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# 0

INTRODUCTION

## Ivan Cabrera i Fausto

Higher Technical School of Architecture of the Polytechnic University of Valencia, Spain.

Architecture schools in developed countries are educating more architects than ever. After graduation, a vast, diverse and exciting labor market awaits them. The traditional professional practice in architecture that we used to know was configured after the armed conflicts in the first half of the twentieth century. A whole continent had been devastated by the world wars and the urgency to rebuild it, mainly to provide dwelling and to restore infrastructures, marked a way of practicing architecture for many years. Those decades were followed by others of economic boom and subsequent population growth. By then, practicing architects faced a meaningful amount of commissions focused essentially in new buildings while they lightly give way in urban planning and other traditional architectural issues. That scenario defined the expectations of our students for many years and became a risky synonym of success among their peers.

This model is being nowadays substantially complemented by new professional tasks as a result of the imposed period of reflection propitiated by the economic circumstances of the beginning of the present century. The global economic crisis hit especially the western economies. Many European countries such as Spain, with a crisis in the construction sector which lasted from 2007 to 2017, saw how their increasing amount of practicing architects were forced to reinvent themselves and the practice of architecture itself. Contemporary architects are now becoming aware of which jobs they can undertake beyond the habitual ones. Perhaps this recently recovered awareness of our capacities might be accepted as one of the few positive legacies of these tough times. But architects are also becoming aware of how society should change in order to avoid committing the same mistakes from the past, and especially of architecture's leadership in these changes.

History teaches us that architecture has always emerged strengthened from any crisis period. Frequently, architects knew not only how to

react to the new circumstances but also how to promote changes from the architectural production itself, and from the underpinning values and reflections that preceded this architectural production or that even are developed simultaneously in an experimental process which never ends.

Our schools, faculties and departments have been devoted until recently almost exclusively to education. But now, a consciousness of the importance of developing research tasks in the same way that other humanistic and scientific disciplines have done has been raised. We have now learnt that architecture is the right discipline for providing answers to a variety of demands put forward by today's society. And it is also the right discipline for posing questions that make society progress in a faster, adequate, fair and even unexpected manner.

Just as Spain played a notorious role in the reinvention of architecture professional practice within the global context, the Higher Technical School of Architecture of the Polytechnic University of Valencia quickly became aware of the importance not only of the imminent, necessary and laudable diversification of employment opportunities for its graduates, but also of the importance of research in architecture within this diversified panorama and its key role in the context of the school itself and subsequently in the context of all architecture schools in the world. An ambitious initiative began to take shape at the end of 2016 among the Valencian school faculty. The challenge was to put research in architecture in the foreground of academic activity in a decisive manner and to be a meeting point of researchers from all over the world and from any kind of discipline, but always linked to architecture and human habitat, whose works would react to the current society demands in an attempt to provide responses or whose investigations would pose new questions in order to design the future.

The strong determination of the event promoters wouldn't be satisfied with a one-time meeting. The desired international conference should

take up permanent residence in the school that was coming up with it with such a meaningful yearning. Therefore, with no additional artifice both the event and its name were born. The first edition of the Valencia International Biennial of Research in Architecture came into being. Quickly and broadly well known by its dynamic and lively acronym, the first VIBRArch was scheduled for the 18<sup>th</sup> and the 19<sup>th</sup> of October, 2018.

Potential participants were encouraged by the aims of the conference. According to the text displayed on the website of the event and which remains up to date and relevant, every society has the right to progress. Each generation should be able to warrant better living conditions for the next generation by means of commitment and tenacity. Research, development and innovation constitute the starting point in order to achieve progress. Regarding architecture, universities, practitioners and firms have developed a remarkable research activity over the years. But occasionally, society and public administrations do not have a clear perception of it as they do with other disciplines. Therefore, the aims of the first edition of the Valencia International Biennial of Research in Architecture were:

- To place in the spotlight research in architecture as the indispensable mechanism in order to warrant progress in human habitat.
- To underline the value of the research potential of architecture schools and faculties from all over the world so as to get the attention of those entities that can fund research.
- To underline the value of architecture's daily practice since most of the works require a previous research and many times the final product constitutes a research product in itself.
- To underline the value of research in the business community which is much more than commercial possibilities of newly developed products and techniques.
- To become a meeting point for those which develop their research in architecture or neighboring fields.
- To highlight architecture's multidisciplinary as a melting pot of multiple approaches, points of view and expertise.

- To become a platform for presentation and debate about studies, findings, novelties and contributions in architecture, encouraging many more to come.

- To showcase researchers in different fields and with different expertise for specialized journals, firms and institutions.

- To open new perspectives for architectural research and to promote the development of multidisciplinary and inter-university networks and research groups.

For all those aspirations, this first edition of the biennial was open not only for architects, but also for engineers, scientists, economists, sociologists, philosophers, anthropologists, geographers, historians, artists, designers, critics, journalists, lawyers, politicians and any academic, practitioner, professional or students with a determination to develop research in architecture or related fields.

Such an ambitious endeavor in terms of scope and potential audience required arranging all proposals in the making according to up to seven thematic areas. Most of their names might remind us the different departments that usually teach in a school of architecture. But this fact shouldn't be understood as an uncomfortable strictly academic drift. On the contrary, since architecture schools thoroughly prepare their students for any aspect of professional practice, a systematic list of scholar disciplines usually means a trustable list of professional fields and labor opportunities. This book has been structured according to the same seven thematic areas employed during the event, so as to allow the reader to focus on a specific matter of his or her interest. Hence, after this introduction seven blocks of chapters are offered. Each block is introduced by an especial chapter written by an acclaimed author who will provide his or her understanding of the state of the art in this matter and will share his or her last works on the field with us. This introductory especial chapter precedes a set of different chapters on the works of many of the event attendees.

