

# Making Architecture Visible to the Visually Impaired

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**Abstract.** How is architecture experienced? What makes good architecture? These are the key questions for both architectural theorists and practicing architects. Today these questions should be asked in relation to the concept of universal design. The Convention on the Rights of Persons with Disabilities defines the term universal design as the design of products, environments, programs, and services to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design. Universal design has become part of Norwegian architectural policy. However, the definition of universal design sets no criteria for aesthetic design. This paper discusses why aesthetics (in the sense of integrated quality and sensory experience of architecture) could be a missing link that unites architecture and the concept of universal design. The paper concretizes this in the light of fundamental principles on accessibility for the visually impaired.

**Keywords.** Universal design, architecture, aesthetics, visual impairment.

## Introduction

Universal design (or inclusive design, or design for all) has an ethical and a legal dimension related to equality and human rights and a social dimension related to the design of our physical environment. The Convention on the Rights of Persons with Disabilities defines the term universal design as the design of products, environments, programs, and services to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design.

By addressing the needs of people with reduced functionality in terms of movement, vision, hearing or comprehension or due to environmentally induced conditions (asthma/allergies), the environment will be usable by all. Universal design has become part of Norwegian architectural policy and as such could serve as a reference for the ideals of our era and be reflected in contemporary architecture.

However, in Norway the construction industry often uses finance as an argument to seek exemptions from building regulations and priorities at the expense of accessibility and universal design. In this context it should be added that a survey of living conditions in Norway shows that 66 percent of wheelchair users aged between 20 and 66 live in homes where stairs, steps, slopes or other obstacles make it difficult

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for them and for others with mobility issues to move around freely outdoors [1]. Perhaps universal design is too closely associated with legislation, regulations, and standards and too loosely associated with fundamental human rights and quality criteria in the built environment?

The challenge lies in designing buildings and outdoor areas that do more than just fulfil regulatory requirements and that stand out as universal from a conceptual, functional, spatial, and material perspective. The conditions associated with the needs of people with movement impairments are often measurable, and architects may therefore provide solutions that can be quantified and performed normatively. Documentation on people with visual impairments also provides the basis for normative criteria, though these are more deficient. The development of a visual language that allows, for example, the blind and visually impaired to find their way around buildings and outdoor areas requires creative solutions for reading and navigating in unfamiliar surroundings.

This paper discusses why aesthetics (in the sense of integrated quality and sensory experience of architecture) could be a missing link that unites architecture with the concept of universal design. The paper concretizes this in the light of fundamental principles on accessibility for the visually impaired.

## **1. The Principles of Universal Design**

The term universal design became formalized in the seven principles of universal design. The principles were developed in 1997 by a working group of architects, product designers, engineers, and environmental design researchers at the Center for Universal Design at North Carolina State University. The principles are applied to evaluate existing design, guide the design process, and educate both designers and consumers about the characteristics of more usable products and environments. The principles are as follows: (1) equitable use; (2) flexibility in use; (3) simple and intuitive use; (4) perceptible information; (5) tolerance for error; (6) low physical effort, and (7) size and space for approach and use.

The principles are important for understanding the origin and development of the term universal design as well as the application of the concept as an innovative strategy. For example, dual-lever mixer taps were gradually replaced by single-lever models which had originally been designed to simplify operation by people with reduced mobility. The change turned out to be practical for everyone. Remote controls, plastic lids for coffee cups, and bent straws are other examples of how knowledge about certain user groups has helped develop products that benefit most people and therefore constitute an improvement in quality.

The relationship between people and space is fundamental to the practice of architecture, and the principles cannot automatically be transferred to buildings and outdoor areas. Principle 2 (flexibility in use) states: "the design accommodates a wide range of individual preferences and abilities." The ability to adapt in function and shape was the basis of a debate on structural architecture in the 1960s and 70s, where the concepts of flexibility and extensibility were key. Housing should adapt to its residents, rather than residents having to adapt to their homes. However, this places demands on the user, both from a resource and an intellectual perspective. Thus, one could say that this principle contradicts the simple and intuitive use of Principle 3.

Moreover, one could question whether the need to have a fixed limited space to occupy and feel secure in could be reconciled with the principle of flexibility in the sense of modifiable buildings and space. This problem is evident in the discussion on schools, where open-plan solutions and large common areas dominate over traditional classrooms. Switching between large and small groups and between different group situations requires joint use and multiple use, which in turn requires flexible building systems. Mobile furniture and units that ‘suddenly’ appear do not give the visually impaired enough time to avoid colliding with them. Standard lighting can also cause problems because it provides no orientation points. Wayfinding elements as an integrated part of architectural design may also hamper a wide range of individual preferences and capabilities. In this context, Principle 2 (flexibility in use) may be applied at the expense of acoustics, orientation, concentration, and affinity [2].

