

Uses and practices of e-health environments: An interactive architecture for effective real-time monitoring of patients

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Abstract: The impact of new information and communication technologies on our societies is universal. They have the advantage of being transversal and affecting all sectors, notably health. E-health, a multidisciplinary field of research, is growing significantly and is nowadays necessary for systems of healthcare. The determinants of this breakthrough in healthcare remain the age demographic of the population coupled with the inadequacy of the health workforce, without ignoring the rising costs of care. This is reflected in the continuing rise in the number of people with addictions, as chronic diseases become more acute, creating a huge need for appropriate technologies. The circumstances are therefore conducive to reflection leading to the modeling of more innovative solutions for effective patient care. The NICT's incursion in the medical field is most often seen as the introduction of tools designed to guarantee or even improve the quality of healthcare services, so our research combines crosses and puts into dialogue the relationship between space and the psychiatric patient. To do this, we approach space as a determining factor in helping people with psychiatric illnesses, and as an interactive, real-time approach to the needs of the sick.

Keywords: E-Health, NICT, ambient intelligence, interactive space, psychiatric patients, hospital

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1 Introduction

To live is to move in, to develop, to move, to appropriate, to desert, to walk, but above all to live the space^[1]. We ourselves are elements of space. By our daily actions, our simple presence, acts and transforms the space spontaneously, generating imperatively a new atmosphere in space. In addition, "The notion of atmosphere engages a sensible relationship with the world"^[2].

At the beginning of the 20th century, Ernst Mach examined the relationship between the physical and the psychic state of individuals through the perception of sensations. He then highlighted the role of movement in any perception^[3].

Then Erwin Straus, in his critical work on the Pavlovian reigning approach, shows that every perception engages an action, that there is no feeling without a movement^[4]. "It is not the physiological functions of the sensory organs that make a being a sentient being, but rather the capacity to approach and the latter does not belong to sensation or movement alone."^[5].

Later, Merleau-Ponty emphasizes that it is not the object that

would be felt and approached, but the sensible quality of the very place of perception, as the place of encounter with the world. Feeling would be the approach and perception would then be movement: "Therefore, if perception as an approach is open to the world itself, each experience is a presentation of this world and not the apprehension of an object"^[6].

Gibson, for his part, shows that space is not qualitatively neutral, but that it presents the potentials of actions at all times. Space gives infinite possibilities of diverse and ephemeral actions, or "affordances" (offerings).

Many architects claim an attitude that takes into account the senses and compose it with the social context as well as with the physical environment. The space in which we live is multi-sensory, dynamic, and relational, and contemporary architecture feels explicitly concerned with these aspects.

On this subject, architects possess knowledge and expertise, often intuitive, which can produce architectures of high quality, both from a sensible point of view and from a point of view of usage.

The perception of environmental factors is a subject that is beginning to be relatively documented in social psychology or in the psychology of space, including in terms of health. The present study was based on several references that precisely introduce the impact of environmental factors on the health of

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patients or people (patients). Osmond's (1957) study on the impact of noise, Ulrich's (1981) research, which deals precisely with the impact of perception of the atmosphere (for example induced by plants) Post-operative hospitalization. In the same vein, research by Tennessen and Cimprich (1995), Kaplan (2001) and Raanaas, Gustave Nicolas Fischer and Virginie Dodeler (2009), Patil and Hartig (2010) report the impact of the space environment on patient health. These authors also assume that the NICT could become tools to aid in the therapy of patients by offering "a solution for the control of atmospheres".

2 The effect of architecture on the clinical health of patients

Gustave Nicolas Fischer and Virginie Dodeler, lecturers in social psychology at French universities, in their book *Health Psychology and the Environment* (2009), discuss the influence of the architectural characteristics of a health building on clinical outcomes. They distinguish five measures related to health and stress in hospital buildings: the level of stimulation, coherence, affordance, control and the reconstituting qualities of space. Indeed, to give patients the possibility to control their environment through technological devices with the use of home automation but also with furniture adapted to their handicap (removable walls when patients are in multiple rooms etc.) allows one to bring a feeling of well-being and security. The latter can be seen as a helping tool in the healing process of the sick.

