HUMANISING ICT TO A SMARTER DWELLING ENVIRONMENT

An attempt to improve individual perception and use of indoor layouts

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Abstract. Dwelling environment is not intelligent if it does not include the concept of home. The emergence of ICT allowed new functions as well as new ways of performing the traditional ones. The need to be online does not remove the need of privacy and to print the site. New ways of living require rethinking dwelling typology to flexibility. Intelligent environments will appear to elevate the sense of home, where security, autonomy, independence, comfort and interaction will be crucial to promote a more qualified life. Technological solutions can be driven in different directions: energy efficiency; lightening and temperature control, video surveillance, access control, etc., assistive environments; entertainment solutions like home theater and professional ones; all have in common to conceive the environment that matches user's expectancies, where human interaction and social participation emerge as crucial requirements.

1.Introduction

The main objective of this paper is to identify and characterise the new functions and occupancy requirements within domestic scenery (such as work, entertainment, shopping, health assistance, etc) to achieve a better quality of life, social integration and individual dignity throughout typology and layout conception, construction process and the information and communication technologies. The promotion of inclusive design concepts in the built environs is a crucial parameter to the investment, promotion, development and management of the building and community. Several architectural and urban solutions have a strong impact in the quality of life of each human being (especially the ones with special requirements) and

pressure segregation from active society and social isolation. The causes are multiple, transversal and complex, in accordance with professional practices, adopted policies and particularly the individuals' mentality. The built environment as that perceived and experienced by individuals, comprehends the need of quality (comfort, mobility, security and health), where the features of the individual as well as the requisites of the functions remain beyond or conceived for the non-existent ideal personage. Dwelling environment acts as the refuge of the individual. Its location and typology are the main parameters influencing its value on the market. However, standard and inhuman environments affect occupants' interactions and daily activities. These difficulties emerge from dwelling typology, area, circulation or equipment arrangements. The influence of the ICT and the considerable changing of the age pyramid motivate and demand a new dwelling model, with the demands from its typology, flexibility, comfort, security and social integration. This reality is more relevant to individuals with special requirements from which the aged ones emerge (Caramelo Gomes, 2007). Intelligent houses ought to be much more than just a show room of technology. Smart buildings and intelligent houses contribute to a superior individual independency (even if some technology dependence occurs) and a performance of a major number of activities. Even though, experiments are needed to evaluate the impact of technology within dwelling environments. Technological improvement has allowed breaking distance and time constraints motivating a different behavior on professional, familiar and personal worlds. The ICT stimulates more time at home while interacting with the functions available within urban environment. Intelligent houses motivate the connection between different devices as houses nevertheless the most important novelty is the possibility to supervise the occupants' everyday activities to improve their quality of life. The awareness of these ideas enables the emergence of principles of inclusive design, lifetime homes and intelligent homes. User's participation is crucial within the dwelling conception/adaptation development to achieve the satisfaction of new performances and requirements of the present society and citizen.

2. Home sweet home – the dwelling concept

"The ideal for happiness has always taken material form in the house, whether cottage or castle; it stands for permanence and separation from the world." (Beauvoir, 1949). The numerous quotations available about the home confirm the importance of our interaction with dwelling environment and its impact into human physical, psychological and cognitive behaviors. Dwelling environment reinvented itself each time that the human way of

living changes. For many centuries home was a public and multifunctional space, as numerous paintings, houses' typological drawings and furniture illustrate. The public and flexible character prevented the sense of comfort and privacy until the 18th century, when houses became smaller, more private and personal losing its public and professional function.

