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"Cognitive biases in Design Thinking processes:
the Active Learning Lab case study"

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*A mio papà che ha sempre creduto in me
e che non posso deludere.*

*A mia mamma che ha sempre avuto
la parola giusta al momento giusto.*

Ad Alice mia spalla destra.

*A Davide per la fiducia, il supporto e la
comprensione.*

*A tutta la mia famiglia per esserci sempre
stata.*

A me stessa per non aver mai mollato.

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Introduction

The interest about the topic of design thinking born after a particular course, or better, a laboratory. In 2016 Ca' Foscari launched this kind of interactive way of learning: in six weeks, students learn and apply some innovation processes to solve real businesses' problems. Design Thinking, the primary method used during the laboratory showed its big potential. Hence my interest on the process and the curiosity to investigate its potentiality and limits.

The article of reference has been "Linking Design Thinking with innovation outcomes through cognitive bias reduction" written by Leanna Liedtka. The authoress, a business administration professor at University of Virginia Darden School of Business, had conducted copious valuable researches on the process and its impact. In this paper, she advances different propositions sustaining that the process, as it is structured and with the tools it uses, permits to reduce cognitive distortions. In her research, any kind of analysis is missing because she relies only on theories. This is the reason why this research born, from the need to discover if her propositions were verified or not and consequently if Design Thinking demonstrates further more potential. Since her paper, the necessity to find a case study upon which conducting an analysis to verify her thesis. It was closer than ever: Active Learning Lab.

This research is structured in the following way. First of all, the first chapter explains the topic of Design Thinking. It started with a brief historical excursus about design and consequently about the methods with which it evolved until nowadays when it is considered one of the most powerful innovation process. Furthermore, the definition of the process and its phases follow. In this chapter, the point of view is the theoretical one just to approach and understand the topic.

In the second chapter, the topic of cognitive biases is deepened. It started from basic information about the decisional processes and some notions about work group, fundamental characteristic of the design thinking process. The core of the chapter is the explanation of heuristics, mental shortcuts employed in decision-making that most of the times lead to errors called cognitive biases. It follows with the definition of biases and the presentation of those ones Liedtka proposed in her paper.

Finally, all her theoretical propositions are described, illustrating all the different tools of the methods that act as remedies. As the first chapter furnished an initial knowledge of

the process, the third one wants to enter more in detail. In fact, as the case study identified employs the process in the educational sphere, it has been necessary to introduce the process also from the educational point of view. The chapter started with the reasons why it is useful to employ the process in educational field and it follows with the definition of the process used on the ground. Moreover, this chapter explains all the different tools used to conduct practically the process.

Finally, the fourth chapter presents the awaited case study, the real core of the research. In order to verify Liedtka's thesis two different analyses have been conducted. First of all, to test the waters and see if the presence of biases was relatively important or not, and so predisposed to be analysed, a quantitative analysis had been implemented. Since then, the necessity to understand why and in which occasions some biases survived. The qualitative research through different interviews helped defining the reasons why and precise episodes in which the biases have resisted to the strong structure of the design thinking innovation process. Conclusions end the research.

1. Design thinking

This chapter on design thinking wants to offer a complete overview of the process. It is important to understand its origin, the evolution of different methodologies that brings this process to be, nowadays, one of hottest in the innovation field. The process has no limits of application in the sense that it may be adopted in any kind of context: business, education, politics and others. For example, within a business design thinking method may be implemented successfully in different areas: process improvement, new product development and new venture creation.

About this human centred approach to solve problems thousands stories, opinions and definitions exist. However, this work does not want to begin with a technical definition of the concept; it does not immediately explain what this process is and how it works. The definition chosen wants to highlight all the elements, the shades and facets hidden behind the words 'design thinking'. It is considered very important in the study to transmit the profundity of the concept rather than explain it as a mere step-by- step process.

As Idris Mootee says:

"Design thinking is the search for a magical balance between business and art, structure and chaos, intuition and logic, concept and execution, playfulness and formality, control and empowerment".¹

In our society, products get obsolete just in few months after their introduction in the market because the competition is fiercer than ever. Companies have the necessity to be one-step ahead of everyone continuously, to be able to solve problems rapidly and satisfy the needs of the customers. In order to survive companies need to generate, embrace and accomplish new ideas continuously, and creativity is the right driver to do it.² Creativity recalls design, design recalls functionality, beauty and renovation; adding a cognitive activity to the design activity conduct to incredible results.

Design thinking, as a problem-solving process focused on the humans, has gained popularity rapidly among the last twenty years, and today more than ever it is one of the word most used, sometimes abused, when talking about business, innovation, creativity and so on.

¹ Mootee, I. (2013). *Design thinking for strategic innovation: What they can't teach you at business or design school*. John Wiley & Sons.

² Brown T., (2009), *Change by design: How Design Thinking Transforms Organizations and Inspires Innovation*, HarperCollins Publishers

1.1 History

This paragraph will be fundamental to understand the origin of a concept that people believe is just the last trend for problem solving. It will explain what happened in the last 60 years in the design sphere: the evolution of the concept of design and the discussion of major design ideologies. The roots date to the '60s, when people started exploring and experimenting the first design practices and techniques. Year after year, until today, copious design theories and methods have succeeded one after another. Each one wanted to improve the techniques and extend the area of practice of the previous.

Design science

Usually the design history is studied in two waves, from the 60s to the 80s and then from the 80s to nowadays, and it all started with Simon. Only with an in-depth research, studies related to the design before 1960 could be found. Richard Buckminster Fuller, architect, designer and inventor, in 1957 coined the term design science. As a mean of his studies he defined the term design as something characterized by coherence and thoughtful intelligence and he applied it to every single artifact, to a whole industry, but also to the universe itself, sustaining that *"our universe is an extraordinarily automated, fantastic piece of design."*³

To characterize his unique design philosophy he coined the term "Comprehensive anticipatory design science". Fuller did not intend the design science as an approach applied to redesign the infrastructures of the industries as it was though the term design at that times; he intended a new kind of application of the method. The approach in his opinion was useful in the implementation of the process of invention and development of particular artifacts. He introduced a rigorous and science based design approach, highlighting the need but also the possibility to applying it intentionally. He conceived the design science as something characterized by a thoughtful intelligence and coherence. The discipline of design science integrated industrial design, architecture, engineering and all the other sciences.

To sum up it is highlighted that the design science as a process is comprehensive, anticipatory, science based and aligned with nature, respectively because is driven by whole

³ Fuller, R. B. (1999). Your private sky: R. Buckminster Fuller: the art of design science. Springer Science & Business Media.

system thinking, is future oriented, is subject to rigorous testing and empirical verification and it reflects nature's underlying principles.⁴

1960s – 1980s: the inception of the design practice

This first wave has been fundamental for what concerns the development of this problem solving approach. What we call design thinking born as 'design', a process where people create and shapes artefacts to solve problems. Its roots date back to the early '60s where its primary context of application were the architecture and engineering fields. What made design acquire a certain importance in those years was its capacity to respond to the rapid environmental changes that were taking place.

An event that played a fundamental role in the field of design and in other fields related has been the World War II. The advent of the war in fact, had pushed men and organization to develop a new strategic way of thinking in order to face and solve problems.

The '60s started with attempts to "scientise" the practice of design, defining and applying a clear methodology in order to understand how design function.

Simon had played a fundamental role using for the first time the term design thinking and proposing the first scientific perspective of design. He described the design "*as a process aiming to improve artificial environment into 'preferred' ones*"⁵. He believed that different disciplines such as engineering, medicine, laws and so on concerned with the improvement of the environment, and so they all concerned with the design process. From this conception, he advanced further prepositions about how only the designers have the power to decide how things should be and should work. It is a task of the design science to realize artifacts that respond to a precise purposes.

*"The engineer, and more generally the designer, is concerned with how things ought to be – how they ought to be in order to attain goals, and to a function"*⁶.

It follows a perspective by which the natural science only deal with how things are made, but nothing has to do with what the environment hosts. In fact, in his vision about the world he explained that it should not consider natural but artificial. This is due to the fact, as said previously, that all the things present in the environment are artificial, men created.

⁴ Papalambros, P. (2015). *Design Science: Why, What and How*. Design Science, 1. doi:10.1017/dsj.2015.1

⁵ Simon, H. A. (1969). *The science of the artificial*, Cambridge. MA. MIT.

⁶ Simon, H. A. (1969). *The science of the artificial*, Cambridge. MA. MIT.

As a natural consequence, what followed was the evaluation of the human brain to be the ultimate 'artifice'. He advanced his proposition comparing a computer with cognition.

He sustained that, being the computer a human artificial with some limitations in processing data, it is consequent that the brain has some limitations.

Simon described the limitations working in this way: when a person has to solve a problem, he obviously wants to find the best solution, but he will never succeed. Let's analyse the situation linearly.

When a person has to solve a problem, his brain creates some barriers to protect itself. These boundaries make it difficult to understand the complex situation of the environment that is requiring solutions. In order to find a solution, designers define all the possible alternatives that respond to that purpose. Then they select the preferred one.

Most of the times in fact, people unknowingly cannot reach an absolute best solution: people choose the one that is the best among the others they had identified, not the best in absolute. This is due to their cognitive limitations: when designers face problems and had to define solutions, they develop them being not fully aware of all the possible opportunities, but considering only those ones they know better.

Designers in fact can only satisfy the needs, as best as they can, but not completely solve problems.

For Simon, the right scientific method for dealing with this kind of *poorly understood systems* is prototyping. Constructing the system, the designer has the possibility to understand these problems and their behaviour.⁷

In the 70's, important contributions had implemented the initial vision of what design stood for and what are its principal characteristic.

What Simon described as poorly understood problem, Rittel and Webber define in the early '70s as wicked problem: "*a problem that is unique, ambiguous and has not definite solutions*"⁸.

These are problems often linked with the system of society and regard particular complex topics as sustainability, climate changes and so on. What Rittel and Webber shared with Simon's theory is the difficulty in the resolution of wicked problems: designers cannot solve

⁷ Simon, H. A. (1969). *The science of the artificial*, Cambridge. MA. MIT.

⁸ Rittel, H. W., & Webber, M. M. (1973). *Dilemmas in a general theory of planning*. *Policy sciences*, 4(2), 155-169.

the problem, because with wicked problems there are not true or false finite outcomes. The resolution of a wicked problem will bring another new and complex problem to face.

Rittel and Webber argue that science cannot resolve problems having open and evolving variables, and this is what differentiates their theory from that of Simon.

Science is too rigid to face wicked problems because of their ambiguity. Science is ok for tame problems, the ones that can be solved with a definite solutions.

What Rittel and Webber bring to the Design thinking theory had been the importance of human experience.

Another strong personality that had brought important contributions to the design thinking sphere has been Victor Papanek. He introduced the moral perspective of the designers: they have certain responsibilities, social and moral, that go beyond product and profit reports. Designers shall take into account wider moral responsibilities, caring particularly about societal fundamental needs.

He reported, "*Recent design has satisfied only evanescent wants and desires, while the genuine needs of man have often been neglected.*"⁹

Papanek spoke of innovation as a solution that reduces the complex to simple: in order to solve problem in the simplest way, he sources experience, knowledge and intuition. He has been the first to integrate anthropology into the design practice to design innovations that are responsible, socially and ecologically.

He sustained the intuitive nature of the design but recognised the impracticality to describe tangibly the intuition for the scope of the innovation.¹⁰

The first to talk about the human-centred feature of design thinking process has been Archer.

In his article, he defined the 10 core elements with which define design:

1. A design must be based on the formulation of a model;
2. The model must be embodied in/as an artifact;
3. There must be creative step in the design process;
4. The process must be based on a purpose and favour intent over exploration;
5. The process must be intuitive but not spontaneous;
6. The process must begin with a need;

⁹ Papanek, V., & Fuller, R. B. (1972). *Design for the real world* (p. 22). London: Thames and Hudson.

¹⁰ Papanek, V., & Fuller, R. B. (1972). *Design for the real world* (p. 22). London: Thames and Hudson.

7. The process must reconcile conflicting variables;
8. The process must be holistic and consider the artefact in a wider system;
9. Design problems are complex;
10. Design must optimize between solutions.¹¹

For the author design is “*a goal directed activity and the designer is trying to proceed in a direction called good*”¹². Furthermore, he predicted the twine between design decision making and the management discourse.

Some years later, he revised his perspective: the design is not a systemic process but it is something embedded in the artistic behaviour. He proposed a new definition of design “*as the area of human experience, skill and understanding that reflect man’s concern with the appreciation and adoption of his surrounding in the light of his material and spiritual needs*”¹³.

1980s – 2000s: appreciation of design cognition

While the first generation of design theory was concentrated on the definition of the design as a science, the second will review the advent of cognitive aspect in the design process.

Donald Schön in 1982 advanced his theory: he defended Rittel and Webber sustaining that science can be applied only to those problems that are definite and well-formed.

Furthermore, he focused on the importance of problem solving in the design process, proposing that it should consist of the setting and the framing of a problem rather than the analysis of the process. The intuitive and tacit nature of design clearly emphasized his vision. He advanced for the first time the activity of divergent thinking when facing the problems, that he called swampy lowlands. When designers involve themselves in these lowlands “*deliberately involve themselves in messy but crucially important problems and, when asked to describe their methods of inquiry, they speak of experience, trial and error, intuition, and muddling through*”¹⁴.

What he advanced is a definition of design as introspective: the process of design is a conversation, personal and internal, between the object designed and the designer.

¹¹ Archer B.L (1965)., *Systematic model for designers*, Council of Industrial Design

¹² Archer B.L (1965)., *Systematic model for designers*, Council of Industrial Design

¹³ Archer B., Baynes K., Roberts P. (2005), *The three R’s*, A frame work for design and education, ch. 8, DATA Loughborough University

¹⁴ Schön, D. (1982). *The reflective practitioner*. 1983. London: Maurice Temple Smith Ltd.

In the same year, Nigel Cross started investigating the design methodology: he concentrated his research on what differentiated the way in which a designer thinks and makes decisions with respect to other professions.

Inspired by this kind of research, Bryan Lawson attempted to solve the same problem and, through a series of experiments, he draws important conclusions.

Scientists tended to be problem-focused, analysing systematically each solution to ensure it complied with rules, while designers tended to be solution-focused, creating multiple solutions immediately and then maintaining only those that work. Cross continued his studies and with Dorst and Roozenburg created the first symposium dedicated to design thinking. It aimed to collect and unify research, experimental and scientific, on the cognitive aspect of the design practice.

He highlighted the intuitive feature of design, that was unique only to that practice and this brought him to claim the independency of design history from art and science stating: "*design has its own distinct intellectual culture*"¹⁵.

In fact, he sustained that "*expert designers tend to emphasise the role of intuition in the generation of solutions, and creativity is regarded as an essential element in design thinking*"¹⁶.

Furthermore, in 1997 Cross investigated the role of such 'creative lead', the explosion of creativity a designer needs during problem solving in the design practice. He found out that the creative lead is not so vague and ambiguous: designers can build 'creative bridges', connecting ideas from unconnected domains to form solutions. In order to do so the process relies on analogical thinking and abductive leaps.

In 1992, another personality carries on studies about design thinking. It was Richard Buchanan and, addressing the interdisciplinary nature and the importance of integrating disciplines in order to "enrich human life" his contribution is still today a rock in the field of design thinking. He saw design as a profession not available to anyone: he argues that design and design thinking are skills that are only "*mastered by a few people who practice*

¹⁵ Cross, N. (2006). *Designerly ways of knowing* (pp. 1-13). Springer London.

¹⁶ Cross, N., Dorst, K., & Roozenburg, N. (Eds.). (1992). *Research in Design Thinking: Proceedings of a Workshop Meeting Held at the Faculty of Industrial Design Engineering, Delft University of Technology, the Netherlands, May 29-31, 1991*. Delft University Press.

*the discipline with distinctive insight and sometimes advance it to new areas of innovative application"*¹⁷.

He had been the first to think about a possible connection between innovation and design thinking, looking at the creation of innovation as that moment when "*the initial selection is repositioned at another point in the framework, raising new questions and ideas*"¹⁸.

Furthermore, Buchanan highlighted the absence of impossible, considered as a cognitive limitation of human fantasy. It can be passed through a better use of design thinking, an instrument characterized by integration of signs, things, actions and environments that respond to concrete necessities and values of human being in different circumstances.

The year before Buchanan published his article, 1991, design thinking has been "scholarized": IDEO formed and showcased its design process, with its terminology, its steps and toolkits, giving the possibility to those non-schooled in design methodology to quickly enter in the design thinking world.

The founders, the brothers Kelley and Tim Brown, proposed the design thinking as a model for innovation for business to face complex situations.

The model focuses on what is desirable by users.

Thanks to its human-centred orientation in fact, the design thinking process through its phases empowers designers to being able to seize all the latent need users sometimes cannot explain. One peculiarity of the method is in fact a deep analysis on customers' needs and the following satisfaction of them.

From the first years of the new millennium until now, design thinking has gained popularity rapidly, its fields of application are widening and in the future it will surely evolve more.

To sum up, here are described the key point of the process as it was seen.

- 1) Human-centred approach: the process is deeply human, people are at the centre. While designing, the designer should never forget it.
- 2) Useful to solve complex problem: the implementation of the projects, with the right execution of all this phases permits the solution of all the problems, from the easier to the most messed up.
- 3) The process is highly collaborative: working in team require each member to invest his best qualities on the process. No one can escape from responsibilities.

¹⁷ Buchanan, R. (1992). *Wicked problems in design thinking*. Design issues, 8(2), 5-21.

¹⁸Buchanan, R. (1992). *Wicked problems in design thinking*. Design issues, 8(2), 5-21.

1.2 Methods

Simultaneously to the evolution of theories has been the evolution of different design methodologies to improve business and services. The analysis will focus on four fundamental methodologies, chosen for their evolution toward the practice of design thinking as it is today. What will be explained will not be a linear progression; it happened that different practices were developed at the same time or were directed to the same industry.

Participatory design

As the term itself suggests, participatory design as a method, aims at the integration of end-user into the different phases of the design process. The benefits behind this technique are different: involving users in the process surely empowers users in their role and most of all, facilitates the system to understand better their needs and to develop a solution.

The first roots of participatory design can be traced back to Plato's Republic. In his stories, Plato talked about the participation of the community as the way with which a democracy could have base its roots. Moreover, the citizens and the community were involved in the discussion of the political policies that should have been implemented. All of this was in fact useful in order to develop a harmonious society.

Also known as 'Scandinavian approach', this active involvement of users brings multiple benefits for three different stakeholders.