3 The introduction of nict's in health spaces: E-Health

The medical sector has undergone profound changes and has a new face. The rise of digital technology, through the incursion of the New information and communication technologies (N.I.C.T.), has revolutionized the approach to health. Innovation has largely contributed to the upheaval of the medical world and health in general. The spread of technologies has made it possible to provide a greater number of healthcare services that are more accessible to all, while improving medical performance and the quality of healthcare services (integration of virtual reality and "intelligent scalpels", telemedicine and tele-surgery, transplants, surgical robots, endoscopy ...) according to Christensen in Blagg (2009). E-health, the concept to which we refer, encompasses multiple components. On the basis of World Health Organization (WHO) resolution WHA58.25 (2005), supplemented by WHO Resolution 148/17 (2011), e-health can be defined as "the use of information and communication technologies in support of health action and related areas, including health care services, health surveillance, health literature and education, knowledge, and research".

Computer science is a universe in constant evolution on several levels: hardware, software, and architecture. Today, computing opens up to a new era: that of ambient intelligence - help to the human being - which, through home automation, is gradually changing our habits, improving our daily life but is also upsetting our societies. Certain societal progress is made against a backdrop of questions about the man-machine relationship. Artificial intelligence wants to develop a chain of events from perception, analysis to reflection and ultimately action. Some architectures take into account intentional attitudes such as desires and beliefs and integrate "practical rationality" as a "medium-fine" reasoning. Multi-agent systems are interacting sets of intelligent agents. This discipline is a sub-branch of artificial intelligence also called distributed artificial intelligence. Intelligent agents can be virtual entities (for example, software) or real beings. In this case, the objective of the SMA (multi-agent system) is the simulation of a set 5 of autonomous and in interaction with the environment. For example, multi-agent systems are an interesting way of modeling societies, and as such have broad applications, extending to the human sciences. Ambient intelligence is therefore at the heart of current technological advances. In parallel, it allows social and societal studies but whose invasiveness must be regularly re-evaluated. Technological evolution is therefore no longer the object of attention of engineers and scientists alone. Ambient intelligence is therefore a project of the future, which must take into account the software, the human-machine interface.

4 Methodology

Our research is a first attempt to understand the relationship between space and the psychiatric patient in Algeria. To do this, we approach space as a determining factor in helping people with psychiatric illnesses, as an interactive, real-time approach to the needs of the sick. In order to do this, we carried out a practical study at the psychiatric hospital (240 beds) Er Rasi of Annaba and the Neurology Department Ibn Rochd Annaba, Eastern Town of Algeria. A questionnaire was adopted for a sample of 25% of inpatients, 50% of whom were female. In addition, a long interview with the heads of services and the nursing staff of the services, was conducted with a guided tour of the places. The rooms of the patients have been carefully selected according to their locations to the different sources of light, noise and the opposite. Our cross-data collection methodology includes a direct approach of the field of ethnographic type, observations and interviews. We aim at the collection of "inside" data that is difficult to access by external quantitative observations. They affect the subjectivity of the users and the feelings of the people. The desire to have access to all the spaces of the hospital and to the different uses made us opt for an immersion of two weeks. We thus circulated in the different places, clothed in a white coat provided by the doctor. This point is important because it allowed us to move freely but, above all, it affected the type of relation-

ship with the various actors: assimilated to the nursing staff, we established with the latter an easy contact but it was also reassuring. On the meaning of our presence spontaneously associated with an evaluation by management; On the patients' side, the white coat gave us a form of authority and legitimacy but also led them to monitor their remarks. In the first days, we were perceived as members detached by the hierarchy, to limit this inconvenience, we proscribed the notes taken in the presence of the users. Over the course of the day, in fact very quickly, we have gained the confidence of the staff of which we have become a sort of confidant on all the problems related to the architecture of the building or even beyond.

4.1 Spatial observations

Our observations focused on the different ways of using space for patients and caregivers. It was observed every day in order to be able to carry out a map of the displacements. Some of these observations were still going on at the same time, except for appointments, and I reported at lunchtime and in the evening, on various maps, the observations on the movements and the arrangements.