Houses developed into personal and intimate environments, revealing the growing awareness of individuality, becoming expression of the residents (Rybczynski, 1986). The professional cluster of the built environment reveals insufficient knowledge about this issue. In fact, built environment presents morphologies, typologies and layouts where the human and cultural requirements are frequently disregarded by political and profitable expectancies. Theoretically, the architect is the professional within the construction's professional cluster who has the responsibility of the conceptualization of the space/place; nevertheless, by professional education or personal interests, has little knowledge and principles about space/place's impact into human performance. This reality is not a new issue. The idea of comfort or intimacy is repeatedly overlooked or replaced by international models, incoherent to a determined geographical location or cultural environment. This reality reveals itself in different parameters such as building location and orientation, form, functional typology, dimensions, spatial layouts, finishing materials, colours, etc… However, the idea of the home still remains in our mind through the childish drawing of the square with two windows and a door toped with a triangle, performing a roof with a chimney with smoke flying to the sunny sky. The home concept elevates this drawing as the symbol of how we think that we live and the way that we would like to live. The relationship between the individual and his/her home is constructed not because a sense of possession, but because of the feeling of permanence, interaction, the memories of a life, a life where he/she/we belong(s). (King, 2008) A home performs many responsibilities: a stage of self expression, a box of memories, a harbor from the outside world, where is possible the experience of nurture and where we can be ourselves without mask or guard (Marcus, 2006). The urban character of contemporaneous society leads to locate dwelling environment into metropolitan areas. The majority is built within peripheral mono-functional areas, with good connections by private as public transportation with city centre from which depends on social and cultural facilities as well as employment. Contemporaneous dwelling areas are expensive which results on condensed quarters and vertical construction. The permanence at home is mainly at night and week-ends. The dimension of families, with special attention to mono-parental ones and people who live all alone, (from which the elderly represent a significant reality), allows the maintenance of the sense of intimacy; the progress of technology as well as better economical and social situation of individuals allow the sense of comfort. Yet, the economic reality

of each person and the real estate speculation merges the need of small areas as the multi-functional character of each room. Like any other technology taking into home, the ICT gained its importance into everyday lives, by allowing new ways of working, amusing and interacting. The emergent presence of the ICT within dwelling environment reveals a new way of living the public character of the place. From a computer terminal is possible to access to information, organizations, and individuals. The ICT has been accepted by different generations and can be very helpful to maintain communication between individuals, such as supporting people with special requirements. Once again, a new way of living challenges the dwelling environment but not the home idea.

3. Home smart home

The use of technology helps the human being to control and settle in to his/her natural environment and to the empowerment of societies. Technology was always a reality within the built environment and it has always been a stimulus for functionality and comfort concepts. The last century saw the emergence of several technologies aiming the performance of the most exigent (in effort and time) activities. Technology inhabits our houses and our ways of living creating the sense of assistance and dependency to accomplish the most simple or complex tasks. They appeared gradually, within particular houses and families but the standardisation of models and the intensive use of them democratised their existence within the majority of families and residences. Albeit the importance of every technology, the ICT emerge as the technology that challenged more significantly and in a minor period of time our way of living and interact. The revolution inspired and motivated by ICT, stimulates new forms of work and living where the access of information and the possibilities of communication decrease geographical and social barriers. People can work, interact with friends and relatives, shop, learn, entertainment, etc. from home, since there is technology available and ability to manage ICT. Dwelling emerges as the function which needs another perception on its conception: flexibility towards user expectations. Even though the differences perceived on the way we live dwelling environment is very similar for four or five decades. The society reveals an urban character, and the construction process, typologies, areas, technological aptitude and locations are defined by the economical empowerment of who can buy ignoring the effective requirements and expectancies of these individuals. Now, with the European economic context, the user, more than the promoter will determine the crucial parameters to perform the decision: price, location, social facilities, flexibility and the ICT access will be definitive to

the choice. Every person will have his/her own life style and will need a spacial and technological solution to answering to his/her personal and professional requirements. The static and indifferent character of dwelling environment illustrates the "non smart" attitude from construction cluster towards the stimulus presented by contemporaneous society. Questions, such as the where or which is the best place to live do not have an accurate answer without understanding user´s expectancies (Gallagher, 2007). The concept of smart houses responds to different approaches: from security and energy automation, remote equipment control, assistive environments to individuals with special requirements and the supervision of human behavior within urban and dwelling environments. The answer given by smart houses must be supported by the abilities presented by the group, family or individual, more precisely in what they can do and which are their expectancies (Dewsbury, 2010). The holistic support of the concept leads us to some beliefs (Table 1 and 2):

