

# Reflections on Accessible Design from the Perspective of the Digital Age

Chenlu Li

School of Media, Wuhan Textile University, Wuhan, Hubei, China

**Abstract:** Provide a comfortable and safe environment for the lives of disadvantaged groups and improve their happiness index. Focus on the basic needs and future security of vulnerable groups, establish standards and norms for digital ageing, and improve the adaptation of older groups to technological life. Through the analysis of audience groups, understand the needs of people with disabilities and disadvantaged groups, analyze the six principles of accessibility design digital principles, based on the comprehensive needs of different groups, combined with the actual accessibility digital platform design cases, provide new improvement methods and ideas for the accessibility design of digital platforms, and explore the innovative ideas of accessibility design in digital platforms. Solve the interaction difficulties of digital platform, so that the disadvantaged groups can also enjoy the convenience of digital technology, while realizing their own value. Being grounded also enhances the designer's own value and sense of social responsibility. Paving the way for future developments in accessible design.

**Keywords:** Accessible Design; Disadvantaged Groups; Digital Platforms; Interaction Design.

## 1. Introduction

There are about one billion disabled people in the world, occupying 15 percent of the global population [1]. 2023 data from the China Disabled Persons' Federation and the National Bureau of Statistics show that the number of disabled people has reached about 85 million, occupying 6 percent of the total population of the country, which is only a little bit more than the population of 1.4 billion people, but this is not the reason for ignoring their normal needs. The existence of design is to serve all people, which will not divide people into three, six, nine, high and low, all are equal, so even the disabled group should have the right to enjoy the design. The idea of barrier-free design originated in 1974 when the United Nations put forward a new idea of design. Accessible design first started in the field of architecture in terms of development, and it was designed to help people with leg disabilities who are in wheelchairs to travel easily by designing safe movable ports[2]. The United States also became the first country to enact laws and regulations related to accessibility. China first put forward the concept of barrier-free design is really 1985, the most beginning to embark on the type of reasoning and architecture. At the same time, the developed countries were to protect the military personnel who suffered the effects of physical disabilities in the battlefield, so that they can work normally, and then the field of accessibility gradually to more areas, until today began to follow the development of science and technology Internet, to the digital platform.

## 2. Characteristics of Accessible Design

### 2.1. Reasons for Accessible Design

Advances in technology have prompted designers to phase out old designs, whether they are newbies, new tools, or new directions that are becoming more and more diverse. The shift from material to non-material design is also based on the digitalization of technology, as people have become more and more inseparable from cell phones and the Internet. In this newer field, cultural content and public mental health and safety have become an important part, and the core goal and

starting point of design activities is mainly to meet people's various needs, while also emphasizing humanistic concerns [3]. This concept is put forward to consider the disadvantaged groups with physical defects, such as those with mild or severe disabilities and declining physical functions, and to explore their needs from their perspectives, in order to help them be able to clear the obstacles in the process of product use as other able-bodied people do, to enjoy a comfortable life brought about by high-quality design, and to improve their quality of life, and to create a barrier-free living environment for people with disabilities and the elderly. Create a barrier-free living environment.

### 2.2. Target Audience

The world develops rapidly, but it can't solve the problem of human's physical disability, can't make this category of people completely no different from normal people, but designers can't ignore the interests of this small group of people because of this, whether from the legal or moral level should pay attention to them, keep caring about them. The audience of accessible design can be divided into four categories, as shown in Figure 1.

Table 1. Analysis of target groups

Type	Trait
Visual impairment	Amblyopia, Total blindness, color blindness
Hearing impairment	Difficulty with whispering. Conversational voices cannot be heard, Loud speech cannot be heard, Hear nothing at all.
Behavioral disorders	Upper Limb Injury, Lower Limb Injury, Single Amputation, Double Amputation.
Cognitive impairment	Elderly: deterioration of vision, hearing, memory, reaction. Children: young, easily distracted by other things, difficulty in self-awareness of dangerous situations.

### 2.2.1. Visual Impairment

Visual impairment can be subdivided into two types[4]. One is amblyopia and total blindness, and the other is color blindness, which is the selective recognition of colors. Among them, color blindness is further divided into four categories, red color blindness that cannot detect red, green color blindness that cannot detect green, blue color blindness that cannot detect blue, and total color blindness that cannot recognize all colors. Although color-blind people are weak in recognizing some colors, they are very sensitive to color saturation and contrast between light and dark.

### 2.2.2. Hearing Impairment

People with hearing impairment can be categorized into three groups[5]. But in fact, no matter how they are categorized, they are viewed according to the decibel level of hearing, which is divided into mild, moderate, severe and total deafness. The different degrees range from difficulty with bass sounds to difficulty with conversation to loud speech to not being able to hear at all. Currently, the only way to treat them is with hearing aids or surgery.

