Designing Care. How Design can improve medical products for a therapeutic wellbeing

Angela Giambattista
Sapienza University of Rome, Italy
angela.giambattista@uniroma1.it

Abstract: The evolution of healthcare sector has been recently accelerating in terms of design both methodologically and technologically, changing habits, structures and the way users and designers look at medical products (Chamberlain, 2015). Going beyond the functional aspect and according to a perspective in which patients are increasingly at the center of the project, the Design discipline must face also the sensitive and emotional aspect of the object with the aim to create an effective therapeutic product/environment (Ulrich, 2004; Dijkstra, 2006). Thanks to some field-based research experiences involving the Evidence-Based Design, the User-Centred Design and Research Through Design methodology, the paper shows how an emotional-sensorial approach in designing products for healthcare can improve the user well-being in therapeutic terms. Through the direct observation of the users and their interaction with the medical artefacts examined, the research has moved beyond the limits of the quantitative data by highlighting qualitative data that has been useful in generating the "Design for Care" model.

Keywords: Healthcare Design, Emotional/sensorial Factors, Therapeutic products, Integrated methods, Design for Care model.

1. Introduction

The concept of health has evolved over time due to many socio-cultural changes such as population ageing but also to alternative approaches to the disease management. Nowadays, care is not merely the absence of biological agents that cause disease, but it “is the outcome of a physical and mental harmonious functional balance of an individual dynamically integrated into its natural and social environment” (Seppilli, 1966). A widening of meaning that thus seems to absorbs the concept of well-being integrating the concept of "quality of care" or "caring for" a person as a whole. In this complex and constantly evolving context, the role of design can be a decisive element for a creative and innovative process in which needs of people, new technologies and products can create a synergy as a base for entirety "health experience ". Therefore Healthcare Design cannot be just the application of design methodologies of the project to the medical field, but must be a multidisciplinary and synergistic process that brings together more...
knowledges such as biology, biophysics and biochemistry, electronics, but also computer science, genetics and nanotechnology.

But what is needs today in designing healthcare products is an aesthetic that goes beyond traditional static form aspects in favor of a new language of form that incorporates the dynamics of behavior (Ross e Wensveen, 2010).

As Foque said, in designing for healthcare, we need to look at an holist approach to tackle the design problem as a whole considering different conflicting requirements: the age, mental and physical conditions of the patients, the high tech of the medical products versus the family atmosphere of homes. Tackling the design problem with a set of straight conditions and a focused design strategy, can be a way of clearing the way for a better end-product both functional and pleasant (Foque et al, 1995).

Thus, in recent years, Design for Healthcare has moved to an anthropocentric approach to concretely understand users’ needs and to provide suitable answers to their real requirements.

The scenario of objects. A possible classification

Due the complexity of the context and the continuous evolution of the framework, the scenario of healthcare object is very hard to profile.

All products, services, processes and structures fall in this category, so a detailed report of the whole panorama would be profoundly hard to be articulated.

In addition, many are the innovation drivers and the challenges that the medical sector has to face in terms of design (aging population, technologically advanced health care, the increasingly intensive care, reduced financing costs and a more and more informed population).

This whole thing requires a new way of thinking, new approaches in providing care and a radical change in in how we design and use products.

Professor Chamberlain, director of Lab4living and President of the Art and Design Research Centre, Sheffield Hallam University says:

“In recent years there has been growing interest in the potential of design approaches to transform health care where we can draw on a tradition of creative and divergent thinking to address these fundamental and yet practical challenges to our societies’ health. These challenges are by definition ‘wicked problems’, ones where there is no single true answer and where design’s strength lies in creatively responding to these complex interdependencies.” (Chamberlain et al. 2015)

It therefore seems clear that Design discipline can really be a strategic and creative element, aimed at incremental and radical innovation of system, products and services for healthcare identifying new use scenarios that affect a wide variety of actors involved in decision-making, design and production processes (Tosi et al, 2015).

