Discovering Architectural Artistic Heritage Through the Experience of Tactile Representation: State of the Art and New Development

The current purpose of many national and international regulations is to ensure accessibility and fruition to the artistic and architectural masterpieces of cultural heritage. The aim of different public institutions or private associations is to allow everyone to discover and appreciate works of art.

Understanding the different form of art is very complex especially for a person with a visual disability, who becomes aware of the surrounding reality using predominantly the sense of touch. Disability includes a series of problems that correspond to different solutions for the fruition of cultural heritage. Accessibility is guaranteed for people with motor disabilities by the removal of architectural barriers, for deaf and hard of hearing people by the communication of the insights, for mental disability with laboratory activities. Instead, blindness requires a different approach, as it proposes problems and requires specific operations.

The article focuses on the issue of accessibility of heritage to blind and visual impairment people, presenting the consolidated techniques and the most innovative ones adopted to communicate the different forms of art, constituting both a source of knowledge and aesthetic pleasure.

Keywords:
Tactile representation; cultural experience; accessibility to heritage; tactile museum
ACCESSIBILITY IN MUSEUM

Museums and all public, private and religious institutions that aim to protect, improve and promote the fruition of the building itself and its cultural contents, must be transformed from exclusive places for conservation and collectibles to learning sites. Therefore, museum and exhibition spaces, according to the directives of the current regulations, can have a social, educational and cognitive role through identity and cultural heritage. In particular, museums must guarantee to all visitor / user categories access to exhibition spaces by removing architectural barriers (according to the principles of design for all), allowing them to consult documents and works of art, involve them in scientific and cultural activities, and inform them about exposed contents. However, it is also essential to provide appropriate assistance technologies, adequate aids and services, and staff training so that the reception to the public is positive and proactive. In fact, it is important that, with its social and educational function, a museum, project the inclusion of people with disabilities. For a long time now, visually impaired people have been asking to access to artistic and cultural heritage. Italian and foreign museums are organizing special guided tours; and are promoting initiatives or temporary exhibitions dedicated to the blind and multimedia products. Instead, the cities place the tactile maps not only in public places, but also inside buildings with architectural and historical value, or in particular urban sites (Bellini, 2000). To make the cultural heritage accessible to blind and visually impaired people, it is necessary to provide a dedicated museum itinerary with a selection of significant works of art explorabile with sense of touch. The history of the building, the exhibition rooms and the works of art must be described through Braille and enlarged characters (according to the principles of legibility and readability), audio guides [a comprehensive solution for the visually impaired or those who are not familiar with Braille reading] and visual-tactile maps. The museum staff must be competent, specialized in the artistic contents and in the specific needs of the visitors. The touchable masterpieces can be sculptures [original or copies] or paintings [for example as drawings in relief [1]] compatible with the needs of security and conservation of the artistic assets.

THE EDUCATION OF THE SENSES FOR THE CREATION OF THE MENTAL IMAGE

The sight knows the reality quickly and effortlessly, and controls the space in an extended field of view. Instead, tactile exploration presents a reduced perceptive field approachable through the interaction of hands with the environment. The blind person investigates the space in a sequential and partial way, and analytically appreciates the details of the objects [such as the surface finish or the consistency of the material] through the micro-movements of the fingers. Blind people trained in tactile exploration are also able to analyze the object with haptic movement sequences that measure the parts investigated. The cognitive movements vary in terms of methodology and rapidity, they can be attentive or distracted [similarly to the visual perception of the eye, not always careful] in capturing details, shapes, dimensions and meanings. Tactile exploration is a process that requires time and concentration due to the reduced ability to discriminate, unlike the sense of sight.

Fig. 1 - Tactile Museum “Omero” in Ancona: copies of well-known sculptures and tactile architecture models.

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It is not possible to transmit in a drawing in relief the same amount of information perceivable through a visual representation of the same size [2], and the sense of touch is not able to perceive the variations in light and color obtainable by the eyes. The perception of the world for the blind is partially different from those who can see: less detailed but objective, where the senses of touch and hearing are more trained and have a "vicarious" role (Grassini, 2000). In fact, hearing and touch allow to perceive the sense of space, the distance between objects and their movements. Near objects (within the length of the arm or the white cane) are known by touch. Instead, hearing perceives distant events, such as voices or footsteps. Sensations are useful for identifying the points of reference and for the orientation within an environment.