At the first instance, the primary stakeholder is the community in itself. Participating actively to the community activities, citizens can explain which are their needs explicitly and this should result in a greater understanding and satisfaction from the community. Moreover, it permits a more adequate use of the resources available, a topic of interest for everyone inside the community.

Secondly, users themselves benefit from this involvement: actively participating in the meetings, users have the possibility to influence the social decisions. Moreover, analysing, evaluating and finally choosing which actions need to be taken; users themselves have the possibility to determine the quality of their life and not being forced to accept decisions taken by a superior institution. Furthermore, participatory design empowers users in the sense that, when they take a decision they are aware of all the possible consequences that this can trigger. If something negative happens, the fault falls on them: there is not the possibility to blame on someone other.

The last stakeholder is the designer: working in contact with users permits him to gather relevant and always updated information¹⁹.

However, all that glitters is not gold. Participatory design presents different pitfalls that need to be highlighted:

- users' experience was neglected;
- it was all about usability, but emotional response was ignored;
- users' opinion were not taken into consideration if were not in accordance with the designers.

In order to overcome these pitfalls, co-design began to emerge, as a more emphatic method to make the end-users more active, making them co-operate with designers. Co-design in fact refers to the "*creativity of designers and people not trained in design working together in the design development process*"²⁰.

User-centred design

Donal Norman has introduced the most significant contribution for the development of this methodology. He re-contextualized the role of users in the design process. The users in fact, became the centre of the methodology. Also the focus changed: if before the designer was focused on the usability of the product and to test his hypothesis, with the user-centred design the focus shifted to the users. The designers were interested on users' experiences, on their interests and latent needs.

Norman sustained the principle of "make things visible" to facilitate the users to understand what they had in front of them, but also discovered errors and took actions to solve them.

Abras in 2004 deepened the research on the topic. First of all he explained that under the same definition of user centred design, very completely different situations can take place. A situation where the users are just consulted in order to understand which are the needs that have to be satisfied could be considered a user centred design. At the opposite, the following situation is always considered a human centred design: the user becomes a partner of the designers and is completely involved in the design process. In this case, with the users elevated to a status of co-developers, the designers had to facilitate the tasks for users through the process. What matters after all is the involvement, at any level.

¹⁹ Sanoff, H. (1990). *Participatory design: Theory & techniques*. Henry Sanoff.

²⁰ Sanders, E. B. N., & Stappers, P. J. (2008). *Co-creation and the new landscapes of design*. *Co-design*, 4(1), 5-18.

Norman stressed the need to fully explore the needs and desires of users and the involvement of the same users have been a natural evolution of the initial need.²¹

It is also important for designers to understand with which type of user they are dealing with. Not all users are equal and the level of interest they have in a topic could be consequently different. Generally, three different types of users are identified. The so-called primary user is the one more interested in a product, is the subject that always uses the product, the primary consumer. The secondary user instead uses the product just sometimes, maybe as a substitute when his preferred product is missing. Finally, tertiary consumers are not direct consumers of the product but are affected directly or indirectly by the use of it by other person.

To conclude, the importance of user involvement lies in the fact of leading to more efficient and effective products.

Service design

Until the first year of 2000, the goods and products have always been the centre of the business. The increasing importance of users' experience and users themselves helped shape a new design methodology called service design. The important change has happened in the perspective of value-chain. All the economists looked at the value chain in a close manner as the sets of activities starting from raw materials process to the sale of the good. What happens after the sale does not matter. What changes with service design is the increasing relevance of value-in-use rather than the old value-in-exchange.

Now it is also important to understand what and how users do with a product after the purchase, their journey and their experience. There has been a clear evolution from the previous method: in the user-centred approach, only users' needs and wants were emphasised. With service design, the definition of users also had been expanded: it includes also all the stakeholders and individuals that interact or are affected by the service system.²²

More than desirability, usability and usefulness the service design process highlights temporality, accountability and most of all relationality between the user and the object.

²¹ Abras C., Maloney-Krichmar, D., Preece, J. (2004), *User-Centered Design*, In Bainbridge, W. Encyclopedia of Human-Computer Interaction.

²² Kimbell, L., & Street, P. E. (2010). *From user-centred design to designing for service*. In Design Management Conference (Vol. 14, pp. 1-8).

The service designers “created a more rough-and-ready, human-centred representation of the service incorporating visualizations of its touchpoints and notes about how service users and stakeholders engaged with them”²³.

The core characteristics of the three design methodologies are summarized as follows.

Participatory Design	User-centred Design	Service design
User testing	User experience	User journey
Efficiency	Needs	Value
End-user development	Users at centre of development	Stakeholders culture

Source: www.ithinkidesign.com, Recap of core characteristics

Human-centred design

The design methodologies since the beginning have always developed in the relation and collaboration between designer and user, leading finally to a more humanized practice: the human-centred design. The process started within technological and product system industries, shifting in the late '90s to a humanised focus. In fact, the methodology looks at the capabilities and behaviour of human beyond the simple interaction with the product itself.

*“Today’s human centred design is based on the use of techniques which communicate, interact, empathise and stimulate the people involved, obtaining an understanding of needs, desires and experiences which often transcends that which the people themselves actually realised.”*²⁴

An important perspective about the approach offered by Rouse, more than defines the process as a set of tools, looks at the approach as a mind-set.

He defined it as *“Roles of human in complex system, enhancing human abilities, aid to overcome human limitations and foster user acceptance”*.²⁵

In his book, sustaining the importance of including users such as affected stakeholders and broadening their narrow perspective, he draws attention to the building of an emphatic design practice.

²³ Kimbel L., *The turn to service design*, 2009

²⁴ Giacomini, J. (2012). Human Centred Design: a paradigm for 21st century enterprise.

²⁵ Rouse, W. B. (1991). *Design for success: A human-centered approach to designing successful products and systems* (Vol. 2). Wiley-Interscience.

The human centred design has four important characteristics:

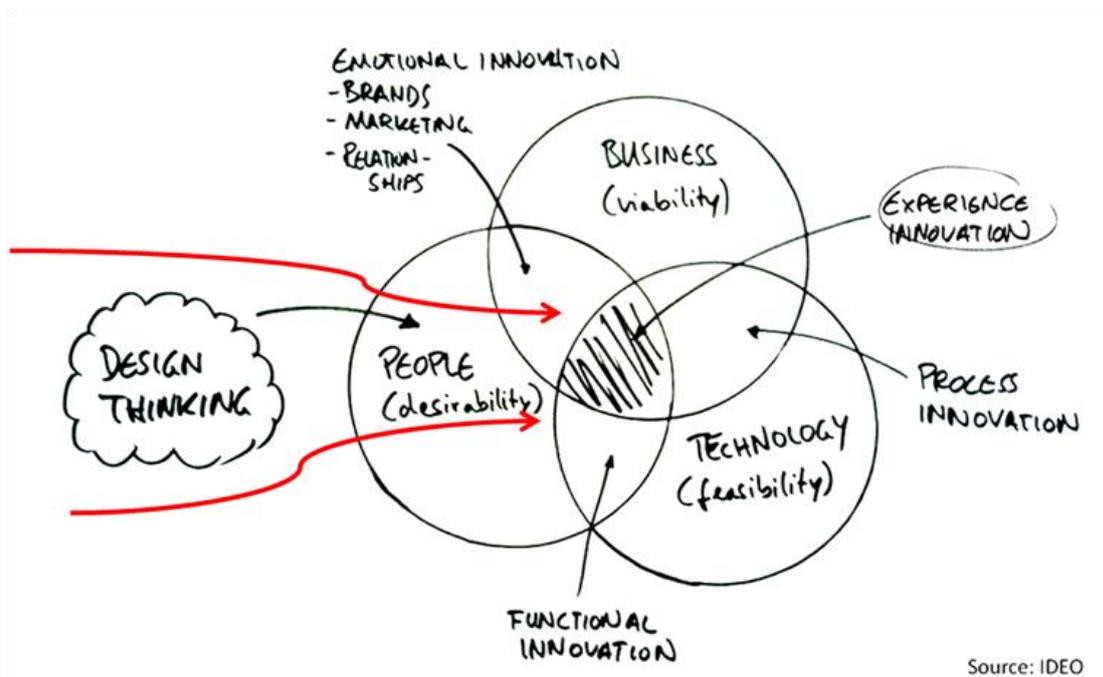
- Active involvement of users
- Appropriate allocation of works between users and systems
- Iterative design solutions based on feedbacks
- Collaborative and multidisciplinary team.

1.3 The definition

At this point it is necessary to define the design thinking process properly, mentioning a well-known practitioner of the methodology. Tim Brown, the CEO and President of IDEO states: *“Design thinking is a human-centred approach to innovation that draws from the designer’s toolkit to integrate the needs of people, the possibilities of technology and the requirements for business success.”*²⁶

Today more than ever, in order to comply with our society and environment, there is the need of an approach to innovation able to integrate itself with the society and the firms for the creation of breakthrough idea. The design thinking process is in fact is very well suited in markets that are rapidly changing and where users’ needs are uncertain. The impact the process can create in those situations are positive: the creation of breakthrough innovations revolt the market and enable significant revenue growth. These are just two examples of the great potential of the process.

Being the process human centred, the starting point is the identification of users’ needs. What follows is the creation of an innovation which is able to integrate those needs with



²⁶ Brown T., (2009), *Change by design: How Design Thinking Transforms Organizations and Inspires Innovation*, HarperCollins Publishers

what is technical feasible in the next future and what is viable in the business. The business model obtained should be sustainable.²⁷

Source: IDEO, What is design thinking

What is needed to develop a solution that takes in consideration all these three factor is a good designer. He should have the ability to be at the same time analytical and emphatic, rational and emotional, methodical and intuitive, oriented by plans and constraints, but spontaneous, for the complete integration of these three factors.²⁸

*"The difference between a fine artist and a designer is that a fine artist cares about personal expression and not necessarily what anybody else care about, or whether it produces financial success, whereas a designer has to care about whether what they are designing will work and provide the economic benefit that it was designed to deliver."*²⁹

The designers, by working closely with clients and customers, have the possibility to propose high-impact solutions not imposed from the top, but solutions that satisfy latent needs of users. The peculiarity of design thinking, that distinguish it from other methods, is the fact that it considers whomever as designer. Each person, also without deep expertise in the design field can run a project of design thinking. This is because the method makes full use of general capacities and abilities that anyone has, in particular the one of problem solving. It relies on humans' ability to be intuitive, to recognize patterns, to express themselves through meanings beyond words and symbols and to construct ideas that have emotional meaning as well as being functional.³⁰

A benefit brought from the collaboration between users and designers in the process is the increase in the effectiveness of the creative and innovation processes. Moreover, the involvement of users produces benefits related to the external image of the company. A finally consequent benefit regards the possibility of an increase of possible loyal users.

²⁷ Brown, T., & Wyatt, J. (2010). *Design thinking for social innovation IDEO*. Development Outreach, 12(1), 29-31.

²⁸ Tschimmel, K. (2012, January). *Design Thinking as an effective Toolkit for Innovation*. In ISPIIM Conference Proceedings (p. 1). The International Society for Professional Innovation Management (ISPIIM).

²⁹ Euchner, J. (2012). *Design Thinking: An Interview with Roger Martin: Roger Martin Talks with Jim Euchner about the Need to Include Intuitive Thinking in the Innovation Process*. Research-Technology Management, 55(3), 10.

³⁰ Brown T., (2009), *Change by design: How Design Thinking Transforms Organizations and Inspires Innovation*, HarperCollins Publishers

In the design process, users are useful to designer because they are considered as experts in their interactions with, and experiences of, determined products and services.

A successful designer must be able to observe the world and understand the people's needs, interests and values. Only once he gathers the information can he develop a novel idea through the innovative thinking. In order to release a satisfactory solution the designer should be able to try different methods of problem solving and be able to work with others.

The design thinker's personality should denote empathy, integrative thinking, optimism, experimentalism and collaboration³¹.

Collaboration, in detail, is fundamental because a group of people, not individuals alone, develops the process completely. Developing an efficient work environment is the starting point for a satisfactory solution.

IDEO identifies three fundamental values for design teams:

- Many eyes: design teams are multidisciplinary and include diversified expertise such as engineering, communication, sociology, and graphics and so on. Each member's perspective helps the other members to see and understand things that otherwise they would not ordinary see.

- Customer viewpoint: designers have to put themselves in the users' shoes to understand their needs, habits and idea but also their attitude toward the subject under study.

- Tangibility: construct mock up and prototypes give the users the possibility to try them and release feedback, helping designers to optimize the solutions³².

The field of application of the process can vary: it is most suited in the creation of new products and services. However, it is not limited to these activities: the implementation of the firm's strategy or the communication represent other possibilities of application. What is necessary in all the fields of application is the deep understanding of the context in which designers have to work. A misunderstanding of the problem, of the latent needs could compromise the final success.

What has been fundamental in the development of design thinking to become a successful method has been a productive mix of analytical and intuitive thinking. Before the diffusion of the process, especially big corporations lacked the ability to be creative and were not

³¹ Brown, T., & Wyatt, J. (2010). *Design thinking for social innovation IDEO*. Development Outreach, 12(1), 29-31.

³² Denning, P. J. (2013). *Design thinking*. Communications of the ACM, 56(12), 29-31.

able to create new products and services to satisfy the unmet needs of customers. In fact they were stuck in the analytical thinking, extrapolating information and realities from the past, accepting a future without changes.³³

This attitude and the continuous changing trends of the society and of the environment rendered the businesses obsolete fast.

Creativity was the key to success and design has been quickly identified as a competitive advantage for value creation. The mix of analytical with the intuitive thinking represents what companies need to be able to survive and innovate. Intuitive thinking alone would let companies get lost in the world of insights and data available.

Through this mix of thinking, companies can analyse the past collecting useful information and create a future that goes beyond the extrapolation of the past.³⁴

For Roger Martin in fact, disruption cannot be attributed solely to the faster movements in technology and shorter cycle times for products, but also to the ossification in the analytical thinking of big companies. He sustained that *"old companies get totally analytical, and they focus on honing and refining what it is that they are currently doing. The little companies come along and challenge that which exists, and they blow the big, old companies completely out of water. I think that phenomenon is a direct function of the predominance of analytical thinking in these big corporations. The problem is less about the world having changed; it is more about the intensity of analytical thinking."*³⁵

System of spaces

Maybe the right formula to run a business or an organization will never. If it is quite sure that it cannot be based only on feelings and intuition, it is true that trusting only on analytical thinking is absolutely dangerous. Among all the alternatives, the processes could be structured or not. The design thinking process as explained by Brown *"is best thought as a system of overlapping spaces rather than a sequence of orderly steps"*³⁶.

³³ Euchner, J. (2012). *Design Thinking: An Interview with Roger Martin: Roger Martin Talks with Jim Euchner about the Need to Include Intuitive Thinking in the Innovation Process*. Research-Technology Management, 55(3), 10.

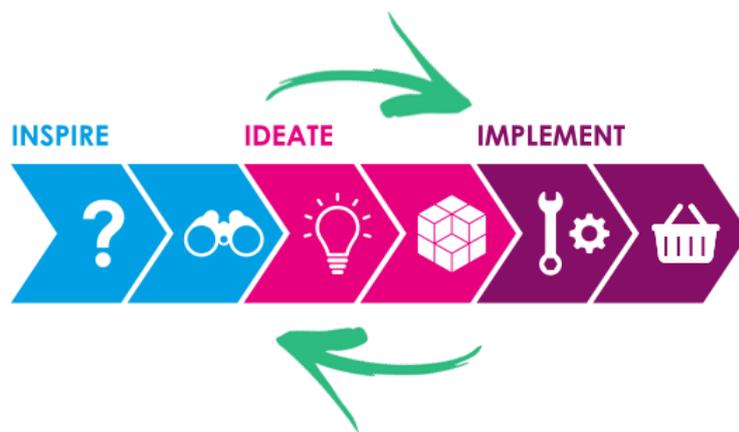
³⁴ Mootee, I. (2013). *Design thinking for strategic innovation: What they can't teach you at business or design school*. John Wiley & Sons.

³⁵ Martin R., *Design Thinking*, 2012

³⁶ Brown, T., & Wyatt, J. (2010). *Design thinking for social innovation IDEO*. Development Outreach, 12(1), 29-31.

The three spaces, described deeply by Brown and Wyatt, are: Inspiration, Ideation and Implementation. It should be clear that the reason why they are called spaces is that they are not always undertaken sequentially: the project may loop back more than once if the team needs to refine its ideas and explore new directions.

Inspiration has to be thought as the space in which the discovery of problem or opportunity that motivates the search for solutions happens, *Ideation* as the space in which through some tools ideas are generated, developed and tested, and finally the *Implementation* space, where ideas conceived in the early space are closed in an action plan.³⁷



Source: www.slow-design.fr, 3I of design thinking

Inspiration

Conventionally, the inspiration's space is conceived as the beginning of the design process, although it is true that designers do not always proceed through these three spaces in a linear way. The starting point of the phase is the brief, defined as "*a set of mental constraint that gives the project team a framework from which to begin, benchmarks by which they can measure progress, and a set of objectives to be realized.*"³⁸ In their book Brown and Wyatt then explain that the brief should be constructed in a way to allow and nurture the designer the conception of breakthrough innovation. In fact, if the brief is too abstract the group risk to wander and to not reach a solution, while it is too defined the resulted innovation could

³⁷ Brown, T., & Wyatt, J. (2010). *Design thinking for social innovation IDEO*. Development Outreach, 12(1), 29-31.

³⁸ Brown, T., & Wyatt, J. (2010). *Design thinking for social innovation IDEO*. Development Outreach, 12(1), 29-31.

be lousy and incremental. What follows the creation of the brief is the identification of users' needs. Traditional methods used to collect such information are focus groups, surveys and interviews but unfortunately it is common that they yield relevant insights because simply people are asked what they prefer. The conventional researches in fact, are useful in the realization of incremental innovation but do not lead to the breakthrough idea designers are looking for create something never seen before.³⁹

It is Brown in his book "Change by design" that explains that a good starting point for a designer is go out and observe the experience of people and how they interact: although people often can't tell us what they want and what they need, analysing their behaviour can provide the designers important clues about their unmet needs.

Moreover, it should be important to work with local partners who both serve as interpreters and guides and also introduce the designers in communities, helping build credibility quickly and ensuring understanding.⁴⁰

Ideation

After the observation of the field and the doing of the design research, the design team begins a process of synthesis: from the big amount of information gathered, the group pulls out useful insights in order to make clear what the opportunities are for change and the different solutions. The usefulness of the approach resides in the creation of multiple options to create choices and different insights about the human behaviour. These could be in fact, different alternatives of vision for the offering of new products, or choices among different ways of creating interactive experiences.

