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Edite Rosa Graduated in Architecture, FAUP (Architecture Faculty of the Oporto University), 1991. Worked in research Center of FAUP (1989-1990). Research fellow of FCT (Science and Technology Foundation), (1999-2003). DEA (Advanced Studies Certification) from ETSAB (Barcelona School of Architecture) at UPC, 2000. Gained her Ph.D. in Architecture from UPC (Catalonia University Polytechnic), 2006. Associate Professor of the Architecture Course of DECA, University of Beira Interior (UBI) in the Integrated Master's Degree in Architecture (MIA) and in the Doctorate in Architecture (DA). Guest Professor of the PhD in Architecture at the Lusophony University (UL). Was professor in MIA and DA at UL, 2013 to 2022 and a professor at ULP, 1994 to 2012. Researcher at CEAU-FCT and Researcher at Arq.ID. Since 1991, collaborates with architect Álvaro Siza Vieira in several projects and works.

1. Title

Strategies for flexibility in housing design through prefabrication

2. Extended Abstract

The present research proposal aims to address flexibility strategies of the contemporary domestic space by incorporating prefabrication elements in the architectural design.

The concepts of flexibility and adaptability are essential characteristics to allow architecture to serve its inhabitants for a longer time, by adjusting to their needs and aspirations but also giving importance to the appropriation of personal character. (Fig.1)

As such, there are two possible fields of research: one inherent to (the concept of) adaptability, mostly subordinated to different social uses of space, and another one closer to (the concept of) flexibility, regarding the possibility of different spatial arrangements. Steven Groák (1944-1998) proposed a distinction between the two concepts, as cited by Tatjana Schneider and Jeremy Till in their book "Flexible Housing" (2007). According to the Groák's definition, flexibility is achieved by modifying the physical form of the building; by joining, splitting, extending, and merging spaces. (Fig. 2)

However it seems that both concepts above reflect the uncertainty of future occupancy and housing demand and here we question why and how?

In fact, as Cristiana Cellucci and Michele Di Sivo refer in their book "Habitat Contemporaneo: flessibilità tecnologica e spaziale" (2016), nowadays housing systems are challenged by an uncertain context, dominated by the rapid establishment of functional and technological obsolescence because they were not designed to optimise the longevity of the sub-systems at play. The current use of materials and components may be bound to fail after a short period due to inadequacy of design integration and the rigid spatial models that derive from them, since they are incapable of adapting to changes in the household's needs over time and meet the user's necessities.

As such, the methodology to obtain flexibility in housing can be by using certain design strategies or through the implementation of technology. Though in order to understand the possible flexibility strategies, this study will focus on the technology implementation path and not on the project's specificities. Here, technology encompasses both construction techniques and materials, as well as structural solutions, or a combination of these approaches.

If flexibility, as Steven Goárk (1992) refers, is the ability of a system to be easily modified and to respond to changes in the environment in a timely and convenient manner, then we may question if it can be considered a strategy and characteristic of a system to guarantee adequacy over time. In nowadays, there seems to be a transition shift from the concept of the home, not as a finished product, but as an ongoing process. So may this validate the integration of technology as a way to extend the life of the building and of the dwelling, and reinforce the commitment of the project on the theme of contemporary living?

Thus, in the thesis, it is intended the analysis of a multiplicity of forms, systems and prefabricated combinations while addressing the contemporary needs of living space, through a matrix of flexibility criteria, as a way of activating "new" ways of living.

However in this abstract, the research focus in contrasting a concept of flexibility with a at least one case study, namely Loblolly House (2006) by Kieran Timberlake, set at the Bahia of Chesapeake, USA, in order to identify a set of strategies. (Fig.3)

It is expected that analysing the case study will raise some criteria that have already been intuited and researching the implementation of flexibility both in the design's form but mainly in the technological system that commands its structure.

In fact, the use of prefabrication as a whole, parts or components, for flexibility, raises several criteria topics such as: the increase /decrease of the surface area by the addition/subtraction of specific prefabricated infrastructure living units; the structural uniformity which allows adaptable building enclosures (façades, floors, ceilings, p.ex.); the dimensioning, form and location of the engineering systems (as bathroom and kitchen units), among others. (Fig.4)

In sum, this research will focus on prefabricated solutions and their integration in the rethinking of the domains of the house's design. From an operational point of view, this research uses analysis methodology based on the procedure of disciplinary instruments and tools (design driven

as schemes and designed analyses) which help to comprise the user's domain, the functional domain and the physical domain. (Fig.2, 3)

The research intends to respond to the user's needs and even anticipate the problems of domestic experience and emerging ways of life understood through design requirements materialized through technological integration and implementation.

An important subsequent angle of this approach will enlighten the link to the changes in use, the need to customize the dwelling and the timeframe involved in a building's life-cycle, allowing a deeper knowledge on prefabrication construction systems and materials, and the collaborative procedures between the intersections of the design sphere (architecture) and the production field (industry).

3. Keywords

Prefabrication, industrialization, flexibility, building systems, domestic space.

4. Images



Figure 1 - Author's schemes, main objectives

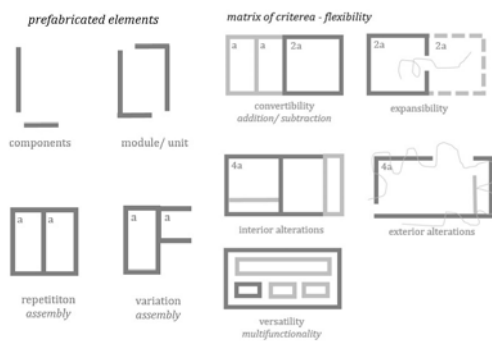


Figure 2 - Author's schemes, specific objectives



Figure 3 - Kieran Timberlake Associates, Loblolly house photos

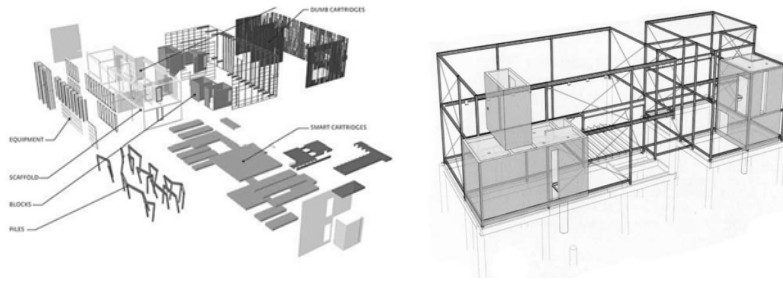


Figure 4 – Kieran Timberlake Associates, Loblolly house renderings

5. Reflection on the on the importance and role of Design Driven Research

This research intends to establish the general concepts and processes associated with the implementation of prefabricated building systems, as a way of highlighting the methodologies and processes of action in the market, narrowing the bridges between architecture and the industry. Although these intersections links, the research will always be address as an architectural design approach perspective, through it questioning and expected results for the architectural field.

To this end, a comparative table will be established between the case studies that will allow demonstrating the intersection between flexibility and prefabrication and how the various systems solve the demand for variability and personalization, through the potentialities of technology. The case studies will derive from field visits to diferent companies operating in the national context (those with more expression in the market and a vast set of solutions). Their analysis will be done through design driven research methodologies with the use of disciplinary tools, as schemes, surveys drawing, sketches and photos beside others. This selections and on-site surveys expet to emphasize good practices and establish reference lines in the integration and application of prefabricated elements as operative devices in response to new contemporary ways of living.