TABLE 1. Users expectations from dwelling environment

What people expect from dwelling environment	
Affordable price	Mortgage impact within salary budget
The guarantee of comfort and dignity during the human life cycle	Person living all alone, from which the elderly emerges as the group with major demanding
	Support the challenges of life and the support to relatives
Functionality	To respond to the requirements of inhabitants daily activities
	Support technology to respond to the trials of different every day routines
Flexibility	To respond to the new functions inside the home (with special emphasis to remote work) and user physical and sensorial capabilities
Being sensitive to individuals and family goals	Enhance individuals and family self-esteem

The relationship between the information layered in these tables, acknowledge that the inclusion of smart environments within dwelling backgrounds stimulates from it more responsiveness to new functions and different users. However, let's take an insight into the reasons of how and why. Intelligent environments enhance the capacity to perform routine activities contributing to independency and consequently self-esteem of individuals. Intelligent environments do not limit themselves to the use of equipment by the person, but they boost the interaction between user and environment to the expression of our emotions, projections of our expectancies and illusions, through odd jobs performance or the remote communication with others. The "intelligence" provided by these equipments and environs, act as a virtual supervisor, which, disregarding obsessive and unsustainable ideas, reduce the sentiment of isolation and loneliness.

TABLE 2. Users expectations from Technology

What people expect from Technology:	
Simple to use	Usability to enhance the use of technology and communication between people
Support the performance of daily routines	Person living all alone, from which elderly emerges as the group with major demanding
	Support the challenges of life and the support to relatives
Sense of security provided by different devices	Intrusion
	Fire
	Inundation
Sense of comfort	Control of light and temperature
Work Entertainment Shopping	Liability on the communication, independently its professional or personal character
	Promotion of interaction between individuals
	Security of information and individuals identity
	Balance geographical and time constraints
Assistive technology	Encouragement of individual independence, namely the one with special requirements
	Promotion of individuals interaction despite individuals demands and background
	Increase the functionality and flexibility of different facilities within dwelling environments
	To supervise human behavior to store information and further communication with professionals
Being sensitive to individuals and family goals	Enhance individuals and family self-esteem

Different research projects are carried, with different objectives although answering to the aims of European Union concerns.

An interesting example is a house built on Ericeira (Domática, 2009), a village located within Lisbon Metropolitan Area, Portugal. It is privately funded and shows the technology required by a labeled smart house. This is a luxury house with 600 m2, built with the most recent domotics technology. In its interior it is possible to identify the management of different energies, a security system, a computer to control different equipments and the connection between the freezer and the supermarket as well as the home cinema equipment. This building is the base of different seminars and visits from engineering and architectural students to increase the study of this subject within academia.

The Smart House of the Netherlands, supported by Smart Homes Association, works as an unsettled house, with 160 m2, where technology and network are the main issues. The house or exhibition area (flexible and disassembled), was settled in different cities during time and is opened to professionals and ordinary visitors, who can experiment the technology available. Human experience is the data gathering from every visit, showing how far technology can go to increase a better quality of life for inhabitants. This approach, maybe outcomes from the beginning of the Association,

1993, when to conceive a smart house, different meetings were arranged with future users. However, despite the data gathering trough out the meetings, some technology was refused by some of the residents during the assessment of the experimental project. Developing technology answering to different requirements and allowing is experimentation by different persons give the possibility of choice by the individual in accordance with his/her needs (Smart Homes, 2010). The German project SETHA aims to improve the living surroundings to elderly. The hub is the communication between people throughout communication facilities, emergency call systems and speech processing devices. More, it explores internal networks for the control of household technologies and environmental factors. The most important point is the use of technology comprehended by individual, as a TV set, to manage the different smart technology available in the living environment (Roe, 2007).