Going beyond the functional aspect, the research has attempted to offer a cross-reading key able to show a segmentation of medical artefacts more linked to the needs than the mere functionality.

A case studies framework that goes beyond traditional static form aspects in favor of a new language of form that incorporates the dynamics of behavior (Ross e Wensveen, 2010).

Consequently, four transverse applied research areas have been identified and categorized, redefining the four categories that PSFK Labs describe as tends in healthcare system.

Since the PSFK trends were more related to high-tech devices, the aim of this classification was to redefine those categories proposing a wider analysis that could encompass products, processes, and services at the same time.
The result was the identification of new scenarios of production and interaction that, thanks to scientific progress and the use of increasingly advanced communication technologies, in conjunction with design practices, are delineating new landscapes of objects:

- Behavioral Nudge, namely new tools and system that lead users to a conscious management of their care both in prevention and management.
  These are devices that work on non-invasive therapeutic methods and tend to conceal the functional character in favor of design choices involving holistic and emotional approaches in the ideational process and rather hide the functional character in favor of design choices that involve holistic and emotional approaches in the ideational process.
  Examples of this may be the projects of the designers Mathieu Lehanneur and Mickael Boulay. With Therapeutic Objects, Lehanneur transforms the relationship between patient and disease, making the drug a communicative and sensory object that play on the emotions of attraction and desire (Fig. 1).
  Boulay, with Transitions, a set of cutlery for the development of motor skills for those with mobility difficulties and that evolves according with evolution of the therapy (Fig.2).

- Empowered Patient.
  This strands covers all products that directly involve the users in the management of care, both within the healthcare system or autonomously (i.e. home care products).
  Some of these home care solutions are introduced to the market as products that allow users to manage their healthcare in a more comfortable and independent way (also economically).
  For these devices we are seeing a shift in the therapeutic resources that brings products and services from the hospitals to the domestic environments and that largely depends on the critical economic conditions in which the world healthcare system is in (increase in care costs, lack of suitable facilities and absence of qualified staff).

- Orchestrated Care.
  This scenario collects products, material and immaterial, connected to the Cloud world.
  These are devices using wearable and mobile technologies that can holistically track the lifestyle of the person by encouraging physical activity and more healthy and conscious lifestyles.
  A paradigm shift in the healthcare field that is now unstoppable also thanks to the technological pervasiveness, the hyperconnectivity, made possible by the miniaturization of ICT systems and the
ever increasing biocompatibility of interfaces (e.g. Jawbone UP, Nike+ FuelBand, Mimo Baby Monitor, etc.) (Fig 3-4).

- Augmented Treatment.

This includes tool and systems using a) high performance technologies such as those used for the visualization through Enhanced Reality and Virtual Reality; b) 3D printing techniques for the creation of organs and prostheses; c) Assistive Technology to design specialized robot.

2. From therapeutic environments to therapeutic products

The Design for healthcare discipline has always been characterized by an approach particularly focused on the aspect of functionality, at the expense of other factors crucial for an effective human-product interaction.

On the contrary, it is now well known, that the relationships between user and product involves, simultaneously and synergistically, different levels defined by Overbeeke as the “trinity of interaction”: cognitive skills, perceptual-motor skills and emotional skills (Overbeeke, 2002). Especially sensorial and perceptual aspects, and the resulting positive emotions, like joy, contentment, love, interest, amusement, and pride, improve individual and collective functioning, psychological well-being and physical health (Fredrickson, 2003).

Some studies in particular, have shown how the perception of shapes, colors and, more generally, the environment in which we live have effects not only on our neurophysiological system, but also on health, wellbeing, psychological status, sociality, and even political participation (Parasuraman, R., 2007).

Therefore the quality of the design and the architecture can play a key role in positively or negatively affecting users through those elements that generate feelings and perceptions of security, comfort, privacy, and psychological well-being (Ulrich, 2004, Dijkstra, 2006).