The innovation of industrial products comes about in various phases such as concept development, testing of prototypes, further development, and implementation. This allows us to develop new and ever better solutions. When it comes to the construction sector, new concepts are built but not subjected to sufficient systematic testing in terms of their quality in use. Thus, the experiences that are garnered only partially benefit future clients/development teams. This means that major experiments are conducted when new schools, kindergartens, and care homes are built without any significant knowledge or expertise being transferred to future building projects [3].

SINTEF Building and Infrastructure concludes that the seven principles are less suitable in architecture and inadequate in a planning and building context [4]. Sanford puts it like this: “Personally, my problem with the assessment based on the UD principles is that they are not validated in the first place. I always argued that instead of using the principles to determine if a design is universal, we should use the design to determine if the principles are valid.” [5] In this context, participation by user organizations and various types of user groups becomes significant. However, the definition of universal design sets no criteria for aesthetic design and spiritual needs [6].

## **2. Aesthetics, senses, and experience**

How is architecture experienced? What makes good architecture? These are the key questions for both architectural theorists and practicing architects. Today these questions should be seen in relation to the concept of universal design. In “An Open Letter to Architects” Davis and Lifchez emphasize that “accessibility is more than a matter of admittance or logistics; it is also a quality of experience. How one feels about a place, how one interprets it, or even whether one can adequately interpret it – these are all less quantifiable, but crucially important, aspects of accessibility.” [7]

This was the introductory quote used for a seminar organized by a Nordic network on architectural research in universal design in February 2013. The program included a site visit to a highly relevant case: the new headquarters for the Danish Disability Organisations outside Copenhagen, designed by Cubo Architects. The building is presented as one of the world's most accessible office buildings, and hopes to serve as a demo facility and a model for future constructions. For example, wayfinding is made easy by decorating specific interior elements of the building with bright colors (Figure 1). The reception desk has two different heights. Fire-resistant lifts can be opened and operated by wheelchair users, and knobs on the railing mark which floor you are on.



**Figure 1.** The new headquarters for the Danish Disability Organisations. Photo: C. Ahmer.

Even if the architects have understood the user functions which the building needs to contain, the user requirements are not integrated with a successful aesthetic design in the sense of integrated quality and sensory experience from architecture. The building contains few materials and elements that appeal to the senses and that could have underlined the building as a model for contemporary architecture. With no clearly defined entrance, the façade is experienced as monotone, hard, and unwelcoming. However, an asphalted parking space with rows of wheelchair symbols signals that this is a different type of office building (Figure 2).

The definition of universal design sets no criteria for aesthetics, only on the functional requirements that need to be met. If one disconnects universal design from aesthetics or artistic design, it becomes associated with architect Hannes Meyer's well-known words from 1928: "everything in the world is a product of the formula function times economy. All art is composition and therefore unfunctional. All life is function and therefore unartistic." [8]

Louis Sullivan's catchphrase *form follows function* is often included in the discussion on universal design. If the definition of universal design does not include criteria for aesthetic design, the visual result is accepted as a by-product of utilitarian design. Many of the most prominent representatives of the modernist movement who were developing designer tools did not interpret "follows" as a logical connection between function and design, but rather as a sort of 'leap' that required a certain artistic sensitivity. Creativity is understood here as the ability to invent something new. Not even the Norwegian architect team behind the magazine *Plan* (1933–36), which was influenced by Meyer, denounced the 'artistic' in the sense of aesthetic quality. What they denounced was an 'artist architect' who – they believed – veiled their technically and functionally inferior solutions with aesthetic formalism, be it traditional or

modernist [9]. Experience shows that when a building becomes a question of money and investment, the objective of universal design often becomes synonymous with minimum standards and checklists. “Where inclusive design is understood as simply the functional response to people’s needs, and the limit of those needs is defined by legislation or codes of practice, the results are sterile, lifeless environments. When the design process is limited in this way, the design professions see it as a threat to ‘good’ design, where the results are worthy but aesthetically dull.” [10]

Architecture that has to be developed in a universal direction must be about more than finding the best possible solution based on practical needs and technical and financial constraints. Aesthetics is about what Davis and Lifchez believe are “crucially important, aspects of accessibility,” meaning aspects that are not measurable, such as the sensory qualities one notices when encountering a building, but also about how shape, space, and structural contexts are articulated and together give the place its atmosphere. “The fact that aesthetics and current trends should be considered as well as functionality makes it possible to move away from specialized solutions, not only in use, but also within the expression of the form.” [6]



**Figure 2.** The new headquarters for the Danish Disability Organisations. Photo: C. Ahmer.

### 3. The Principle of Unity

How can architects develop buildings in the direction of universal design? Thinking through how people who are blind or visually impaired will see and experience architecture may be one approach to answering this question.

