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# Research by Design in Architecture: an approach into the exploratory research phase

## Abstract

In the scope of design, research has been a difficult issue to respond to the real necessities throughout the process of thinking. Even the "design" word is meant to be used in several different fields of knowledge and practice (from industrial design, computation systems to architecture).
Concerning Research by Design (RbD), there is a sense of vagueness, both in terms of methodology and aims. That's the result of its own essence: design is the result of a big creative endeavour and research is focused in concrete results due to certain questions or problems.
Focusing in the architecture discipline, RbD is commonly the most used work methodology. In this sense, we can say that there are so many RbD as many architects and architecture students in the world. So can we improve this kind of research and take it to another level, integrating it into the field of the so called traditional research?
The purpose of this paper is to understand more about the "exploratory phase" in the RbD approach. This phase is based in data and collected information as well as individual experience. This paper tries to understand and improve the critical thinking implicit in the "exploratory research". This critical thinking is linked to certain "strategic questions" and "operational links" that guide the researcher into a more under-

standable research practice. The final aim is to lead the RbD to a more sustained internal validity (satisfactory conclusions among the variables experimented) and external validity (generalise the findings to an appropriate community).
Keywords: Research by Design, Architecture, Exploratory Research Phase, Critical Thinking, Creative Thinking

## 1. Introduction

Scientific method, which is the basis of any traditional form of research, consists briefly and essentially in the collection of data, its observation and experimentation, as well as the formulation and testing of hypotheses. The aim of this method is to have substance conclusions, and through these conclusions, guarantee some safe knowledge basis for continuing researching and achieving knowledge. "The institutional goal of science is the extension of certified knowledge", said Robert Merton in 1942. In "The Normative Structure of Science", after three centuries of some independence of science, Merton distinguish some basis to modern science: "Communalism", "Universalism", "Disinterestedness" and "Organised Skepticism". All together, these fundamentals agree in the idea of science with a sense on communal good: knowledge.

The importance of the scientific methodologies are visible in huge technological advances and scientific knowledge in the last years. This "traditional" method or procedure has characterised natural science since the 17th century and has maintained its fundamental methods based in systematic observation, measurement, and experiment, and the formulation, testing, and modification of hypotheses. Although procedures vary, these steps should be repeatable to avoid mistake or confusion in the vast field of knowledge. These rules guarantee a good way to prove hypotheses in different environments, but also to ensure validity in scientific means. Maybe these two advantages are the key to the continuous and successful development of these methodologies up to today.

Although this persistent accuracy, many researchers advocate the importance of intuition in scientific methodologies. In 1908, in an interesting review about research in mathematical reasoning and other exact sciences, Henri Poincarré points the importance of intuition in research and learning. He say's "(...) that is no reason for not cultivating their intuition, for they would form a wrong idea of the science, if they never looked at it on more than one side (...). It is by logic that we prove, but by intuition that we discover." (Poincaré, 1908, 129)

This intuition is the result of a creative act which exhibits, at the level of a cognitive thought, a set of new conceptual entities on a trial basis as an act of understanding and bound to a warrant to be established for predictive or descriptive purposes by a set of cognitive controls. For Kant, there is, in the mind *a priori*, the pure form of sensuous intuitions in general, in which all the manifold content of the phenomenal world is arranged and viewed under certain relations. "This pure form of sensibility I shall call pure intuition." (Kant, 1781, 43-44).

So, intuition represents the subject and includes the "Eureka!" discovery and other sudden mental revelations in which one's mind now perceives a new or different fit or solution of pieces of a puzzle (problem) in the scientific method.

The main attention called here is to remark that knowledge depends as much upon intuition as it does upon logic; and that these aspects are interdependent. The nature of the rational act is much more complex than supposed, and simplistic views of cognition must irrevocably be discarded even for the scientific method, which can be seen as static and prudent.

It is commonly known that intuition has an important role in the RbD process. Certainly, the intuition lack of control in RbD is the reason to the scepticism, criticism and the minor evolution of this specific research method, comparing to other methodologies more in line with scientific method.

Nevertheless the assumption of a subject intuition in academia scientific method, some other criteria can be in conflict with RbD, specially the last fundamental that question empirical and creative research, according with Merton basis to modern science: "Organised Skepticism" or the idea that all ideas must be tested and are subject to rigorous, structured community scrutiny.

The understanding of the exploratory phase, as a phase in RbD that involves the main part of the subject cognition, may be a crucial study to evolve and demystify the idea that free critical and creative thinking can be an operative process in Researching by Designing.