Furthermore, testing competing ideas one against the other permits a great quality and persuasive outcome. As the two-times nobel prize winner Linus Pauling said "*To have a good idea you must first have lots of ideas*".

An idea, in order to be considered effectively innovative and satisfy a need people do not know to have, should go beyond the actual state of things, sticking out from the throng.

It is clear that more options mean more complexity and that it could be a problem if there are time and budget constraints. However, the big problem that hit nowadays' business is

³⁹ Brown, T., & Wyatt, J. (2010). *Design thinking for social innovation IDEO*. Development Outreach, 12(1), 29-31.

⁴⁰ Brown T., (2009), *Change by design: How Design Thinking Transforms Organizations and Inspires Innovation*, HarperCollins Publishers

their tendency to seek the ease. They are not willing to invest time and money if the outcome is uncertain. This pushes most businesses to restrict their field of action and it inevitably will give rise to incremental and obvious innovation.

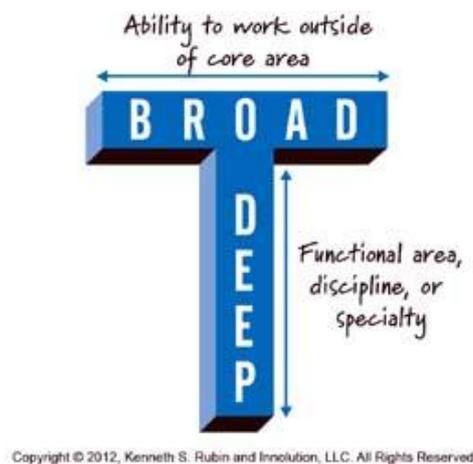
It could be true that in the short run this strategy may be more efficient, but it tends to make the organization conservative and inflexible in the long run.

The use of divergent thinking is clearly an opportunity and a mean to reach the innovation, and should not be considered as a barrier. Divergent thinking is fulfilled through the multidisciplinary of the team: the capacities of the members are diversified and they seek for sharing and collaboration.⁴¹

The multidisciplinary is an approach that during the last years had spread among business rapidly and efficiently. However, it is not so easy to be implemented correctly.

In fact, in order to operate within an interdisciplinary environment, an individual needs to have strengths in two dimensions. Each member of the team needs to possess a deep knowledge about a specific area in which is an expertise and that allows him or her to make tangible contributions to the outcome (vertical axis). Moreover, the design thinker needs also other generalist knowledges that go beyond one's own (horizontal axis).⁴²

Brown defined these people "T-shaped" person.



Turning back to the process, this team continues with a structured brainstorming: once some key words are identified, the group starts generating all the words linked to the key ones, without any limits. For someone some words at the first glance could mean nothing but

⁴¹ Brown, T., & Wyatt, J. (2010). *Design thinking for social innovation IDEO*. Development Outreach, 12(1), 29-31.

⁴² Brown T., (2009), *Change by design: How Design Thinking Transforms Organizations and Inspires Innovation*, HarperCollins Publishers

behind some absurd words it could be hidden a great potential. Typically, each member writes his idea in a Post-it™. The reasons of the visual representations are the necessity to fix an idea before forgetting it and to facilitate others understanding a complex idea.

What follows is the grouping and sorting of the different ideas, maintaining the good ones while dropping out the bad others.

Implementation

In this third phase, the group starts to work effectively on the ideas selected as the best in the previous phase. In fact, it has to define an action plan in order to come up with the final solution. The core activity of the implementation phase is the prototyping: with the competencies of the group, the idea they have in mind is turned into a rough actual product. Only once the group has concluded the prototype, it has to be tested and refined if necessary. Through this method, the group is able to find out possible consequences or implementations that were not expected: it helps the group to build a reliable and stable long-term success.

The final step after the prototyping regards the implementation of the communication strategy. An efficient tool to do this is storytelling: through a kind of tale narration, it is possible to communicate to other people, the idea, the values and the emotions that rely in a product.

Unfortunately, today the usage of design thinking to fulfil properly and completely a problem solution is something very difficult to find. Lot of social enterprises use the process' tools only intuitively. They brainstorm in order to create ideas but then fail to cluster the idea. Or they start doing questionnaires but they do not know the exact recipient. Researches demonstrate that lot of organization do not use the method extensively.

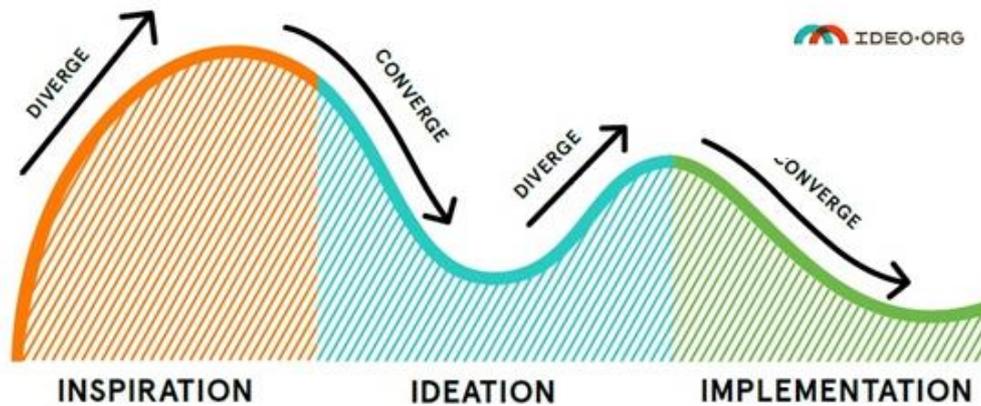
Some of them do not want to even hear about it. The reasons are multiple.

Lot of organizations are reluctant in embracing the process because they are not able to appreciate the potential of human centred approaches. Furthermore, companies are not interested in the balance of the three pillars of design thinking: users, technology and business. Moreover, they consider the process too abstract and creative for the field of work of their business.

After the reluctance, another big impediment for the implementation of the process in the organizations is the fear of failure. What happens is that experimentation and failure in today

business are barely accepted. Due to this companies prefer to not even try to adopt the method for the fear of failing in succeeding.

What it is fundamental to be highlighted is the importance of open the mind and think outside the box. The graph below help to summarize the concept.



Source: IDEO, 31

The first phase starts with the divergent thinking. Ideas then converge to understand concretely the problem. The second divergent phase happens in the conception of new solutions.

"Design thinking can lead to hundreds of idea and, ultimately, real world solutions that create better outcomes for organizations and the people they serve."⁴³

The method of 3I is just of the copious to explain the structure of the process. However, in the third chapter there will be seen other definitions that properly fits the educational purpose of the process.

⁴³ Brown, T., & Wyatt, J. (2010). *Design thinking for social innovation IDEO*. Development Outreach, 12(1), 29-31.

1.4 Critical perspective on Design Thinking

When dealing with the writing of a research like this one, the writer must have the state of the art of the argument under control. Surfing on the web, leaf through the pages of a book permit people to understand the topic and being able to write about it. When someone becomes an expert about a topic then, he or she has the possibility to release critics about it.

This is what happened with design thinking method during the last years: before this time in fact, the practice of design thinking was considered quite perfect and fundamental for the creation of innovative solutions. Examples of the premises are that it regards being creative more than all, that all of us can be a designer, that following the right sequence of the process the result is almost guaranteed for all kinds of problems. These premises could be also right if a shallow vision is adopted. The design thinking process is more than writing something on coloured Post-it™ and fill up the wall of a room with them. It is more than a pleasant creation of a prototype.

It is not efficient to exhibit the process just as an easy and funny tool for innovation. First at all, it diminishes the value of the process itself: but also it questions the expertise of skilled designers. In fact, a strong critique moved toward the design thinking process is that it lacks the rigor of critique. Natasha Jen sustained that each individual before joining the process shall have a critical sense, asking himself if he is possessing the right skills to undertake the process. Not everyone could be a design thinker, otherwise "*what makes professional designers special?*"⁴⁴

Moreover, if the process is seen a sequence of steps the critique phase does not exists, but despite this, it is essential in every single steps: a critical vision improve and helps the definition of the problem and the selection of useful information in order to deliver the right solution.

Another point of reflection regards the conception of the design thinking process more as the end than a mean to reach an objective. This is not correct; the process is certainly useful but it represents just a portion of the innovation iceberg that drive designer to a solution. A holistic vision of the final innovative idea should be promoted, not an outcome strictly linked to the process.

⁴⁴ Jen N., Talk at 99U's Conference

A final provocation: How people can be a process that is codified and repeats each time the same sequence of steps considered innovative?

2. Biases in innovation

In this chapter, the research gets straight to the heart of matter: the cognitive bias. The analysis starts with the definition of the decision process because it is in this field that cognitive biases begin and take place. The biases are seen as the erroneous consequence of heuristics. Moreover, a classification of the specific biases that occur during the design thinking process are listed and analysed.

2.1 Decisions

"What is the main problem we have to solve?"

"How can we satisfy this need?"

"Which is the best alternatives?"

During the design thinking process, designers find themselves continuously in a situation where making a decision is fundamental to proceed and develop a solution. Conditions of certainty develop better-taken decisions; however, there are numerous cases where uncertainty dominates the choice. In difficult conditions, what help ourselves to develop a decisions are mental shortcuts called heuristics. Sometimes, however, these shortcuts bring to a "false" result called bias. To better understand what happens in innovation, when and why this error arises, the phenomenon will be deeply analysed.

A decision is a voluntary and intentional behaviour that comes after a reasoning that responds to a situation. What characterize it are three components. First at all, the decision maker must have the possibility to evaluate a possible *course of action* or an alternative. In fact, there could be no decision if there is just a single object of choice; then he shall develop some expectations relative to the different course of actions, producing some expected *outcomes*. Finally, given that an action brings another action, the decision maker should be aware of the *consequences* that can arise with a choice of course of action rather than the other.

It is common to say that people take decisions to solve problems but in the reality there is a clear difference between decide and solve a problem. In *problem solving* the decision is bounded by the objective that must be reached, while in *decision making* the decision comes by a reasoning about the best alternative within a series of options. Specifically, solving a

problem implies finding the right solution within a certainty domain, like use a formula to solve a mathematics problem.⁴⁵

Take a decisions instead, does not imply in a bounded way a domain made by certainties: when you play in the stock exchange no formula can give you the certainty to win so you make decisions on probabilities.

The process

When a person has to make a decision found immediately himself comforting by a host of possible challenges. In decision making, people have to undertake a process made up by the problem structuring where he becomes aware of the problem, of the possible course of action, collect information before arriving at a final solution.

During the years, different theories have been proposed, each one articulating the process in different phases. Newman in 1991 proposed an eight phases' decisional process:

1. Problem definition

The starting point of every choice is to recognize the problem to face. Only once the problem has been identified the process toward a solution starts. There are two types of problem, the structured and not structured ones. The former is well defined, there are numerous and high quality information and a precise number of alternatives. Objectives are clear and it is possible to find the best alternative. The problem recognition in this case is something obvious and immediate.

The latter kind of problems instead are complex, the uncertainty dominates and there is not a best solution: it is necessary to search the one that better satisfies the choice's criteria.

2. Objective definition

Whatever the problem is, once defined, it is fundamental to define the objective in order to make clear quantitatively or qualitatively what wants to be reached and how.

3. Information gathering

Today more than ever, information coming from television, newspaper, social network, books, and word of mouth and so on is bombarding people.

In order to make a decision, first at all people have to gather information from the external environment.

⁴⁵ Pravettoni G, Leotta S., *I processi di decisione*, 2015

From the big amount of data collected, people have to evaluate singularly each one of them, holding only those one that are relevant for the problem's solution.

4. Alternatives definition

There is a decision only if there is more than one alternative. When searching a way to solve a problem, different alternatives come in the mind of people.

Some alternatives are workable, others not because for example they exceed the limits in terms of time or costs. People evaluate all the alternatives and drop out the impracticable ones.

5. Establishing criteria

The central activity in the decision process is the choice within the alternatives. It is obvious that people want to choose the best alternative, but it is always relative. In fact, people choose a list of different criteria in order to evaluate each alternative.

6. Model creation

At this point, after the definition of the criteria, there is the need to understand the relations between the objective, the alternatives, the data and the criteria. The definition of the different relations should be not always easy. The identification of these relations is usually called "construction of the model".

7. Evaluating outcomes

With the model created people are able to estimate in advanced the outcome of each workable alternative on the chosen criteria.

8. Decision

When the previous steps of the decision process are completed, the final step is the choice of the best alternative. If the other steps have been made in an accurate manner, the choice of the best alternative can be effectively done with the confidence that it is the one that best suited the problem. ⁴⁶

Structural decisional processes need a remarkable quantity of time, an elevated commitment and cognitive effort, because often information is not completely available and the choice of the best alternative results more difficult.

It is clear that the decisional process cannot begin until recognition of the existence of a problem takes place. From that point, people start a process in order to reach the best

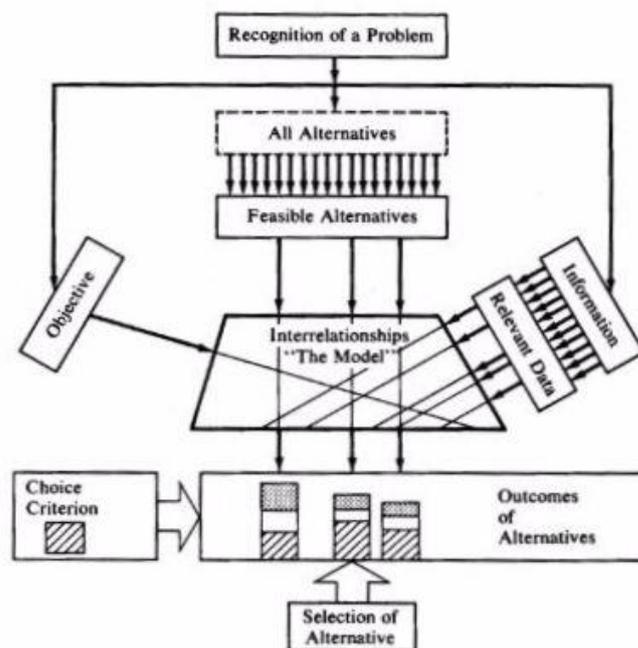
⁴⁶ Baumeister, R. F., & Newman, L. S. (1994). *Self-regulation of cognitive inference and decision processes*. *Personality and Social Psychology Bulletin*, 20(1), 3-19.

alternative. Ideally, the decisional process made by these eight steps is the general route that people follow.

However, rarely people solve problems through an exactly linear sequence of steps, because in the reality implementing the whole sequence of steps without problems results difficult.

In fact, it is very hard to complete each step without taking into consideration the effect of the other steps. For example, the gathering of coherent and relevant data can suggest the existence of another practicable alternative.

Likewise, it can happen that in order to identify new possible alternatives there is the need of additional data to be gathered. The sequence of the eight steps should be difficult to imagine as the exact process to follow. The following scheme better illustrates the process. In fact, it gathers visual elements in a more flexible and realistic way. It does not indicate what comes first and what follows the identification of the problem. Effectively, once the problem is identified, different steps of the decisional process could be considered in parallel⁴⁷.



Decision making process

⁴⁷ Baumeister, R. F., & Newman, L. S. (1994). *Self-regulation of cognitive inference and decision processes*. *Personality and Social Psychology Bulletin*, 20(1), 3-19.

Group decisions

As in the design thinking process, often a group of people, rather than a single individual, makes decisions. The dynamics change: people get involved in two processes.

The first regards the analysis of the information relative to the problem; the second is the management of the relation between the components of the group.

It is a common thought that decisions made by a group are more accurate and reliable than the ones taken by the single person because “more heads think better than one”, even if each member is not competent as the others. This opinion is based on the assumption that a group of people produces more ideas and is able to integrate different opinions of each single component in a single final decision. The decision of a group is the result of a process that involves different persons, interests, points of view that are different from one another.

In the '60s and '70s, different researches about group decisions focused on processes with which groups combined interests and preferences. Davis in 1973 proposed the model of social decision: the scheme considers the initial preference of each component and tries to establish the probability that each alternative has to become the final group decision⁴⁸.

Social cognition, and more generally cognitive psychology, influences recent researches: the group is considered as an information-processing unit for problem resolution⁴⁹. This perspective focuses on the ways with which the group elaborates, codifies, stores up and retrieves information useful to make a decision. The difference between classic and modern studies regard the focus: the former studied the change of preferences while the latter focused on the construction of the information, combining and sharing preferences.

One pros of groups is the great quantity of data produced and examined compared to the one of the single person. Ideally, in fact, each member shall contribute sharing his relevant information to the group and the group shall consider all the information from each member during the discussion and when coming to a decision.

There could be two different types of information: unique information if a single member has information unknown by others, or common information, if more members share the knowledge of an information. Obviously, when information is combined during the discussion the amount of data is better in terms of quantity and quality. The discussion is a

⁴⁸ Davis, K. (1973). *The case for and against business assumption of social responsibilities*. *Academy of Management journal*, 16(2), 312-322.

⁴⁹ Larson, J. R., & Christensen, C. (1993). *Groups as problem-solving units: Toward a new meaning of social cognition*. *British Journal of Social Psychology*, 32(1), 5-30.

process of identification, selection and share of information possessed by the group as collective and useful for the decision.

If the group is able to use this amount of information effectively, the group can run into a decision very fast. However, it often happens that the group does not effectively use all the information it has: groups spend lot of time talking about things all of them already known, not focusing on examining new and unknown information brought by a single member⁵⁰. Inevitably, if people do not share or mention information, those will have a minimum impact on the final decision of the group.

Some expedients can simplify the exchange of information:

- decreasing the load of information: de-structuring the problem in smaller problems diminishes the amount of information to be analysed;
- using memory supports: take notes before having the discussion with the group helps member to forget nothing important;
- remember always that sharing information is at the basis for a good decision.

At a certain point, the group must make a decision: until the '60s the common thought was that the final decision corresponded to the mean of the preferences. In this phenomenon called "normalization" members have to find a compromise. The mean of the preferences becomes the norm for each member. In this way, the group avoids each kind of conflict and the status quo is maintaining. With the advent of the time and with deeper researches, today, the phenomenon of "polarization" dominates the group decisions. This characteristic consists in producing an extreme decision with respect to the mean of preference: it could be safer or riskier. The common tendency however, is the production of a riskier decision.