### 2.2.3. Behavioral Disorders

Behavioral disorders are more carefully categorized by physiological characteristics[6]. People have many limbs, and basically a certain part of the body cannot be used normally, but the design needs to consider designing products with different needs according to the severity of different physical impairments. However, in the digital design, the most general concern is the hand limb damage, after all, no matter how to design are difficult to escape the hand movement interaction, of course, can also use voice assistance.

### 2.2.4. Cognitive Impairment

The main groups of cognitive impairment are the elderly and young children[7]. Elderly people are characterized by physiological degradation, including vision, hearing, memory, reaction, visual color only support high saturation, brightness of the color, hearing is almost in a mild, moderate position. Reaction and memory because of the brain's slowing down of information reception and processing is also difficult to support complex interactions and interface jumping, almost all of these problems are included, but not to the point of reaching a serious state. Young children are characterized by their young age, easily distracted by other things, and difficulty in self-awareness of dangerous situations. According to Piaget's theory of cognitive development of children, children can be divided into three periods; the initial stage is the sensorimotor stage, where all behaviors are in a spontaneous and unconscious state. The middle period is the transitional stage, in which the child has a mind of its own, but the behaviors it performs are less cognitive. The final stage is the mature stage, in which thought and action are unified and in which in-depth thinking can take place. Of course, products for children are difficult to listen to children's ideas, and often need to be tested or other means to observe children's experience as users through the perspective of a third party, which leads to a more difficult design process, and the user's participation will also be relatively weak.

## 2.3. Principles of Accessible Design in Digitalization

Based on the above characterization of the user groups the principles that should be followed in the accessibility design can be followed in the stage of the user's use in order to use the product in a better, more perfect and more accessible way.

The principles of accessible design can be discussed in six areas.

### 2.3.1. Principle of Fairness, Justice and Equality

In the field of design, as an objective thing, although it is guided by people, but in the process of design can not include personal concepts and personal preference settings, the whole process should follow the principle of openness and transparency[8]. Maintain the principle of equal treatment for different users of different genders, races, ages, behavioral habits, physical conditions, cultures, etc., do not discriminate against any group or gender in the user, to provide equal design opportunities, even if it is a vulnerable group, can not ignore their needs, but to be tolerant and respectful of them. Do not discriminate, do not ignore, treat everyone and every group equally. Starting from the different characteristics of different people, consider their different needs, and design products according to different standard requirements. But in barrier-free design designers instead ignore the interests of the majority of people, more favor and respect for vulnerable groups, ignoring the normal needs of healthy people. The humanistic care and equality of design, any group should enjoy digital life, should not just make life convenient for some people, but make life difficult for others. For example, in some interface designs, more consideration is given to the visual needs of the elderly, and large areas are used with high purity, high saturation and high brightness colors, and fonts are maximized as much as possible to deal with them, but for normal users, such high purity, high saturation and high brightness colors will bring visual fatigue and dazzle people. Therefore, the design should ensure fairness and equality for all people and all groups.

### 2.3.2. Principle of Selective Applicability

The products in the design should be left open to avoid a single form of expression. The digital platform cannot be treated as a disposable consumable product and cannot be thrown away after use like physical type of products, so the most important thing about digital products lies in the adjustability. Products should be created with the needs of people of different ages at different stages in mind. This means that when a child of 5 needs to learn the simple knowledge of addition, subtraction, multiplication, division and ABCD, but when the user is 10 or 15 years old, just the basic knowledge can no longer meet his/her needs. Therefore, at the beginning of the design, we carry out stage classification and design different functional requirements according to age to help them further expand their knowledge.

### 2.3.3. Simple and Easy-to-understand Operation Principle

The best example of this is inevitably the interaction mode of the Jieyin platform, which, unlike long video playback, does not rely on the constant click-back-click mode for video playback, but instead chooses to use only the up-and-down sliding interaction mode. This simple and straightforward method can be used to navigate through videos normally, whether as an elderly user or a young child, a disadvantaged person with a disability or a normal person. The pages are almost fluent level 1 pages, which can be used by relying on simple interactions, greatly reducing the memory burden.

### 2.3.4. Information Visualization and Security Principles

We maintain a clear and unified style of visualization to make the target information more prominent and ensure that the main information is distinctive, avoiding the phenomenon of "clusters of demons", which may prevent users from

focusing on important information. At the same time, to ensure the security of the platform, clearly display the need to obtain private information, the user's permission before collecting, to ensure the smoothness of the information presented, arranged to avoid clutter.