Touch perceives the shape and size of the things, such as the type of surface and the consistency of the materials. However, the ability of sight to perceive colors is not replaceable: an object is recognizable through other indications, but the chromatic qualities cannot be referable with the other senses. A blind person from birth has no possibility to understand the description of a color. “For a blind born color is just a name, an abstract word” (Grassini, 2000).

Hearing education involves the distinction of different types of sounds (acuity, rhythm, timbre). In addition, the use of touch must be disciplined. For blind people, it is necessary to teach them to explore by moving both hands, and possibly all fingers. The exercise refines the ability to discriminate in relief and interpret them. Touch must also allow the different materials to be recognized (plaster, wood, metal, etc.), the different types of fabric or fabric (cotton, wool, silk, etc.), the tactile characters of a surface (smooth, rough). The formation of the mental image therefore requires a series of steps that require a certain time. If the object to analyze has large dimensions, the blind person must understand its characteristics through two steps: a quick and brief initial exploration, and a subsequent one to acquire the details. The blind person forms a mental outline of the internal form first, and then proceeds to an analytical exploration to identify the details and insert them correctly in the right place in the constructed mental scheme (reference to the context). The capacity for abstraction and memorization is the fundamental element without which no tactile representation would be possible.

Even the interpretation of figures in relief can involve a considerable effort in learning. The base of the vision is two-dimensional: the images that form on the lower part of the retina are two-dimensional. At the brain level, the comparison occurs between the images of the right and left eye, formed with the two perspectives slightly different for the distance between the two eyes that involve different angles. However, a blind person is used to knowing and touching objects in their three dimensions: flattening and abstracting them are operations that are not easy to process quickly (Grassini, 2000).

Tactile figures can be useful if realized correctly, but it is necessary for the blind person to be able to decipher and recognize them. Touch, less able to perform refined analyzes than sight, requires tactile images that are simplified, schematized and enlarged. In addition to the issue of color, another serious problem for a blind person is understand the perspective, an optical illusion of which the blind will never have experience. Painting took over the technique of perspective construction after many years of experience in the figurative field. The perspective mechanism is explainable and understandable only on a conceptual level, but the blind person does not have a perceptive experience in this regard, understanding is possible through a high level of abstraction not always possible with subjects in the developmental age (Grassini, 2000).

**DISCOVERING THE ARTS THROUGH THE EXPERIENCE OF TOUCH: REPRESENTATIVE METHODS**

Art is a fundamental component of our culture. Visual impaired people cannot always make use of a valid and meaningful aesthetic education and neither can they explore artistic assets. In the past, there was a little attention to the needs of the blind on the issues of cultural accessibility. Only in the last few years, there is the interest in solving these problems, in order to give to the blind person concrete possibilities to enjoy artistic assets. It is necessary a long and careful educational process that involves the blind person from kindergarten. The blind artistic culture has a significant gap linked to the absence of a serious education in the field of figurative and plastic arts, often reducing itself to information of a notional nature.

The blind person will be able to appreciate the aesthetic value of a sculpture or architecture...
known through relief reproductions if he has been educated to understand and interpret art through tactile exploration and if he can benefit from direct experiences on places [Grassini, 2000].

A fundamental aspect is to ensure visually impaired people an adequate aesthetic education for all the forms of art and the use of touch. In fact, after reconstructing the process of forming the mental image, it is also necessary to transmit to the blind the aesthetic value of the works, in the case of accessibility to the cultural heritage. The tactile exploration of a work of art is a process of gradual selective reading [Gualandi & Secchi, 2000].

For the learning of art, the notions related to the different civilizations, to the historical periods, to the artistic current and to the specific ones of the single authors must be added to the aesthetic canons. Another fundamental aspect is the knowledge of the symbolism used in the different contexts. The arts have different characteristics and problems but can also be made accessible to people with visual impairment, as evidenced by the various initiatives and experiments proposed by some national and international museums that aimed at addressing these issues.