Different factors explain this risky behaviour:

- in comparison with the individual decision, each member when making decision in a group shares the responsibility of the choice and it makes members feel less responsible in case of failure;
- sharing information and discuss with other members helps each one develop familiarity with the problem;
- the risk is perceived sometimes as a value to pursue.⁵¹

⁵⁰ Stesser G., Titus W., *Pooling of Unshared Information in Group Decision Making: Biased Information Sampling During Discussion*, 1985

⁵¹ Stoner J., *Risky and cautious shift in group decisions: the influence of widely held values*, 1967

Until this moment, the research analysed the pros of working with a group. However, there are obviously some cons. One of them worth citing: the Group-Think. It all started from Irving Janis who defined the group-think as “*A mode of thinking that people engage in when they are deeply involved in a cohesive in-group, when the members' strivings for unanimity override their motivation to realistically appraise alternative courses of action.*”⁵²

Janis started his research on group-think analysing different political decisions taken by the United States within the '40s and the '70s that did not bring positive interests to the government. Nowadays, the areas of application of this phenomenon are wider and group-think is still recognized as a valid model in most texts within social psychology.

Concretely, members arrived to the point of considering the group itself, and being part of it, the most important element, more than the purpose for which the group has been created. In fact, inside the group different dynamics take place: members strive for a quick and painless unanimity on the issues, they analysed the issues and the risk connected superficially. Each group member suppresses his personal doubts, becoming silence dissenters and following the leader's suggestions.⁵³

Janis identified three different types of antecedent conditions for the group-think manifestation:

- a) Cohesion of the group: a cohesive group forces deviated members to be compliant with the group.
- b) Organization structural faults:
 - insulation of the group;
 - no impartial leadership;
 - no group norms about methodical procedures;
 - members are too homogeneous.
- c) Situational factors:
 - external threats causes high stress;
 - recent failures, excessive difficulties, or moral dilemmas induce temporary low self-esteem.⁵⁴

⁵² Janis, I. L. (1971). *Groupthink*. Psychology today, 5(6), 43-46.

⁵³ Hart P. (1991). *Irving L. Janis' victims of groupthink*. Political Psychology, 247-278.

⁵⁴ Janis, I. L. (1971). *Groupthink*. Psychology today, 5(6), 43-46.

If happening collectively, these conditions provoked a tendency for concurrence seeking by the members of the group, making members lose the motivation to be too harsh in their judgment referred to colleagues' idea. Consequently, this concurrence seeking manifested itself as a series of symptoms.

These symptoms fell in three categories:

- a) overestimation of the in-group with corresponding negative stereotyping regarding the out-group;
- b) close-mindedness;
- c) pressures for uniformity.⁵⁵

The presence of these conditions and symptoms that taken singularly should be positive, lead to wrong decisions.

Finally, the research wants to list some advices to make avoid group-think trap:

- It is not recommended to leave the burden of decision to a single member;
- Having different opinions about a topic is so natural;
- Discordance and different points of view can help the group to take accurate decisions because various information are discussed deeply;
- Invite external people and experts to the discussion;
- Minorities can bring innovation;
- Not being scared by conflict: it helps!
- Forget stereotypes and "ready-to-use" solutions;
- Spend some time thinking about how to proceed.⁵⁶

⁵⁵ Hart P. (1991). *Irving L. Janis' victims of groupthink*. Political Psychology, 247-278.

⁵⁶ Janis, I. L. (1971). *Groupthink*. Psychology today, 5(6), 43-46.

2.2 Heuristics

People make decisions in different situations, using different strategies. As it has been previously noted, people can find themselves facing structured problems or not structured ones, where uncertainty dominates. The risk, and so the uncertain situation, is a subjective construct that is strongly influenced by how each individual interprets the event. In fact, different people finding themselves in different contexts perceive a risk differently. When individuals evaluate a risk, often they do not have complete information about that risk, and they cannot resort to statistics or other objective data. To solve an uncertain situation, people retrieve as much information as possible from the memory and from their experiences.

With respect to this, Tversky and Kahneman have revolutionized the research on human judgement, identifying a series of inferential rules that simplify the cognitive works implied in the assessment of probabilities and the evaluation of risks, the so called "heuristics".

Heuristics are defined as "*methods for arriving at satisfactory solutions with modest amounts of computation*"⁵⁷ rather than "*a rule of thumb, strategy, trick, simplification, or any other kind of device which drastically limits search for solutions in large problem spaces*"⁵⁸.

Heuristics indeed are a kind of thought shortcuts that permit humans to simplify the reality and at the same time having a complete coherent representation that have sense and meaning. Assuming that they cannot always be perfect, but knowing that they are often effective tools for dealing with complex and uncertain situations, it could be supposed that the human mind employs them spontaneously and naturally.

An interesting characteristic of heuristics is identified: the accuracy-effort trade-off.

Heuristics permit human to take decision saving efforts but at the cost of accuracy. They allow decision makers to process information less deepened but faster, in a less effortful manner.

However, it is not always a loss for people: sometimes they face decisions that are not so important for them to spend lot of time to be solved.⁵⁹

There are three principal cognitive heuristics: availability, representativeness and anchoring and adjustment.

⁵⁷ Simon, H. A. (1990). *Invariants of human behavior*. Annual review of psychology, 41(1), 1-20.

⁵⁸ Feigenbaum, E. A., & Feldman, J. (1963). *Computers and thought*. New York.

⁵⁹ Gigerenzer, G., & Gaissmaier, W. (2011). *Heuristic decision making*. Annual review of psychology, 62, 451-482.

Availability

When a person gathers information from the external environment to evaluate a solution for a problem, often he tends to search only those information that are near him, and so that are cheaper in terms of time and cognitive activity. This heuristic is commonly used in situation in which people have to judge their reality basing it upon the frequency or probability by which an event occurs. Specifically, decision makers "*assess the frequency of a class or the probability of an event by the ease with which instances or occurrences can be brought to mind.*"⁶⁰

The term availability is used referring to two different process: the ease of recovery from memory and the ease of imagination of events.

The more the mind is able to recall similar events to the one under evaluation, the higher probability of verification of this event is judged.⁶¹

Over time however, studies have revealed that people may rely on different aspects of the accessibility of information when making decisions: what comes to mind and how easily it comes to mind.

Instances of large classes are recalled better and faster than instances of less frequent classes; associative connections are strengthened when two events frequently co-occur, occurrences are easier to be imagined than unlikely ones.⁶² Thus, a person could estimate the numerousness of a class, the frequency of occurrence and the likelihood of an event by assessing the ease with which mental operations of association, construction of retrieval can be carried out. Obviously, it is not necessary to perform the activity of retrieval or construction, the person only has to assess the ease with which these operations could be performed.

Representativeness

The probability or the frequency of an event is based on similarity between the event and the standard: an event is in fact judged probable if it "*(i) is similar in essential properties to its*

⁶⁰ Tversky A., Kahneman D., *Judgment under uncertainty: heuristic and bias*, 1974

⁶¹ Tversky, A., Kahneman, D. (1973). *Availability: A heuristic for judging frequency and probability*. *Cognitive psychology*, 5(2), 207-232.

⁶² Tversky A., Kahneman D., *Judgment under uncertainty: heuristic and bias*, 1974

parent population; and (ii) reflects the salient features of the process by which it is generated.”⁶³

The functioning of this heuristic is better explained with an example. A person has to answer to this question “What is the probability that A belongs to/originates from/generates B?” When the decision maker faces the question he does not consider probabilistic or logical relationships between A and B. Rather he makes his decision based on whether A is representative of, that is, similar to, B. Similarity in fact, being an important feature of cognition, permits ease of judgment.

One of the fields in which the representative heuristic does not always produce good results is the stock exchange: the investor in order to decide where to invest, interprets the past performances of the listed firms as being representative of its general performances that will continue to have in the future. In detail, if the firm has a series of good (bad) past performances, the investor is optimistic (pessimistic) and so he will over-evaluate (under-evaluate) company’s stock. The same happens in gambling: players analyse past results and believe that if something happens more frequently than normal in some periods, in the future there will be the less probability that it will happen. When people have to make a decision base themselves on a generalized and simplistic opinion that is not founded on the analysis of each single case. Acting like this, players do not care about simply probability of each event, thing that should be done: in fact, the relation of correlation or similarity between events is independent from their frequency. The phenomenon that take place in those cases is the “base-rate neglect”: people tend to ignore completely the base rate of a particular event, basing their judgment solely on how much representative the event is of its class.⁶⁴

Anchoring and adjustment

“In what year was George Washington elected president?”

“What is the freezing point of vodka?”

These are just two of numerous questions of which only few people know the correct answers. However, most of them can arrive at a reasonable estimate by tinkering with a value they

⁶³ Kahneman, D., & Tversky, A. (1972). *Subjective probability: A judgment of representativeness*. *Cognitive psychology*, 3(3), 430-454.

⁶⁴ Kahneman, D., & Tversky, A. (1996). *On the Reality of Cognitive Illusion*, 103 *Psychol. Rev.*, 582, 582-83.

know is wrong. Concretely it means that lot of people know that the United States declared its independence in 1776, so president Washington must have been elected sometime after that. Applying the same reasoning, lots of people know that alcohol freezes at a lower temperature than water, so vodka must freeze at something colder than 100° C. When people face questions like these, they spontaneously anchor their response on information that readily comes to mind and then adjust it in a direction that seems them appropriate. The anchoring-adjustment heuristic represents a situation in which uninformative and random starting points unduly influence the decision maker. This the starting point "*may be suggested by the formulation of the problem, or it may be the result of a partial computation*".⁶⁵

The decision maker then continues with the adjustment of that initial point in the light of further information stemmed from the memory or from external sources. The adjustment typically tends to be insufficient and this makes the results biased: what happens is if a process starts with a low (high) anchor, the final judgment tends to be an underinvestment (overinvestment) with respect to the true value. This is because when people have to evaluate hypothesis of the true value, they tend to confirm their personal hypothesis with external information, making the comparative assessment generating information disproportionately consistent with the anchor value, biasing the final judgment.⁶⁶ It is also worth noting that if, for the same questions, two different starting points are given, the two respondents will give two complete answers, and so the anchor will bias the results. Moreover, once the adjusted result falls within an implicit range of plausible values, the decision maker stops the adjustment. However, the adjustment is done toward the expected direction but with an insufficient magnitude.

Finally, anchors, even if irrelevant or extreme, have large effects on people:

- The effect of the anchor is the same, if both people are aware of its influence or not;
- Often, when the anchoring heuristics is working, people think it is not;
- Anchor plays a role even if people think it is uninformative;
- clarifying the anchors' effect to people does not reduce the anchoring process.⁶⁷

⁶⁵ Tversky A., Kahneman D., *Judgment under uncertainty: heuristic and bias*, 1974

⁶⁶ Epley, N., & Gilovich, T. (2006). *The anchoring-and-adjustment heuristic: Why the adjustments are insufficient*. *Psychological science*, 17(4), 311-318.

⁶⁷ Sunstein, C. R. (2003). *Hazardous heuristics*.

Heuristics are used in judgment often because people do not have other means available to make decisions. However, there are different points of view concerning the reason why people also rely on them even if there are other methods as the theory of probability.

Simon supposed that people employ heuristics because the human mind does not have enough computational abilities that would be necessary to demonstrate a rational behaviour.

Kahneman and Tversky instead had an opinion slightly different: they thought heuristics were based on evaluation – natural evaluation – that people carry out automatically and not intentionally during the process of perception and comprehension of the messages.

Due to this, they believed that heuristics were not means to solve complex problems, but means that could suggest responses naturally also to simple problems.

As it has been analysed, each heuristic consists on a consistent saving of efforts for the decision maker, but often leads to a biased result and this is what this study wants to highlight.

However, the reliance of heuristics and so the results of biased decisions, are not restricted only to the beginners: experts and experienced researches are subject to cognitive bias when adopting heuristics and thinking intuitively as well.

Below is a final overview of the three principal heuristics with the related examples.

Heuristic	Field of application	Example
Availability	Memory-based judgments of frequency or probability	Overestimation of risks that are easily available in memory
Representativeness	Judgments of likelihood of instances belonging to a category	Birth order son-daughter-son-daughter more representative of random outcome than son-son-son-son
Anchoring and Adjustment	Quantitative estimates on a unidimensional scale	Cost calculations biased towards starting value

Source: Cognitive Psychology: Revisiting the Classic Studies, Recap of principal heuristics

2.3 Biases

When people rely on heuristics in order to make decisions in a situation of uncertainty, often it happens that the human cognition produces as results distorted representation of the objective reality. Cognitive bias is define as “*systematic error in judgment and decision making*”⁶⁸.

The reasons why these errors happen are motivational factors, cognitive limitations and the adaptation of the human being to the natural environment. Deepening the researches, three final causes are highlighted.

The first reason is heuristic: as it has been previously said, most of the times people use shortcuts or rules-of-thumbs when processing information because time and abilities are often scarce. Although these heuristics work in most of the circumstances, often the results present deviations from the rational reality. The use of this simplified reasoning could be due to the high costs in the real time required to run complex algorithm to solve problems rather than simpler ones. It has been demonstrated in fact that people solve problems differently when they are under time pressure and when the motivation to be accurate is low. A clarifying example regards often people with a certain reputation: they often tend to be identified by stereotypes rather than individual characteristics.

Moreover, there could be costs in evolutionary terms: being the functioning human brain very complicated, the development of some circuits to elaborate information avoiding bias would be surely costly. It would hit the ontogenesis process that would require an increase in the length but also a change in the allocation of energy among the different development processes.⁶⁹ For example, the turn on of a complex algorithm process could require a removal of energy from another mechanism.

The second reason for the arousal of bias seen biases as artifacts: if the problem in hand it is something that the human being has not being designed for, the responses will be systematically irrational and biased. The artifacts can arise from the evolutionary novel problem about formats or contents.⁷⁰

⁶⁸ Mata, R. (2012). *Cognitive bias*. Encyclopedia of human behaviour, 1, 531-535.

⁶⁹ Haselton, M. G., Nettle, D., & Murray, D. R. (2005). *The evolution of cognitive bias*. *The handbook of evolutionary psychology*.

⁷⁰ Haselton, M. G., Nettle, D., & Murray, D. R. (2005). *The evolution of cognitive bias*. *The handbook of evolutionary psychology*.

The former regards the formats of presentation of information: frequency rather than probabilities are two different formats to display the same information.

The first case shows the number of times an event occurred in a given time and it is something easily observable in nature. Probabilities instead, reduce the rate of occurrence of an event to a number between 0 and 1. What differentiates one from the other is the easiness in the results calculation.

The latter instead regards the different kind of content of a problem: it could happen that the solution of a problem implies the use of logic. Researchers had demonstrated that people produced negative performances when dealing with abstract rules of logic rather than easier reasoning strategies.

The error management theory is the third reason why biases happen: when people have to judge something or someone the human cognition mechanisms tend to produce systematic errors. The final judgment in fact can be biased in two different directions:

- a false positive error is an error that occurs when you think someone or something possesses a certain characteristics while it is not true;
- a false negative error instead occurs when you fail to detect certain characteristics.⁷¹

The kind of error committed depends on how costly is each kind of error.

The biases related to the error management theory are linked to three kinds of situations. When a person finds himself in a situation of potential threat the cognition interprets the situation and responds with the more suitable type of bias. Other people, an animal or an object can cause the threat. To better understand the logic behind the error management theory in this case, it follows an example. A person listens to two different sounds: the first increases in intensity with time while the second will decrease. The error management bias will make him judge that the first sound was too close to him than the second, also if they are equally distant from the individual. It guarantees the self-protection if in the real life he perceives a noise that is coming closer to him.

A second case of error management bias regards the evaluation of interpersonal relationships. When a person undertakes a relationship, the error management occurs in different situations: a sexual over-perception, the scepticism and so on.

This is a kind of misleading perception example within the sexual sphere: "What did she/he mean with that wink?". Men habitually stumble on the over-perception bias: the false positive

⁷¹ Buss D. M., (2014), *The Evolutionary Psychology Handbook*, Buss D.M. editor, 2nd edition

error is activated when he think the she has interested on him because the cost of believing it also if it not true is smaller than the costs of a missed reproductive opportunity, that happens in the case in which he fails to detect the interest.⁷²

The final situation in which an error management bias occurs is the evaluation of the self. A person took part of a contest: when evaluation his/her behaviour the cost of thinking positively, that has been better to have tried also if he/she will fail, is smaller than the one if she would not have participated.⁷³

Innovation

As it has already been said, the presence of cognitive biases is common to all the situations in which a person or a group of people have to take decisions: the result is distorted.

What interested this study specifically is the presence of cognitive biases in the innovation field, in particular in the process of design thinking. The research in fact, wants to focus only on those cognitive biases that are strictly linked to the process. A former study conducted by Jeanna Liedtka hinged on the link of the design thinking with innovation through the presence of cognitive biases. The author advances a series of propositions arguing that some theoretical characteristics of design thinking are able to minimize the presence of determined biases in the process. She divided the biases in categories but in practice, she does not confirm her studies with actual facts.

This is the reason why this research has been undertaken. It wants to carry out the following theory: first of all, it describes which are the cognitive biases that hit the process of design thinking that could jeopardize the final innovative outcome.

Moreover, it has conducted a case study in order to understand, quantitatively and qualitatively, if it is true that the process of design thinking is able to reduce cognitive bias or not.

Among the copious types of cognitive biases that exist, primarily studied by Kahneman and Tversky, Liedtka has identified eight final biases that have an influence on innovation, leading to a distorted result.

1) Projection bias

⁷² Baumeister, R. F., & Vohs, K. D. (2007). *Encyclopedia of social psychology* (Vol. 1). Sage.

⁷³ Haselton, M. G., Nettle, D., & Murray, D. R. (2005). *The evolution of cognitive bias. The handbook of evolutionary psychology.*

It regards the general tendency of people when thinking about the future to imagine it strictly resembling the present or at least the past. This bias in fact, pushes people to underestimate or not consider at all any change in actual preferences or situations. When someone has to pack for a vacation, when finding himself grocery shopping it happens lot of times that he is influenced by its current situation without considering that the moment in which the decision that he takes now will be useful only in the future.

As in innovation, innovators start developing an idea at time T_0 but the innovative products will be launched in the market and used in the future at T_1 .

A person that expects to innovate projecting the personal or customers' present preferences into the future and so do not considering any changes of personal or customers' preference the result should reconsider the concept of innovation.

The result of these activities leads to no novelty at all.

2) Egocentric empathy gap

Personal thoughts, preferences, tastes are the core of this bias, but from the previous it changes the recipient: if in the projection bias it is yourself, in the egocentric-empathy it is someone else. The innovator in fact, tends to do not consider others' preferences, being convinced that those resembled his ones. The bias neglects completely the identification of the self in someone others' shoes.

It could happens when the individual possesses private information and takes for granted that other people possess his same information. Furthermore, innovators during the process often fail to consider that their mood could be different from the customers' one.