So far the reader must have noticed that doesn't have conference proceedings in the hands. That would have wasted the opportunity that

gathering all researchers in Valencia for two days meant. The contents of the presentations made in the framework of the first VIBRArch were reconsidered after the event as a result of the intensive debates held during the fruitful plenary and parallel sessions. Therefore, each chapter is not only the contribution of the author of the research but also the contribution of many other researchers who provided their insights during the conference, being that the reason for such a long lapse during the closing of the biennial and the publication of this book. That fact adds an unexpected but wonderful final achievement to the list of aims of the conference which is that the biennial was an amazing laboratory for composing a book on the current state of research in architecture. In many cases, the members of the scientific committee of the event agreed on extending their supervising work and the contents of the chapters have been reviewed as well, endowing this publication with a noticeable quality.

The first block of chapters focuses on "research by design in architecture". It is widely accepted that too often the discipline of architecture carries since the middle of the 20<sup>th</sup> Century a deep segregation between both scientific and rational knowledge, and factual knowledge which is derived from the experience of the building itself. Hence the distinction between objectivity and subjectivity has been undermined since the 1960s. Different paths can be followed when facing this polarity and not necessarily self-sufficient: case research that can provide knowledge for the group, or group research that tends to provide guidelines of interest for the case. But from the whole to the parties of from the parties to the whole are not the only possible approaches, since systemic architecture considers the case as an example of the behavior of the general organism and consequently connects with it by means of the rules and laws that govern it. Anyhow, the inexistence of consistent accounts on an uncertain and undervalued future makes each project experience and opportunity, maybe unique, for enjoying and experimenting, turning it into a sounding board of what we have and what we miss. In this context, four possible challenges in design research emerge: revising

again the dissociation between theory and practice; deepening in that rupture through time dimension; taking back research to widened disciplinary keys, which are also reviewed, transversal and pierced by the changing social and cultural foundations; and finally fostering that the aesthetic review leads the way for transformation.

The second block of chapters is devoted to "ethics, critical thinking and narrative in architecture". The term "architectural narratives" refers to a kaleidoscopic approach from architectural practice due to the lack of universalizable certainties. The necessary factual enlargement is linked to a troublesome scenario: society prescribes educational profiles endowed with a decreasing critical force, favoring profitability; the hermeneutic hurricane of the turn of the century has skirted intrinsically architectural debates, so as to deepen in speeches highly influenced by the exterior such as identity-autonomy, authenticity-simulation, and so on; and finally the fight among three different positions regarding the information overload typical from the information age which are the need of scientific communication for concordance between rational true and factual true, the formal postmodernity relativism; and the post-structuralism or those oppositions between critical postmodernity and radical criticism which bear the debate on the lack of limits for interpretation. This block encompasses works on ethics, critical thinking and narrative in architecture which encouraged debates on totality and territory, technology and nature, design and action, multidisciplinary, aesthetics and many more.

The third block of chapters deals with "ideation and representation in architecture". Not frequently found on the covers of architecture research journals, graphic expression appears as a vivid field for architectural experimentation and research in synergy with many other disciplines related with research in architecture. This block encompasses a few works from different fields of architectural graphic expression focused not only on depicting or narrating architecture, but also on new methods for conceiving it. Research activities on new graphic survey techniques, new modelling and render methods, and even new

ways for depicting urban flows and dynamics were debated in the intensive common sessions which led to this publication.

The fourth block of chapters focuses on “city, territory and landscape”. These three linked topics with their own internal and external dynamics and with their different scales constitute thrilling research scenarios to be tackled from multidisciplinary and interdisciplinary points of view. Among these contexts, urban fabrics and public space constitute a base for research from morphological, functional, social and environmental perspectives. This thematic area includes reflections on the geographic field of the city, the territory and the landscape, also including those tools for its analysis and interpretation such as cartography, big-data, etc. Among many others, the hereafter topics were discussed: human scale, morphology and activity in the city; occupation, sustainability, permanence, transformation and mobility regarding territory; and landscape as cultural heritage, natural scenario to be protected or recovered, rural or urban, and many others.

The fifth block of chapters is devoted to “building technology and advanced materials”. The specificity of the architecture education in Spain which endows its graduates with a strong technical background makes this field a must and not only for invited engineers. Only innovative building systems and evolved materials will make possible to satisfy the ever more demanding comfort levels and social ambitions. This thematic area includes works on many different topics related to these demands and ambitions such as building smart monitoring; innovation solar and wind control systems; building techniques for a better building energy efficiency; implementation of renewable energy systems; building materials and techniques which reduce CO2 emissions; continuous innovation and improvement in conditioning techniques; and new materials, methods and building techniques in structures for architecture.

The sixth block of chapters deals with “theory and criticism in architecture”. Nowadays it is widely accepted that in the current architecture context it is important to reflect upon the role of theory and criticism in order to determine

strong foundations for knowledge, evaluation and design in architecture. On one side, it would be helpful to review the current validity of contributions in theory and criticism from the past, as well as relevant contributions from other disciplines such as philosophy, arts, science, sociology, engineering and many more. On the other side, it is also interesting to track links between theory and criticism with the current architectural practice and the goals of contemporary society, focusing our attention in specific questions such as housing which should provide a response for the new ways of living and for the different society groups.