### 2.3.5. Principle of Difference

The difference between adults and children is obvious. Children often need to use a large number of sensory systems to communicate with the outside world when receiving information, and the product needs more interactivity and experience. When looking at things, children pay more attention to the front and will be attracted by the chaotic colors, compared with text information, they prefer colors, shapes, and have a better perception of things. Therefore, for children users, considering their physical and mental health, the interactive buttons should also be set larger and more eye-catching, and avoid excessive functions and crowded interface, so that they have enough space to operate. And in order to improve users' concentration, situational interaction is not indispensable. In addition, taking into account the connotation of the product should be full of positive energy, children's worldview often affects the later development of people, have a correct worldview and concepts in order to grow up positively and healthily, the purpose of the product should also contain educational significance, to inspire the cognitive and thinking ability of young children and exercise the ability to think independently[9].

### 2.3.6. Reasonable Size Planning Principles

Interface often need to plan in this layout, such as the design of the navigation bar, the layout of the functional areas, etc., the height and size determines whether the user in the use of the product is moderate. One of the most taboo to hide the revealing buttons for the sake of interest. For example, advertising buttons in the interface display are often set up very hidden, very small size and color similar to the page content, to prevent users from finding the close button, completely inconsistent with the interface design plan. The correct interface layout should ensure a clear and concise layout of choices, intuitive for users to access information, so as to maximize the efficiency of information transfer.

## 2.4. Case Study on Barrier Free Accessible Design

Gaode Map has specially designed a color scheme for visually impaired users that meets their needs. Starting from the simulated view of color-blind people, it conforms to the visual logic of visually impaired users, and according to the recommendations of the Japanese study on accessibility color scheme, it replaces red with vermilion, green with blue-green, and purple with fuchsia, which weakens the disturbance caused by visual impairment, increases the information recognition, and tries to achieve the state of being indistinguishable from that of the normal people.

Xiaomi has designed a feature in the phone about recognizing ambient sounds to assist hearing impaired users. This feature recognizes ambient sounds around them, such as fire alarms, explosions, smoke alarms, etc., and can collect the sounds and then convert them into text to alert the user. Users in danger, but also because the phone sound display text alert and escape, in the design of the level does help, but no one will look at the phone 24 hours a day, so in the absence of attention to the phone and so on? There has to be some other aids to go with it, and it's really hard to completely solve

this problem with the display alone.

After watching numerous ad campaigns, the most impactful Apple ads were the ones featuring people with disabilities. This includes users with mobility impairments who have lost their arms or legs, users who are blind or hard of hearing, young children, and the elderly. In this advertisement, the accessibility of the different groups of people using the Apple product line is presented, the most impressive of which is the replacement of the blind person's eyes on the phone, which can be turned on by voice, and then by holding the phone up high, it can be adjusted according to the surroundings of the voice announcements, and then make a route to travel. As well as in the interface all have a narrator function, and support for adjustment. It greatly reduces the inconvenience of the disadvantaged groups when using it and improves the quality of life.

## 3. Methods for Improving the Design of Digital Platforms for Accessibility

Today's accessibility design methods should focus more on the user, return to the origin, and let the disabled and disadvantaged groups participate in the design and put forward their own needs, so as to better improve the design methods that already exist.

Digital platform accessibility design is difficult to integrate comprehensively, each group has different problems, so before entering the platform can be a self-test or mode selection, according to the different needs of each user, choose a different mode. For visually impaired users can choose the mode of color improvement, for hearing impaired users can choose to avoid sound control mode, and so on, according to different needs to choose different modes of information transfer, the use of design means, so as to achieve accessibility to the ability to obtain information.

The most common issues in digital platforms are nothing more than colors and fonts. Prominent color contrasts the first time with the rest of the interface location and information to pull the gap. Striking contrasts help users access information and reduce reading difficulties. In addition, pure color sometimes for the visually impaired is not an effective and perfect solution to their own problems, but also need to rely on some graphic changes, such as the use of text to assist, enter the wrong information, "right" symbols into the "wrong" symbol icon! In order to improve the access to information effectively, users are given a variety of means and methods to convey information. Of course, audio assistance is also essential, when interacting with the voice broadcasting function, but should not violate the basic principles of design, giving the user the right to choose, self-selected switch, change mode.

In the use of the digital platform rarely exists in the case of revealing the sound, generally there is sound, mostly in the case of video viewing, add subtitle function in the video, for the ear-blind people can watch the video content through the subtitle function, for the ear-weak users can also be through the subtitle auxiliary function and the sound fusion to obtain information. At the same time, set the sound volume auxiliary function, for the weak hearing patients, can hear the sound but need to amplify the sound can be users, design sound amplification function, collect the weak hearing users of the hearing system level, set different gears, in accordance with the use of their own hearing, amplify the original sound, in order to achieve their own hearing can be heard in the range,

or with the combination of hearing aids. Hearing aids have become almost the most effective tool for improving hearing. Combine digital platforms with hearing aids to deliver digitized information.

