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Transversality and Common Ground in Architecture, Design Thinking and Teaching Innovation

Sádaba-Fernández, Juan
Department of Architecture, University of the Basque Country, Spain, sadaba@ehu.eus

Abstract

We are currently facing a new social and technological situation that demands a different and renewed approach to the way we teach architecture and design as a whole. It is not the first time that the economic and social situation triggers a crucial shift in the way we understand this matter. Learning from the Bauhaus (stepping onto industrial design), the school of Ulm (new step onto non-tangible design) and Design Thinking as an outcome and commercial product consequence of the 'design rationale' of those years of the twentieth century, we can build over the foundations of the classical architecture design studio practice, a set of exercises, methodologies and a general approach in order to handle the future of architectural teaching. Today, we can merge the experiences of Bauhaus and Ulm, Design Thinking and the classical architectural teaching to frame a coherent and holistic approach to architecture and design.

Keywords: *architecture and design thinking, design methodologies, bauhaus and ulm, architectural teaching, teaching innovation.*

1. Introduction. Framing the Problem of Design and Architecture in the Present World

1. 1. Current Situation

The world of technology, design and research has exploded into many pieces, blurring the traditional borders of the niches of design we were used to. Nobody will be surprised that in the coming years architects take responsibilities on previously unexpected jobs. Currently '*Design schools do not train students about these complex issues, about the interlocking complexities of human and social behavior, about the behavioral sciences, technology, and business'* (Norman, 2010). However, we may posit that architectural approach to problems is *per se* a powerful set of tools to address both technical and design problems under a global perspective.

As a matter of fact, today we have a problem in framing and finding a definition for design. Tracing back what happened to the nineteenth century *beaux-arts* concept of design '*identified with classical teaching methods based on redrawing typologies and the analysis of compositional elements'* (Lizondo, Bosch, Ferrer, Alapont, 2019), we could point out two important historical milestones that redefined the way we understand design, plus one extra recent social and technological situation that added a twist to the previous.

We could posit that these historical milestones were settled and intellectually structured by two seminal academic traditions: the Bauhaus and its almost immediate heir, the school of Ulm (Hochschule für Gestaltung Ulm), that flourished very much interconnected to the world wars that smashed the world and in the very heat of the Industrial Revolution. This is not a coincidence, as it was precisely the new social and technological order established by the Industrial Revolution what triggered the onset of a new way of understanding design, a concept on which we will go over later in this article.

The current social and technological changes (someone might name it 4th Revolution) are blowing up traditional idea of design. Since the 50's and 60's, coinciding partly with Ulm, design theory and practice started off a new life nurtured lately by the fundamental addition and disruption of the Information Technologies, the 'intangible' needs (Moggridge, 2006).

The goal now is to put all the pieces together and frame properly what design is, what to do with it and how to teach it. We are using the word *design* and not directly Architecture also following tacitly the Bauhaus tradition in which architecture was so much the core and wrap up of design itself that it did not even need to be explicitly quoted.

1.2. Rationalization of Design

From a strictly teaching and academic level we can convene that since the Ulm years and beyond, the specific knowledge demanded by computing offered an open field for new 'stakeholders' to acquire a prominent role in the definition (temporary maybe and not solid enough) of design, that for the first time in history moved away from the hands of the 'designers' to be under the control of mathematicians, coders, engineers and social scientists (Broussard, 2019).

This phenomenon, this new leaders of design started by trying to understand the "Design Rationale' (Kunz, Rittel, 1970) from a scientific/mathematical methodological point of view, applying in several occasions a mindset that is rented from the binary linear world of computing, and assuming the idea that enough data taken, any problem can be solved… no matter if 'wicked'.

We might dare to suggest that this path is a bit dangerous and is moving so fast that we need to recap and reset our positions. Our objective should be to systematize and frame architectural and design teaching for the near and far future.