Finally and surprisingly successful, the seventh block of chapters focuses on “architectural heritage and conservation”. The interpretation of history has traditionally opened new ways to build the future. The geographical and timescale framework is vast enough to cover stages which comprise from ancient cultures to contemporary times, being a transversal and multidisciplinary approach an interesting endeavor. This thematic area encompasses works by researchers interested in critical reading of history of architecture, and history of construction. Architectural heritage and conservation constitutes, undoubtedly, an extremely window of opportunity in modern practice that has induced the development of many fascinating research lines and even the questioning of the concept of heritage itself.

This book shows the results of the works on research in architecture of a meaningful group of researchers, which includes academics and practitioners, from all over the world. It constitutes a wonderful picture of how research in architecture is nowadays. The Higher Technical School of Architecture of the Polytechnic University of Valencia is pleased to share it with all of you.



# 1

BLOCK 1: RESEARCH BY DESIGN IN ARCHITECTURE

## INTRODUCTION TO BLOCK 1

### (RE)SEARCHING ARCHITECTURAL DESIGN

Constantin-Viktor Spiridonidis

School of Architecture of the Canadian University of Dubai, UAE.

School of Architecture of the Aristotle University of Thessaloniki, Greece.

#### Architectural innovation and research

The professional architectural practice was for centuries the dynamic incubator of innovation in architectural thinking and creating. Architectural educational environments were the places where the innovations of the practice obtained their legitimization; either through theoretical elaborations of their values and principles, or through their further development and dissemination done by the virtuality of the numerous projects they elaborated as part of their teaching. As the key teaching figures of the Schools of Architecture were in most cases distinguished practicing architects, architectural innovation and the contemplation on the new values and priorities emerged from this very particular, and to a certain extent, peculiar relationship between education and practice. This bond was rather resilient as it managed to remain strong and alive during the so-called Beaux Arts tradition as well as during the Bauhaus dominance in architectural culture(s) of the 20th century. The former inclined more towards the artistic and intuitive pillar of architecture, the latter more towards its scientific and rational one. Both of them followed the nonlinear and unpredictable dynamics of the history of our societies and cultures.

The progressive adherence of architecture, as a discipline, to the rationality of sciences, opened the doors of the Universities to host Architecture as part of their education culture and tradition. Even in the cases where Schools retained their autonomy as institutions, their programs and education directives were profoundly affected by the internationally dominant academic spirit established by the end of the fifties. As part of academia, Architectural education was gradually detached from the request for the intuitive and

empirical innovation, strongly aligned to the avant-garde practice, to create a new pole of knowledge generation, the Research. Innovation and Research appeared as a new bipolarity, driven by different bodies and looking through different trajectories of the 'new' in architecture. Having to do with the 'to be revealed' after 'being questioned', research as an academic practice is always a perfect mirror reflecting the ways we are questioning in a certain period of history a domain of knowledge and interrogating the processes, paths and itineraries through which new understandings, considerations and speculations of this domain are revealed<sup>1</sup>. Research as an academic action aiming at generating knowledge, insights, and understanding of a discipline, is a dynamic process always conditioned by questions motivating it. Research questions are always the driving force of research shaping its practices, determining its methods, forming its tools and ordering its outcomes. As these questions emerge from the dynamics of variable and unstable cultural and economic environments, they do not remain steady, fixed or static, but they are in permanent (trans)formation, (meta) morphosis and (re)consideration. If researching the design research would be a question, then the investigation of the core questions would be the appropriate vehicle to reveal the dynamics of the evolving and permanently modified intellectual background of design research activity. What changes can we detect in the research ethos and questions addressed by researchers in the domain of architecture and how are they linked with the broader environment of architecture thinking and practice?

Academic research in architecture has a rather short history given that doctorates, as a proof of

<sup>1</sup>It is interesting to note that in the Greek language, the verb 'to question' (ερωτώ) has the same root with the verb 'to research' (ερευνώ). The common root is the verb 'ερω' which etymologically express an act of speaking or operating but in the case of the verb 'to question' the purpose is to make something to be heard while for the verb 'to research', to be revealed. (Spiridonidis 2014 pp. 192-193)

research excellence across a broad spectrum of disciplines, emerged in the beginning of the 19th century<sup>2</sup>. Doctorates in architecture were initiated in the early 1960s in the USA by Schools of Architecture attached to Universities (University of Pennsylvania, Cornell Princeton, and MIT, Columbia, Harvard) and in the same period in Europe. These first doctorates focused almost exclusively on the history of architecture and the technological part of the building like analytical studies of their performance, as the declared need at the time was to generate excellence in knowledge on architecture and its materiality to support the development and the teaching of this subject in Schools of Architecture. Since then, Architectural research was institutionalized, and its further development was dependent not only upon the dynamics of changes in the discipline and practice but also upon the internal and contextual policies of the institutions it was dependent upon.

Schools of Architecture nowadays have become the ambitious nests of architectural research to generate new architectural knowledge. As the mission and social project of academia is not only to transmit but also to create knowledge, Schools institutionalize their research record through doctorate programs. Significant production of doctoral research, even though not yet systematically recorded, can be estimated in Europe, in an average number per year to be between 110-140 doctorates<sup>3</sup>. However, the vast majority of schools with a research record are producing academic knowledge which has somewhat limited operational value in practice and a restricted impact on the production of the built environment. Even though they contribute to the generation of new architectural knowledge, Schools of Architecture remain, to a large extent, transmitters of the innovation generated by the advanced experimentations happening in a distinctive part of architectural practice or by research in the domain of the building industry.

