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Waysensing

abstract

A major longevity due to the progress of medical science and social-economic conditions brought an apparent well being for a longer period of time. But reality shows that a large part of older people present a major dependency generally related to health problems. People over 60 years show some vision losses dependent of the gradual aging of the eye functioning being most of the pathologies identified related with low vision provoking intensive medical care needs in ophthalmological services, in hospitals. Most hospitals do not dispose of an effective wayfinding system or even one adapted to the special needs of the patients with visual impairment or low vision condition, which in fact need effective colour contrasts, dimensionally adapted written information or even haptic perception information for more efficiently promote readability and orientation.
The use of sensory-motor wayfinding systems joining a correct colour use for legibility and readability of the written information, associated with simplified pictograms and supported by guidelines and tactile textures on the pavement alerting for the orientation system, may result in an effective way of displaying information in hospital environments.

keywords

older people, haptics, visual impairment, waysensing, hospital environment

Introduction

This paper is integrated in on the author's PhD research project where the main objective is to introduce haptics (touch) in a wayfinding system in hospitals, mainly ophthalmology areas, in order to promote independent mobility and self-esteem in the elderly people with low vision. The principles of universal design are important, and potentially progressive, in seeking to restore disabled people's self-esteem, dignity and independence, while encouraging the development and implementation of user-friendly design (Hall & Imrie 2004, p.16). Universal Design (Design for all or Inclusive Design) can´t probably not respond in absolute to the needs of all low vision pathologies using only colour and typography in wayfinding systems, particularly in hospitals. This is due to the different visual impairments and the variations of the depth of vision (Hind 1996 apud Hall & Imrie 2004, p.17).

To transform a hospital environment wayfinding effective to this target group, we need to promote it through a multisensory way (Herssens & Heylighen 2008, p.102) by introducing foot haptic touch and not just a visual representation. Their spatial experience relies mostly on the haptic sense, which appears to be the foundation for cognitive spatial representation (ibid.). Introducing the sensory mode of touch is to integrate our experience of the world (Pallasmaa 2005, p.11). When touching we experience the operation of two distinct sensory subsystems, the cutaneous and the kinesthetic

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senses. In functional terms the first one provides the observer of information about the stimulation of the skin surface and the second one provides static and dynamic information about the relative positioning of the head, torso, limbs and effectors used in touching (Loomis & Lederman 1984).

Haptic perception

Pallasmaa (2005) in his book "The eyes of the skin – architecture of the senses" underlines the importance of the tactile sense for our experience and understanding of the world, over the visual sense. Referring Ashley Montagu's medical evidence on confirming the primacy of haptic realm he writes "touch is the parent of our eyes, ears, nose and mouth. It is the sense which became differentiated into the others, a fact that seems to be recognised in the age-old evaluation of touch as the mother of the senses" (Pallasmaa 2005, p.11).

The difference between the visual and the haptic processes is that haptically we perceive every part separately and on reverse we start by seeing the whole, but do not see the structure immediately (Rèvész 1955 apud Herssens & Heylighen 2008, p.106). Whereas visual sensation only relies on two-dimensional information, c.q. an image, haptic stimuli are three-dimensional in the first place, but can be felt as two or three-dimensional dependent on the scale of the environment (Herssens & Heylighen 2008, p.105). But in every day perception, touch and vision operate together (Klatzky & Lederman 2003, p.147). Elderly people with a low vision condition cannot rely on their vision to perceive the environment, they need to experience space through touch (foot touch) in order to be able to act independently in a building and to find their away around as well as to ensure a safe walking. A haptic system on the pavement can be introduced in a wayfinding system as a way to promote a sensory access to information for this target group. The development of a wayfinding system that uses adjusted colour and colour contrasts to the pathologies of low vision, such as communication signs on the walls and guidelines on the floor with haptic information "where the perceiver seeks information from the world by exploratory movements" (Klatzky & Lederman 2003, p.148), may produce the results needed for the visibility of a hospital wayfinding system.

There is a acceptability by people for touching floor surfaces, via the shoes, on contrast of people being averse to touching certain objects in public spaces (Visell et al. 2009, p.149). The introduction of a sensorimotor task on the pavement does not imply an increased sense since it is implicitly engaged on normal walking (Visell et al. 2009, p.150). Active touch, what is ordinarily called touching, is an exploratory sense and may be termed tactile scanning, by analogy with ocular scanning (Gibson 1962, p.477).

Touching involves very different types of information (e.g. regarding pressure, temperature, shape) and uses both cutaneous (e.g. skin perception) and the kinesthetic receptors (e.g. perception of muscles, tendons, joints) (Gibson, 1962; Loomis & Lederman 1986 apud Herssens & Heylighen 2007). But the kinesthetic sensitivity may change making older adults more susceptible to falls and more variable in sensing movement, touch and body position (Fisk et al. 2004, p.25). Our footsteps can gives us an impression of our balance, our positional awareness, the ground's texture and dimensions, but the sound which is produced by our shoes can give us tactual architectural information as well (Herssens & Heylighen 2007). Visual impaired people as all humans compensate for deficiencies or weaknesses in one sensory modality by relying on another sense, without necessary being aware of it (Krippendorff 2006, p.143). We use all our senses to perceive

and use the environment. We do not use one specific sense to do it, but as normal vision people sight is the first sense used, leaving although other senses aware.