1.3. Current Transversality of Design

As we stated before, the role and reach of the designer are evolving fast due to the advance of new technologies and other global factors. This situation demands a new definition of these aspects in order to be able to tackle design problems in practice. Furthermore, the borders among the traditional design disciplines are getting more and more blurred, requiring the designer to work at different scales in size and scope. Other disciplines like engineering, economics or ICT, among others, also interact with this 'vertical' axis, in a 'horizontal' direction. Interactions, physical and virtual links and filtering layers create this geography of design that demands a common method in order to define and refine the role of the designer in this richly interwoven network.

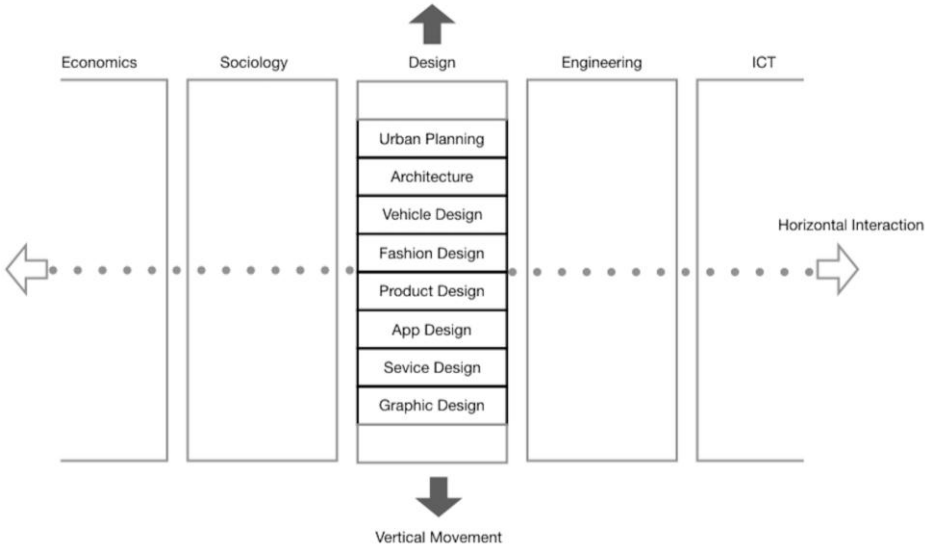

Fig 01. Map of Design Relations. Vertical Movement versus Horizontal Interaction

The North/South vertical path brings us through different aspects of one discipline: design in its diverse fields; the East/West horizontal direction brings us to travel through and interact with other pillars, each with its own disciplinary syllabus: engineering, economy, sociology, information and communication technology (ICT), marketing…

2. Evolution of the Concept of Design. A Brief Recent Historical Overview

Once the problem and objectives established and with the goal of clearing up the horizon in order to frame the pedagogical basis for the teaching of architecture and design (together or separate) in the coming years, let us take a look at previous experiences. The Bauhaus and Ulm started off adapting their teaching basis to their social and technological situation and as a consequence they gave birth to a whole new vision of design teaching that can be studied and revisited today (Ranjan, 2005).

In this direction, we might want to take a look at two core insights. On the one hand, check other experiences and attempts to develop teaching methods inside and outside academia (pretty prolific in the last decades due to the influence of the analytical methodologies) and on the other

hand reframe the limits and scope of design and architecture. The pedagogical basis needs to incorporate a solid framework over which we can build contents, methodology and tools in order to obtain a well structured teaching method that can evolve continually without betraying core fundamental principles.

2.1. The contributions of the Bauhaus and the School of Ulm

How did the Bauhaus introduce the *zeitgeist* in order to establish these basis? Basically they felt they had to introduce the industrial and mass production methodologies and make art and design available to everyone. Design principles were key and transcended disciplines, what provided a more holistic approach that could be applied both to architecture and design. As a general sum up of the most important step forward that the Bauhaus dared to take, we can say that it created the shift from the traditional elitist fine arts to a more democratic art in which the very soul of industrial revolution would embreed with traditional art creation to give birth to what we today call industrial design or even further, our general understanding of design for marketable objects/things of any size and use.