More and more museums are aiming to break down cultural barriers that hinder access to the artistic heritage to those with visual impairments. The all-round reproductions of sculptures and architectures are easier to understand, because the blind person is more familiar with three-dimensional reality. Instead the two-dimensional figures in relief, often used as reading and communication tools for paintings, and bas-reliefs present many more difficulties than an all-round sculpture. The correct understanding of a tactile representation depends on multiple factors, including: the coherence of the object to be explored with the characteristics of touch, the motivation of the person, his culture, the education of the sense-perceptive-motor system of the "hand" and the blind person’s good knowledge of the specific characteristics of the mode of representation he is exploring.

The *sculpture* is certainly the simplest and most accessible form of art for the blind. A careful tactile investigation defines in the mind of the blind person the correct mental image of the work. The reading of a *bas-relief* is more difficult, because it implies a greater sensitivity and preparation of the user. To describe a sculptural work, especially a bas-relief, it is appropriate to refer also to the content, as well as to historical information and aesthetic evaluations.

The large sculptures can be made accessible through their reproduction in small scales (to grasp the general scheme of the work) and by real-size details (for analytical exploration). The scale variation is also applicable to make perceptible the details of small sculptures. In addition to the production of casts and copies of the sculptural works of art (specially designed to be touched), it is important to give the opportunity to explore some works of art preserved in museums and galleries, overcoming, where is possible, those prohibitions that do not allow to touch the artistic assets. In any case, a fundamental aspect is to integrate tactile exploration with careful and adequate verbal support.

In *architecture*, the conceptual element assumes greater importance. Geometric relationships have a decisive role and the architecture is connected to a practical destination with functional purposes, whose awareness contributes to an aesthetic judgment.

To discover the architecture it is important to provide scale models or models that faithfully reproduce the monument or the original building, to give an overview of the work and to facilitate the understanding of the styles [structure and details]. The models can be disassembled to better understand the structure of the building, the internal distribution and the construction elements. Sometimes the models reproducing the main public architectural monuments of a territory are present in those buildings. This also allows...
a direct visit to the monument: this is important, because the blind can touch certain parts of the building, recognize architectural elements, walk inside, perceive the dimensions and experience the atmosphere.

Furthermore, the relief drawing is another useful representative method to describe elevations and plans (such as tactile maps) [3].

The approach of the blind to painting, photography and graphic arts in general is more complex.

The visual arts seem to exclude those who do not possess the sight from any kind of possible enjoyment and fruition.

The issue of painting or two-dimensional and chromatic representations constitutes a "perhaps insoluble" problem for blind and visual impairment people [Grassini, 2000].

It is important that the blind person, despite not being able to appreciate the chrome-luminous features of a work, knows the content and peculiarity of the stylistic current. In this way, he can refer to the complex of the work of a certain author, to the historical period and to the cultural trend, as well as to the biography of the artist and his personality. Aspects that constitute knowledge of the painting, although the color and depth characteristics of the scene represented are not fully appreciable.

Unfortunately, the artistic education of the young blind person is limited to simple notions of the history of art and in some drawings in relief. Instead, several art museums use transpositions in three dimensions of some famous works as the interesting and pioneering study and research activity undertaken by the Tattile Museum of Ancient and Modern Painting Anteros and the Francesco Cavazza Blind Institute of Bologna. The paintings are reproduced in perspective bas-relief form: the shape and composition of the objects represented are perceptible to the touch.

The expert staff of the Cavazza Institute handcraft these three-dimensional copies of the paintings [fig. 7-8]. The transposition from painting to bas-relief takes place by appropriately modifying the works of art according to the principles of tactile perception, without distorting the work itself. It is necessary to evaluate the degree of legibility of the relief in respect of the tolerable tactile thresholds. This is why the degree of plasticity of the relief depends on the interpretation of the aesthetic qualities of the translated work and on the need for legibility.

The design requires a teamwork between the modeler-sculptor, art historian, tifilology assistant and the pedagogist. During the realization and completion phase, blind people, who have gained experience in the field, test the reproduction of the bas-relief paintings. This work implies an enormous level of competence.