## 2. The importance of Research by Design

The word design has three mandatory meaning possibilities. On one hand, it can be considered as a noun: "A plan or drawing produced to show the look and function or workings of a building, garment, or other object before it is made ("he has just un-

veiled his design for the new museum")"[1]. On the other hand, design is considered a verb: decide upon the look and functioning of (a building, garment, or other object), by making a detailed drawing of it ("a number of architectural students were designing a factory")[2]. The word can also be considered as an adjective: with submodifier designed ("specially designed buildings")[3].

In each of one of these examples, design presupposes the condition of a reflexive action. Therefore, in this paper, design is always seen as a thinking reflexive action that presupposes an activity in which data, practice and knowledge are aggregated, used as a basis for new assumptions, actions, and new findings can be generated, tested and consolidated. Regarding architecture, RbD studies "what architects do every day: conceiving of built forms by responding to clients, programs, budgets, and other "real-world" factors" (Groat and Wang, 2001)

The difference between exact science and science linked to practice in design, art and architecture, is that regarding science linked to practice in design, art and architecture, is not in its genesis, to prove or to evolve a particular hypothesis, but develop creative thought and processes that lead to the development of a solution for a question or aim.

Assuming the role of subjectivity in the design process, is understandable that this design process is different from the process of researching which we hold to be based in facts and adequate methodology in traditional academia research. It's also important to refer, at this stage, that in art, architecture and design, research has two ways of approach: a traditional approach to understand themes related to the discipline, and RbD, when design itself is the interest to produce academic knowledge. However the two possibilities, as much as I defend the possibility to do RbD in academia, its possibility depends on the subjects freedom to work. On the other hand, the academia interest in RbD must be focused in the intuitive and creative cognitive potential as well as in the ways to develop thoughts into practice, more than to prove observations and hypotheses, as it happens in traditional scientific methods.

RbD is definitely a non-traditional form of research, referred to art-base or practice-base disciplines research. Design can be just little referred to facts and much more referred to subjectivity research. In this sense, the leading subject (designer, architect, artist) uses his own process to lead into his object. It's possible to develop a

[1] Definition in Oxford Dictionary in http://www.oxforddictionaries.com/definition/english/design (31 March 2014)
[2] Definition in Oxford Dictionary in http://www.oxforddictionaries.com/definition/english/design (31 March 2014)
[3] Definition in Oxford Dictionary in http://www.oxforddictionaries.com/definition/english/design (31 March 2014)

base-rules protocol that controls decisions in RbD. However, once these rules are defined, computers and all kind of software can reproduce methodology and data, bringing solutions to the table. Do we want to substitute man to software, after milliards of years in its creative form? Man is an artist and produces beautiful and extremely interesting thoughts into objects since his existence. Science at times can put together part of the knowledge, but not every kind of knowledge.
The RbD disregard, in detriment of traditional scientific methodologies, means going against one of the primordial instincts of man: create art.
In academia, RbD can signify a good way to artistic evolution. RbD can be a sub-group of academic research, but this means a readjustment in the way of seeing, making and evaluating all the process of researching in design. The base of this change is in the recognition of the importance of the subject in all the process.
This research recognise four stages in RbD: preparatory phase, exploratory phase, execution phase and valorisation phase.

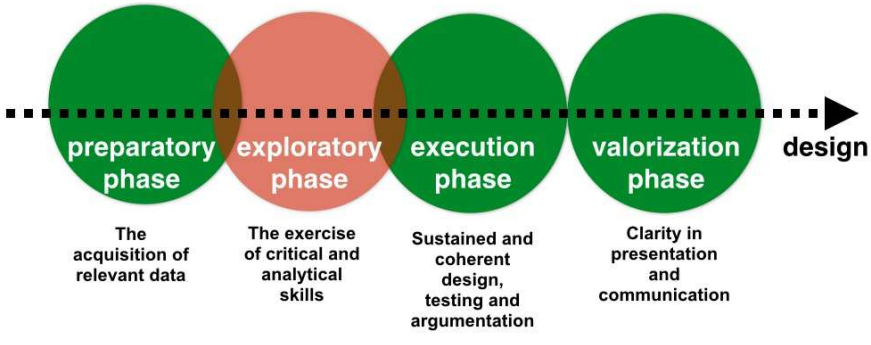



FIG 1 - Summary scheme of the four common stages in RbD.