*'One of the most famous slogans for which the Bauhaus is renowned is Gropius's catch phrase used for the 1923 international exhibition held in Weimar: "Art and Technology: A New Unity." This is the theoretical model in which the philosophy of the Bauhaus was grounde*d' (Findeli, 2001).

How did the school of Ulm introduce the *zeitgeist* in order to establish these basis? Ulm took a step forward from the Bauhaus. While in the beginning, under Max Bill, it started somehow as a continuation of the Bauhaus methodology and approach, it moved on, with Maldonado mainly, to tackle the concept of design understanding the process as a system. Social sciences and other "non tangible" elements were incorporated. Computer thinking was already present in their strategy, without still real computers mainly, though. *'…its scientific content was increased and emphasized, especially with contributions from the human and social sciences. "Science and technology; a new unity" could well have been the new slogan at Ulm'* (Findeli, 2001). This vision became most present under the late influence of Rittel, who created the concept and term of the 'wicked' problem, a clear approach to design problems from a mathematical and hyper logical mindset.

What happened since Ulm? What´s the situation now and how do we have to adapt? To say it in a very basic and simple way, 'computer guys' took the lead, analyzed the creative mind and came out with their conclusions and methods. (Brousssard, 2019) These methods, like 'Design Thinking' and others emanate mainly from the United States and therefore became a brand, a product that can be applied to our fast market society to methodologically induce innovation in anything in life, from companies to coaching people and solving smart city problems.

The School of Ulm was on from 1953 to 1968, taking an important part in the onset of this embryonic 'Rationale' in design that will be brought up and nurtured since the 60's until today, shaping a still not completely defined frame for 'creative' activities. With different but potentially complementary approaches, this Central European evolution occurs in parallel to the North American tradition started in the 50's with Buckminster Fuller and the Scandinavian culture of participatory design of Utopia and other groups (Szczepanksa, 2017).

The introduction of design rationale and the appropriation of the concept of 'Wicked Problems', taken from Social Sciences in order to tackle design problems was solidly settled by mainly Horst Rittel (Rith, Dubberly, 2007). The immediate consequence of this is the systematic creation of brainy methodologies that are able to address them without the need of a certain intuitive capability.

What is the frame, the concepts that we have to establish now as the scope on which our syllabus and teaching contents will be built? What is our *zeitgeist*, what happened and what changed since Ulm until now?