The ability to know how to read a work of art requires a thorough preparation of the user.

Knowledge of perspective representation is essential for understanding painting, such as the
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EXPERIENTIAL DESIGN FOR HERITAGE AND ENVIRONMENTAL REPRESENTATION

Although it is not easy for a blind from birth to understand the rules of vision, it is necessary for them to follow a learning path, through an adequate work of didactic mediation, in order to mature the spatial and imaginative-motor concepts. To address this kind of path, the person must have an intense motivation.

The importance of the realization of propaedeutic tables (fig. 9) in which the subjects are read from different points of view and from the perspective of visual cone, and partial, frontal, profile, foreshortening views. However, it is not so easy for a blind from birth to understand the rules of vision. It is necessary for them to follow a learning path, through an adequate work of didactic mediation, in order to mature the spatial and imaginative-motor concepts. To address this kind of path, the person must have an intense motivation.

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Concepts of visual cone, and partial, frontal, profile, foreshortening views.

The role of the designer is fundamental: he, with his awareness and professionalism, is a mediator between the images and the user. The relief drawing is very useful to represent simple and schematic objects, maps and floor plans of buildings, graphs and geometric drawings.

Overview of the research carried out, considering the development of a methodology allows to analyze and quickly classify the state of the art of the field, to give meaning to the research carried out on tactile representation of architectural artistic heritage. The developed methodology is intended to be used in the future for the development of other research projects, as it allows to quickly identify the main results obtained and to compare them with the state of the art.

In this context, the bas-relief has its limits. It is effective in expressing forms, but it is not effective when it comes to highlighting the chromatic values of a work: in fact, colors cannot find a plastic translation. To try to communicate the chromatic effect, it is appropriate to speak, making analogical associations and evoking the previous sensory experiences of the blind person.

The painted bas-reliefs with chromatic emphasis are useful for visually impaired people. In this way, the user approaches the knowledge of the color in relation to the shape. Even enlargements of the details of the work of art guarantee the visually impaired an excellent support for the tactile experience and facilitate the fixing of meanings. The audio support and the descriptions in Braille are indispensable to reinforce the haptic perception with historical and artistic knowledge.

In addition, paintings are represented through the different methods of relief drawing (fig. 10). In this case, the relief has lost the function of directly recalling the volume of objects; it makes perceptible to the touch the points, the lines, the surfaces and the different elements of an image. It is possible to communicate to the reader the essential form of the objects [including the volume] and their reciprocal relations strictly in the context of a two-dimensional representation. However, these are images specifically designed for a blind person.

The drawing in relief appeals to the potential of haptic perception, but it must also confront its limits and its specific characteristics. To represent complex and three-dimensional objects through plane figures and therefore with only two dimensions, orthogonal projections [and not perspective] are the most direct and effective method of making possible such a form of translation.

The drawing in relief, in order to respect the requirements of touch, in addition to imposing the assumption of a particular representative code, requires a specific effort of interpretation of the surrounding reality, intended to select the essential elements and, at the same time, those most easily represented through this code.

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and change the level of detail based on the scale reduction; the relief thicknesses used are understandable on touch threshold; the materials are suitable and the surfaces are finished.

There is no better representation technique than the others, but the most suitable depending on the type and range of users, topic and situation: aspects that require careful analysis of limits and advantages according to the needs to satisfy.

TACTILE MUSEUMS AND NEW ACCESSIBILITY INITIATIVES IN TRADITIONAL MUSEUMS

The various associations for the blind are often promoters of multiple initiatives aimed at allowing the blind to access the artistic heritage.

The most important experiences regard the establishment of special exhibition structures, such as the dedicated tactile museums, and “adaptation” interventions and integration measures in traditional museums [guided tours, information in Braille and enlarged characters, temporary exhibitions and tactile works of art for all]. The copies and models reproduce works of art that are scattered throughout the world and are often difficult to reach, but also inaccessible (works placed on tall pedestals, protected in crystal cases or barred from prohibitions). Hence, the need to create museums that collect reproductions of the most significant masterpieces, possibly dividing them according to different categories of historical or aesthetic interpretation.