In particular in the field of architecture has been observed this special attention in creating psychologically comfortable hospital environments, both for patients and staff. These environments can actual be defined as “therapeutic environments” in which a greater sensorial satisfaction generates positive effects on psychological wellbeing, and therefore also physical.
Designing Care. How Design can improve medical products for a therapeutic wellbeing

The original concept of “therapeutic environment” emerged for the first time thanks to the scientific work of the nurse F. Nightingale who, in 1859, developed a toolkit of practical recommendations for the management and handling of the hospital environment for therapeutic purposes. In the 60s, the concept has evolved by linking to the Evidence-Based Design (EBD) theories and achieving a solid scientific basis. From that moment, more and more emphasis has been placed on the impact of physical and psychological comfort of patients on healing and satisfaction. This assumption is also valid if we shift our attention from the field of architecture to the field of design where, however, the elements to consider are completely different. The research in healthcare design field is a relatively emerging research topic. In fact, only in recent years there’s been an increased interest in the potential of design approaches form which thought patterns and creative practices may be obtained to face fundamental challenges for the health of our society. These examples imply a marked coexistence between medical disciplines and design that, through its practices, can be considered as a propulsive element for the creation of innovative products and services. In this sense, the design for healthcare discipline must respond to the increasingly clear attitude of making the products and services, both material and immaterial, more and more “invisible” and non-discriminatory in order to induce the user to an almost “absorbed” use, by which the experience of cure is no longer considered traumatic and disturbing but a simple daily habit.

3. EBD + UCD + RST. Integrated methods for healthcare products

Pay attention to real needs and experiences of people who have to relate to a service or a medical product, it is extremely important for the development of successful innovative solutions (Parameswaran et al., 2010).

Accordingly, the advancement of scientific evidences related to disease and care, supported by the methodologies of design discipline, can play a key role in designing in the healthcare field. The Evidence-Based Design methodology, born with the aim to demonstrate how the features plants or buildings can produce a certain effect on the occupants’ outcomes, is able to integrate individual clinical expertise with the best available external clinical evidence from systematic research in order to ensure the best results in a medical treatment (Sackett et al. 1996).

As Rob Tannenin suggests in the article “Designers, Take a Look at Evidence-Based Design for Health Care”:

“EBD techniques are not just applicable for the design of hospitals, but for the design of products within and beyond healthcare” (Tannenin, 2009)

It therefore seems clear that EBD approach can be transferred also to the Design disciplines, in particular to the Product Design field, favoring its integration with User-Centered Design (UCD) methodology. But even if the EBD and the UCD can be considered valid methods in the research and observation phases of users and contexts, the parallel application of a practical approach such as Research Through Design (RTD) (Zimmermann, 2007) can increase the potential of a healthcare product by intervening iteratively during the prototyping phase.
The RTD is an approach to scientific inquiry that takes advantage of the unique insights gained through design practice to provide a better understanding of complex and future-oriented issues in the design field.

The term RTD was introduced for the first time in 1993 by Christopher John Frayling who introduced the idea that there are three types of interaction between research and design (or art): research for art and design, research into art and design, research through art and design (Frayling, 1993).

In recent years, this approach has been mainly used in the field of Human-Computer Interaction (HCI) (Zimmerman, Forlizzi, & Evenson, 2007), but its application to other design research fields is constantly advancing.

The iterative, exploratory, and constructive manners of this approach makes it a scientifically valid research strategy that can be implemented and supported by additional methodologies.

In the healthcare field, the integration of RTD, EBD and UCD, can be extremely effective in managing the process of design medical products by promoting the shift from therapeutic environment to therapeutic product (Fig. 5).

These observations were translated in the “Design for Care” model (Fig. 6), developed during some field research experiences and useful as a tool for designing for healthcare. To the structure of the UCD approach (den Buurman 1997, Gould and Lewis 1985), in addition to a preliminary desk research on neuroscience and healthcare field, were associated methodological tools of UCD and neuroscience as essential support tool in the investigation and verification phases.

The model and the experimentations evolved at the same time through the reiterated process of RTD according to which the design practice and the prototype are the medium for answering the research questions and verifying the hypothesis.

