

Preface

Design, as a discipline, is rapidly evolving and expanding its field of applications and interests, out of the boundaries of traditional products and interior design domains; researchers are focusing their attention towards the development of material and nonmaterial products and systems, including communication strategies, services and industrial and social organizations. At the same time, Design theories and methodologies evolve and gain importance out of the usual domain of product design, and design cultures provide the basis to drive trans-disciplinary approaches to afford complex and troublesome problems.

In the field of Design theory, a growing attention is dedicated to recent discoveries produced by brain sciences and this new contribution of knowledge seems to influence considerably the re-thinking of project cultures and design methodologies.

There are various kinds of knowledge. Physics provides mathematical models used to predict phenomena; Economy does the same, but in the long run¹; western Medicine builds partial models, does experiments on a disease and uses double-blind trials to verify the effectiveness of such models; eastern Medicine follows a cosmological model, based on a metaphoric symbolic knowledge; Psychology is composed of a set of different branches, each of them using a different approach, but generally using mental models,² and the evidence of the suitability of the model is got from the results in applications; and so on.

¹ Unfortunately “... In the long run we are all dead” (J.M. Keynes, *A Tract on Monetary Reform*, 1923, Chap. 3).

² Not only Psychology is using “mental models”, i.e. hypothetical structures able to represent behaviours, and then to forecast; this is typical of each science; mental models are often conflictual for the same phenomenon, such as the corpuscular versus wave light models in Physics; nobody is believing that there is an observable quantity called “Superego”, but the term is able to recall mental concepts, and then to explain behaviours. What we observe here is the fact that many disciplines have epistemological methods, except design, and we think that Design schools require a more rigorous epistemological approach.

In general, there are “hard” and “soft” sciences: the former, such as Physics, base their models on mathematics, while the latter use less formal models. Both are in any case characterised by models able to explain phenomena, to forecast behaviours, and, most of all, to be transferred to other individuals, to communities, to build schools.

Traditionally, Design knowledge was not characterized by specific models and the word itself is never explained in the literature of the discipline: definitions of Design are usually operational (Archer 1973; ICSID 2004; Cox 2005; Bürdek 2005; ET 2012).

The backbone of Design knowledge is better defined in terms of project methodologies and practices, and the creation of innovative products and solutions—material and immaterial—is pursued by fostering models and knowledge extracted, and in some way opportunistically adapted, by several (if not all) other disciplines such as sociology, anthropology, material sciences, mechanical engineering and so on. On the other hand, following tradition, design and more, Italian design can be also described in terms of aesthetic research, and it strives for absolute quality, pursued by masters who embodied technical skills and artistic inspiration, and who were capable to innovate shapes of objects, also bringing new meanings into daily things, such as lamps, chairs or electrical appliances.

Design deals with functions and meanings, and produces solutions valuable both in terms of satisfaction of practical needs and non-material demands; the meaning part is the most intriguing and specifically associated to Design, as discipline with no equivalent in other project disciplines. Traditionally, designers’ ability to create beautiful things relies on their artistic skill: working as applied artists, designers create appealing objects capable to tickle senses and to arouse emotions; the aesthetic quality of designed artefacts is due to intuition and expertise, not to a scientific modelling of human emotional behaviours.

In the Italian tradition, masters of Design mainly counted on their own ability to achieve an optimal synthesis between aesthetic visions, technical and industrial constraints, functional needs and market requirements. Their personal culture and capability allowed them to deal with the complexity involved in the design process of objects and solutions, and the creative process could be implicit and mainly individual. Their professional capability, and the fertile cooperation they established with captains of industry after the Second World War sustained a new flourishing of Italian industry, influenced consumer tastes and behaviours, and finally inspired generations of designers all over the world. The masters of Italian design were not scientists: some were architects and some had art or other similar background education; they *signed* their pieces of work, and felt responsible for the final quality as they expressed themselves through it as artists do. Through the shape of material objects of daily use, such as tables, chairs or domestic appliances, designers broadcasted conceptual memes and metaphors, giving a contribution to social innovation, shaping tastes, setting trends. These designers were Masters, able to nurture disciples, more than to create schools.