The idea to reuse the TV sets appears very interesting. Certainly it is easier to interact with a comprehensive technology but also because this equipment appeals to the visual and audit senses of the individual and if providing interaction increases the sense of companionship, and the communication (although virtual) between individuals. A camera and a microphone included, increment the communication visual and/or acoustic between inhabitant and a central system which can be easier than the interaction between individual and a standing machine. This idea can also be supported by the success presented by the different assistance provided by help lines that regards issues like violence against elderly, domestic violence, AIDS, alcoholism, etc. However, technology does not replace human contact. Smart environments can be programmable and can systematise human routine activities. The challenge is to transform these apparatus which obey to our commands in machines that recognise our identity, dignity, requirements and behavior. Diverse research projects are ambitious on this direction; special attention to the ones based on home' labs and users' participation (House_n - MIT; AwareHome - Georgia Institute of Technology; Centre for Usable Home Technology, University of York; *Making Smart Homes Smarter* - Ulster University). The results achieved show the importance and the near future acceptance of these themes. The interaction allowed and motivated by computers network stimulates a different way to accept and manage technology. The individual understands technological apparatus as a digital being disregarding the traditional idea of inanimate object (Turkle, 2005), thus they will understand home environment. Nevertheless, more important than activities and supervision performed by technology is the social integration and interaction needed by human being. Crucial to achieve it is the opportunity provided by the system to be in contact with another being, even if virtual,

supported by visual, acoustic and touchable senses. Human communication and interaction can be the key to activities and monitor performance.

4. Conclusions

Contemporaneous dwelling environments pulse between luxury typologies and discrete solutions to answer to different social stratus. Maybe this is due to a small participation from users (whenever possible) but the first insight goes to political, economical/social expectancies, which fences the humanisation of the built environment. Dwelling environment is not intelligent if it does not include the concept of home. Technology is not the aim of the question; the aim is the sense of security, comfort, independency, autonomy privacy, comfort and communication/interaction which can increase the human' quality of life. To achieve these beliefs, sciences such anthropometry, ergonomics, proxemics must be considered along the conception, construction and maintenance of the place. The increase of flexibility in built environment, especially in dwelling encourages the balance between human and building life cycles. The emergence of ICT allowed new functions as well as new ways of performing the traditional ones. The need to be online does not remove the need of privacy and to print the site. Dwelling typology ought to be re-imagined to increase its flexibility and modernisation to achieve the human requirements throughout life. Elderly can be identified as a group that used to be autonomous and owner of its decisions; in consequence, mature people deserve to stay in their place independently familiar or individual needs. A deep survey (observation and interviews) on how this group lives in build environment reveals the standard home as a constraint to their mobility (daily activities in interior) and the contact with exterior. If home is by definition the refugee of the human being it can not be his/her golden cell, forcing dependency on others, increasing isolation and the sense of uselessness. Dwelling typology should be drawn to maximize human daily activities; the layout must help the orientation and the perception of the space and the finishing ought to be helpful to the comfort and the identification of the user with home environment. Technology will appear to elevate the sense of individual's autonomy and the sense of home from the domicile. Technological solutions can be driven in different directions although users expect that the innovation available identifies dwelling as a home, and not as a domestic laboratory; for that is essential to include users' (especially focused samples) participation to conceive dwelling environment to guaranty the fulfilment of expectancies. People tolerate sensors, cameras and actuators since they increase the sentiment of security and autonomy but interaction with other persons (even virtually) will be the chosen way to promote the desired independence. TV sets and monitors helped by camera, microphones

and touch surfaces can recognise the identity and the position of individual. A virtual communication established with a person can motivate the sense of trust and familiarity/inclusion. The communication established motivates to schedule the day and to communicate with different individuals with different expectancies and relations with the user. This equipment can also observe and collect information about the physical and emotional status of the person, which will be reported and considered by a control centre. A similar experience of interaction' benefits can be observed from the use of Wii by elderly, which stimulates the physical ability as well as emotional and social levels (Kain, 2010). The use of TV set, or a kind of, can be an easier way to achieve more complex solutions increasing the sense of ethics by providing the desired privacy and the social interactions, expected by the users.

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