The design experiments focused on two projects related to the medical field:

1) BIOTIN project, a biodynamic Integrated System for the Treatment of Premature babies in Intensive Care Units consisting in a tilting incubator for a proper neuropsychiatric development of newborns;

2) MOnarCH project, a service robot for edutainment that improves the quality of life of children in the oncology wards through a Human-Robot Interaction based on the transmission of the 8 fundamental emotions (joy, trust, fear, surprise, sadness, disgust, anger, and anticipation).

Within these experiments, the emotional and sensory factors of the users have played a decisive role in all phases of project activity (research, design and testing), intervening transversely in the different steps of the process.
Designing Care. How Design can improve medical products for a therapeutic wellbeing

Fig 6
Design for Care Model

- Neuroscienze
- Psicologia Cognitiva

Prestazioni Connessioni

Health

+ UCD
+ Design Health Experience
+ Patient Focused Healthcare

Know People Know Contest

+ Evidence-based design

Design Process

(Early) Prototypes

User Evaluation

Final Prototypes

Learning about users
Ricerca Desk
Ricerca Field

Metodologie Neuroscientifiche

Metodologie User Centered Design

Sperimenazione

+ Conceptualization
+ Research Through Design

Forme

Learning about products
4. Care Scale. For an evaluation of healthcare products

In a particularly complex design context and little exploited in terms of applied research, the present research led to the definition of the “Care Scale” (Fig.), an operational tool able to guide in the evaluation and classification of medical devices.

The aim was to create a tool for analysis and classification of medical artefacts, material and immaterial, which takes into account the greater number of all those factors that participate, in different ways, to the constitutive process of producing the shape of a product. And, in detail, the tool refers both to factors concerning the use and the function, but mostly to the emotional and systemic relations (Maldonado, 1976).

For this purpose, the five Care Factors that are involved in the design of a medical product have been identified:

1. Functional Factor

Namely the level of effectiveness, efficiency, safety and comfort that the product has. In other words if the product is able to fulfil the tasks for which it was designed and how much;

2. Systemic Factor

This factor goes beyond the simple concept of product. It focuses indeed on the relations generated between the product and all the actors involved by organizing and optimizing all the parts within the scope (Bistagnino, 2011).

The healthcare product is thus understood in its systemic complexity where interaction is not only between user and product but between user, product, environment, service and system.

3. Emotional Factor

It is more closely related to the User Experience and to the processes that make it possible to create an emotional contact between user and product, establishing the level of emotional involvement between the parties.

In particular, this factor refers to the emotional aspects emerging during the human-product interaction, with a reasoning mostly based on the analysis of cognitive and emotional experiences. The emotional factor also considers the “pleasure in use”, that is, the pleasantness and the satisfaction perceived during the use of an object.

4. Sensorial Factor

Sensorial aspects of interaction can be defined as closely related to physiological processes governing the understanding of the signals that came from the objects. The detectable parameters are essentially derived from the physical features of the stimuli by identifying the sensory system(s) most involved in the use of the product.

5. Affordance Factor

The term affordance indicates the real and the perceived properties of an artefacts, and in particular the fundamental features that determine how the object should be used (Norman, 1988).

Therefore, this factor, aims to identify the physical quality of a medical device that suggest to the user the right actions to manipulate it.

All the five factors are reflected in a scale of value that graphically returns the, more or less significant, level of Care that a medical device possesses.

Through the Kiviat diagram, the 5 multiple variables are arranged in a sequence of spokes with the same centre.