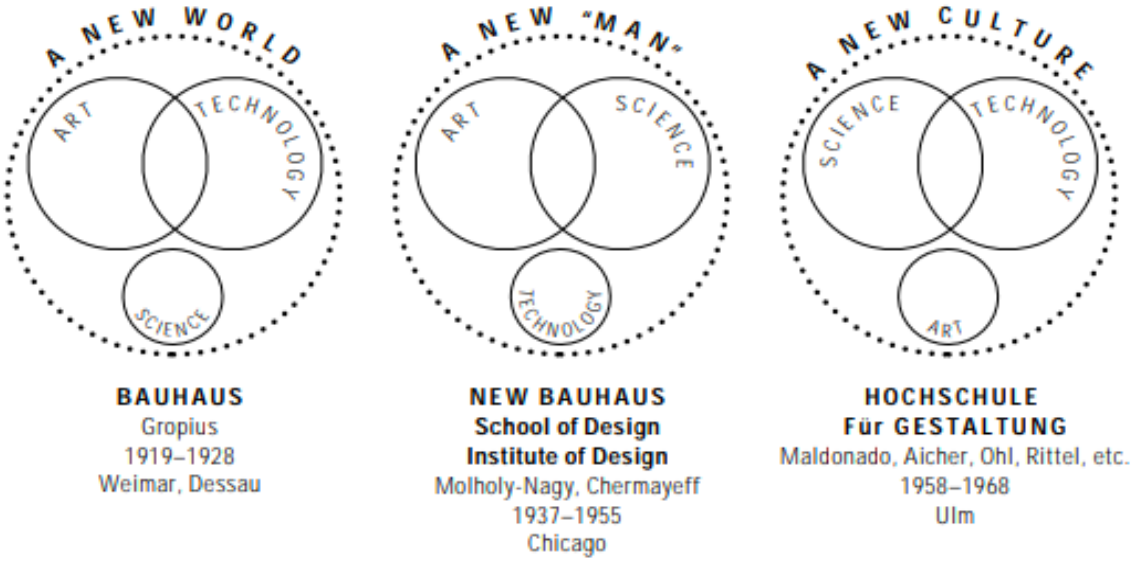

Fig 02. Art-Technology-Science in the diffrente schools as proposed by Findeli (2001)

2.2. Moving Forward. Today

The global vision of design developed in the twentieth century opened up a new path and gave birth to something that we could dare to already call a 'tradition' or teaching style. Even though the outcomes of all this adventure of knowledge is wide and difficult to organize, and in order to establish a category of elements to analyze, we can track the blueprints of this path in the world of academy and professional design. On the other hand, we might isolate and examine those methods and instruments that emanated from the classical teaching of architecture and maybe recuperate them with a tweak in order to make them useful again and optimize their results.

Regarding the first point, the outcome of this addition of the 'rationale' into the world of design, Design Thinking as an individual entity with its own personality, could be framed as a well organized result and sum up of what happened in these decades. As for the common ground shared with (and inherited from) architecture, there is a clear backbone conducting both teaching and research: artifact and prototype. Artifact and prototype not only built the core of this path, but also became the trunk on which the different and diverse methodological branches of 'rationalized' creativity methods, instruments and exercises grew up.

At this point, it´s time to recap and organize this path and methodology for the zeitgesit of our time. We need a merger between all the achievements of Design Thinking, reviewed and tweaked and the classical teaching methodology of architecture, as the paradigm on which all the previous was initially rooted and a perfect match between technology and human design. Not an easy nor tiny task in front of us, but already some examples and references around the world to be based on, experiment and grow. Not only Bauhaus and Ulm expanded the world of teaching.

3. Academic Tools: Building a New Way by merging Bauhaus, Ulm and Architectural Teaching

Once established the goals and general methodology, we have to point at the tools to be used in order to get architectural design matched again with what society demands nowadays. We followed the path from the start of the 20th century that went through the Bauhaus and the school of Ulm reshaping the holistic concept of design.

3. 1. What is Design Thinking and how it can help Architectural Teaching

In this article we name as Design Thinking (DT) the corpus of methodologies (even outside the external specific brand 'Design Thinking') that evolved from the brainy German breakdown of the design mindset in a structured Design Rationale (mostly in the school of Ulm) all the way to a North American Style creation of a product to be applied not only onto design but also for entrepeneushisp and creativity, as wide as this terms might be.

Design Thinking exercises and tools are nowadays set to address digital non-tangible 'wicked problems' related mainly to digital design and entrepeneurship. It´s true that they can be, and can effectively be, used in product design but as we have seen, since the 60's the design rationale current tried to specifically tackle this kind of problems much more than the initial more physical problems that the Bauhaus aimed at facing. However, some of these exercises can be perfectly added to our usual design studio teaching. This capability might be key in the near future, both for students to be able to tackle a wider scope of job positions and for the faculties of architecture to remain attractive as design training hubs.

At this point, it is key to build a potential set of activities that can be used on one only academic term, extended to a full year or even spread over several years of study. The backbone of this methodology will be rooted on two main complementary approaches:

1. The classical architecture design study methodology, which is based on:

    1.1. Designing freely but inside a technological framework

    1.2. Prototypng and iteration with continuos crits and reviews

2. The Bauhaus addition to the previous, which provides a more holistic vision of design linked to market and manufacturing of products, adding artifacts and a hands-on approach to the skills-developing set.

