Sound, image and more: a synaesthetic design strategy to alleviate pain in hospitals

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ABSTRACT

Hospitals are often considered stressful and unpleasant environments. A large number of people point the constant exposition to unpleasant sensory stimuli (e.g., blinding fluorescent lights, incessant electronic noises, smells of chemical substances, unpleasant textures, and so on) as one of the main causes of stress. In healthcare design, those problems are usually addressed by eliminating /diminishing the aggressive sensory stimuli. This monomodal approach might result quite insufficient for the design of health-related environments, where sensory perception should participate to have a positive impact on people's wellbeing. In this paper, we present a synaesthetic design approach applied to design an environment with the aim to promote wellbeing, named the Sensuous Project. Particular attention is given to the perception of pain, a sensory modality for which the design of cross-sensory interactions, including sound, image and other concomitant stimuli, are particularly important due to their potentiality to produce analgesic effects.

INTRODUCTION

It is commonly agreed that hospitals are stressful and unpleasant places. The presence of unpleasant stimuli in the environment is pointed out as one of the main causes of stress, also aggravated by the fact that people's sensitivity to sensory stimuli increases in periods of illness (Nanda, 2017).

In healthcare design, the traditional design approaches often propose the reduction (or the complete elimination) of the sensory stimuli (stressors) from the environment, in order to instil calm and provide comfort to patients and workers. An example could be the reduction of noise levels in a neonatal care unit with the use of soundproofing coatings. This is a typical subtractive approach: uncomfortable stimuli are gradually removed from the environment, without being replaced by positive ones. As a result, healthcare environments often result: empty, sterile, cold, boring, and in general monotonous (Duarte et al., 2019). In most of the cases, the designed solutions are focused only on one specific sensory modality (sense), as in the case of the acoustic modality in the above-mentioned example. A monomodal approach is one that is restricted to one specific modality. In healthcare design, the traditional monomodal approach could be insufficient because:

1. There could be another concomitant stimulus, in another modality, that might interfere with the designed solution;

2. Monomodal approaches do not consider cross-sensory interaction existing between different modalities;

Although people tend to consider the sensory modalities to work separately, the human perception could never be isolated under a specific modality. If it is true that the action of sensory receptors is stimuli-driven and produces what is commonly called sensation (the translation of the electromagnetic, mechanical, thermal or acoustic stimuli in a neuronal signal), phenomena of sensory perception involve the interpretation, the meaning and the organization of these sensations, that are integrated with our memory and with other information coming by different sensory modalities (Calvert et al., 2005). All the modalities are internally connected: people have modalities, and they are multimodal most of the times (Park & Alderman, 2018). It is impossible to consider vision without hearing or tasting without smelling. These mechanisms are the basis of the synaesthetic connection between the senses and they are prevalent in people daily lives (Merleau-Ponty, 1945).

The importance of considering the systematic connection within the different sensory modalities is addressed in the field of research of synaesthetic design. Synaesthetic design is a multidisciplinary field that aims to coordinate all sensations stimulated by an artefact, in our case the environment, basing the design choices on the systematic connections between different modalities, that became the real focus of the designer (Anceschi & Riccò, 2000; Córdoba et al., 2014; Haverkamp, 2013; Riccò, 1999, 2008).

DESIGN FOR PAIN: THE SENSUOUS PROJECT

The idea of having just the right perceptual rates of positive stimuli in healthcare environments was first proposed by Rapoport, back in 1979 (Gordon & Rapoport, 1979). To this purpose, a synaesthetic design approach in healthcare design could be used as a strategy that, beyond the simple elimination of sensory stressors, proposes the introduction of positive stimuli able to reduce pain. Pain, itself, is a sensory modality and is triggered by the nociceptors: peripherical receptors belonging to the visceral system. In spite of being considered a peripherical modality, the study of specific chronic conditions, as phantom limb pain, has demonstrated that pain has a greater component at the level of the Central Nervous System. Starting from this discovery, theories as Gate Control Theory (Melzack & Wall, 1965) and the successive Neuromatrix Theory (Melzack, 2001) suggested that the pain perception could be modulated by the proceeding of sensory inputs and cognitive events, with the use of sensory counterirritations. The most common examples of sensory counterirritation are the use of cold temperature (cryotherapy) or the Transcutaneous Electrical Nerve Stimulation (TENS) (Boensch, 2011; Riley & Levine, 1988). In other cases, auditory and visual stimuli are used as a strategy to alleviate pain, in particular:

1. Audio-analgesia was the name given to a series of experiences done starting from the ‘60s in dental medicine. The use of sound (a white noise with specific features) was found to reduce pain perception (GARDNER et al., 1960; Gardner & Licklider, 1959; Howitt & Stricker, 1966; Morosko & Simmons, 1966)

2. Light-colour analgesia is the name given to a series of experiences that use chromatic light to distract patients and have a direct effect in alleviating acute/procedural pain (Rahimi et al., 2013; Yousuf Azeemi & Raza, 2005)

SOUND & IMAGE

For this study, in which the environment should be designed adopting a synaesthetic design approach, it is important to have optimal control of the multiple variables present in the environment, manipulating a large spectrum of sensory stimuli, with the maximum efficiency, embracing not only acoustic and visual stimuli, but all the electromagnetic (light), mechanical (sound, pressure and vibration), thermal (temperature) and chemical stimuli (smells). Nevertheless, auditory and visual stimuli have important features for several reasons:

1. An image has the extraordinary capability to distract people (children in particular) even in situations of acute pain perception. Distraction is commonly used as a non-pharmacological technique in pain management.

2. The interchangeability of white and chromatic at different intensities is considered to produce good outcomes in terms of distraction;

3. Sound, as a mechanical stimulus, has the capability of producing acoustic stimuli as well as vibratory (tactile) ones. The exposition to low-frequency sound stimulation (40Hz) can produce counterirritation in the auditory as well as in the tactile modality.

4. Sound and image are at the basis of the most important multimodal perceptions. The information coming from a visual modality is always compensated by the information coming from the auditory one, and vice versa.

CONCLUSIONS

In spite of being a common practice in healthcare design, the subtractive approach (in which the sensory stimuli in the environment are eliminated/diminished) could fail in the design of an environment that could produce an analgesic effect in patients. By analysing phenomena of cross-sensory interaction between different modalities we suggest that concomitant stimulations between auditory, visual and other stimuli could produce concomitant counterirritations that might alleviate pain in patients, possibly without extra pharmacological intervention. This effect is being explored in the Sensuous Project, in which a synaesthetic design approach is being applied to design an environment with the aim to promote wellbeing.

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