For users with behavioral disorders mostly need to operate with one hand, but there are too many click buttons in digital platforms that are difficult to operate with one hand, so sometimes invisible design is needed, mostly used for sliding interactions, up and down to browse the information, left to return to the previous page, and right to go to the next level of the page. On this basis, it can also be designed in multiple ways, such as combining with the phone's own side buttons or multiple clicks to achieve the operation instead of clicking the button, which greatly reduces the operation. Most of the solutions to the cognitive impairment are focused on the function of increasing the size of the font, which is the easiest to solve.

In addition to the basic "treating the symptoms", the idea of "universal design" needs to be incorporated as much as possible. The idea is to include as many different needs as possible in the same product, regardless of whether it is a generally normal and healthy person or a disadvantaged group of people with disabilities, without revealing their own "weaknesses", and all of them use it in a uniform way, only in the difference of the mode of use, to avoid the bad design of accessibility. The method lies in the protection of the disadvantaged groups of the vast majority of self-esteem, they themselves because of physical disabilities and produce low self-esteem, ambivalence, if the product on the extra emphasis on its special features, the surrounding will inevitably have a sympathetic eye, but in the use of the product, it is more difficult to sit still, resulting in embarrassment[10]. Focus on the user's inner world, in addition to meeting the basic materialistic desires, but also need to focus on whether they are healthy and upward development of the heart when using, to provide positive emotions.

In the final analysis, whether it is a visual or hearing impairment, whether it is a child or the elderly and so on, for the disadvantaged groups to give them can not only target only rely on a solution, leaving room for more good, a variety of different ways of information transfer, to help the disadvantaged groups more easily and conveniently access to information. Designers in the design process should always pay attention to and understand the user, study the user's behavioral patterns, psychological state and the degree of cognition of the designed product, in order to ensure that the product design meets the actual needs of users. Explore the various needs of users in depth, give full consideration to the plurality and different needs of users, commit to providing services to users, ensure that the products are user-friendly, meet their expectations, help users improve the quality of life and satisfaction, honor the respect and emotions of users, ensure that users' privacy and security are not jeopardized, truthfully present the functions of the designed products, and sincerely demonstrate the purpose and strategy of the design,

and for users to choose freely and prevent misinformation. By guiding practice through the study of user experience in the process of product design, it can provide designers with a broader mindset and perspective to scrutinize problems and solve them, thus improving design efficiency.

## 4. Conclusion

With the satisfaction of basic needs, people begin to pursue higher level things. More and more people are focusing on the disadvantaged groups, expecting that they can change their lives by designing hand breaks. This paper analyzes the specific characteristics of the barrier-free user population and the difficulties they will encounter in use, summarizes the principles of barrier-free design in digital platforms, and then, based on specific cases, proposes a barrier-free digital platform design method based on the disadvantaged groups, which combines universality with individuality, so as to help them better improve the experience of using digital platforms, build up their self-confidence, and be able to enjoy the intelligent and digital era to the fullest, while letting the design better serve each group. digital era, and at the same time let the design better serve everyone.

## References

- [1] LI Xiangqun,LIN Hua. Analysis of information accessibility design[J].Intelligent Building and Smart City,2023(10):37-39.
- [2] HE Xiaomei,YANG Ying. A review of the current status of research on accessibility design methods[J]. Packaging Engineering, 2023,44(06):60-73+116.
- [3] Wen Yanqun. The spirit of humanism in barrier-free design[J]. Journal of Sanming College,2015,32(03):57-61B. Smith, "An approach to graphs of linear forms (Unpublished work style)," unpublished.
- [4] Zhang Mengxuan. Display design ideas for visually impaired groups[J]. Art and design(theory),2019,2(12):62-63.
- [5] Han Ke. Research on Accessible Design of Community Outdoor Public Space under the Perspective of Sensory Compensation [D]. Beijing Jiaotong University, 2023.
- [6] Liang Xuesong. Research on the design of barrier-free guide system for tourist attractions based on the needs of "identification"and"behavior"[J].Decoration,2012,(03):131-132.
- [7] Huo Wentong. Research on the use of barrier design in contemporary books [D]. China University of Mining and Technology,2018.
- [8] M. Young, The Technical Writers Handbook.Mill Valley, CA: University Science, 1989.
- [9] Wen Yanqun. The spirit of humanism in barrier-free design[J]. Journal of Sanming College,2015,32(03):57-61.
- [10] Yang Jianmin. A test of the principle of "equal access" in barrier-free design[J]. Journal of Beijing Institute of Technology (Social Science Edition),2008,(04):95-99.