The risk connected to it is that the innovative idea will satisfy completely the innovators' preferences but not those of the customers. Moreover, the product's value will also suffer.

3) Hot cold gap

Emotions, feelings, moods influence everyday our decisions. The problem linked to this bias is that the innovator when conceiving an idea could found himself emotionally laden or completely not and could not be able to remain consciously indifferent to it. The former case is the hot one: strong feelings as anger, stress, excitement, optimism go through him. While in the cold state, the individual undergoes feelings of calm, full rationality and decorum.

The threats of the bias resides in different situations. The evaluation of the potentiality of an idea could not be so asaccurate because obviously the evaluation changes depending on what is the mood of the individual. Moreover, the individual should consider possible

changes in its mood in the near or faraway future. Not being aware of these dangers could compromise the success of the business.

4) Focusing illusion

When an innovator is developing an idea, he has to care about all the different aspects that play a role in the ideation and creation of this idea.

It seems obvious that within a product surely some aspects weight much more than others and so researchers have to spend more time on specific attributes. Independently from the time dedicated, what counts is that the innovator has always under control all the attributes. In fact, it could happens, and it is the disclosure of the bias, that the innovator focuses all his interests only on limited specific attributes and their effects, at the expense of the others that if considered would have had an important effect.

The final evaluation of whether idea is biased is if too much weight is conferred to limited attributes of the idea. Kahneman in fact sustained that *"Nothing in life is as important as you think it is while you are thinking about it."*⁷⁴

5) The planning fallacy

Kahneman and Tversky originally considered this bias as the tendency of people to underestimate or not consider the time needed to complete a task. Habitually people tend to be optimistic with the duration of specific own project, convincing themselves that it takes three weeks to conclude a one-month duration project.

When applied to design thinking it leads to underestimate the time required to complete the innovation without considering that a good innovator always develops a solution in case of failure. This bias in fact could not compromise the success of the idea, but its happening surely would determine the livelihood of the business.

How does it works? The planning fallacy bias is based on the consideration that people do not consider the possibility that in the future, and in this case an innovation, could fail.

Habitually, in fact, the vision of the future is positive, while the past is always thought as a mix of both positive and negative events. Organizations lot of times succumb to this bias, being not ready to react with an alternative in case of failure of an idea.

6) Endowment effect

The bias represents a distortion in the evaluation of objects, ideas and so on: in fact, it has effects in different contexts. What it proposes is the general, but irrational, tendency of

⁷⁴ Kahneman D., Nobel prize in Economics in 2002

people to evaluate things they already have more than they would be willing to pay for something that is new. Obviously, the act of paying is not referred strictly to money, but also pain, pride and so on. The consequence of the bias is a loss aversion that makes a person preferring to pay a high price to maintain something they already own than buy the same thing new. A loss aversion in fact, takes place when the loss of something hurts

It means people overvalue everything they own.

Specifically applied in the design thinking process, the bias happens when a person does not want to give up an idea he/she already have because it would be more painful than acquiring a novel idea.

7) Hypothesis confirmation bias

What happens when an individual wants to demonstrate the accuracy of his/her certainties or idea? 99% of the times, hypothesis confirmation bias is the most probable answer.

People in fact, are inclined to search only the information that confirm their certainties, undervaluing all the others that contradict them. The worst hypothesis happens when the information is completely rejected. As the psychologist Peter Wason demonstrated people in fact, in order to confirm their hypothesis seek out evidences for confirmation, interpreting or at least manipulating information in the manner they prefer.

The cliché behind this bias is that people are prone to believe what they want to believe.

What follows is then a different way to examine information: people in fact tend to scrutinize information challenging their personal perceptions and certainties more in detail than those confirming them.

8) Availability bias

A strict relation with the namesake heuristic explained before might make it easier to understand this concept. Initially, when considered as a heuristic it states that while judging an event, the general tendency is the one of conferring more probabilities to events that come in mind easily. When considering the movement to the bias the concept behind does not change. In fact, the definition of the availability bias in respect to the innovation process of design thinking is the following: people generally prefer options that are easy for them to imagine.⁷⁵

⁷⁵ Liedtka, J. (2015). *Perspective: Linking design thinking with innovation outcomes through cognitive bias reduction*. *Journal of Product Innovation Management*, 32(6), 925-938.

It is important to highlight that Jeanna Liedtka proposed gap in her paper a ninth bias the Say/Do. The reason why it has been excluded voluntarily is that it does not focus on designers but on biases coming from the customers, and it is not of interest in this research.

The authoress in her paper divided the previous biases in two categories. In the first category, she identifies Projection bias, Egocentric Empathy bias, Hot and Cold gap and Focusing Illusion bias those biases related to the difficulty of people to see beyond themselves. In fact, within these biases it happens that the people have difficulties in taking into consideration someone else experiences, preferences, current states respectively for the first three abovementioned biases. Moreover, due to the Focusing illusion bias designers are concentrated on themselves and influenced excessively by some precise factors.

In the second category instead, there are the Planning Fallacy, Confirmation, Endowment and Availability biases. What characterized this second group is the imperfection in the evaluation and test of the hypothesis created. This means that innovators fail to generate ideas that are respectively to the biases optimistic, preferred, strictly linked to the first idea and unimaginative.

For each category, Liedtka identifies the key theoretical points or practical tools of the design thinking process that are able to mitigate the take-over of cognitive biases on design thinking processes. Moreover, according to the different phases of the design thinking process, the writers has identified where each remedies offered by the design thinking process can act against cognitive biases.

Let beginning with the first category of cognitive biases. The remedies of design thinking against the arousal of these biases during the idea generation are:

- 1) The collection of deep information on others done within the empathy phase;
- 2) The improvement on the ability to imagine someone else’s experiences and
- 3) The team work.⁷⁶

Each one of these remedies plays an important role in constructing the dominance of design thinking. The actions these remedies carry out are methods implemented during different stages of design thinking process.

The table behind summarizes the concept that will be fully explained later.

Remedy	Need finding	Ideation	Experimentation
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⁷⁶ Liedtka, J. (2015). *Perspective: Linking design thinking with innovation outcomes through cognitive bias reduction*. Journal of Product Innovation Management, 32(6), 925-938.

Deep data	Perspective taking		
	Ethnography		
Imagination	Visualization		
Team work	Sense-making tools	Collaborative ideation tools	Disconfirming data focus

Source: Liedtka J., *Linking design thinking with Innovation outcomes through cognitive bias reduction*, 2015. Remedies of design thinking process against cognitive biases

In order to explain how design thinking is able to mitigate the arousal of cognitive biases Liedtka advanced three different important prepositions on the three remedies identified.

The first proposition states *"By insisting on the collection of deep data on customers' concerns and perspectives as central in the need finding stage, design thinking mitigates the effects of the projection, egocentric empathy, focusing, and hot/cold biases"*⁷⁷.

The authoress supports her first proposition with the perspective-taking skills mixed with the ethnography. In fact, it has been find that the conduction of research on others, on their life, their culture and habits helps the development of novel idea for the solution of others' problems. The methods illustrated by the authoress are qualitative interviews, journey mapping and observation.

This consequentially permits the designer to rely on those people as a source of primary information. The fostering on novel idea is favoured and facilitated from the observation, the understanding and the adoption of the different point of views. The designer collects people's preferences and experiences, leaving aside its personal ones.

The second proposition focuses on the ease of imagination and it states *"By improving decision-makers' ability to better imagine the experiences of others in the need finding stage, design thinking mitigates the effects of the projection, egocentric empathy, focusing, and hot/cold biases"*⁷⁸.

The fundamental visualization tools implied in this second proposition are the storytelling and the use of metaphor. Visualization in fact, facilitates the use of imagery and is absolutely necessary in a process as it is the design thinking. Imagery could be abstract or visual.

⁷⁷ Liedtka, J. (2015). *Perspective: Linking design thinking with innovation outcomes through cognitive bias reduction*. Journal of Product Innovation Management, 32(6), 925-938.

⁷⁸ Liedtka, J. (2015). *Perspective: Linking design thinking with innovation outcomes through cognitive bias reduction*. Journal of Product Innovation Management, 32(6), 925-938.

What interested the authoress is that is foster the creativity of designer is imagining customers' experiences.

It can happen within different way. One is the use of stories that help designers taking into consideration all the possible detailed aspect of a fact, also the most particular ones that in other cases would have been forgotten.

Furthermore, the use of metaphor in respect to the one of stories, will help designers to imagine a situation in a different way and not always taking it for granted. It fosters the imagination of scenario in which the designer relies less on his past experiences and preferences.

The final proposition for the mitigation of this first category of biases is the following: "*By insisting that innovation tasks be carried out by diverse, multifunctional teams, design thinking mitigates the effects of the projection, egocentric empathy, focusing, and hot/cold biases*".⁷⁹

It focuses on the importance of working in team, in particular multidisciplinary teams as the typology used in the design thinking process. Obviously, in each team each person has his own preferences and idea. Working in team help each one of them explaining his point of view and listen to the others. It follows that the group will be able to contrast all the internal personal opinion. Moreover, working strictly with people with different background foster the creativity.

The authoress identifies three different tools the group can implement. What she intended for sense-making tools are instruments as the mind-map, useful for the members of a team to facilitate the creation of a "common mind" and proceed to the phase of ideation in a situation of information symmetry. In fact, writing or drawing an idea on a sheet of paper makes easier for other person with totally different knowledge understanding the concepts. In the phase of ideation, the tools as brainstorming leverage the differences in knowledge between members. The no-rules rule helps everyone to actively join the activity.

Moreover, "*design values like withholding judgment, avoiding debates, and paying particular attention to disconfirming data and the tensions difference creates encourage more innovative team solutions*".⁸⁰

⁷⁹ Liedtka, J. (2015). *Perspective: Linking design thinking with innovation outcomes through cognitive bias reduction*. Journal of Product Innovation Management, 32(6), 925-938.

⁸⁰ Liedtka, J. (2015). *Perspective: Linking design thinking with innovation outcomes through cognitive bias reduction*. Journal of Product Innovation Management, 32(6), 925-938.

The first category of biases and the relative remedies proposed by the authoress have been analysed. Now it is the turn of the second category of biases, those ones relates to the flaws in the conception of novel ideas.

Even in this case a table will help summarizing the different remedies identified before the full explanation.

Remedy	Need finding	Ideation	Experimentation
Becoming better tester	Perspective taking ethnography		Creation of pre-experience
Multiple options		Creating multiple options	Test multiple options
Reflection on results			Disconfirming data focus

Source: Liedtka J., *Linking design thinking with Innovation outcomes through cognitive bias reduction*, 2015. Remedies of design thinking process against cognitive biases

In this second category, Liedtka proposes other three propositions with three different methods to limit the take-over of cognitive biases during the final test of the ideas.

In the first proposition, she sustained that *“By teaching decision-makers how to be better hypothesis testers, design thinking mitigates the effects of the planning fallacy, confirmation, endowment, and availability biases. It does this by insisting that they prototype, surface unarticulated assumptions, and actively seek disconfirming data.”*⁸¹

In order to test without fallacies one remedy provides the use of pre-experience. With this tool, the designers can experience their idea obtaining fundamental deep feedback by users. Applying the method, they have to take into consideration specificities and details, mitigating the search for ease ideas.

Moreover, for what concerns the impact on defining hypothetical success or failure, Liedtka explains the importance of hypothesis testing and assumption surfacing. In order to do this she uses a research conducted on the topic: who explain a hypothetical success succeeds more than someone that explain a hypothetical failure. Moreover, who succeeds better is the one that explain the failure without being full committed to a set of expectations.

⁸¹ Liedtka, J. (2015). *Perspective: Linking design thinking with innovation outcomes through cognitive bias reduction*. Journal of Product Innovation Management, 32(6), 925-938.

She uses this example to sustain that the emergence of assumptions forces the designer to analyse deeply his idea and describe in detail his expectancies.

Assumption surfacing is related to different aspects of an idea that make it attractive for users: value creation, feasibility, scalability and so on. This mitigate the arousal of over optimism and prone him and his group to the gathering of disconfirming data.

The second proposition states, "*By insisting that decision-makers work with multiple options, design thinking mitigates the effects of the planning fallacy, the hypothesis confirmation bias, and the endowment effect.*"⁸²

As it is structured, the design thinking method foster the creation of multiple options, because having lot of alternatives permit designers to approach the best solution as more as possible, while having just few opportunities make designers chose the least worst option. This is the way through which the over optimism and endowment effect are reduced. In the first cases, lot of alternatives mitigated the development of over optimism on one single idea. Each one of them have different attributes and each one of them worth to be analysed and taken into consideration.

Moreover, being compelled by the method to develop different options makes the designer and his group desisting to be attached to their first idea, reducing or completely eliminating the endowment effect. Finally, it reduces the hypothesis confirmation because in order to make the best decisions they have to analyse deep all the aspect of the idea, the pros and cons. Designers cannot concentrate all their efforts just on finding preferred information, those one that only confirm their idea.

In order to develop a compelling idea they have also to evaluate disconfirming data.

The last proposal of the authoress focuses on the experiments: "*By insisting that decision-makers conduct and reflect on the results of marketplace experiments, design thinking mitigates the effects of category 3 biases*".⁸³

Applied in the last two phases of prototype and test, the market experiment give the group the opportunity to assess which are the key characteristics of an idea, why it works or not and how to they can change their idea in order to make it perfect. The field experiments

⁸² Liedtka, J. (2015). *Perspective: Linking design thinking with innovation outcomes through cognitive bias reduction*. Journal of Product Innovation Management, 32(6), 925-938.

⁸³ Liedtka, J. (2015). *Perspective: Linking design thinking with innovation outcomes through cognitive bias reduction*. Journal of Product Innovation Management, 32(6), 925-938.

need to resemble as more as possible the reality. In fact, all the external stakeholders should take part of the experiment.

Finally, experiments furnish the occasion to become aware that there are some factors not taken into account yet that play an important role.

All the propositions advanced by Jeanna Liedtka however, both of the first and second category, lack of practical validation. In the fourth chapter, a complete analysis, both quantitative and qualitative will state if the reasoning of Liedtka should be confirmed or not.

3. Design thinking in education

Surfing the web, whether the research is “design thinking” or “design thinking process” what will appear in the Google section of images will be a set of coloured hexagons, Post-it™ and wavy graphs. This chapter will explain what these images mean and exactly how the process is put into action in the education field.

However, first at all, what is important is to understand why education field represents one of the applications of design thinking process and where it comes from to be useful in the context.

3.1 Why education?

As it has been previously said, design thinking evolved as a way to solve problems.

The process, characterized by the mainly use in the management arena, has been at the centre of interest and discussion for the way through which it solves problems.

What happens is a resolution of a managerial problem obtained with an approach similar to a designer would use to solve his design problems. The reasons why design thinking has taken place in the education field are linked to the managerial one. In fact, as Dunne sustained “*what has implications for managers ultimately will affect business schools. As managers become more interested in design methods, business students will need to develop competency and business schools will, in turn, be expected to provide courses in these approaches.*”⁸⁴

In his interview with Dunne, Roger Martin deepened the rationale behind the use of design thinking in the business school. He started with a reasoning about how business’ people should act like designers.

They are accustomed to work with very complex problems, called wicked problems. Their way of collaborative and integrative thinking relies most of all on the analytical, or abductive, thinking. This way of thinking is characterized by the analysis of a situation, problem and criticality breaking them up into a series of smaller problems. Thanks to this, the person sees the problem from a different point of view. The logic behind the analytical thinking is the logic of what might be and it implies a vision of creativity for the development of new ideas.

⁸⁴ Dunne, D., & Martin, R. (2006). *Design thinking and how it will change management education: An interview and discussion*. *Academy of Management Learning & Education*, 5(4), 512-523.

The computation of a solution is drawn easily and faster with respect to critical thinking.⁸⁵ Also known as deductive thinking, this way of reasoning makes people follow the logic of what should be or what actually is, considering the consequences.

If people use only this type of thinking, they reduce all to something they already know, to do without crossing over their “comfort zone” of knowledge with novel ideas.

The proposition that Roger Martin advanced in his interview with Dunne is the fact that it is correct for business people to rely on deductive and inductive skills, but for them it would be useful to combine these skills with the abductive, or analytical, ones in order to find solutions outside existing predetermined alternatives.⁸⁶ This proposition is just one among all those Roger Martin had proposed. His primary concerns however, is the fact that businesses need to understand that they have to change their attitudes and work methods. The table below helps summarize his proposes of changes.

Feature	From traditional firm..	..to design shop
Flow of work Life	Ongoing tasks	Projects
	Permanent assignments	Defined terms
Style of work	Defined roles	Collaborative
	Wait until it is right	Iterative
Mode of thinking	Deductive	Deductive
	Inductive	Inductive
		Abductive
Source of status	Managing big budgets and large staff	Solving “wicked problems”
Dominant attitude	We can only do what we have budget to do	Nothing can’t be done
	Constraints are the enemy	Constraints increase challenges and excitement

Source: Design Thinking and How It Will Change Management Education: An Interview and Discussion, Martin’s proposal of change

⁸⁵ Dunne, D., & Martin, R. (2006). *Design thinking and how it will change management education: An interview and discussion*. *Academy of Management Learning & Education*, 5(4), 512-523.

⁸⁶ Dunne, D., & Martin, R. (2006). *Design thinking and how it will change management education: An interview and discussion*. *Academy of Management Learning & Education*, 5(4), 512-523.

In order to obtain managers able to use collaborative skills, abductive way of thinking and change of the attitude toward the solution of problems, there is the need to intervene early. This means that during compulsory education, these fundamental skills for the future need to be imparted to students.

Helping students develop a more flexible and creative way of thinking and enabling them to immerse themselves and adapt to different contexts without difficulties are the challenges that the schools today are facing.

In his blog, a Harvard professor proposed seven skills that are needed to survive in the business world:

- 1) critical thinking and problem solving;
- 2) collaboration across networks and leading by influence;
- 3) agility and adaptability;
- 4) initiative and entrepreneurialism;
- 5) effective oral and written communication;
- 6) accessing and analysing information;
- 7) curiosity and imagination.⁸⁷

It is due to these reasons that processes as the design thinking are catching on the education field.

A research of Sheer and Nowesky hinges on the use of constructivist learning in education to permit the development of some of the previous characteristics. The authors' proposition is that the constructivists learning theory can be put into action through the method of design thinking.

Proceeding with order, the constructivist learning theory "*suggests that humans construct knowledge and meaning from their experiences*"⁸⁸. The strict consequences of this active way of learning process is that each individual develops a personal knowledge that depends on his/her vision of the world. Specifically, the knowledge of something comes from the meaning that an individual confers to it. The context in which it is taught influences learning. What is fundamental for the authors of this theory is to transmit students the capacity to constantly adapt to situations, immersing themselves in the context.