This succinct RbD scheme reveals some of the most evident phases and issues about RbD. However, the present argument about the importance of the subject analysis, critical thinking and creativity gives a little more specificity to this summary scheme (Figure 1). To go a little further, it's important to understand the subject role in RbD.

## 3. The Exploratory Phase

The exploratory search is a research action that takes part in RbD. According to the ideas of this paper, exploratory phase is not a merely task in the entire linear process of RbD, but is controlled by the subject and has a circular and central role in the process.

*3.1. The role of the subject in DbR (Exploratory Phase)*

Currently, concerning RbD, is a recurrent idea to have the aim in the best design. Nevertheless, we have numerous examples of good research (and RbD) which result in a not so interesting object or final goal. This happens in architecture, design and art. How many excellent sketches give place to not so good results? On another hand, we see many examples of research that evolves into masterpieces, and many other examples of artists, designers and architects that study sketches and create evolution from the work of other creators. So, it's important to emphasise that sometimes the own process is research by itself and, for that reason, can be an excellent basis to think of.

The specific case of *The Return of the Prodigal Son*, from Harmensz van Rijn Rembrandt is an example of RbD that takes place during a period of 32 years of concept evolution time, forsake and reinterpretation, all centred in the same thought or research.

*The Return of the Prodigal Son* is a Rembrandt oil painting and one of the latest works of the Dutch master, who died one year later, in 1669. The first registered thoughts occurred in 1636 in an engraving. This represents the first step in his process. This first moment shows a recumbent father over his vanished son under the family and servants eyes. The position of forgiveness is perceived by the evidence of his lowness position sustaining and protecting his missing son. The son, reveals a rough face, nakedness and bare foot consequent of the hard times, but also shows that he is asking for forgiveness with his knees on the street floor. The open window represents the openness of the father. Son's face is heavy, it seems to deserve the fathers punishment. Father and son form one gathering piece, while all the other characters seem curious and sceptical as they are alienated physically in terms of body and facial expressions. The composition seems like a scenario.

Six years later, Rembrandt returns to the theme, but with a slightly different vision. This version marks the second step. Father and son continue together in one whole piece, but the gathering seems not as static. Father appears to make a movement of caress in the head with one hand, and with the other hand, he's upholding his son in a

more loving way. The father's position is more of a receiving attitude, comparing the previous protection. The group of other characters here is substituted by one character: the other son. In this second sketch, father and son are under the heavy look of his other son in a small and simple familiar ambiance, rather than the first approach, that presents much more religious aspects.

In the latest version of Rembrandt, there is an evident evolution regarding these two previous attempts. This version is one of his last works, that was found in is workplace after is death. Here, Rembrandt involves us into the painting, by identifying us with the son. This has not happened in the previous works. Son's feet are the first thing we see and he's position (facing the father) we share. In this position we should ask: would we been generous like the father or stay in the background like the other son? Rembrandt also evolve in terms of perspective. Here, he uses perspective in a more human and intimate scale. With these actions, Rembrandt deviates downright from religious aspects and enters directly into human feelings. With his forthcoming death, Rembrandt puts himself in the prodigal son's position after a life full of similarities with this scene and these feelings. It's also evident the gathering of ideas from the two previous experiences.

The Murillo work, which is painted almost at the same time as Rembrandt's latest work, is a clearly reinterpretation or inspiration in the first version of Rembrandt's *Prodigal Son*. In this version, father and son are looking at each other while servants are bringing out the clothes. A cow is ready to be killed to feed and celebrate the return of the prodigal son. Religious symbols are everywhere: white dog as purity, the sacrifice of the animal and the son's hand almost praying to God (father).

Throughout this artistic process of almost four decades, Rembrandt allows a powerful and introspective insight into one of the perennial issues of human existence. The most likely, it was possible, because his process took a life time research. The life time experience, that we can see in Rembrandt's work, as parallels in many other artists and proves the importance of the artist/designer experience and subconscious ideas in the work of art and in design. That said, we can think of the methodologies importance, but we can not forget the inner side of the artist/designer/architect.

Also, another important lesson that we can take from this comparison, is that the process itself is an important matter to study. In this case, it was used by the artist himself and also by another artist as a kind of inspiration or base for new other thoughts.