3. The Ulm (and posterior) addition to the later, which contributes with including the final user in the equation through diverse methodologies that go from participatory design to innovation, dealing with 'persona' concepts and team work.

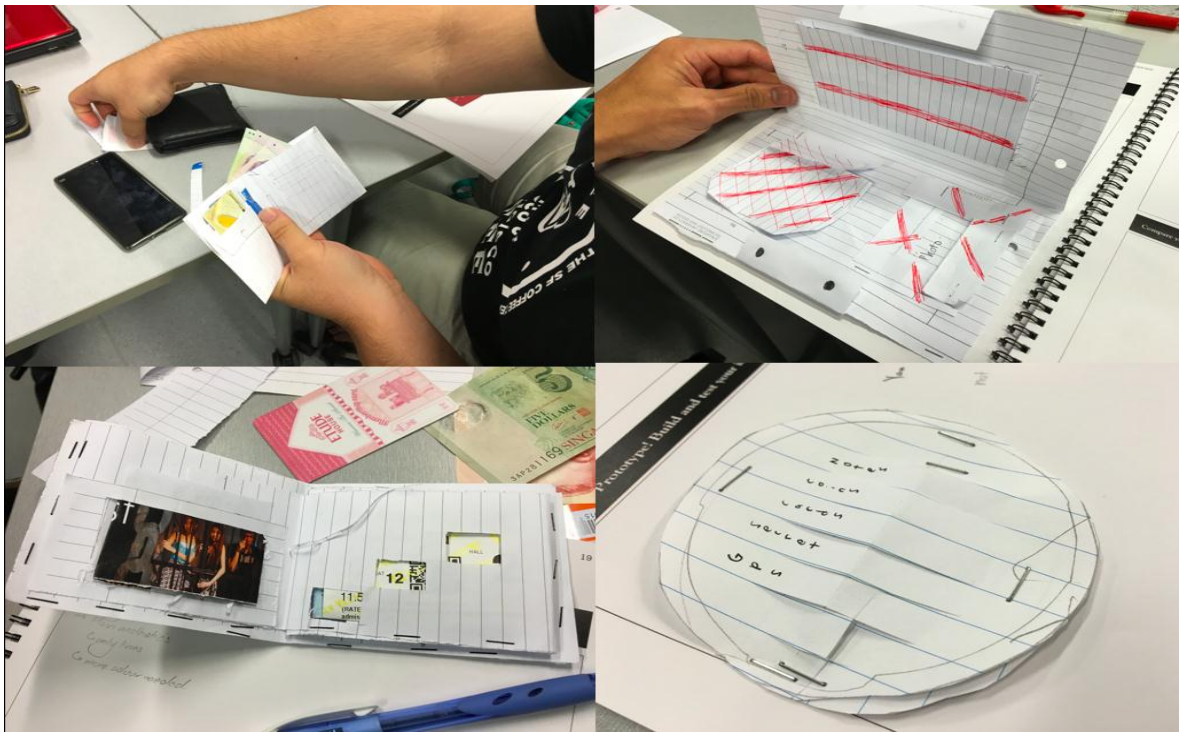

Fig 03. Hands on Approach to Design. The Wallet Exercise

3.2. Getting Theory into Practice

This article is based on my personal experience teaching theory and practice of architecture and design in Asia and Europe. Among other materials, the Design Journal of the Singapore Unversity of Technology and Design (Sosa, 2014), created for the 3.007 Introduction to design course (SUTD, 2019) is a very interesting example to check. Based on all this knowledge and practice, we are structuring a set of academic material, methodology and tools partly presented in this length-limited article.