4.1.1 Regarding patients

The different furniture fittings of the rooms were made by the patients. This shows how patients can personalize their rooms, what they allow themselves, and what their room for maneuver is. Through visits with doctors, nurses or nursing aides. We have thus been able to draw up three major planning scenarios.

Places of socialization and their use. What are these places, how to appropriate them, which were created by the architect and which are the fruit of the patients?

4.1.2 Concerning staff

For the staff, three themes emerged. The manner in which the various staff members use the rooms (doctors during visits, nurses, nursing aides), the way with which they appropriate the corridors (according to the schedules it is the territory of the aides/nurses, and at the time of the visits it is that of the doctors), and, finally, their places of relaxation.

4.1.3 Results

women raise the problem of the interdependence of the spaces of circulation that is confirmed by the disposition of the rooms. The issue of insecurity was mentioned by 1/3 of the women because of the people from outside and the mixity created by the design of the building. The tunneling effect caused by the narrow corridor serving the rooms and its elongation gives half of the patients (women and men) continuous anxiety from 2 PM until 6 PM(Figure 1). The presence of cladding on the windows of the rooms led all the patients to interpret space as a place of penance. The noise generated by the morning visit of the medical staff is perceived as a source of nuisance for 4/5

of the patients. The hospital has a garden frequented by more than 3/4 of the men from 11 AM to 1 PM and from 3 PM to 5 PM. On the other hand, 1/3 of the women use only one corner of the garden from 2 PM to 4 PM(Figure 2). The layout of this garden remains inappropriate for its use for both sexes(Figure 3).

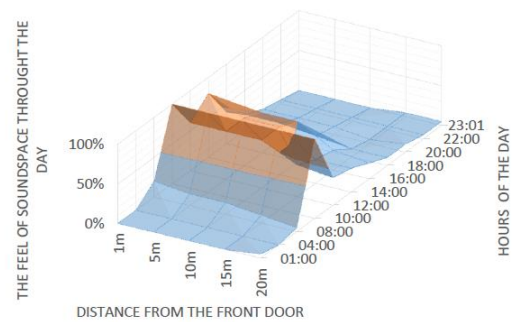


Figure 1. The feel of the soundscapes throughout the day, and the distance from the front door by the patients. Source: Author 2017

4.2 The report on NICT

4.2.1 Regarding patients

During the interviews, 80% of the patients revealed that they had a smartphone, 50% of them with an average age of 35 years were constantly connected to the Internet network through the 3G or 4G services. 90% of patients reported having an internet connection at their homes.

4.2.2 Concerning staff

During the days spent in the hospital, we noted that 100% of the medical staff automatically connected their smartphones to the Internet once they were on a break in their places of relaxation, using the services of 3G or 4G. The registration of patients and the processing of files as well as their classification is always done manually in registers, the telephone line cut; doctors, nurses and nursing aides denounce using their personal lines at their expense. Lack of connection with other services, and to the internet. Doctors and nurses seem to have a general idea of technological advances in the field of health.

4.2.3 Results

By addressing the concept of e-health, its protocol, instructions for use, and the diversity of offers and services it offers, 100% of the patients questioned as well as 100% of the personnel who compose the medical body say they are favorable for its experimentation. Indeed, they shout their confusion as regards the logistics, which they considered outdated and dilapidated(Figure 4).