<sup>2</sup>Cf. Dunin-Woyseth, (2005), p. 83.

<sup>3</sup>Cf. Voyatzaki, M. (2014), where the doctorate experience of Schools of Architecture in Europe is presented and analyzed.

<sup>4</sup>Cf. in Spiridonidis, C. (2009) the presentation of the different paradigms of architecture and architectural design during the last sixty years.

<sup>5</sup>The terms research about, for, by, through design do not have a common content neither between the researcher not in the relevant literature. This is why redefine each one in the context of this presentation. For the different definitions Cf. Jonas, W. (2007, p.191), Till, J. (2008, pp. 7-8) and Dunin-Woyseth, (2005, p. 83-88).

This broader environment of architectural research does not remain stable over time. Various approaches can be detected and related to the socio-cultural dynamics in which architecture as a domain of knowledge and practice is dependent upon. These approaches are formed under the influence of the altered disciplinary priorities emerging from the way architecture is conceived in different periods of its history<sup>4</sup> as well as from the socio-political environment which controls the market and the administration of Higher Education Institutions.

### **Architectural Research under the scope of the Sciences**

#### Research about<sup>5</sup> Architecture

In its early days, Architectural academic research was conceived as scientific research, or rather an objective investigation of 'problems' in which the observer had to retain a distance from the subject of observation to avoid any possible interference on the observed subject. This science-centered approach was built upon a conception according to which all humans have the same basic natural needs. Architecture had to rationally assure these needs, guided by their measurable components. The necessary spaces to host these needs were provided by the scientific analysis and the ergonomics in the form of universal standards, going beyond any variations due to geography, society, and culture. Following the positivistic model of scientific knowledge-building, these research approaches conceived research as an objective verification of previously formulated hypotheses. Their fundamental dogma was based upon the (hypo)thesis that the quality of architecture can be enhanced by enriching knowledge on the history of forms, on the performance of their materiality and on the rational processes through which these forms had to be created. All this knowledge had to be investigated under the scope of the sciences.

## Research for Architecture and Design

In the scope of this approach, architectural design was considered as a problem-solving activity based upon rational and scientific grounded decisions. The research question this approach addressed to design was 'how we could define a process which could assure rationality and transparency'. Dominant design methods in the sixties and the beginning of the seventies were a typical expression of this research approach FOR a (better) design outcome, consistent to the set of values dominant at that period of time.

In order to solve a design problem, the architect had to de-compose rationally the space to be created in distinct elementary functional units and to identify the appropriate relations between them. The measurement of the main characteristics of those units together with the relations between them assisted the designer in re-composing the analyzed space in a new rational order. Rationality and transparency in design were two fundamental values of this rational paradigm. The 'glass box' experimentations encompassed the academic research expectation to define reasonable steps in the design process to assure a better quality of architecture and to eliminate the risky intuitive interference of the architect's subjectivity.

### **Architectural Research under the scope of the Humanities**

#### Research about Architecture

The recognition by the Universities of the research about Architecture as valid scientific research rewarded by the highest academic degree, the doctorate or the Ph.D., offered the possibility to the academic research to be extended in the domain of Architectural Theory. Postmodernism in the seventies and the eighties accentuated the social and cultural nature of the human and questioned its conception as natural species. In this context, Architecture established new research questions addressed to humanities through disciplines like sociology, political sciences, psychology, semiotics and later on, in the nineties, philosophy. Thus, doctorates in the History and Theory of Architecture focused on the way these

disciplines could use their scientific tools and premises to offer a better understanding of architecture as a socio-cultural phenomenon emerging in their academic territory. All these research experiences strictly followed the rules of academic writing and research ethics and, in their majority, were guided by the methods of inquiry developed in the humanities. Their impact on architectural practice was minimal (if any).

The shift from the sciences to the humanities in the construction of architectural knowledge and the continuous use of research methods borrowed by the disciplines attached to each one of these two domains raised the issue of the need for the discipline of architecture to be founded on its own epistemological premises. The ambiguous and unstable location of Architecture between sciences and/or humanities raised the request for more precise coordinates of Architecture in the established spectrum of the domains of knowledge. To escape from this hybridization, Architectural academia in the eighties started to investigate the epistemological foundation of Architecture by introducing a new research dogma. Since novelty is the fundamental component of architectural creations. It can only be empowered by enhancing the knowledge on architectural ideas, meanings and other intangible references motivating the creative process and not by defining measurable rationalities to guide design processes inspired or even imported from decision theory, systems theory, and engineering. As the humanities always questioned the absolute research objectivity, this new approach, by 'legitimizing' the subjectivity as necessary constitutive of creation, raised the issue of its involvement in academic research.