As a start of the course, mostly if they are Freshmore students with no previous contact with design, it is key to open their mind and prepare them to be ready to create. This is something usually missing in traditional architecture design studio techniques, in which students go directly to designing architecture all of a sudden, without much warm-up. At this point, two sets of exercises might be useful, as a general approach and not excluding other adds-on:

- Purely creative 'beaux arts' exercises that are more related to liberating your mind, like Itten used to do in the Vorcurs of the Bauhaus. Here we can include Blind Drawing which consists on drawing without looking at your hands, drawing your right hand with your left and viceversa, material collage interpretation of musical rhythms or any other brain opening technique directly borrowed from Fine Arts. picture of blind drawing
- Analysis of existing designs. It might be of any scale, ranging from small products to architectural and urban design, but always including technological factors. The analysis will be done by groups and presented in class. Every aspect should be analyzed: aesthetics, function, user, innovation, market, cost… Might be that what they studied will open a field of research where they will work along the course.

The second step is key, as it will introduce the students in designing by themselves. We would encourage them to work in groups and study the process of design (Design Rationale) and the final use, something not often taken into account as part of the traditional architecture design studio methodologies. It is at this point that participatory design, user centered design and Design Thinking activities are extremely useful.

There are hundreds of exercises that can be applied here, but we might agree that those exercises training students to rationalize and properly use the process of design and those getting students familiar to participatory design and user research might be key because they also add an extra asset for architecture students.

3.3. Specific Exercises

Despite the vast amount of exercises that can be introduced here, based on experience with architectural and other kinds of students, there are some that proved specially fruitful.

3.3.1. Problem Scoping and Observation. Sketching.

This first step is important, and even if in architectural teaching it is sometimes given for granted, when proposing an exercise, namely a building, helping the students identify the real difficulties and focus on what is really important, might be key in the development of their skills. Still in this phase, students will lack many skills, but it is usually helpful to make them confront a real exercise in which they might need to confront not only design in a classical way, but the needs of a user. In this exercise, typically one students asks their partner about what they need for a wallet. It is a wallet, because it is done this way in DT as a typified exercise, but it can be any other object. It forces them work fast (60 minutes) on a hands-on design that has to fulfil the needs of the partner (empathy). It is a sort of warm up exercise that can be used in the case of architecture students by creating a fast hut or dwelling in a tree or something under the partner's requirements. The wallet project usually utilizes paper sheets, but it can be done with any material. Both partners have to end up with a prototype. it is also useful to work on body awareness (Itten did it very often) and montage, which is important to understand the usage process of a product (like photograms in cinema). Body awareness can be practiced through the design of wearables and will be a good asset to design interior spaces and architecture. Splitting the expected use of the wallet or any object/system designed in explanatory photograms is also very much encouraged.

3.3.2. Creative Teamwork and Participatory Design. Personas, Interviews, MVP and Tests.

The contribution of DT and Scandinavian design in this part of design is crucial. Today, we can not understand design without it. Service Design itself, an important field of design for the non-tangible gets strongly rooted here. Traditionally, again, architecture teaching does not focus much on working with final users, categorized for design purposes as Personas to apply typologies and start defining the purpose and use of the design. Working on a Minimum Viable Product (even if a building) might help us empathyze and understand how the design works. In class, tests and interviews are not always feasible, but nderstanding the process by exercising it with peers is interesting.

Fig 04. Pugh Chart and 6-3-5 at Singapore University of Technology and Design. 3.007 Introduction to Design Course