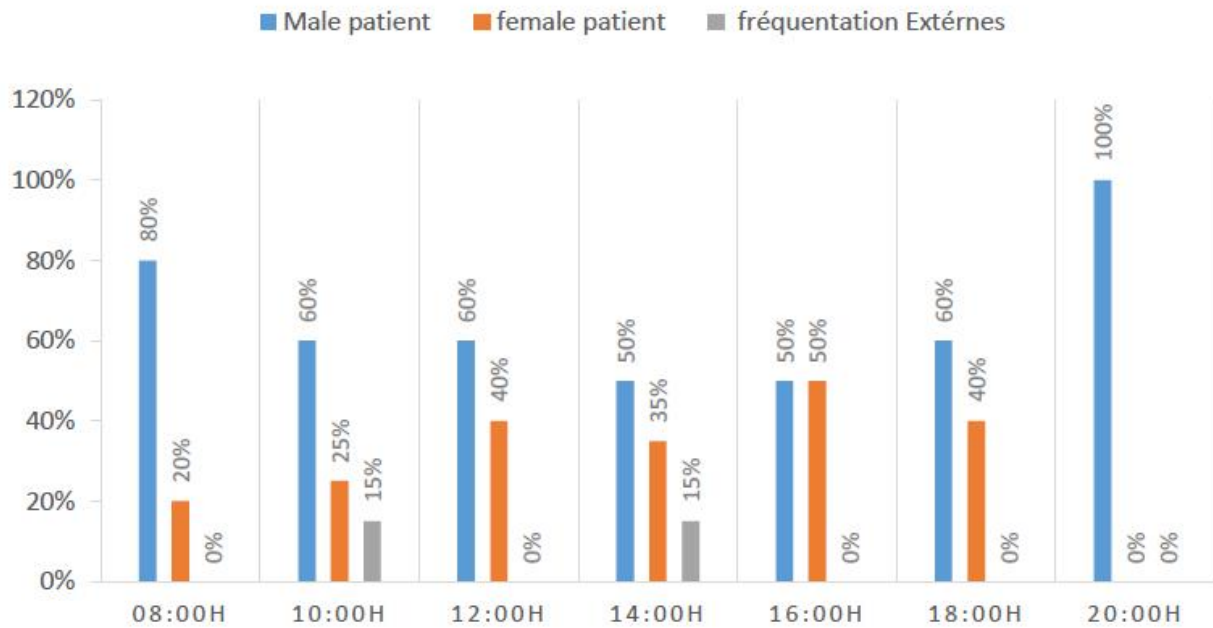


Figure 2. The attendance of the patients in the garden. Source: Author 2017

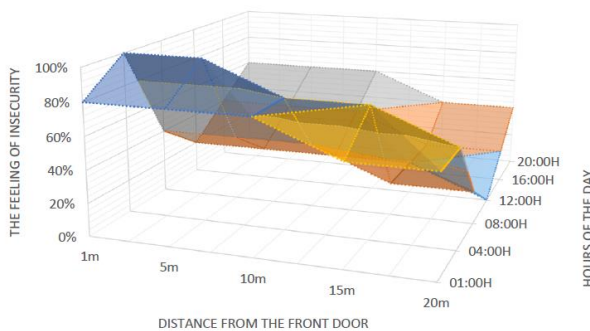


Figure 3. The feeling of insecurity in the case of females patients. Source: Author 2017

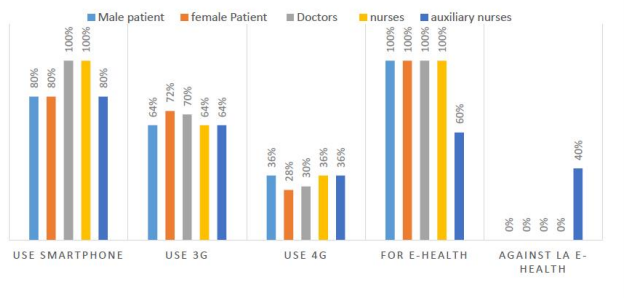


Figure 4. The feeling of insecurity in the case of females patients. Source: Author 2017

5 Conclusion

The users' acceptance of space and the notion of quality of life cannot be foreseen. The gap between the space conceived and the space experienced experiences a discrepancy between the sensitive created by architecture and the sensory needs of individuals, more specifically in our case, that of psychiatric patients. The ambient intelligence made possible thanks to the NICT is one of the keys that could improve the offer of healthcare in Algeria. Indeed, e-health has revolutionized the approach to health. The spread of technologies has made it possible to provide a greater number of healthcare services that are more accessible to all, while improving medical performance and the quality of healthcare services (integration of virtual reality and "intelligent scalpels", telemedicine and tele-surgery, transplants, surgical robots, endoscopy, etc.). The latter will then be optimal by integrating its notions in an intelligent building that responds to a flexible and interactive architecture based on intelligent networks, ambient intelligence and cognitive radio technologies. The introduction of NICT's in the health sector in Algeria is still very precarious. In order to create a connected hospital that meets international standards, it is imperative to boost the use of NICT's in the various services to realize the different spots.

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