Progressively, Design as a profession developed into a discipline with dedicated university courses, Ph.D. research activities and scientific publishing; progressively,

design as a practice moved from authorship to teamwork and co-design methodologies became more robust and rigorous, also including contributions coming from a growing number of disciplines: ergonomics, sociology, anthropology, psychology, brain sciences. Design is not yet a scientific discipline, and in large part it is still based on experiential knowledge. But designers now deal with multidisciplinary project teams and, especially for immaterial solutions (such as in the case of service and of experience design), the final shape—and therefore, the final meanings carried by the solution—depend on a number of factors, difficult to keep under control. So, in order to produce meaningful innovative design, designers must upgrade the way they work and their knowledge.

A research on any kind of subject should be aimed at the construction of models allowing to:

- understand phenomena;
- forecast phenomena;
- invent phenomena.

The phenomena of interest for designers are those connected to human activities and human well-being. Human activities and well-being are considered in Design from a social and collective point of view, but also in terms of individual perception, and so in terms of subjective, personal, specific and not necessarily shareable perspectives. From this point of view, Design research must provide models able to explain the phenomena related to human experience in its generality, but also to cope with individual variability. Anyway, Design research should produce knowledge useful for design practice and should always address toward a search for quality.

Recent scientific discoveries in the field of brain and perception sciences (and their popularization through some books unveiling their importance, especially in marketing) are arousing growing attention in the research of several disciplines such as Economics, Marketing, Communication.

The main reason for this popular interest is quite obvious: neurosciences, brain mapping activities, modelling of decision processes provide highlighting on the most hidden and unconscious mental processes; automatic decision processes become less mysterious; individual and collective perception phenomena find new convincing explanations.

However, scientific models do not produce in themselves good design as the knowledge of Gestalt laws is not enough to guarantee good graphic design. So the question to discuss now is how Design can include brain sciences into design practice, without losing its soul.

Thanks to the contribution of new knowledge provided by brain scientists, Design faces great opportunities to evolve. This evolution is mandatory as design practice faces great changes from the technological, social, economical and industrial points of view.

Brain sciences explaining cognitive and emotional processes can be introduced into the project culture in several different ways and for a number of reasons. In

some recent works [f.i. Norman (2004) and Van Gorp (2012)], Design methodologies are treated as kitchen recipes, including tools, techniques and procedures including prescribed activities; thanks to models provided by neurosciences, the complexity related to human emotions and cognitive processes are reduced to handy constraints to be taken into account through purposely ideated activities, but this approach, implicitly inspired by a reductionist vision of the world, is not the most promising; on the contrary, it seems to reflect an undervaluation or, worst, a miscomprehension of the original and irreplaceable role of Design as a specific form of anthropology and a specific facet of epistemological praxis.

The present book resumes the results obtained during several years of research activity carried on by the author; the research was based on theoretical work and experimental design and prototyping of innovative concepts of product and services.

In detail, our fields of interest include:

- brain sciences as a basic knowledge, useful in modelling cognitive and emotional mental processes activated by products, services and communication created by design;
- the role of brain sciences in the upgrade of design methodologies, in order to support the design of complex artefacts, and mainly of non-tangible solutions, as digital services and systems;
- the importance of knowledge provided by brain sciences with respect to creativity, awareness and responsibility in the design of innovation.

The present book intends to give a contribution to Design theory, exploring the importance of new scientific discoveries to support innovative design practices, but also emphasising the need for continuity with respect to authorial work based on individual intuition.

While we were writing this book, almost every day we found news in the newspaper indicating the growing importance of brain sciences in every field of project: automatic interpretation of facial expressions are used to measure and analyse the involvement and emotional reaction in front of movie trailers; sentiment analysis on big data flows provides accurate forecast about political elections; computer engineers design safety systems based on emotion analysis systems; window dressers of shopping malls orient their activity on the basis of affective computing software application, made available for reasonable prices.

In the light of these changes, it is only natural to ask ourselves about the future of Design as a discipline able to provide messages, contents, emotions through the shape of material and non-material products and services and, mainly, through the creation of experience. Will engineers together with scientists definitely substitute Design? Will brain sciences and big data eliminate the need for poetical inspiration? Will functional Magnetic Resonance remove the need for creativity? How will Design education change in the light of new knowledge?