In *Principles of Design in Architecture* (1981), Smithies refers to the principle of unity. This principle is concerned with the visual composition in architectural design,

meaning the syntactical relationship between individual parts and between the individual parts and the whole in visual terms. The visual elements are: proportion; texture; color; tone; solid and void; direction; and form or shape. The author does not connect the visual elements to accessibility in architecture, but specifies that the aspects of unity should be seen not as a checklist but rather as a set of interrelated requirements, the importance of which is partly subject to individual preference and greatly influenced by other principles of design [11].

- *Proportion.* In the age of humanism, architectural principles were influenced by Vitruvius' proportional system, which revolved around the notion of the perfectly built man. The Vitruvian Man came to symbolize the significance of the human relationship with architecture. The need to develop appropriate design tools was something which concerned many leading representatives of the modernist movement in architecture. The most notable attempt to resolve this issue was devised by Le Corbusier. The Modulor, which he patented in 1947, comprises two numbered series in a geometric progression based on the golden ratio and a figure of a male body measuring 183 cm in height. The Modulor was intended as a universal system of standardized dimensioning of all types of mass-produced objects. An acknowledgment that the population consisted of different people with different functional abilities would lead to a different way of developing and presenting planning proposals as well as consequential evaluations.
- *Texture.* For the blind and visually impaired, the surface structure of materials is highly significant. For the visually impaired (who use whatever vision they have to orientate themselves), visual contrast is important, while tactile contrast is used as a supplement. The blind and the severely visually impaired will orientate themselves with the help of non-visual information from their surroundings, such as sounds and tactile characteristics. The materials should therefore provide sufficient acoustic feedback when touched by canes.
- *Color* is one of the dimensions in the visual world which facilitates perception of and orientation in space by the visually impaired. Color composition and contrast can make the shape of a room more visible and accentuate different functions, building elements, and other details.
- *Tone.* It is a common misunderstanding that the blind and visually impaired need strong colors, but different tones are essential [12]. "If you half close your eyes and look about you [...] it becomes quite evident how much we rely upon tonal variation both for the identification of what we see, and as an element of composition." [11] A contrast can be both a color contrast and a luminance contrast (gray-tone contrast). Color contrast affects what people see because colors also contain codes used in our surroundings. The luminance contrast, which is associated with our ability to perceive depth and movement, is essential for seeing in three dimensions [13].
- *Solid and Void.* The relationship between solid (material) and void (openings and windows) affects both the visually and hearing impaired. The visually impaired need wall surfaces to help them navigate. Large glass surfaces that

are not protected can be very challenging in bright daylight and sunshine. A survey shows that this creates the biggest problem for visually impaired people in buildings [13]. Windows at the end of a corridor should also be avoided because they often create backlight and thus be blinding. Many people with hearing impairments have to lip-read to be able to understand what is being said, and this proves difficult if the speaker is standing against backlight. The same applies to those who are deaf and who are dependent on seeing someone using sign language.

- *Direction.* Layout is important. Because the easiest way for people with impaired vision to orient themselves is by moving in straight lines, communication areas should be perpendicular to each other. Entrances and vertical circulation with elevators, stairs, and ramps should be clearly marked to make them easy to see from a few yards away. The relationship between solid and void constitutes a strong element of external composition. Voids can give directional emphasis because they normally appear dark and so tend to provide tonal contrast. Wayfinding for spatial organization and circulation systems should be an integrated part of architectural design. The Norwegian wayfinding system is based on requirements for tactile and visual contrast but allows free choice of material, aesthetic design, and choice of color.
- *Form or Shape.* Architecture expresses functional and aesthetic sides which communicate with each other. While long, narrow corridors require progressive and rapid movements, wider corridors signal that there is space for rest. Circular rooms with skylights or dome-shaped roofs are often used in mingling areas and meeting rooms because the shape is supposed to bring people together (Figure 3). Examples from architectural history of the work of Frank Lloyd Wright (Guggenheim Museum) and Le Corbusier (Villa Savoye) provide historical perspectives on how an inclusive and architectonic element such as a ramp is an integrated part of architecture. However, people with impaired vision find it hard to navigate in irregular and non-right-angled constructions. Daylight, artificial lighting, and colors should be planned together with the aim of accentuating the main shapes and points of interest in the surroundings. The ability of light to form shadows will contribute to making contours and surface shapes more visible.