The important consequence of this new shift is the emergence of Criticism as a specific discursive category, which by encompassing subjective and objective statements, became an attachment initially to, or an embodiment in the History and Theory to obtain, progressively by the nineties, an equal status as part of the trilogy History-Theory-Criticism (HTC). Architectural Criticism was not considered as a "fault-finding" process but as an instrument, either to uncover

truth from meaningful signs or to preserve it into expressive formal settings<sup>6</sup>. Either attached to the revitalized, in the seventies, Frankfurt School critical theory as a neo-Marxist approach, or to the Criticisms of the Radical School of Lacan and Derrida in the nineties, Architectural Criticism became the dominant theoretical discourse and as such, subject of academic research. However, research related to Architectural Criticism appeared always dependent upon the methods and principles of the subject areas on which it was attached and backed up (for example semiotics, linguistics, hermeneutics) and it did not generate any pure architectural reasoning. In many cases the covered research objective was not only to reveal the hidden truths of Architecture but primarily to prove the operational value of the borrowed methods in architectural research.

#### Research for Architecture and Design

With Criticism, academic research in architecture is not only focused on its creations' connotations, but also on the ways these values and meanings are affecting and directing the creative action. Research for better Architecture and Design is now oriented towards the observation of the designers' behaviors, strategies, manipulations as signs of their thinking to create statements on the observed activity and elaborate useful conclusions. To assure this deep insight into the contents and the codes through which values form architectural creations, the Design research studies the designer's discourses to trace the paths through which ideas are embodied into designed forms.

In this approach, design research does not seek to formulate and implement methods that will assure a rational itinerary from the 'problem' to the 'solution'. The design is now conceived as a socio-cultural phenomenon, including natural and social components, and for this reason the design problems are 'wicked' problems<sup>7</sup>, the solution of which is not possible to be ruled

by predefined problem-solving processes. In the first steps of this epistemological turn, the request to generate knowledge on and for the creative practice was considered to be done by observing the behavior of the designer and by studying it through different subject areas like psychology, brain neurology, and behavioral sciences, sociology, politics, semiotics, etc. The association of the Architectural Research with these disciplines produced an impressive encyclopedic scientific knowledge. However, its impact was extremely limited on the quality of architectural production, on the enhancement of the responsiveness of architectural creation to the needs, demands, and requests of the culture and the society and to the articulation of a pure architectural reasoning for which it was initiated.

#### Research by Design

By the mid-nineties this research strategy was questioned, setting a new argument: While scientific observation and reflection wishes to reveal and describe something that is already present, creative practice deals with something, which does not exist and lies beyond the creative imagination of design practitioners. Even though scientific knowledge of comparable existing architectural phenomena can aid innovative speculations, there is no reliable evidence that the experiences of the past will be valid in the fast-changing, broader context affecting the spatial forms and arrangements. Architecture as the act of creation is neither a science nor an art. It is a creative discipline<sup>8</sup>. Consequently, research in architectural creation must not and cannot follow the rules of scientific research strictly. As a discipline, architecture aims at giving structure and form to social reality even if it is not able to fully explain it in scientific terms. All its actions are directed by the experience of this reality, which is the basis on which speculation on the representation of space is possible. On the contrary, the sciences aim at describing reality by knowing about

<sup>6</sup>Cf. Raman, G.P. and Coyne, R. (2000), p.83

<sup>7</sup>Cf. Rittel, H. (1974 ) pp. 273-276.

<sup>8</sup>The claim to recognize Creative and Performing Disciplines as a Sector with its Qualifications Framework is presented in the Report of Tuning Educational Structures in Europe Program entitled Towards a European SQF for the Creative and Performing Disciplines and the Humanities pp. 9-10. University of Deusto 2012. <http://www.eq-arts.org/wp-content/uploads/2016/09/sectorial-qualifications-framework.pdf>

its functioning-operation. These two different natures cannot be investigated with the same research method and ethics.

Architecture as a creative discipline needed its research method; a method in which the observer can be an actor of the observed practice. An external (scientific) observation of the creative practice can only describe a part of its reality, leaving its most significant part unrevealed. The involvement of the researcher in the creative process seems to be the only legitimate way to make this act subject to observation and reflection. This speculation introduced a new ethos into the established academic research tradition. The researcher not only observes but also acts on reality under observation. The research by design promoted as the proper method to research architecture and requested its legitimized position in academic architectural research. It is progressively established as the avant-garde trend of research on architectural creative practice by the turn of this century it is still at the center of the debate on architectural research globally.

Radical interpretations of the above consideration of research by design sustain that the creative practice is by itself an investigation, that can be considered as a research activity, and implicitly design practice could be a research process. By equating research to practice this position creates confusion concerning the differences between design research and practice. This confusion has been nourished by the wish of academics to bridge the abovementioned schism between architectural academia and practice fueled by two different directions. The first was the endorsement of architectural Criticism as the central core of architectural thinking which, by embodying theory and history, had practice as its main subject. The second direction was the reforms in higher education systems around Europe and the USA, according to which a doctorate appeared a necessary condition to teach in Higher Education Institutions. Architectural academia, under this pressure, engineers forms of academic recognition credits (equivalent to a doctoral degree) to professional practice.

## Architectural Research under the scope of Information

If in Architectural research the notion of the system was the cornerstone of its approaches under the scope of sciences and the notion of structure the basis of its approaches under the scope of humanities, the information plays the same role in the construction of the contemporary architectural intellect. By introducing the binary form one/zero, information can cross the polarities between the sciences and the humanities. Moreover, it establishes a common mental environment able to transcribe and describe all the crucial agents that form and transform artifacts, earth, organic life, materialities, and abiotic actors<sup>9</sup>.