⁸⁷ Wagner, T. (2011). *Tony Wagner's seven survival Skills for 21st century*, <http://www.tonywagner.com/7-survival-skills/>

⁸⁸ Bada, S. O., & Olusegun, S. (2015). *Constructivism learning theory: A paradigm for teaching and learning*. *Journal of Research & Method in Education*, 5(6), 66-70.

Among the different types of approaches that could be implemented in education to develop the creative thinking, the design thinking process is one of the most used.

In fact, it fosters students' metacognitive skills.⁸⁹ Moreover, the process forces students to be open-minded, to be empathic and not consider personal ideas better than others'. Design thinking used in education helps students learn and understand the mean through which the end is reached.

Obviously, the process is not so aseasy to be learnt and taught. No one can improvise themselves as an expert in design thinking. This is why lot of institutions have supplied specific courses dedicated to the process.

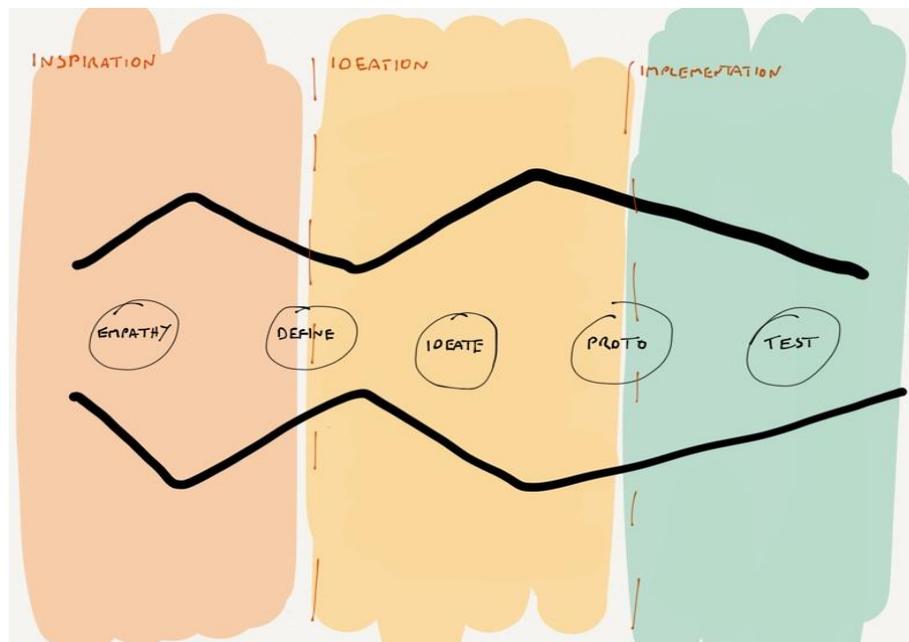
⁸⁹ Scheer, A., Noweski, C., & Meinel, C. (2012). *Transforming constructivist learning into action: Design thinking in education*. Design and Technology Education: An International Journal, 17(3).

3.2 The process

As previously said, there has been a great emergence of courses dedicated to the design thinking process. The two most famous institutions offering such courses are the d.school in Stanford and IDEO of Tim Brown. The teachings offered by the two is the set of the toolkits, the definition of the five phases and the transmission of the best practices.

Before starting, it is necessary to make clear that what has been explained in the first chapter is the definition of the IDEO of the design thinking as a system of three interconnected spaces. What comes now is the definition of the process as the practical way with which the process is put into action through five different phases.

The graph clearly illustrates the different phases and the two methods overlapped.



Source: www.stackexchange.com, How the IDEO model fits into d.school model

Explaining both the d.school and the IDEO method would result in a boring explanation; however, it would be erroneous and counter-productive choosing one at the expenses of the other. Because of this reason the research wants to propose something new: a refreshed vision of the two processes mixed, without altering their characteristics.

Therefore, in order to explain the theory and the phases the model chosen is the one of d.school, the design school based in Stanford, while for the explanation of the tools and activities carried out, the model used is the one of IDEO.

The reason behind this choice is in the way the methods explained the design thinking process. In particular, d.school is considered the best on how it theoretically describes the process, while IDEO equips as no others useful tools to be applied during the process.

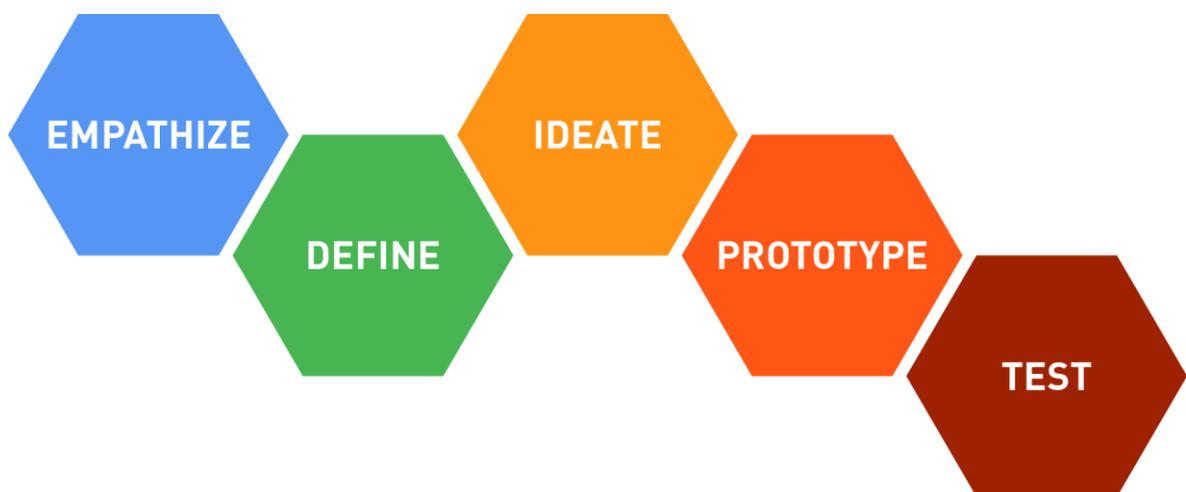
A decisional factor has been the first phase definition.

D.school defined it as “Empathize” while IDEO as “Discovery”. In a human centred approach as the design thinking, no discovery can be made until the designer or innovator develop a degree of empathy with the users.

The process proposed by d.school presents five different phases: Empathy, Define, Ideate, Prototype and Test.

Habitually, the defined phases come orderly, one following the other. However, during the process there is the possibility for the group to go back to the previous phase without any kind of problem. This way the innovator is sure that, if he makes a mistake, it can be easily fixed.

The two graphs below explain the phases and the actions undertaken.



Source: www.dschool-oldstandford.edu, Design thinking process

Before starting, it should be useful to remember that people with different backgrounds make up the process. The members of the work groups habitually are below the sets of ten. Having a restricted and multidisciplinary team makes the process work and fosters the innovation.

Empathize

Design thinking born as a method to tackle complex problems. In detail, it is a human-centred approach to solve problems. What interested the group of designers is to understand the realm in which they are working. They have to understand the primary problem and the context in which it is developed. However, what interested the designers most of all is to understand the target audience stroked by the problem, its feelings, what it does and what it says.

This is what designers have to do in the first phase of the process, but how can they do this? Empathizing with the users is the answer.

In a human-centred approach in fact, people are the centre of the process and each one of them having personal characteristics, different attitudes and motivations toward the problem. A design thinker does not only need to enter in contact with people, he has to do it in an empathic way, because users are the subject of work and designer has to dedicate himself completely to the project. There are both active and passive actions to be undertaken: the designer can talk and interview users actively or he can decide only to observe them passively during interactions between themselves or with the environment. In each kind of situation design thinkers are able to gather different types of information. For example when a user explains his opinion about something, he often explains subconsciously needs he has that are not yet satisfied. At the same time, when the user does not know to be observed, he could act and behave freely, in a way to reveal information useful for the designer, not achievable through a conversation.

The design thinker has to put aside personal preferences, ideas and assumptions because what matters is to gain the needs and insights of users.

What matters in this phase is to gain as more information as possible about all and in the end, these must be processed in order to have the situation under control and to develop insights. The d.school guide proposes to collect information also in a visual way, pasting on the wall photos or Post-it™ that depict users, some quotes, impressions and so on.⁹⁰

After the explanation of what is useful in the empathy phase, here the research proposes some actions needed to be carried out, defined by IDEO, to be used in this first phase.

⁹⁰ D.school, *An introduction to design thinking, the process guide*, <https://dschool-old.stanford.edu/sandbox/groups/designresources/wiki/36873/attachments/74b3d/ModeGuideBOOTCAM P2010L.pdf>

In order to enter and understand the context where the problem arise the following actions are suggested. First of all the challenge needs to be understood by the whole group, after that each member of the group has to share all the information he already has about the context and build his knowledge filling the gaps he missed with others' group knowledges. Moreover, it is in the very first instances of the process that also the target audience needs to be identified. Then the group starts to prepare the research. The main actions to employ before entering into real contact with the users are four. The identification of sources of inspiration helps the group to make a plan where listing all the activities and the people from what the members want to learn. Then the selection of the research participants follows, only those most interesting worth an appointment. Thirdly, the questions are formulated to yield valuable results: a designer cannot arrive at the appointment with users being unprepared and inventing demand in that moment. Finally, the group has to prepare the fieldwork, deciding who talks, who takes notes, who observes the behaviour of the users and so on. Then the real information gathering starts: designers have to develop empathy toward users. They have to immerge themselves in the context learning from users with the scope to obtain information about their needs. Moreover, also enter in contact with experts of the field permits designers to learn and access in-depth knowledges. A final suggestion consists of seeking inspiration from an analogous contexts to obtain a new and fresh perspective.⁹¹



Source: www.dschoold-standford.edu

Define

This second phase of the design thinking process is focused on collecting and making sense of all the information gathered. After the divergent phase of the empathy and research, it is now the turn of a convergent phase.

⁹¹ IDEO, (2012), *Design thinking for educators*

There is a need to sum up in a certain sense what has been found until that moment. After having acquired the right competencies the designers process the huge amount of information collected.

What matters is to take the right perspective: if information is analysed in an erroneous way, there are two fundamental losses. First of all, omitting relevant information compromises the result of the process. Moreover, it represents a loss of time that can influence negatively the completion of the process in the right timing. Only if the information is analysed correctly the group is able to define which needs must be satisfied.⁹²

Defining means transforming chaos into clarity: with the knowledge and skills acquired, the group is able to define concretely and explicitly which is the problem. This is what it means to create a point of view: correctly defining the problems and the users' needs. Defining the problem statements and a set of narrow constraints helps the group in that moment stay focused on the objective and not waste time on other things. However, it cannot get in the way of a creative vision. The same is true for the needs. It is better to focus on a specific need and satisfy only that one rather than try to address copious needs without succeeding in anyone of them. Moreover, what is useful for the process is the formulation of insights, generally intuitively obtained by putting together some scattered information.

The creation of a correct point of view has to consider and combine the users and their needs, with insights as to obtain a kind of guiding principle toward the solution.⁹³ In summary, this phase of the process consists in two precise actions: analyse and synthesize.

However, which are the key activities to employ? They follow below.

First of all, there is the need to share information. It starts with the documentation that each member does about his thoughts and impressions after the first phase and with the sharing of personal findings with other members. A method to do it efficiently is the use of stories. Members must be able to listen to their mates actively.

Once the stories are shared, there is the need to find a meaning. The first action is the clustering of information in order help to the designers to make sense of findings.

⁹² D.school, *An introduction to design thinking, the process guide*, <https://dschool-old.stanford.edu/sandbox/groups/designresources/wiki/36873/attachments/74b3d/ModeGuideBOOTCAM P2010L.pdf>

⁹³ D.school, *An introduction to design thinking, the process guide*, <https://dschool-old.stanford.edu/sandbox/groups/designresources/wiki/36873/attachments/74b3d/ModeGuideBOOTCAM P2010L.pdf>

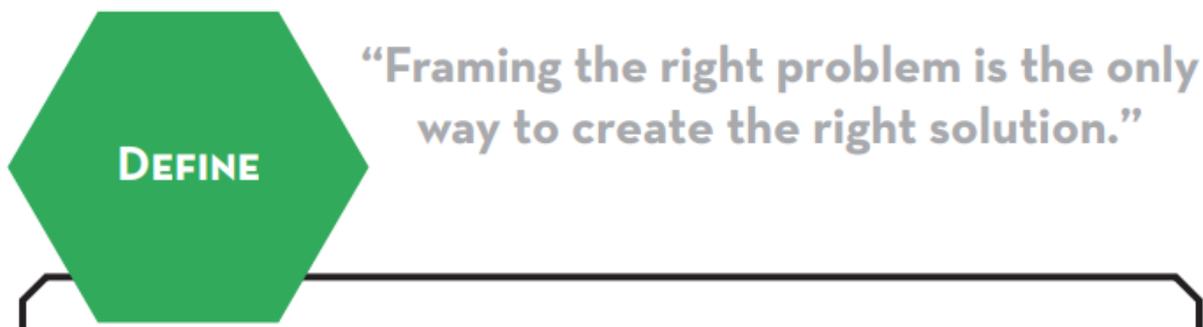
These are analysed and the group highlights links between different types of stories. It is important to leave behind immediately stories that are not as important.

In order to develop problem statements that act as a guide and that are useful through the whole process, it is a common to use the HMW questions. Combining the users' needs and the insights, the group have to develop questions on how they could solve a particular aspect of the problem. Those questions starting with "How might we..." can help member to open up to new ideas to solve a certain users' need. The propositions advanced from those questions should suggest how to make changes in the actual situation in order to empower and improve the experience of users.

More questions can be developed for the same insights in order to have then the possibility to catch and reasoning about multiple aspects.

A final tool of this phase is the definition of the different customers: the creation of the personas. In this way, the designers have the possibility to list all the possible users of their product or service. Personas are different from target. A target could be "Men, born in 1948, divorced with two sons". Take for example Prince Carlo and Ozzy Ousborne: they correspond to the target but surely their needs and preferences are different. Personas are useful to understand which are the different needs to be satisfied and for who the designers are particularly working.

Before starting the third phase of the process, it is useful to represents in a visual way all the needs, the insights and the HMW questions. This will help in fact to have under control without difficulties all the materials.⁹⁴



Source: www.dschoold-standford.edu

⁹⁴ IDEO, (2012), *Design thinking for educators*

Ideate

With this phase, the group gets to the heart of the process: it is in the moment of idea creation, where creative solutions are ideate to solve the problem!

The only rule that dominated the creation of idea is that there are no rules. This means that minds must be open and design thinkers have to think outside the box. The ideation in fact, requires a new divergent phase, after the initial one of the empathy. There are not wrong ideas, there are no limits, no idea is far-fetched, nothing has to be considered impossible and judgments must be deferred.

More than all, this last proposition consisting on separating the creation of ideas from their evaluation has to be considered the most important among the others.

The reason lies in the effect that it produces on the human mind: the member has the opportunity to making room for creative idea and while doing it, he/she appeases his/her rationality, knowing that the evaluation and examination will come later.

Members must try to go beyond obvious solutions: the design thinking process stimulates and foster the innovation toward extreme limits. There is the need of ideas that subvert the existing market; there is the need of drive to breakthrough innovations. The result has to be an extended set of creative ideas that are able to solve the determined problem identified in the previous phase. The same ideation phase helps users to develop and employ a different view of the problem. This could led to a wide collection of ideas that might open up a new perspective, requiring an iteration of the two initial phases, empathy and definition. In this way, there is the possibility to fix better the characteristics of the new idea.

The final step of the phase focuses on the ability of the group to evaluate the ideas and to conserve only those best ideas that worth to be prototyped in order to understand if they can work as a final solution.

The best technique to employ in this phase is without a doubt brainstorming.

First at all, the group has to prepare it carefully: Post.it™, pens and markers cannot be missing.

The presence of people who are not part of the group can be another ingredient to add to have a perfect brainstorming! Before starting, obviously, the group has to choose carefully some key words or concept around which develop the brainstorming.

Following the rules of not having rules, the brainstorming can start! Sessions of brainstorming are not so long; it is more productive and efficient to makes numerous but short session.

Once the topic is defined, a selected facilitator will facilitate the collection of different divergent ideas, writing them on a post it and posting them on the wall. The use of mood boards, a set of imagines that conjure up the concepts, created earlier can help designers to think about the brainstormed topic in a different way.

Once lot of ideas are produced, the group has to cluster them and voting for those that worth to be implemented. They can use different criteria to do this: the most creative idea, the most rationale choice, the one more unexpected and so on. Then it follows a sketch of the idea. A useful technique used to understand if the idea selected might work or to create further ideas is the brainstorming 635. Rohrbach ideated the method in the 1969.

The figures composing the name state for these indicators: 6 are the persons involved in the brainstorming, 3 are the ideas developed for each component and then 5 are the minutes of each session. Each person starts writing on a sheet of paper 3 creative ideas. After 5 minutes, each member passes the sheet to his mates at the right. At this point, each member can decide to implement the ideas already written by other members or can decide to add new creative idea. The brainstorming phase is finished when all members have written on all the sheets.

Once the idea is selected the group has to evolve it, trying to structured it more concretely thus developing a kind of list with the description of the most important aspect and its functioning.



Source: www.dschoold-standford.edu

Prototype

Until this moment, ideas are just thoughts. Each designer has on his mind which is the solution and how it works. There is nothing concrete. Moreover, there is the possibility that within the group each designer has a particular point of view about the idea, that can differs

a bit from others. How can the group understand which is the best way to implement an idea? Implementing it!

With the phase of prototyping design thinkers have the possibility to assess if their idea is good and works in a simple, cheap and fast way. In fact, in order to understand the efficiency and the feasibility of an idea designer do not need to print it with 3D printers, using technical and expensive material. A prototype is a scale down, rough and rapid mock up of a product rather than a service that is used to convey easily the idea behind it.

The goal of this phase is to permit designers to understand if their ideas developed in the previous phases work. They do it by making users enter in contact and live an experience with the prototype.

In order to assess the value of an idea, having something in their hands that they can try, use and experience, makes the evaluation easier and more trustworthy, with respect to an evaluation expressed after a verbal description of the idea.

The objective of this action is to obtain feedbacks from those who in real life will need and use the products or services. Only the interested users in fact, can give designers the confirmation of the feasibility and usability of the products. After that, designers have the possibility to maintain an idea if users are excited, to drop out an idea if it had not worked, to implement it with additional features if it lacks something or to redesign it partially. Each feedback, whether positive or negative, represents a fundamental element for the designer in order to deliver the best solution

All of this means that designers have the possibility to fail quickly and cheaply!