FIG.2 and 3 - Sketch of *The return of prodigal son*, Harmensz van Rijn Rembrandt, 1936, The Hermitage Museum, St. Petersburg / and Sketch of *The return of prodigal son*, Harmensz van Rijn Rembrandt, 1642, drawing with pen and brush, 19 × 23 cm, Teylers Museum, Haarlem

FIG.4 and 5 - *The prodigal son*, Harmensz van Rijn Rembrandt, 1969, oil on canvas, 262 x 205 cm, The Hermitage Museum, St. Petersburg / and *Return of the Prodigal Son*, Bartolomé Esteban Murillo, 1667-70, Oil on canvas, 236 x 262 cm, National Gallery of Art, Washington

For that I mean, that in RbD the subject exploratory phase can be an interesting study, because there is an emphasis in a series of personal endeavour in the connection of the multiple data available to the designer.

*3.2. The creative act and operative design research*

The creative act is not a factory in the sense that is not a process to imitate or reproduce. A creator is not someone who works for pleasure or by force. A creator is someone who does something he has to do. The essential part of the necessity to create any kind of art is to have an objective, a purpose or an intention. An architect, for example, creates a solution to a need or problem, but, by doing it, he is not just projecting a way of sheltering. An architect, as a creator, produces an experience with an functional excuse. With this experience, the architect makes a connection with the user, by making understandable a certain idea.

An idea, in this context, is basically a cognitive work that connects different existing information (or data) in an interesting way, or in an "encounter" way, or a way that communicates a special viewing or experience to others. That's not a thing that architects, designers or artists do for no reason. The act of creation is, in this sense, a call or a need to communicate the engaging, thought-provoking or the beauteous. So, in an architectural creative process, the architect connects, in is own way, existing ideas or data which are already linked with architectural processes. These existing ideas or data can be from other lines of knowledge, but they have resonances in architecture thinking or designing process and are used by the architect to produce an "encounter". And this "encounter" (Deleuze, 1987) is the reason to make architecture as a work of art.

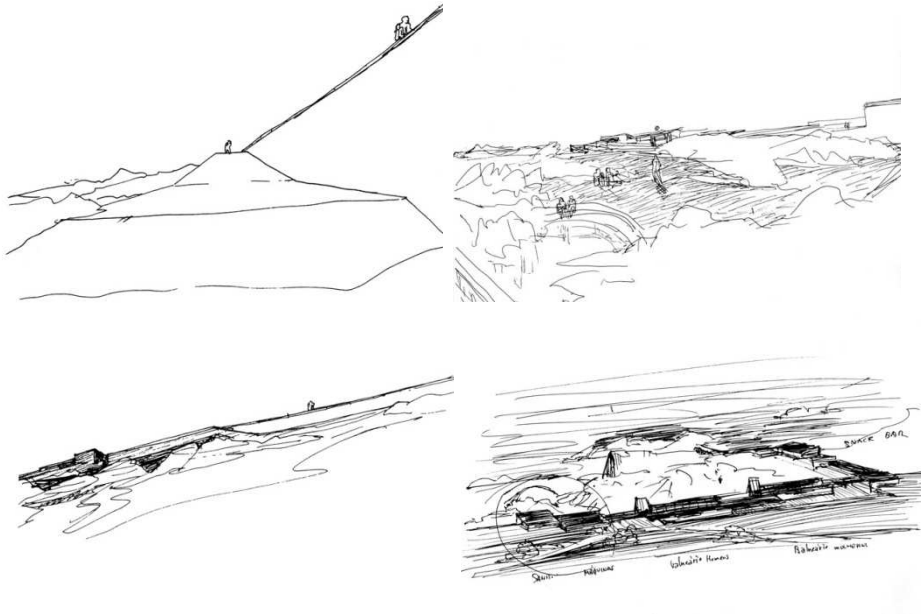
We can then understand the importance of the creative subject in the creation process. In RbD, the creation act can not be put into exam in each research. The creative act is a part of RbD and maybe the only part it should be completely free in this process. The creation process has been subject of many studies and it´s important to continue looking for the different artists approaches, but that's not RbD. In RbD, the main goal is to make designing and research, attached to it, part of the academia.

A clue for the understanding of RbD as a process or methodology in academia can be seen in the work of architects. Álvaro Siza is an example that places visible the link between creation and design practice.

Regarding his sketches, Siza gives them the status of "notes" or "exercises" (Siza, 2013) and not the quality of "artistic drawings" (Siza, 2013) to exhibit as work of art. Siza profits from the connection between his hand and his mind as a "thinking hand"[4]. According to Siza, drawing is not a skill or an addiction, but rather a comple-

[4] Siza referring an expression of a famous architect (that he does not say who is) about his drawings: "a mão pensante", ibidem

mentary thinking action, by purely thinking and imagining, that leeds to forwards results.