In this understanding, the building is neither a technical artifact researched by the sciences nor the meaningful encapsulation cultural connotations investigated to be interpreted by the humanities. It is now conceived as the outcome of a morphogenetic process which, through information processing, attributes to its materiality capacities of self-organization and self-adaptation to multiple and dynamic environments (Voyatzaki, 2018, p.12). The building is now 'intelligent' or 'smart', an alive artifact. Its design is directly regulated by the information scripting which supported by the computation, delivers its own generative code, its DNA, from which its form is emerging. The human to which architecture is addressed is no longer conceived as the dominant agent and controller of natural elements and artificial things. It is now located within the natural and artificial environments it created, not recognized as the unique agent who can safely form and transform them. The building becomes an artificial part of the planet the life of which it is invited to assure and protect.

Computers were initially used in the sixties and seventies to assist the architect on rational decision making related to functional arrangements in different design methods. After the eighties, digital tools primarily focused on drawing and representation techniques, enhancing the drawing speed, accuracy, quality,

<sup>9</sup>Cf. Spiridonidis, C. (2019), p. 24-25

and information. In all these cases, they assisted the design process without significantly challenging neither the geometries traditionally used by architects nor the established values at that time. In this collaborative scheme between human and machine, it was clear who is enacting and who is representing.

There is nowadays a radical shift in the role of computation in architectural design. The intelligent machines, that is to say, the machines who can react and adapt to a spectrum of external stimuli and learn how to cope with them can no longer be conceived as the assistant of architectural practice. They can act as the collaborator or a kind of subcontractor, who grants a particular set of skills to be performed and carries out part of the creative process. Architects can convey part of their work to the machine, introducing this way an informal division of labor in the creative process. In this context, the creative act is no longer done by the human but also by the machine and other agents acting and affecting the creative process and its outcome.

The reconciliation of the polarity between the sciences and the humanities that nourished the debate of architectural research in the last seventy years, is in the center of intellectual preoccupations of post-human thinking. The same concern is for other polarities established by the anthropocentric intellect like life versus matter, given versus constructed, mind versus body, human versus nature, immaterial versus material. In his context, the Architect and the machine form a symbiotic assemblage dominated by the embodiment of, at least, two main agents, each one with different intelligence and skills<sup>10</sup>.

This new form of vitality which replaces the single architect creator, human and machinic is invited in this new context to eliminate the predefined standards of previous forms of computation and to be open to random and unpredictable stimuli, providing (design) responses as a creative ground on which new ideas and patterns could be tested and

implemented. As Braidotti states (2013, p.26), post-human contemplations are dominated by the investigation of new vitalities keeping them open and distant from any scripted determinism or inbuilt purpose or finality.

We are experiencing a new architectural research paradigm which we can call research through design. In research through design the main focus is not on the outcome of the creative process but rather on the type of affectivity and symbiosis the involved agents can develop offering unpredictable ideas, formations and materialities<sup>11</sup>.

### Reactive + Proactive Architecture

As we have mentioned elsewhere<sup>12</sup>, when the gods in ancient Greek mythology decided to attribute traits to living creatures, they entrusted a pair of Titans to undertake the task. The one was Epimetheus, whose name, in Greek, means "hindsight", or literally the "after-thinker" or 'after acting' or 'reacting' and the other one, his brother Prometheus, whose name means "foresight", or literally the "fore-thinker" or 'before-acting' or 'proactive'. Prometheus attributed a positive trait to all animals and left with his brother the completion of the task. However, as Epimetheus had no ability to proact, when it was his turn to attribute to humans a positive trait, he realized that there was nothing left. Prometheus, very disappointed with his brother's performance but also with his fault, stole from Zeus the fire and from Athena, the Goddess of wisdom, curiosity, and imagination and gave them both as gifts to the humans. He was severely punished for his crime to give to the humans something that belonged exclusively to the gods and that would enable them to observe, imagine, invent, create, use and develop tools, techniques, machines, and technology, but also sciences, arts including architecture.

The polarity between 'proactive' and 'reactive' marks the entire history of humanity and Architecture as well. The development of Architectural thinking has some periods where the view to the future is dominant and some

<sup>10</sup>Cf. Coole, D and Frost, S. (2010) p.8

<sup>11</sup>These agents could be human, computation, artificial intelligence, living organisms, different forms of materiality etc.

<sup>12</sup>Cf. Spiridonidis, C. Voyatzaki, M. (2017, p. 166)

others when thinking of the past is prevailing. As we cross the period we examined we can see that in design research, these two poles are increasingly approaching by the end of the human-centered era to achieve their total amalgamation in the post-human thinking. The two brothers are now reconciled.

When the limits of polarities become blurred, the distinction of well-defined categories becomes a theoretical exercise which in practice loses its clarity and distinctiveness. This is the case of the research by design as a term which characterizes a certain approach to the design research. Possibly due to its popularity, it tends to encapsulate all research activities which incorporate into their expected outcome a 'product' which can be either a design proposal, a guide, a building element or component, but also a statement, a comparison, a test, a case study. We tried to locate the research by design in the panorama of the recent architectural research adventure and to circumscribe its epistemological references before and after its appearance as a research experience. The articles presented in this chapter, follow in their majority, different approaches of research for design, implicitly stating the ambition of the term research by design to cover all aspects of the research practice at present. Either as reactive or proactive, these research cases can make us think about the open question 'what architectural research is.'

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## CHAPTER #1.01

### LESSONS LEARNED IN THE PASSIVE DESIGN OF SOCIAL HOUSING REPRESENTATIVE OF THE MEDITERRANEAN VERNACULAR ARCHITECTURE

Begoña Serrano Lanzarote<sup>a</sup>; Leticia Ortega Madrigal<sup>b</sup>; Lucía, Ramírez Pareja<sup>b</sup>; Laura Soto Francés<sup>b</sup>

<sup>a</sup>IRP, Universitat Politècnica de València, Spain.