For dedicated tactile museums, those places are intended expressly but not exclusively for people with visual disability. These structures aim to make the cultural heritage accessible through its transposition with appropriate modes of representation in terms of tactile exploration and a qualified training and assistance activity for understanding the contents of the works of art.

The images represented with this methodology, despite all their limitations, guarantee a greater amount of information and a faster approach than a simple verbal description; then they imply a much smaller expenditure of means compared to models in three dimensions or representations in high relief.

Drawings in relief and three-dimensional reproductions, obtained with traditional and technological methods, are effective if: real artifacts, buildings or parts of them are physically inaccessible; the reproductions have been simplified many works. The maximum number of works [unknown] that a blind person would be able to remember without confusion is 15/20.

These museums are entirely accessible to the blind, specially designed for them, but sometimes offer activities also for the sighted, such as educational workshops for children. Sometimes they testify to the evolution of the typhlologic discipline. The Tactile museums are places of education, which provide the cognitive tools necessary to better appreciate the different types of experiences of use of the tourist-cultural heritage proposed to the visually impaired in the most disparate contexts.
The memory of a tactile image is much more unstable than a visual one and needs to be renewed over time. The advantage of these special museums is to give the blind the opportunity to discover new things and to repeat the experience by revisiting those already known in the past.

The main European museum is the Tifologico Museum of Madrid, famous for the reproductions of the well-known Spanish and international architectures [fig. 11]. In Italy, the Tactile State Museum “Omero” of Ancona, important for reproductions of architecture, sculptures and paintings from different eras (from ancient Greece to contemporary art). The Tactile Museum of Varese known for the models representing the territorial context to the architectural detail [fig. 12]. At last, the “Anteros” Museum of the Cavazza Institute of Bologna, where famous paintings become three-dimensional as perspective bas-reliefs.

In addition to the dedicated tactile museums, the number of museums that aim at removing cultural barriers and creating tactile routes and initiatives aimed at making their works accessible also to blind and visually impaired people through traditional methods and new technologies are growing in number.

Among the most interesting and modern initiatives for accessibility to the artistic heritage: the temporary exhibition “Hoy toca el Prado” at the Museo del Prado in Madrid, where tactile paintings of famous paintings are reproduced with 3D printers. “Doppio Senso” at the Peggy Guggenheim Foundation in Venice [fig. 13], a tactile journey in which some works of the collection are reproduced in relief in termoform or minolta.

The most innovative exhibition is Touching Masterpieces, at the Prague National Gallery, in which famous masterpieces such as the Venus de Milo [fig. 14] or the Bust of Nefertiti can be explored tactiley through data gloves, virtual haptic gloves. However, even in small Italian cities, the interest in the accessibility of heritage has had its results. In Gorizia, in Friuli Venezia Giulia, for example, the project “Gorizia ConTatto” was organized, which includes several tactile installations in the most significant architectural sites of the city. The project, conceived by Italia Nostra, involved the creation of maps of a place in relief (of the city castle and of the Jesuit church), reproductions of two Character Heads by Franz Xaver Messerschmidt [fig. 14] through structured light scanning and 3D printing, and the prototyping of city building facades.
NOTE

[1] The image in relief is composed of points, lines and surfaces perceptible by touch. The drawing must be simple and essential, to allow the formation of the mental image of the represented drawing. The different levels of relief and textures communicate the idea of color.

[2] A drawing in relief with too many details could create confusion and disorientation for the blind reader.

[3] There are many drawing techniques for blind people. They differ in the complexity of construction, the costs of production, but above all the height and precision of the drawing in relief. The most important are the Braille in graphic mode, the gaufrage, the thermoform, the serigraphy, and the microcapsule paper process. But also the collage and the rubber top, used for educational purposes. Cards with drawings in relief representing the plan or facades of an architectural complex, made in termoform or with other relief techniques and methods, are very useful. These cards are easy to reproduce and distribute to the user, printable at home on microcapsule paper and the Minolta oven.

REFERENCES


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