#### 4. Human Movement

Leon Battista Alberti, the Renaissance architectural theorist, saw houses as small towns and towns as large houses in which people move from room to room. "Within a space or building, between spaces and from inside to outside, human movement is a major factor and influences the whole building arrangement." [11] Smithies may be one of the first architects to emphasize that every design should be considered in terms of movement for older people, disabled people, and wheelchairs users. It is from this perspective that the abovementioned visual elements in architecture become interesting. For example, spiral-shaped ramps and oval or round circulation areas should be avoided.





**Figure 3.** Tangen Upper Secondary School (2010), Kristiansand. Photo: C. Ahmer

In Norway the drive towards universal design has primarily involved work on legislation, standards, and detail design. These have been and remain important factors, but detailed requirements have occasionally meant that the planning and development process has become detached from the holistic approach. Solutions which may be satisfactory in their own right often appear removed from the rest of the structure or from their surroundings. Universal design is about people, senses, and movement and about how multiple properties and forms of movement must be applied to get from one place to another. The various elements mutually affect each other, and the sum of their individual contributions determines the usability of a space. If architecture is to develop in a universal direction, an analysis of room function and user group movement patterns must be the basis of the design.

“We use totality. That is what we use first, and that is what gives meaning to the details,” proclaimed Norberg-Schulz [14]. People with ‘normal’ vision perceive first the totality of the room and then the individual elements within it. For the visually impaired, the process is the opposite: individual elements are perceived first, and then a perception is formed of how the individual elements are linked together. The opportunity to perceive the totality will depend on the clarity, so the contrasts and lighting, and how complex the visual image is [12].

The criteria for inclusive architecture should be based on both scientific and tested conditions and criteria based on experience. Quantitative assessments aim to evaluate architecture in relation to controllable data, measurable criteria, standardized specifications and regulations. Qualitative assessments are targeted toward features that cannot be measured, such as experiences and – the sensory aesthetic experience of an architectural project.



Architects should make more use of the heightened senses of the blind and visually impaired with a view to enhancing accessibility. This also applies to a large extent to the senses of hearing, touch, and smell. Hearing is used to distinguish between sounds by localizing and analyzing them to determine movement and direction. The sense of touch can help identify different objects, structures, and materials. The skin can feel changes in air flow and temperature. The feet can distinguish between different materials in floor surfaces. The hands can feel tactile maps, signs, and other forms of tactile information. The sense of smell is also important for orientation [12].

The senses can be a source of inspiration in the design of public buildings and outdoor areas. Is it possible to channel surface water in such a way as to create wayfinding systems between outer and inner spaces? Could living elements such as plants and water act as orientation and reference points in public spaces? What is the significance of skylights (which bring the weather into the building) and daylight from multiple angles (providing an indication of the time of day) as wayfinding factors? Which design should one choose for rooms for socialising? Reflections on the subject: movement, sight, hearing, touch, and smell in relation to universal design can offer a richer experience of architecture to everyone.

## **5. Conclusions**

This paper discusses why universal design and aesthetics (in the sense of integrated quality and sensory experience in architecture) are two sides of the same coin. The fact that people have different physical abilities should be reflected in the design process and in the ultimate solutions. For example, making architecture visually interesting for the visually impaired is a prerequisite for developing contemporary architecture in a universal direction. In this context, the principle of unity in architecture may offer a supplement or an alternative to the seven principles of universal design. Principles are not fixed objectives or rules; they represent a method of communication which allows us to consider the designer's intention and attempt to satisfy them [11].

Knowledge about functional impairments is particularly important for architects, as it is they who to a large extent develop solutions and recommend materials which users have to live with for many generations. Poor solutions are often the result of rushed and flawed decisions that are often made in situations where time and money take priority over quality. Architects have a responsibility to visualize the consequences of the choices they make, regardless of developers' requirements and unwillingness to focus on accessibility and universal design.

The way in which architecture is presented in architectural publications often sets the standards for quality. Presentation of inclusive buildings based on solutions that represent innovative thinking, imagination, and visual expressiveness in design, color, and use of material is crucial. Universal design should therefore be an integral part of architectural education rather than be classified as a separate subject in bachelor's or master's degree program. If universal design is made into a specialty area or skill, it runs the risk of being wrapped in theoretical jargon and of being made peripheral to the design process. This could make universal design less binding and less accessible for both students and practising architects, and contradicts the concept of universal design as an integrated and inclusive approach.

Architecture is an important cultural expression that represents and documents contemporary life and values. Modernity's architectural concepts are also marked by a need to justify the contemporary. The 'universal man' is no longer a metaphor for humanity in architecture. In this perspective, universal design is a reference to the ideals of the 21<sup>st</sup> century which should be integrated both as functional and aesthetic qualities in contemporary architecture.

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