Figs.6 to 9 - Álvaro Siza sketchs of Piscinas das Marés from, Atelier Álvaro Siza, accessed at http://www.rupturasilenciosa.com/Piscinas-das-Mares

The Portuguese architect, known by his sketches, classifies his own work as "preparatory". And, following the idea of a complementarity between hand and mind, in the sense of a reflection, sketching is a complementary way to develop ideas and projects. In this sense, this is an very good example of RbD.
These four examples of Siza sketches illustrate an important relation between cognition and exploratory work to lead into a final idea. According Carlos Castanheira, Siza sketches are a way to pick up the essence of a place and find a built form in balance with nature (Castanheira, 2009). Castanheira also clarifies that drawing as an intention to work the functionality of a building and, at the same time, achieve freedom from the project operative needs.

FIG.10 - Swimming pool at Leça da Palmeira, Photography Heimo Paffhausen, in http://www.heimo-paffhausen.ch/2013/08/piscina-das-mares-alvaro-siza-vieira

*3.3. The Exploratory Phase as central control in RbD*

Returning to the RbD process and it's four different and differentiable phases, maybe is now possible to understand a second view, more precise about role of the subject in the exploratory phase. Each one of these phases has an important role in the whole process, but there is a difference between exploratory phase and the three other: preparatory phase, execution phase and valorisation phase. Exploratory phase is the centre of the creation as well as the most personal, creative and intuitive part in the process. Perhaps, exploratory phase is the most interesting part to study, comprehend and operate.

Through the presented examples, it's possible to understand three characteristics about the exploratory phase:

- the subject is mandatory in RbD. It's so personal that his process can take a life time research;
- the own process is research by it self and it´s not a linear process and, for that reason, can be an excellent basis to think of;

- there is an important relation between subject cognition and exploratory work to lead into a final idea.

In addition to these more visible features, The examples make visible some other important features to understand:

- Subject carries life experiences and knowledge of other experience (own or other's).
- Subject observes data in a kind of contemplation of the several parts of the "problem". In this phase, a set of indicators about the theme can arrive to the mind of the subject. In this process, some order or connections can arrive and the first formulations can meet some criterion.
- Through critical thinking, in exploratory phase, subject can make connections between data and propositions, producing relational connections, some more evident and others more complex. Of course, here the experience and creativity of the subject are major factors towards a more accurate and interesting exploratory process and better results.
- Execution phase occurs in this exploratory phase, where subject may merge observation, contemplation, small practical experiences and tests through cognitive thinking. This process can have a more methodological experience (drawing, mockup, assemblage) or a more personal vision (through an imagination process).

The relationships that subject builds may not be methodical in a time, space or functional sense. So, there's no historic or other mathematical comparisons. However, there are theoretical or hypothetical connections. This discrepancy can produce a richer interpretation.

Through this circular exploratory phase, subject can achieve the "big encounter" (Deleuze, 1987) as Deleuze calls the connection between "different blocks". To architects, this Deleuzian "big encounter" can be the project or final research result: the design.

An exploratory phase good understanding grounds a good basis to an "a posteriori" valorisation phase, since researcher has in his hands the information in a lucid way. This lucidity concerning the exploratory phase brings accuracy and clarity meaning to the design presentation and communication. In academia, as we all know, these are two leading goals to valorise the researchers work.

*All in all, the creative act is not performed by the artist alone; the spectator brings the work in contact with the external world by deciphering and interpreting its inner qualification and thus adds his contribution to the creative act.* (Duchamp, 1957, 77-78)