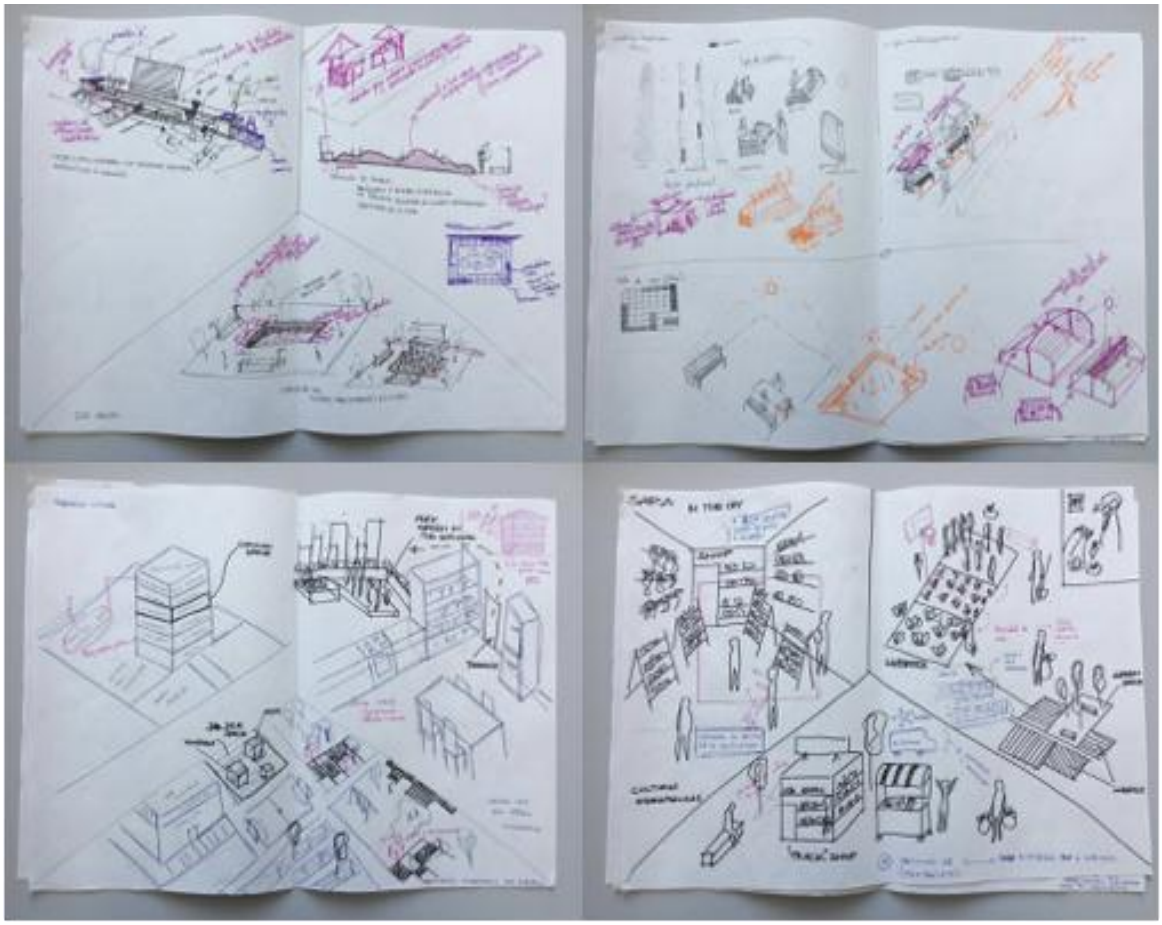

Fig 05. 6-3-5 exercises at "City and Territory in the 21st Century" at the University of the Basque Country. 6 participants (3 in this case, due to the group size), 3 ideas, 5 minutes each (double round to make it like 6 participants). Every participant draws in a different color. You pass it on and the next one draws over your idea and so on

3.3.3. Functions and Programs. Design Approach. Functional Diagrams, Pugh Chart…

This phase is located in the middle of the design process and takes parts form traditional architecture teaching, in which 'the program' is always key to the process. However, DT included some brainy aspects in the process that can be useful for architecture students's skills development. Functional diagrams help understand the way things are used and processes occur, also in architecture and urban planning. Just to mention a few of other tools, Pugh Charts are very useful for students to find what is appropriate in a design and what is not relevant. Taking decisions in a design process is one of the most difficult skills to acquire. Life Cycle Assessment, also borrowed from engineering and ecomaterials sciences, get the students in to the real world of designing with materiality.