Another opportunity the prototype phase offers is the fact that it allows all the most valuable ideas to be pursued and to not encourage designers to be committed to a certain direction too early. It should be clear in fact, that there must be no emotional attachment towards a specific idea: designers have to be completely free personal preferences, and they have to build the prototype with the users in mind.⁹⁵

When groups of work come to this point there are different feelings: someone is happy because with his creativity can create a mock up just with cardboard and glue while someone other is terrified because consider a service impossible to be prototyped.

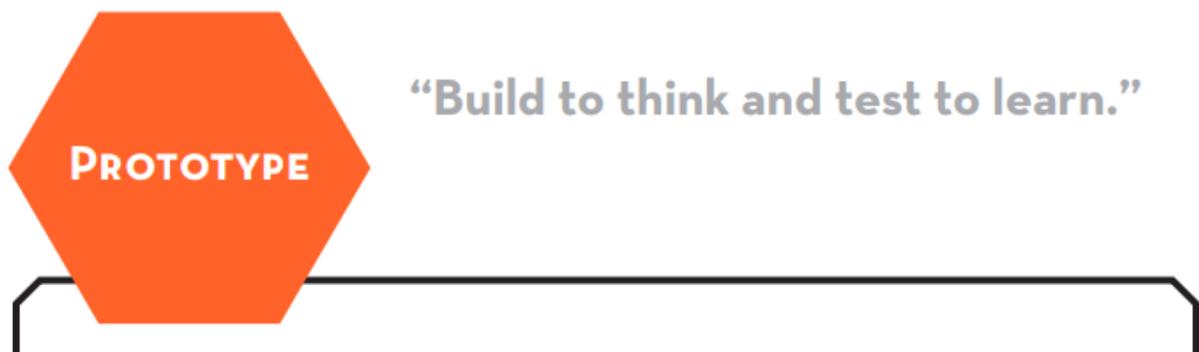
⁹⁵ D.school, *An introduction to design thinking, the process guide*, <https://dschool-old.stanford.edu/sandbox/groups/designresources/wiki/36873/attachments/74b3d/ModeGuideBOOTCAM P2010L.pdf>

There is nothing impossible: for example, through a reconstruction of the environment within which the service is provided with LEGO, it all becomes simple and funny. It's enough to move the little men within the space, explaining the user the different activities supplied to obtain a feedback from him. In addition to the well-known mock ups and models, the IDEO manual proposes as prototypes also play-roles and diagrams.

When the prototype is ready to be experienced the group has to decide who invite to the feedback session. Moreover, it has to create some open questions to gain as more descriptive feedbacks as possible, to understand which are the area in which intervene. There is the need of openness, critiques have to be accepted because are constructive. What is important is to take notes of all the arrangements users propose and to not miss anyone of them. Once gathered all the feedback the group has the possibility to evaluate the relevance of each one and decide which changes worth to be applied.

The prototype is iterated newly: the new version has to emphasise the characteristics already liked by the users and, more important, to being able to defeat barriers existing in the previous model.

A designer has to prototype until his work completely satisfy the users.



Source: www.dschool-oldstandford.edu

Test
In a certain sense, this phase has been described above. It consists of receiving feedback from the users when they interact with the prototypes. The mood designers must develop with users it is always the same: being open minded and being able to develop empathy. Designer have to catch the opportunity supplied by the test of the ideas. It in fact, furnished a further occasion to enter in contact and empathy with the users designers are working for. In this case, the empathy developed should be slightly different from that one of the initial

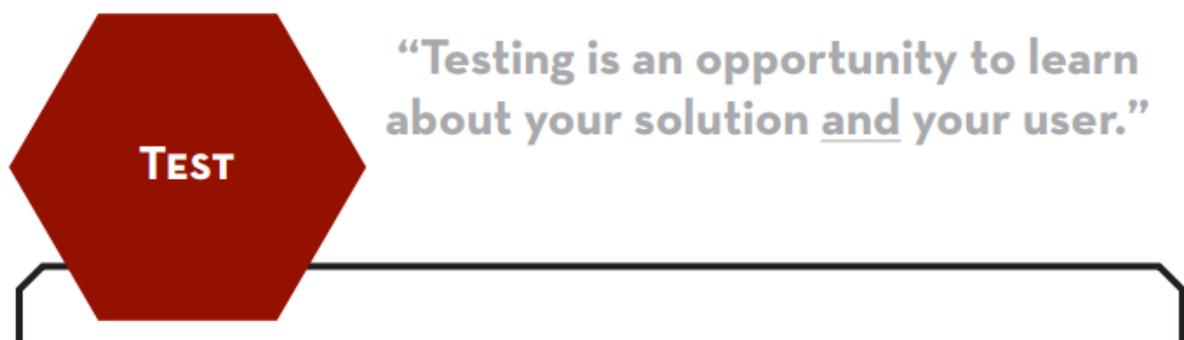
phase. It is different because now designers have clear which is the problem and they are ready to propose a solution for that problem and needs.

What interested them is not just things users liked or not, but the reason why. Having a conversation with users, making them talk as much as possible about their opinion, asking them why they would prefer A instead of B, grasping the tiniest details help designers understanding which are the changes necessary to make users satisfied at 100%.

Test the ideas is useful because it permits to refine the products or solutions until they reach their best version. In order to do this, it might happens that the process need to be iterated a not defined number of times. Reiterating the process permits to catch some details not considered at first instances.

Designers can learn from users that there is the need to just refine the prototype as they have to go back to the initial phase because they have failed to define the right point of view.

What the d.school suggest is to *“A rule of thumb: always prototype as if you know you’re right, but test as if you know you’re wrong—testing is the chance to refine your solutions and make them better”*⁹⁶.



Source: www.dschool-oldstandford.edu

⁹⁶ D.school, *An introduction to design thinking, the process guide*, <https://dschool-old.stanford.edu/sandbox/groups/designresources/wiki/36873/attachments/74b3d/ModeGuideBOOTCAM P2010L.pdf>

4. Active Learning Lab case study

4.1 The laboratory

Active Learning Lab is a laboratory of innovative teaching created by the University Ca' Foscari of Venice in 2015. The name itself of the laboratory suggest the understanding of his mission: it offers to students the possibility to learn new important methods for innovation in an active way. They enter in the business field bringing in it a breath of novelty.

During the process in fact, students, divided in interdisciplinary groups, face the resolution of real problems of holdings of the territory. The primary methodology applied during the process is the Design Thinking supported then by the Business Model Canvas and, since the last edition, by Lego Serious Play.

Since 2015 there have been six laboratories, the seventh is starting in these days. As it is for the design thinking process, the laboratory works with different typologies of businesses. The first two editions and the last regarded primarily the society. The topic were the urban innovation and regeneration, smart cities, and the sustainable tourism. The other topics have been the following: sustainability, agrifood, design and made in Italy and finally market innovation. Some of them are Favini, Unifarco, La Donatella, Stevanato and the municipality of Treviso.

Initially, the laboratory was open only to master students of the university Ca' Foscari, while since the two last editions it has extended the application to students of others universities.

It is important to highlight how the Active Learning Lab is structured.

The laboratory started as a collaboration with Fondazione Ca' Foscari and Azzurro Digitale. Fondazione deals with the contribution of the development in three important area: the economic, the social and the cultural one. With important funding obtained by both private and public institutions, Fondazione Ca' Foscari is able to realize services and activities and supply them to all the different stakeholders.

The primary objective of the insitution are the enhancement of the research and consequently the opportunity to seize important new possibilities of growth for the university Ca' Foscari.

The second collaboration necessary for the implementation of the laboratory is the startup Azzurro Digitale. Funded in Padua in 2011, it offers consulting services about digital transformation. They guide small medium enterprises during the transposition to the digital world or the development of internet of things through two methods: Design Thinking and Open Innovation. In fact, what Azzurro Digitale offers to the project of Active Learning Lab

are experts of Design Thinking process. During the six weeks of work, the students are never abandoned; in fact, they can rely on different people during the process.

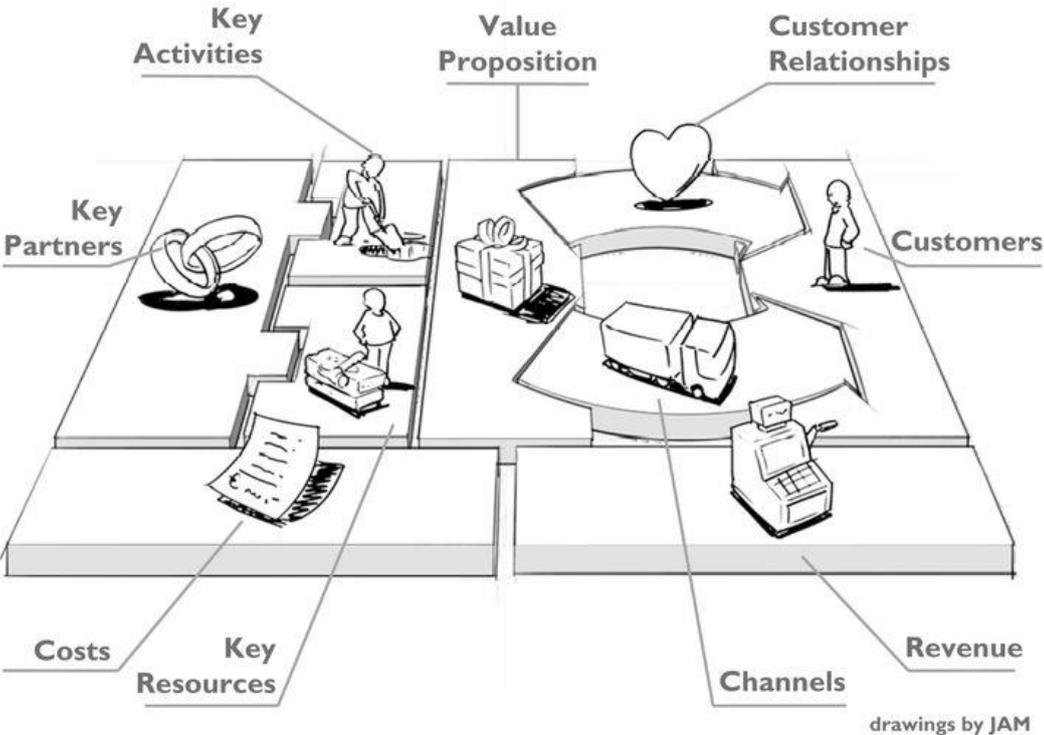
The most important figure for the students is Davide Boschiglia, a product designer that followed through the whole process the students, pushing them to rely on the structure of the process. Moreover, each group of students is entrusted to a facilitator. These persons, before the beginning of the laboratory, are rightly prepared with the different methodologies in such a way to be always prepared if the group found itself stuck during the process.

The Active Learning Labs are structured in the following way. The first week is educational, permitting students to approach the different methodologies implied in the process. Experts of the sector coming from Azzurro Digitale take the lessons.

As the theory and the practice of the design thinking process have been analysed deeply previously, before explaining the functioning of the Active Learning Lab, it is better to explain the other method employed in the laboratory.

Business Model Canvas

The Business Model Canvas is one of the most known method used by holdings and firms to innovate their business model. The core of the functioning of the method lies in the visual representation of the key point of the business, the way in which it creates, distributes and catch value from the customers. The picture illustrate the nine frames of work.



Source: www.businessmodelcanvas.it, The structure of the nine frames

The structure of the canvas in which people work resembles the previous, with the difference that the arrows become rectangles. When the canvas is printed, people, starting generally from the customer segment, start filling each rectangle with post it. Each rectangle responds to different demands.

'Customers Segment' generally is the starting point of the process. It permits to identify which are the customers to which the business products are addressed and if they are integrated in the business model. In this rectangle, designers describe the recipient of the products that could be the mass market, or a niche market, or the different segments. Without knowing for whom the business work, it could fail to assess the other frames.

'Value Proposition' regards what the business is doing, which are the business' products or services that deliver value for customers, which are customers' needs the business satisfying and why the business should be the first choice of the customers. There are different answers: the novelty, the customization, the price, the design, the brand. The value could be both qualitative and quantitative.

The 'Channel' frame is useful to identify which are the way through which the business reaches the customers. They could be channel of communication, distribution or sales. Channels represent the touchpoint between the business and its customers with which the same business deliver its value. The channel obviously depends on the segment of customers: different segments require different channel.

The 'Customer Relationship' outlines which are the relations the business establish and maintain with its actual customers in order to make them loyal to its products, or to acquire new ones. It briefly regards how the business interacts with its customers. Examples of these frames are the newsletters, the personal assistance after the sales, the communities and the co-creation.

Each segment of customers, through a dedicated channel, buy a product that bring him a certain value. This produce a stream of revenue for the firm. This is the reason why there is the rectangle 'Revenue'. It is important to analyse and make clear how and through which price mechanism the business produces value. The business analyses what each customer is willing to pay, the way with which he prefers to pay and so on.

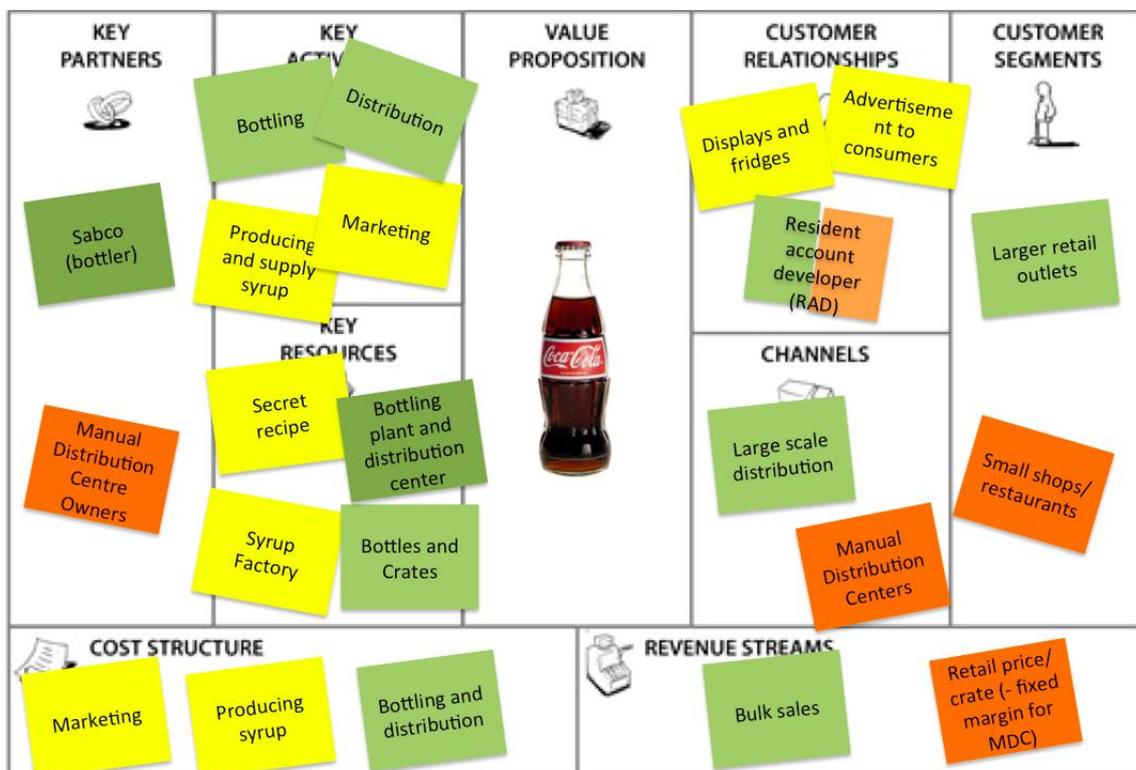
Each customer segment, reached through a channel, acquiring a product that offers a certain value bring to the firm a stream of revenue. More customer segments imply more streams of revenue.

The 'Key Resources' frame represents the fundamental assets that an organization needs to create and sustain its business. The resources could be financial, human, physical or intellectual.

Another frame is the one of 'Key Activities': in this category are listed all the activities the business need to carry out in order to supply its own value proposition, to reach new possible customers and maintain them. All of these activities at the end are useful to generate stream of revenues.

It happens regularly in the business sphere organizations rely on external figures to carry on their business. The 'Key Partner' frame is the rectangle of reference. The business uses partners for different scopes. It can externalise the development of key activities to partners because they could be more expert and have precise technical expertise for the development of a particular object. Moreover, partners can provide the business key resources not reachable in others way.

Finally it comes the 'Costs': only once the organization understand its infrastructure of the business it is possible to derive the amount of the cost in which the business itself will incur. It analyses which is the cost of each activity, which are the costs of resources and the possibility to implement economies of scale or of scope.⁹⁷



⁹⁷ Osterwalder, A., & Pigneur, Y. (2012). *Creare modelli di business. Efficace per ispirare chi deve creare o innovare un modello di business*, Fag, Assago (ME).

Source:www. ctcentrepneur.com, Coca Cola business model canvas

The example of the Coca Cola business model canvas makes clear the functioning of the method: each customer is associated with a colour and it will be used in all the other frames. It will facilitate the lecture of the canvas.

With this simple and extreme intuitively structure, the Business Model Canvas permits everyone, with different background, to understand all the complex elements that are implied in the functioning of an enterprise.

The method in fact, favoured the comprehension, the analysis and the discussion of the business and at the same time creativity and sharing.

The model has changed in the three laboratories where the topic was the urban innovation. When the organizations partnered with the Active Learning Lab played a role in the society, it satisfy social needs and it derives value directly for the society. Due to this, the Business Model Canvas become Social Business Model Canvas. The structure changes a bit: due to the diverse structure and the different interests of a social enterprise in respect to business enterprises, some frames are added, to have a complete view of the business model.

Within this method, what is important is to highlight the 'Mission' of the organization to be implemented in the society and so its social value proposition. Moreover, it has to be clear the 'Problem' the social enterprises wants to solve and the 'Needs' the 'Beneficiary' have. Furthermore, this model adds the figure of 'Competitors' and of 'Donors'. Enterprises working on the third sector in fact have the possibility to collect resources from the external environment. Examples are foundations by banks, by private citizens or enterprises.

Once the students have understood the Design Thinking process and the Business Model Canvas they are ready to start practically the work.

The Lab's structure

The businesses involved in each laboratory are 4 and the total number of students are 40. In this way, creating groups by 5 persons, there are two groups working for the same enterprises. This puts students in a competitive environment as the one in which each business find itself every single day.

The first week of the laboratory ends with the Blue Wave. It is 30 hours full immersion session of work in which the group accelerate the solution of its design challenge. This permits students to get into the heart of the process and understand the business for which they will work for the others 5 weeks. In fact, during the first hours of the blue wave each group meets

for the first time the enterprise for which it will work and has the possibility to ask all the possible information to the managers.