When using a building, in particular a hospital, we don't have to adapt ourselves to this environment, but it is the environment that has to be adapted to us (Herssens & Heylighen 2007). There is a need to rethink and adapt the functionality of a particular building to the needs or special needs of their users. Those are inclusive/universal/for all design objectives, aiming at usability and comfort for as many people as possible regardless age, ability or circumstance (ibid.). Our ability to cope effectively with the environment begins with our capacity to process sensory input, although advancing adult aging brings with it systematic reductions in the efficiency of our sensory systems (Schieber 2006, p.129). People are living longer, remaining more active into older age, and remaining in their homes longer before finding the need for "assisted living" arrangements. Aging brings with it changes in perception, cognition, and control of movements (Fisk et al. 2004, p.4). The ultimate goal of the science and the practice of human factors is to ensure that human–system and human–environment interactions will be safe, efficient, and effective (ibid., p.13).

Waysensing

Waysensing can be defined as the visual and haptic sensorial capacity that allows a human being of collecting the explicit information of the physical environment, in particular the spatial organization, in order to act in conformity.

Figure 1.
Literature review thematic areas (author)

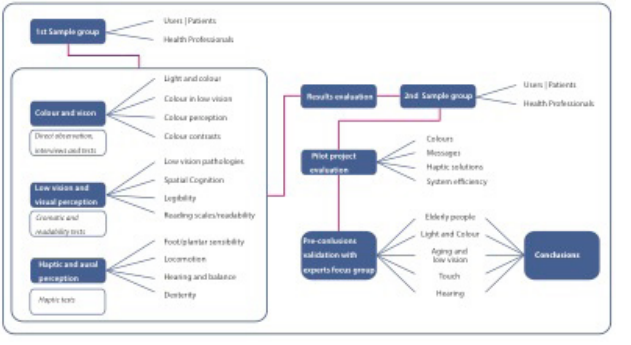
Waysensing is the result of the merging of the wayfinding principles, concepts and updated research held and expressed in a vast existing literature with the senses perception of the target group in the experienced environment.

Names like Lynch (Lynch 1960) and the evolution of the wayfinding concept from Arthur and Passini (2002), Mollerup's (2005) wayshowing structured visual information concept, Golledge's wayfinding behavior (1999) and so many others that have and are contributing for the construction of a specific area of investigation that is essential on mobility, independence and self-esteem for all of us, in particular in today's increasing life span worldwide (WHO 2003). This longer living does not reflect problems of health in elderly people. A very large proportion of this age-related increase in the prevalence of visual impairment can be accounted by three classes of ocular pathology: cataract, age-related maculopathy (ARM), and glaucoma (Schieber 2006, p.133).
Although the research project aims to evaluate elderly patients with low vision pathologies and their interaction with the hospital environment, this paper is mainly focused on the haptic system literature review.

Methodology

Supported by a participatory design methodology this research will evaluate through interviews and tests the visual acuity, color and contrasted color perception, legibility and readability in the different patients low vision pathologies; on haptic tests measuring the foot haptic perception to textures, and the independent mobility of patient's locomotion and dexterity.
Through different phases of evaluation (see Fig.2) of the target group perceptions the research will seek for the necessary answers building efficient information for the design project. All the data acquired will permit obtain some pre-conclusions of the research phase that will lead to the development of the design process of creating a pilot project for a specific part of this hospital. This area will be a lab of experiences and tests with patients and users to validate the pre-conclusions and recommendations obtained in the prior phases.

Figure 2.
Research evaluation process.



Case study

The experimental research will be held in a public ophthalmology hospital (around 5.000 patients/month) offering a variety of services, such as consultations, exams, treatments and eye surgeries.

A general observation of the natural and artificial light conditions will permit to establish and parameterize optimal condition for interpreting the orientation information for all pathologies and minimize the effects of shades in some areas. Through direct observation of the patients and users usage of the building, the main axes of circulation and the most used areas will be evaluated so that the localization of the necessary information for an effective waysensing system will be implemented.

Conclusions and future work

The waysensing system will represent a more sensorial way on the deconstruction of the built environment, in particular hospitals for people with low vision condition. By promoting an independent mobility on these patients it will also promote self-confidence and self-esteem on them. Having patients and users acting by themselves in the building is expected and to leave more effective working time for doctors, auxiliary teams and nurses who actually spent a great deal of time showing and helping users to find their way around, are the research hypothesis.

The waysensing system concept is perfectly applicable to situations with absence of light even if they are for normal vision people, for instance to auditoriums and exhibition places. There is always information that can be conveyed by haptics, especially when visual noise is present.

The future work is to start the experimental phase in hospital, with the preparation of a specific area for interviewing, testing and the installation and implementation of the pilot project.

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