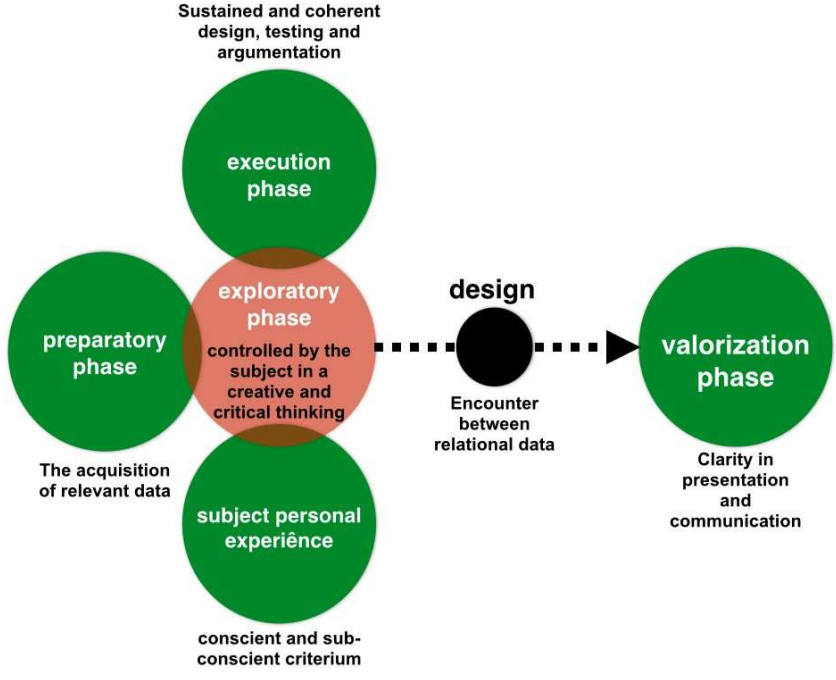



FIG.11 - Summary scheme of Exploratory Phase and it's position in the RbD operating organisation (The scheme is based in the examples and ideas developed in this paper).

## 4. RbD in Academia with a more central role in Exploratory Phase

The degree of subjectivity introduced by the subject in the exploratory phase is one of the major factors responsible for some disinterest by academia in RbD. This factor related with the specificity of this kind of research, provides little space for improvement. However, by studying a bit more the exploratory phase, is more easy to find development and improvement in this study field.

First of all, it's important to choose a pertinent purpose to research and design. In RbD we can have two scenarios: one with a programme and a goal to achieve (for example, an order to a specific building in a specific place) and another where research itself can open ways to resolve a problem or adds major inputs in a final object/subject (for example, a specific question, like how is it possible to reformulate a certain area/building/material/atmosphere/light). Both ways are beautiful paths to

follow in RbD. But, chances to do RbD are infinite, as long as researcher as the opportunity to interconnect "blocks" and achieve "big encounters" (Duchamp, 1957, 77-78).
To a more responsible, sustainable and accurate research in RbD, and following the conclusions of this paper, it's important to develop improvements in the ensuing areas:

1. Improve the subject with experience and development of critical and creative thinking. Encourage the subject to perform a critical observation of facts, data or blocks of information. Simulate de subject to ask big questions to question reality as it is, and give more space to intuition and critical thought.
2. In relation to data, it's important to do an accurate database or information collection, but it's also important to let, if desirable, subject interfere and assume a data out of the traditional scientific methods. The link between the subject and the preparatory phase can bring more precise and relevant data assemblage.
3. In relation to practice, it's important that the subject has control of practice test methodologies. The more he controls the practice methods, the more freely subject connects cognitive thoughts with testing practice (drawing, modelling, information procedures, photography, etc.). Moreover, it's important that the subject is open to try innovative forms of research to reach a certain goal and even go further.
4. In relation to the valorisation phase, it is not considered in the exploratory phase, but it's important to be adequate, since academia needs to get learning from RbD. As described, the "big encounter" is the most value in creative work, and it can be presented in two different forms: the final object as a result and its gains; as well as the process, particularly the exploratory phase, by clarifying the way to explore the process, the questions, the practice or the cognitive connections.

## 4. Conclusion

The disciplined society that Foucault identified probably also wants to discipline and control the creative act. In this sense, can art and creative disciplines as architecture resist to control and, at the same time, evolve in a more academic way? It is a difficult answer. At the same time, the growing awareness of the intrinsic strengths of design thinking within its own context and a growing acceptance of design on its own terms helps to recognise that design has its own distinct intellectual culture in academia.
On the other hand, research can be seen as a structured flow of research activities. It includes logical assumptions of research activities that are permeable to creative thinking and creativity. This creative thinking is desirable in the way that allows designing (particularly in architecture) with a solid base, but in a individual or group lead.

Even in cases that computational methodologies are used, the parameters used deserve to take into account a creative and critical thinking.
The interest in RbD is not to prove hypotheses, but get new interesting, useful and beautiful approaches to a problem. This paper demarcates the importance of the RbD in academia, by clearing the importance of the creative and critical thinking in art and design disciplines. This process can not be comparable with traditional scientific methodologies and has got his own path in research and in academia. The roll of academia is to recognise this difference and accept other ways to measure and to apprize RbD.

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