe also comes with some examples of what they consider design for all. The egg carton is one example because of the combination of protecting the eggs, at the same time as it is possible to open the carton with one hand. It is also easy to find the carton in the refrigerator for a blind person because of the tactile design.

In addition to this Plos et al. claims that “Design for all is the European version of Universal Design with a focus on Informational Technology. It is supported by the European Design for All e-Accessibility Network (EDeAN) whose goal is to set some European design guidelines” According to Klironomos et al. the EDeAN is from 2002 and is a part of the European Commission’s action line to support the development of the European Information Society. [20]

8. DISCUSSION

The previous sections have been looking at the different terms one at the time, but there are also people who consider them the same. In the article of Newell and Gregor [21] they state that; “The “Design for All” / “Universal Design” movement has been very valuable in raising the profile of disabled users of products, and has laid down some important principles. In its full sense, however, except for a very limited range of products, “design for all” is a very difficult, if not often impossible task, and the use of term has some inherent dangers.”

In this section they claim that design for all and universal design have the same meaning, because the lack of differentiation. They do not mention any difference and they do not use the world "and" which could indirectly say that there are two different terms. Instead they are using the symbol "/" which generally means that they terms are equal. They also do not mention the term of design for all as a method, but rather the direct meaning of the phrase "design for everyone", stating this would be impossible.
There are also other examples of people who think the three terms have the same meaning. In the article of Gual et al. [22] they state that: "It is appropriate to clarify that, around the same time as the creation of Universal Design(UD) other synonymous terms such as Accessible Design, Design for All (DfA) and Inclusive Design (ID) also came into use." The use of the word "synonyms" means that they define it to have the same meaning.

In Plos et al they say that: "Universal Design or "Design For All" aims to conciliate two approaches that seem conflicting (...): designing products for mass market, intended for average, ordinary, healthy users; and designing specialized or dedicated products (like Assistive Technologies) intended for people with disabilities." Also here the two terms are presented to have the same meaning because of the use of the word "or".

In the article of Smith [23] he uses the 7 universal design principles throughout his article to achieve a result in inclusive design. This also shows that the two expressions are being used without the knowledge of what the different terms represent.

Yasemin Afacan states in her article that: "(...) Universal design has been widely accepted and expressed all over the world, which is also known as "inclusive design" and "design for all." [24] Even the definition from The British Standard Institute is very similar to Maces definition on universal design. When Maces definition says "the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design", the definition to The British Standard Institute says that "the design of mainstream products and/or services that are accessible to, and usable by, as many people as reasonably possible (...) without the need for special adaptation or specialized design."

Based on all this examples it is fair to say that the three expressions have the same meaning and understanding for many people.

By just using the definitions and other quotes referred to in this article, the different terms of universal design, inclusive design and design for all can be said to cover the areas of products, buildings, internet, environment and services as can be seen in Table 4. (Other definitions not mentioned in this article could result in a different coverage.) All three terms try to cover as much as they can in their definition, but the only definition that covers all the areas mentioned in the table, is design for all. To be sure the definition of design for all covers everything in their definition, they sum it up in the end by saying: "-in short, everything that is designed and made by people to be used by people – must be accessible, convenient for everyone in society to use and responsive to evolving human diversity."

But there are people who are skeptical to use the expression "design for all", as we could see from the quote in the beginning of the discussion part by Newell and Gregor [18]: In its full sense, however, except for a very limited range of products, “design for all” is a very difficult, if not often impossible task, and the use of term has some inherent dangers. They continue by saying; "Providing access to people with certain types of disability can make the product significantly more difficult to use by people without disabilities, and often impossible to use by people with a different
**Universal design** | **Inclusive design**
---|---
One-size-fits-all | Personal adjustable

*Figure 4: Illustration on how universal design and inclusive design differs in definition*

When comparing the methods of universal design, inclusive design and design for all, it shows that they all have some sort of principles, guidelines or methods attached to their name. In universal design the 7 principles are very important and are being referred to in several articles [10][20][25], while in inclusive design there is more than one approach. When designing for the broader population one could either follow the 11 principles that University of Cambridge has developed, or one could use the inclusive design cube method. In design for all there was only a method from EIDD Sweden, but no common design for all-approach. Though all of the approaches and guidelines mentioned in universal design, inclusive design and design for all, can be considered to be a regular design approach with greater focus on the end user. This is shown by the focus on the user and testing during the development in all of the approaches.

When looking at the diagram listing all the articles published on Scopus (Table 5) one can see that universal design has the most published articles related to its term, which is logical when one is thinking of the American connection to the term. Comparing inclusive design and design for all shows that there is more or less the same amount, but that design for all has a significant larger amount of published articles before the year 2005. Because design for all does not have a method linked to its name, except on the Swedish webpage to The EIDD – Design for All process, it is likely to think that the expression is being used as a name for the concept of designing for a broader population rather than a single method. The two other terms has rather well-know methods linked to their name, while design for all does not. To simplify it, one could say that the term of design for all is more overarching and does not say anything about the method used or the process of getting the final product, but rather the group of products/buildings that are accessible and usable for most people.

<table>
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<tr>
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<th>Universal design</th>
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*Table 5: an overview over articles connected to the three terms and which year they were published.* [24]
9. CONCLUSION

Already in the research part of this article, it was clear that most people consider the three different terms as equal. Some thought they had different origins, but still meant the same in the end. Finding literature that were dedicated to one of the terms and at the same time did not state that the term was equal to one or more of the other similar terms, was hard. Still there were some articles and pages that stated the uniqueness of each term.

Based on the research in this article it is fair to say that the three terms all have the same goal; to make the end product usable for as many people as possible, despite disabilities and age. It is also reasonable to say that many people think the three terms have the same meaning. When looking at Table 4 and the overview in which case the different terms are being defined, universal and inclusive design cover together all areas except the internet. Only design for all cover this area mostly because of the European Design for All e-Accessibility Network.

The three terms have their origins in different parts of the world, but as years have gone by, they have become more and more alike. Because of this, one can say that there was a difference of the meaning in the beginning, but now these differences are being less noticeable.

When using a specific method, it is more reasonable to call it by the term connected to the method, rather than one of the other terms. But regardless of which term being used when designing for a broader part of the population, it would be understood as a way of designing so as many people as possible can use it.

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