This book is a contribution to the research for answers to these questions, but also an attempt to reinforce the cultural continuity between old and new design approaches.

Without laying any claim to providing a scientific background to this discipline, nor to replacing the needs for creativity, we believe that this book could give some contribution to the enlargement of the horizon of designer practice, as well as to take a little bit farther the boundaries of the discipline knowledge.

While it is essential to update the discipline in the light of new scientific knowledge, it is also essential to think back on its specific finalities and methodologies, and also to develop a debate on the new ethical issues and professional responsibilities provided by the inclusion of brain sciences discoveries into design practice, also learning from Italian design tradition, where designers signed their pieces of work, and fully assumed the responsibility of practical and cultural consequences of their actions.

The Book

Design is not a scientific discipline. Design can be defined in a number of different ways and the goal of reducing the amplitude of the existing definition into a unique statement is a useless task. As a start, we will assume that, following the tradition of Italian Design history, Design is applied art, or a discipline aiming at making more robust the activity of designing solutions to problems. The invention of new solutions to practical and non-material problems and needs is quite a natural activity for human beings, but Design can provide tools, methodologies and a cultural background supporting projects of more qualified objects and services. The quality refers to the functional and formal (aesthetic) attributes.

Design deals with human needs, wishes, attitudes, tastes, potentialities, cognitions, culture, so exploiting every form of anthropology. Furthermore, Design deals with technology, and the role of Design is the invention of technology applications, aiming at the fulfillment of human satisfaction in the amplest sense.

Design is changing since human societies and values, and cultures, and organizations are changing. The main changes in Design can be listed in terms of:

- from material products to non-tangible goods, from objects to services;
- from static things to interactive solutions;
- from artistic authorship to teamwork and co-design;
- from the aesthetics of material shapes to user experience;
- from Design as style counselor orienting tastes, to Design for Social Innovation.

As Design changes, we need to update Design theory and methodologies. Our contributions to the upgrade of Design theory exploits knowledge provided by brain sciences and it is based on the proper use of this knowledge for a number of purposes.

Our first aim is a sounder explanation of the mechanisms of attraction exerted by objects coming out of traditional design and being qualified in terms of shape and appearance. Our thesis is that the scientific knowledge of emotional thinking, and notably Panksepp results, modelling emotions as primary activities mainly of the limbic system, can be suitably employed to analyse the correspondence between material (mainly visual) attributes of Design objects in terms of their capability to arouse primitive emotions in users. This kind of analysis produces new awareness with respect to the so-called formal qualities of Design objects, induces new readings of the social relevance of design as an activity aimed at vehicle contents, messages and values through implicit communication related to formal attributes. Furthermore, a greater awareness of the communication consequences of emotional outcomes of design choices makes design activity more powerful and therefore more responsible.

Our second aim is to demonstrate how brain science results can contribute to update design methodologies, providing conceptual tools useful in all project phases: from preliminary ethnographic analysis to concept generation, to prototype and evaluation tests to team building and management in multicultural and multidisciplinary project groups. To these purposes, Design can draw a number of useful models of emotional thinking, referring to different authors making research in the field of brain sciences: besides the above-mentioned Jaak Panksepp, in the book we extract useful knowledge from the works of Vilayanur Ramachandran, Marianella Sclavi and others, whose writings have been precious to us during the last years. We mainly focused on an Interaction Design, which is the application domain we operate in most, but results could be extended to all other fields of project activity.

Finally, the third part of this book presents some design experiences conducted following the design approaches illustrated in Part 2 and employing brain science knowledge as conceptual tools useful in the project of practical solutions. These case studies illustrate how traditional design can be empowered by new knowledge, enforcing creativity and increasing the importance of Design-specific contribution in the field of project cultures.

Conflict of interest The author reports no conflict of interest.

The Neuroscientific Basis of Successful Design

How Emotions and Perceptions Matter

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2015, XIV, 108 p. 80 illus., Softcover

ISBN: 978-3-319-02800-2