3.3.4. Communicate and Convince. First Prototypes. Scamper, 6-3-5, Videos.

No need to say communication is important and it will be crucial once students are out of the nest flying on their own in the real world. Neverthless, in this phase, we found two exercises (not meaning to discard any other) truly useful and applicable to architecture teaching.

6-3-5 exercise, consisting on 6 participants on a table each of them with a paper sheet and 3 color pencils. Each one draws three ideas on a concept and passes it over to the next one who will draw on top of them for another five minutes. At the end of the rounds we will have many ideas created in collaboration by different hands on the same paper. This exercise works really well for architectural design, breaking the classical boundaries of ego and my own-paper-nobody-touches-it. No need to stick to time limitations, it can be over a longer periods of time, over different days… experience says we can work differently for different scales and situations in architectural design, as compared to product and IT design.

SCAMPER (Substitute-Combine-Add-Modify-Puttoanotheruse-Eliminate-Reverse) is also a healthy activity for architects. It can be used to go on when you feel stuck with your own project or even to take a classical reference like Vilel Saboye, i.e. and learn by testing what happens when you Substitute-Combine-Add-Modify-Puttoanotheruse-Eliminate-Reverse on it. This is one of the most educational exercises you can play with students for them to understand the internal logic of projects.

3.3.5. Hands-on Working. Fablab. Artifacts, Prototypes, Crits and Reviews.

Artifacts and prototypes, namely scale models when we are strictly in the field of architecture, are an inseparable part of architectural education and student doings. We could posit, as we already did, that the actual essence of it was initially borrowed by the first product designers from exactly from this educational tradition. However, over the years, after the first formal Fabrication Lab (FabLab) was created at MIT, this hands-on working activity evolved on its own, proposing students a way to work in groups that gives iteration and prototyping a whole new meaning. The concept of artifact in the non-tangible design world deserves an article (or more) by itself, but we can say that what today might make a difference between prototypes and arch models is that they work, they actually try to convey some performance.

Fig 06. Artifacts and Prototypes at SUTD. Architecture and Wearables

This idea is very important to take into account. In a very rough, global taxonomy, we can say that today we find two big groups of prototypes. Some prototypes need very few formal requirements to try and replicate/mock a potential service so that we can test product usage, reactions and behaviors. We have also physical prototypes in the filed of product design, following a more physical testing of materiality and function. At the Singapore University of Technology and Design in Singapore, students are encouraged to work by groups and elaborate working prototypes on the Fablab during the term (SUTD, 2019). This work was to be done in groups and the teams are supposed to come up with a final prototype that explains the service/product and incorporates some kind of technology that makes it actually function. It can be electronics (Arduino, robotics, Python…) or just a piece of an architectural solution, furniture or alike. Nowadays, merging these two worlds, the tangible and the non-tangible in an educationally logical fashion is key for the future of young architects being shaped up for new work requirements.

4. Conclusions

The academic world related to architectural teaching is evolving as fast as architectural practice itself. Furthermore, the convulsion that the emergence of New Technologies produced in our society in the last decades is pushing us to find new methodologies and teaching practices that can help us provide our students with enough tools to tackle a world of design/architecture with newly expanded/blurred borders.

This is not a new phenomenon, and by checking on past benchmarks of design teaching that already involved a holistic approach to design, blended together with architecture, namely Bauhaus and Ulm, we can pick some guidelines on how to address our current evolving scenario. In parallel and partly as a consequence of these two milestones, new design and teaching methodologies were born as a result of the rationalization of the design process.

Taking the classical architecture design studio teaching methodology as a core starting point to many of these new methodologies and to the very beginning of Ulm and Bauhaus, should stand up for this well balanced mindset building in which creativity works together with technological limitations and add all these findings in design methodologies and reationalization of the thinking process in order to provide our students with a set of tools that can be applied successfully in pure architecture and in so many other faces of design.

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