<sup>b</sup>IVE, Valencia Institute of Building, Spain.

#### 1. Introduction

In 2014, buildings sector reached about 38% of the final energy consumption in Europe. Residential buildings were responsible about one quarter of this final energy consumption, being non-residential buildings responsible about the remaining 13% (Eurostat, 2016). One of the ways to reduce the energy use in buildings is to consider the implementation of passive strategies in the building design, what leads to a reduction in the energy demand for both heating and cooling (Suárez & Frago, 2016). The European Commission has proposed long-term targets for energy demand reduction and countries throughout Europe are introducing a range of policies to deliver that reduction (Sorrell, 2015). Under the Energy Efficiency Directive, Member States have already developed National Energy Efficiency Action Plans setting out actions to reduce demand for heating and cooling (European Commission, 2016).

Bioclimatic passive design tries to reconcile energy saving issue as well as the associated environmental impact reduction with the quality of the environment inside the buildings (Cañas et al., 2011). Even if policies focused on the energy demand reduction have entered into force relatively recently, vernacular architecture based on bioclimatism concepts has been developed and used through the centuries by many civilizations across the world (Singh et al., 2009). Since vernacular architecture was performed by the people as a direct response to their needs and values, these buildings show a greater respect for the existing environment. They do not reflect theoretical aesthetic pretensions and use local materials and techniques, repeating throughout history models which take into account the constraints imposed by the climate (Coch, 1998).

By applying the six main principles developed by the Passive Design Guide for the Built Environment (Alonso et al., 2014) to a selected vernacular dwelling case study, we will prove that some recent relevant achievements in the field of bioclimatic architecture can be considered as lessons derived from vernacular heritage.

#### 2. Methodology. Presentation of the case study

The Passive Design Guide for the Built Environment was conceived as a tool to establish a guidance which enables the achievement of the energy consumption reduction goal in buildings by means of energy demand limitation. By prioritizing the use of passive solutions that take advantage of the climatic and the surrounding conditions, the guide contributes to reach users comfort and also promotes economic savings for them (Alonso et al., 2014). Although the guide is envisaged to serve as a starting point for decision making in early stages of the building design, it is also possible to observe if these passive strategies were employed in a building already built and, therefore, if the mentioned principles were taken into account for this existing building design.

For this research, the methodology selected has been the second one. That means to make an exhaustive and comprehensive analysis of an existing case study to identify what passive strategies had been previously considered during its design and construction, as well as how these passive strategies have been applied. The selected case study is a set of social single-family houses in Valencia, built in the early 20<sup>th</sup> century to respond to an exodus of immigrants coming from the countryside to find work in the city. As well as housing the growing rural immigration arriving to Valencia, one of

the main purposes in building these housing estates was to provide shelter for people who lived in places that did not cover the minimum health standards (Instituto Valenciano de la Edificación, 2016). The choice of this housing complex as a case study is due to the fact that it is the only remaining one, of all those built at the beginning of the 20<sup>th</sup> century with the guidelines mentioned, in Valencia. The characteristics on this building are analyzed below.



Figure 1. Case study street view (Instituto Valenciano de la Edificación, 2016).

### 3. Discussion of research results

#### 3.1. Main principles in the Passive Design Guide

The Passive Design Guide for the Built Environment proposes a valid methodology for analyzing the applicability of the most adequate passive strategies at any geographical location regardless of the building typology. The six main principles developed throughout the guide take into account a series of previous general recommendations related to the location and the architectural design of the building, which should be reconsidered by their importance in the energy efficiency (“DIS–General building design” and “MET–Improved thermal envelope” principles). Since suitability of a passive system for a particular site depends on the climatic conditions of the location and on its geographical characteristics, different instructions for checking the suitability of the cooling and heating strategies are provided (“CS–Solar heating”, “PS–Solar protection”, “V–Natural ventilation” and “TA–Air treatment”

principles) (Alonso, et al., 2014). These main principles are explained below:

-DIS. Considerations about the location, shape and orientation of the building are decisive for capturing the sun radiation and taking advantage of it.

-MET. The building thermal envelope is composed of all enclosures and partitions limiting living spaces from the outside or from the non-habitable spaces. An adequate design, including layers of thermal insulation and inertial elements, is essential to ensure the efficiency of other passive strategies.

-CS. Only through the different building elements design and composition, it is possible to employ solar radiation as an energy source to increase the interior temperature of the building in the cold months.

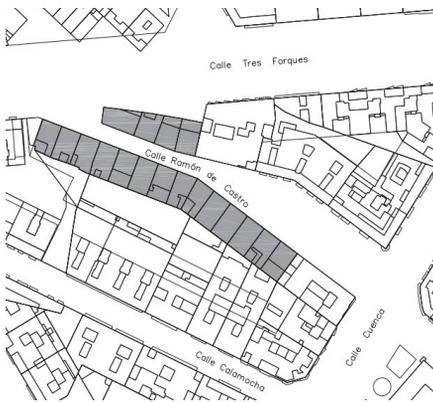
-PS. To avoid overheating caused by an excessive solar radiation, there are several systems whose aim is to protect the building envelope from sun impact, especially in heat periods where thermal gains have negative effects to achieve interior comfort.