Each spoke representing a Care Factor identifies the level for each factor (0 to 5); the distance from the centre identifies the value of the variable relative to the maximum reachable value. By linking all the values on the spokes a resulting polygon is generated; its area will mathematically indicate the exact “degree of Care” that the medical product possesses.
In addition to the 5 variables, the chart also identifies two reference spheres where the medical product is positioned: the personal sphere and the structural sphere. If the centroid of the polygon will be on the upper area (personal sphere) this will identify that the product is able to provide to user a particular satisfying experience during the interaction with the product, both emotional and sensorial. On the contrary, if the centroid will be on the lower area (structural sphere) this will identify that the product it mostly satisfies the performances going beyond the user in favor of highly functional aspects. The Care Scale has the advantage of not being a closed and restrictive tool. It can easily be adapted in different design contexts and it can be used both for the analysis of already defined products (Fig. ) or as a tool for designing features in future design concepts.

References

AA.VV., (2014) *Future of Health Report*, PSFK labs + Boehringer Ingelheim.
Buurman, R. den. (1997) *User-centred design of smart products*. Ergonomics 40.10.
Chamberlain, P, et al., (2015). *The State of the art of design in health: An expert-led review of the extant of the art of design theory and practice in health and social care*. Sheffield Hallam University.
Dijkstra K, Pieterse ME, Pruyn A. (2006) *Physical environmental stimuli that turn healthcare facilities into healing environments through psychologically mediated effects: systematic review*. Journal of Advanced Nursing; 56(2): 166–181.
Frayling, C. (1993) *Research in art and design*. Royal College of Art Research Papers 1, 1,1–5.
Fredrickson, B. L. (2003). *Positive emotions and upward spirals in organizations*. In K. S. Cameron, J. E. Dutton, & R. E. Quinn (Eds.), *Positive organizational scholarship: Foundations of a new discipline* (pp. 163-175). San Francisco, CA: Berrett-Koehler.

Giambattista, A., Buono, M., Di Lucchio, L., & Duarte, E. (2016). Design for care. Prodotti percettivi per il benessere terapeutico. Tesi di Dottorato di ricerca Internazionale in Design e Innovazione—XXVIII Ciclo. Vol. Unico, pp. 1-204.

Giambattista, A., Teixeira, L., Ayanoğlu, H., Saraiva, M., & Duarte, E. (2016, July). Expression of Emotions by a Service Robot: A Pilot Study. In *International Conference of Design, User Experience, and Usability* (pp. 328-336). Springer International Publishing.

Gould, J. D., & Lewis, C., (1985) *Designing for usability: key principles and what designers think*. Communications of the ACM.

Norman D., (2004). *Emotional Design*, Apogeo, Milano.

Overbeeke, K. et al., (2002) *Chapter One: Beauty in Usability: Forget about Ease of Use*. Pleasure with products: Beyond usability 7.

Parameswaran L., Rajmakers J. (2010) *People-focused innovation in healthcare. How Philips Design supports development of solutions for the ever-changing healthcare landscape*. Koninklijke Philips Electronics N.V.

Ross, Philip R., and Stephan AG Wensveen. (2010) *Designing behavior in interaction: Using aesthetic experience as a mechanism for design*. International Journal of Design 4.2.

Sackett David L, Rosenberg William M C, Gray J A Muir, Haynes R Brian, Richardson W Scott. *Evidence based medicine: what it is and what it isn’t* BMJ 1996; 312 :71

Seppilli, A., (1966) *L’educazione sanitaria nella difesa della salute*. L’educazione sanitaria, 3, 25-49.

Tosi F., Rinaldi A. (2015) *Il Design per l’Home Care. L’approccio Human-Centred Design nel progetto dei dispositivi medici*. Firenze: DIDA Press.

Ulrich R, Zimring C, Quan X, Joseph A, Choudhary R., (2004) *The Role of the Physical Environment in the Hospital of the 21st Century: A Once-in-a-Lifetime Opportunity*. Robert Wood Johnson Foundation.

Zimmerman J., Forlizzi J., & Evenson S. (2007) *Research through design as a method for interaction design research in HCI*. Paper presented at the SIGCHI conference on Human factors in computing systems.

About the Author:

**Angela Giambattista** PhD in Design and Innovation, University of Campania "Luigi Vanvitelli". Research Fellow at Department of Planning, Design, and Technology of Architecture, Sapienza University of Rome, Italy.