-NV. In natural ventilation, air renewal is exclusively produced by wind action or by the existence of a temperature gradient between the air entry and exit points.

-TA. Air introduced into the building can be pre-treated to reduce its temperature or to increase its humidity degree.

#### 3.2. Case study description. Mediterranean vernacular housing features

The housing complex Ramón de Castro – whose name is due to the name of the patron supporting its construction–, was built in 1906 by the Building Society of Houses for Workers in Valencia (Instituto Valenciano de la Edificación, 2016). In a first phase, twenty-five single-family houses were built. Four years later, in 1910, the neighborhood was enlarged with nine more dwellings. At present, only eighteen of the thirty-four houses remain (Traver Monterroso, 2017). The complex is located on the Camino Viejo de Valencia in Patraix, a district located in the southwest of the city (Figures 2-3).



Figures 2-3. Case study aerial view (@Google (2018) and municipal plot plan (Arнау Amo, 2010).

The dwellings correspond to a single-family house on one floor typology. The majority of them have a backyard, planned to avoid easement problems and to make the most of the 120sqm plot. A new concept of housing – different to the rural house- was pursued. The central load-bearing wall, which is characteristic of rural architecture, is eliminated and replaced by two studs, so that the structure does not have an interference with the distribution. The staircase giving access to the attic in the rural house is suppressed, since the house is projected on a single floor, and the vestibule is reduced in size. These changes involve a greater number of rooms (hallway, three bedrooms, a living room, a dining room and a kitchen) where the kitchen is designed independently, without being part of the dining room as in the

rural house. The toilet and well are in the 54sqm backyard, attached to the house (Municipality of Valencia, 2013) (Figure 4).

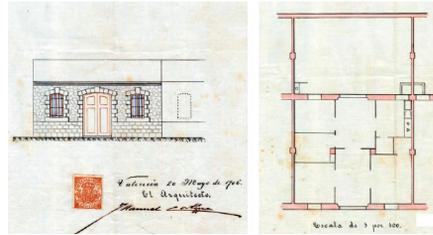


Figure 4. Municipal plot plan (Arнау Amo, 2010).

The Ramón de Castro group is one of the four single-family housing districts that the Building Society of Houses for Workers in Valencia built in the outskirts of the city, and the only one of them that remains.

### 3.3. Application on the case study of the principles in the Guide

#### 3.3.1. General Building Design (DIS)

The dwellings were built on agricultural parcels, in two opposing rows separated by an inner street as a central axis giving access to all them. Since they are facing each other, some are oriented northeast, while the ones on the opposite side are oriented southwest. Dwellings are crowded together to achieve thermal protection and to form a dense structure for shading, which shows that it is possible to find in an urban layout the same characteristics and tendencies that have influenced the building design (Olgyay, 2002).

Regarding to orientation, even if the location of some of the houses in the case study is not the most favorable one, a less suitable position can also be improved by taking into account measures for satisfying the other passive design principles. As a matter of fact, other studies indicate that more than a 60% reduction in energy demand could be achieved (Jones et al., 2014).

### 3.3.2. Improved Thermal Envelope (MET)

The façade walls, which are also load-bearing walls, are composed of a mixed system of mortar blocks on the foundation, limestone masonry on the upper part and a composition of solid bricks in the corners and at specific points such as the jambs and lintels. Mortar and river gravel blocks on the plinth, up to a height of 0,90-1m and measuring 50x20cm, have their joints filled with lime mortar. The total thickness of the façade is about 40cm (Traver Monterroso, 2017).

In this case, the principle *Improved thermal envelope* was applied using massive wall constructions. Massive structures were the most common vernacular dwellings in both cold and hot climates, due to their ability to store and radiate heat, and reduce infiltration by creating a tight envelope. Given the proper thickness, a massive envelope will reverse the temperature inside a dwelling, transferring heat absorbed externally during the day into the structure at night, and then doing the opposite during the night. Examples of massive wall constructions include rubble and earth, wood covered with packed earth, rammed earth, adobe bricks, large wood timbers, and large stone with earth or mortar as the binding agent (Zhai & Previtali, 2010).

The window opening is also one of the most important elements on the thermal envelope, since it is more sensitive to external conditions as the opaque part. Window openings will be analyzed in more detail in solar heating and solar protection sections.

### 3.3.3. Solar heating (CS)

Solar radiation received by window openings can contribute to decrease heating needs in winter. Depending on the altitude and latitude characteristics of the location, and on the window geometric characteristics, solar contribution through window openings can be an important conditioning strategy (Larrumbide & Bedoya, 2015).

Three hollow compositional axes make up the symmetrical façade (Figures 3-5). The rear façade, resting on the courtyard, follows the same pattern. On both façades, doorways act as fenestration bringing in light and air. The size of windows is related to the nZEB principle of reducing the primary energy consumption (Poggi et al., 2015).

### 3.3.4. Solar protection (PS)

Although this principle can be generally applied to the building envelope, in this case study the solar protection is focused on building openings (Manzano-Agugliario et al., 2015). Solar protection elements effectiveness largely depends on their position relative to the facade opening. The most effective systems are those blocking solar radiation from outside, before heat penetrates the building interior (Alonso et al., 2014). Solar protection elements adjustable for users play an important role in these dwellings, being both blinds and shutters the main systems employed in this case study (Figures 6-7). They provide, as well as shading, light and breeze.



Figures 5-6. Façade (Traver Monterroso, 2017).

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