They receive a small design challenge to develop during the 30 hours and then, at the end each group present to its innovator the work done and receive feedbacks. This serves the students to understand what the firm is expecting from their work.

Then from the second week the groups reset all. They receive a new complete design challenge and they start employing the methods. Each week correspond to a phase of the design thinking process. The work progresses in the following way.

The first phase is called Research. Inside the group, the members divided among themselves the areas that are important to analyse: the history of the business, its competitors, the technical research linked to its field of work and most of all which are its customers. In fact, it is important to remember that the method implied is human-centred and the groups have to design for customers, not for themselves. During the week, they have to fulfil also the business model canvas with the information obtained about the value proposition and the customers. At the end of the week the group presents its outcome to the expert that help them to understand if they have centred the topic.

In the second week, the 'Analysis' they develop a deep knowledge about the customers, entering in contact with them. Through personal interviews or online questionnaires, the group has to understand the relations the customers have with the product or service create by the business for which they work. According to its design challenge in fact each group draw up different questions to obtain information they consider important for the resolution. This is the most important phase because students cannot fail to identify the target for which they have to work. This analysis week is important for the groups to fix on the business model canvas the information searched the previous weeks about the customers, their needs and the relationship with the business.

In the third week students gets into the heart of the process: the Ideation. They identify some principal key words related to the challenge. Using the tool of brainstorming then they start creating as many ideas as possible, without any limit. Other tools used are the mood boards, the mind maps and the brainstorming 635. From the burden of alternatives then they evaluate which ideas represent a hypothetical design path. For what concerns the business model, during this week the designers identify which are the key resources implied to develop the activities performed by the business.

In the 'Prototype' week each group implement the design path they have choose between all the alternatives. It is important that with a piece of cardboard, glue and scissors also the most complex elements are reproduced. Active Learning Lab is opening itself to other methods of work. One innovative methodology implied in the whole process but especially in this phase of prototyping, licensed by LEGO, is the Lego Serious Play. It offers to businesses the possibility to enhance the innovation and their performances. Reproducing the context of the business and the new ideas with LEGO the designers have the possibility to build a story within which the new different scenarios are represented.

Prototyping permits each group to understand if their ideas are feasible to be produced and if users are satisfied or not. In the business model, this phase helps fill out the frames of costs and revenues.

Finally, it comes the 'Test' week, the last of the Active Learning Lab, where the final ideas are presented to the firm. Students finally discuss the idea, the pro and cons directly with the managers.

Consequently, the firm decides if implementing some those ideas or not. However, it is important to mark that some students, thanks to the Active Learning Lab, started a period of internship in the firm for which they have worked.

4.2 The analysis

The scope of this research is to delve into the study of the presence of cognitive biases in the process of design thinking. As written before, Jeanne Liedtka with her paper for the first time has envisaged a possible link through design thinking and the cognitive biases. In her research, she identified six propositions claiming that design thinking as a method for innovation reduces cognitive biases. The research of the authoress however, being the first that explore this field, lacks of an analysis on the ground that demonstrate if her assumptions are valid or not.

This has been propositions by which this thesis started.

If no one else has already done it, this research wants to bear out if the propositions of the authoress are effective or not. It could represents a starting point for further scientific research, aiming at confirming a relationship between innovation and cognition.

This research started with those personal curiosities needed to be solved: is it true that the design thinking process reduces cognitive biases? Which kind of relation could exists between an innovative process and errors produced by people's cognition?

In order to respond to this answer the necessity of a case study arouse. Active Learning Lab had been selected to prove if Liedtka's thesis should be validated or not. The reason of this choice has been the personal experience witnessed first-hand with the laboratory, firstly as a participant student and then as a facilitator. The fact of having used the method first-hand, know its functioning and having seen from an external point of view the work progressed has pushes myself to undertake this line of research.

The structure of the research is such that it analyses if and which biases have resisted, influencing the design thinking process and provide motivations and episodes of the fact. The research in order to investigate biases' presence and confirm or not Liedtka's thesis, has needed a double analysis: quantitative and qualitative.

The first analysis carried out has been the quantitative one. Through an online questionnaire addressed to 80 students who have attended the laboratory, it looks over which biases resisted and in which phase of the design thinking process. The qualitative research followed. It served to investigate how the biases had resisted, interviewing the students by telephone with detailed questions. The narration of episodes that had happened has been useful to contextualize previous answers. Finally, students' qualitative answers have been analysed through a scientific structured method, the Gioia method.

Quantitative analysis

The first analysis has been important to understand if there were the basis to take on the research. The reasoning behind the creation of the questionnaire has been the following. Starting from the eight biases that affect the innovation process proposed by Liedtka, there have been created different questions for each bias in order to understand if the bias was present or not. The second step has been the clustering of these demands according to the phase of the process in which the bias related tend to emerge.

These are the 38 demands asked divided in the different phases of the process.

Information gathering (Research and Analysis phases)

1. I took into account only my experiences.
2. Once known consumers' preferences, I reported similarities with mine rather than discrepancies.
3. During the research phase, I preferred information that were supporting mine.
4. I excluded ideas and information that contrasted mine.
5. I gave less importance to ideas and information different that mine.
6. Since exploration phase, I hypothesized a possible solution to the problem.
7. I hypothesized a solution to the problem and then gave up it because I did not found confirmation with consumers' needs.
8. Before developing possible solutions, I waited to discover consumers' needs.
9. I have sought similarities between my ideas and consumers' ones.

Create solutions (Ideation phase)

1. I have been influenced by my experiences in conceiving innovative ideas.
2. I took into account common experiences with consumers and I rest on them the new idea.
3. In conceiving new ideas, I have evaluated data that were contradictory to my certainties.
4. I had difficulties to give up my first idea.
5. I took decisions without thinking about them too much, being influenced by "hot state". (Optimism, excitement, stress etc.)
6. I pondered my choices mainly in a "cold state". (Calm, rationality, restraint).
7. When thinking about innovative ideas, I imagined all possible solutions, feasible and not.

8. When taking decisions in “cold state” I lost my instinctive component.
9. I did not consider important solutions that were difficult to imagine.
10. I preferred incremental innovation.
11. I have been as objective as possible, not being influenced by my mood.
12. I considered possible opinion’s changes due to a mood opposite to the current one.

Test idea (Prototyping and Test phases)

1. I emphasized on some idea’s attributes without took into account other attributes’ effects.
2. I left out the evaluation of specific attributes that I considered less important.
3. When forecasting the future utility of an idea, I gave the same importance to all the attributes of the idea.
4. When forecasting the future utility of an idea, I analysed the effect of specific attributes, to the detriment of others.
5. I considered the hypothesis of change in the attributes of an idea.
6. I analysed deeply those information discordant with my ideas.
7. I searched similarities between my ideas and those ones of the customers.

Final project evaluation

1. I evaluated my project identifying myself in the final consumer, with experiences and preferences different from mine.
2. I evaluated the final product upon factors different from the ones of final customers.
3. I planned an alternative in case of unsuccessful project.
4. During the project, I have been able to distinguish my preferences from the consumers’ ones.
5. I considered the possibility of success greater than the one of failure.
6. I evaluated my ideas as infallible.
7. Once known consumers’ preferences, I put in evidence similarities with mine rather than criticality.
8. Being too sure about my ideas has been unproductive.

The method used for the administration of questions had been a Google Form. The respondents were asking to evaluate the degree of occurrence of the different facts and so of the different biases.

The possible answers were structured in this way.

Never	Once	Sometimes	Often	Quite Always
<input type="radio"/>				

Among the 80 students to which the questionnaire was forwarded, a total of 60 responses have been collected. To start the analysis, the answers have been catalogued in an Excel file. For each question, it was calculated the different percentages of any answer. Then, questions were valid and thus analysable only if the percentage of 'Sometimes', as the neutral answer, was less than 50%.

The answers conducted to the following results. It has been confirmed the presence of four biases with an incidence greater than 50%: it means that more than 30 people over 60 have confirmed the presence of the bias.

The biases and the relative answers that confirmed the presence follow.

I considered possible opinion's changes due to a mood opposite to the current one.	I analysed deeply those information discordant with my ideas.	I searched similarities between my ideas and those ones of the customers.	I considered the possibility of success greater than the one of failure.
BIAS	BIAS	BIAS	BIAS
Hot & cold	Hypothesis confirmation	Egocentric empathy	Planning fallacy
PHASE	PHASE	PHASE	PHASE
Create solutions	Test of solutions	Test of solutions	Final project

Personal characteristics of the positive respondents as the age, the gender and the educational background did not seem to have played an impact on the results.

Qualitative analysis

The confirmation of the some bias's presence has trigger the necessity to understand why these biases resists to the process of design thinking through their opinion and through episodes happened during the six weeks of work.

In order to do it other questions have been drawn up.

- 1) Have you had difficulties in detaching from your own ideas and preferences? Have you had difficulties in developing empathy with customers?
- 2) Can you explain me an episode of over-identification with the customers?
- 3) Do you think that the design thinking process as it is structured, helps people overcome these difficulties?
- 4) When coming up with a product or the final solution it could happen that not all attributes are taken into considerations (costs, economic feasibility, technical feasibility, etc.). Has it happened to you and your group? Which were the reasons?
- 5) Is here something that makes difficult to imagine possible changes of the idea in the future? Does design thinking help designers to think about possible changes?
- 6) Had your mood influenced your actions and decisions? Is there a particular episode that worth to be cited?
- 7) During the innovation process, it could happen to take into consideration and prefer those ideas and information that support personal ones. Had it ever happened to you?
- 8) Which are the weakness of the design thinking that permit this happening? In your opinion, could the process be structured in such a way that it does not happen eliminating the subjectivity of designer?
- 9) If there have been, which have been the difficulties in giving up the first idea?
- 10) Do you think optimism had play a role in your project? Do you see it as a positive or negative thing?

The number of students interviewed is 20.

When analysing qualitative data often there is the risk to follow personal interpretation and this could cause to question the veracity of the analysis itself. During these years in fact, the qualitative research has been criticized because of its lack of rigour in the analysis of data.

Due to this, in order to confer a certain validity to the research the Gioia method is used.

The authors explaining the functioning of traditional methods of interpretation highlighted the necessity to overcome the reliance of existing and already known constructs upon which

people elaborate information. Acting in this way, there is the possibility to miss something with a meaning in the elaboration. They provided an elaborated systematic inductive approach working in this way. *“We do not presume to impose prior constructs or theories on the informants as some sort of preferred a priori explanation for understanding or explaining their experience. This means that we make extraordinary efforts to give voice to the informants in the early stages of data gathering and analysis and also to represent their voices prominently in the reporting of the research, which creates rich opportunities for discovery of new concepts rather than affirmation of existing concepts.”*⁹⁸

The method requires the representation of information in a systematic way: researchers take both in consideration the information coming from the informants and the information grounded on the theory with which interpret informants' responses. In the research the former will be called evidences while the latter codes. This serves to do not fall in the “going native” trap: lot of times it happens that immersing himself in the context the researcher loses his neutral perspective becoming too influenced by the interview's point of view.

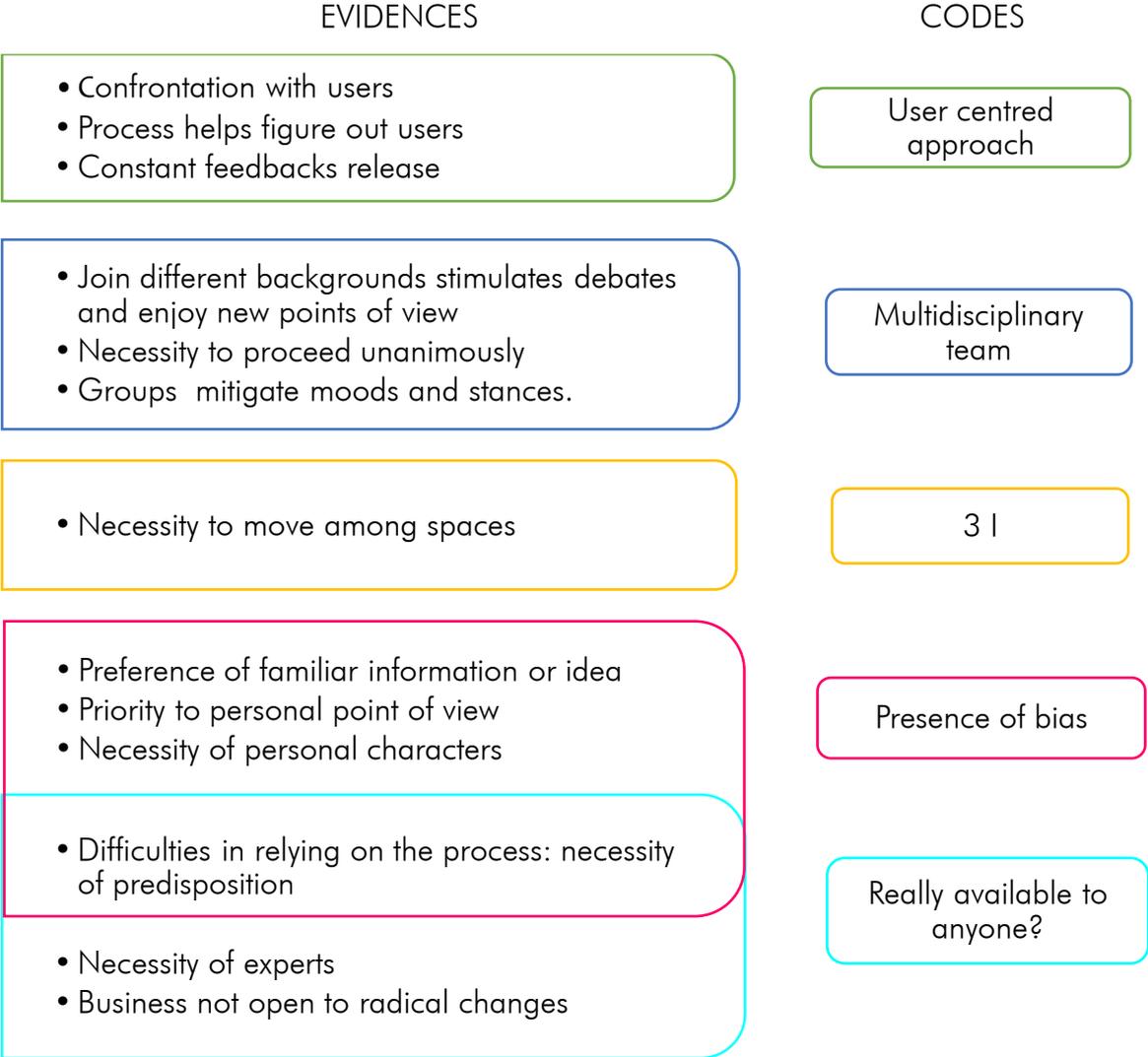
The method requires the first analysis of all the responses as the respondents namely express them and an initial subdivision on different categories. In order to do it, it serves to have all the responses under control. Obviously, the categories are at the discretion of the researcher. The similarity between categories permits them to be merged to have a complete view on a determined area of a topic. In this way, the researchers collect all the evidences they consider important. In addition, an episode that comes separately may be fundamental as others coming copious times because it can help to depict aspects otherwise missed. To describe what a category or the combination of these mean there is the possibility to create a descriptive label. Once the clustering is done, there is the necessity to understand if the phenomena observed and the emerging themes recall aspects of the theory by which they could be explained.⁹⁹ It comes the moment of coding. Different evidences or a group of similar ones can conduct to a specific theoretical area that support the informants' opinion. The necessity to analyse also singular happened episodes at this stage permit the researchers to deep and explore new field of knowledge.

⁹⁸ Gioia, D. A., Corley, K. G., & Hamilton, A. L. (2013). *Seeking qualitative rigor in inductive research: Notes on the Gioia methodology*. *Organizational Research Methods*, 16(1), 15-31.

⁹⁹ Gioia, D. A., Corley, K. G., & Hamilton, A. L. (2013). *Seeking qualitative rigor in inductive research: Notes on the Gioia methodology*. *Organizational Research Methods*, 16(1), 15-31.

The application of Gioia’s method in this research started with the transcription of all the answers in post it in order to not being influenced by the respondents. Once transcribed all the quotes different categories arouse. The categories identified were Anchoring, Predisposition to change, Empathy, Creativity, Design Thinking process, Errors, Consumers, Optimism, External environment, Communication both positive and negative, Theory denial and Group’s work.

It is important to mark that each quote could belong to different categories because these links help contextualize the event and develop a clear vision of the fact in reference with the theory. In fact, it has been thanks to these links that the first evidences come at hand. Visually, having under control the quotes and the realm of belonging facilitate the work. Appendix X reports the conduct of the method. The results of the analysis are summarized below.



Results of the first three evidences and the following codes confirm the theory about design thinking and what Liedtka advanced as propositions in her paper.

Let analyse the results in order.

1. The first element of theory identified by the interviews is the confirmation of the human centred feature of the process. Liedtka in the paper started her researches with a review of the principal characteristics of the process and highlighted the necessity to focus each efforts on the relationship with customers. The centrality of the customers and users is fundamental in this process. The authoress identifies tools as the ethnography in order to conduct researches on users and interacting with them in order to catch further details. Within a human centred design, outputs are not just a matter of style. The result of the employment of this kind of approach is a product created "ad-hoc" for each user. In order to understand the reasoning behind the necessity of a human centred approach an example is proposed. Let think about the surrounding environment in which people live. It is thought and developed for an average user: a person with an average weight, height, balance that sees and hears without any problem. However, the necessity of an external environment that respond to personal needs is the same also for people that do not belong to the average. Thanks an increasing importance of users' satisfaction, human centred design proposes itself as a method to design at personal level.

Students of Active Learning Lab got the point sustaining "*I was not working for me, I was working for others. They were the centre of my project*".

The theoretical coding of the human centred design has arisen thanks to three evidences labelled as follow that will be analysed one by one.

- Process helps figuring out users

Students consider the two first phases of the process, research and analysis the most important of the process. They appreciate the lectures about the initial phase and the explanation of the methods through which reach the objectives of customers' knowledge within the two first weeks. In fact, it is thanks to the knowledge of the phases and the related tools that students were prone to approach customers and understand their needs. The tools used most to figuring out the users has been the ethnography research as it testify this quote "*I was working for Dolomia and doing the research I found that exists, albeit narrow, a portion of cosmetic market addressed to men. I stupidly though they used female products.*"

- Confrontation with users

"The process encouraging the interaction and confrontation with users helps us when we had too much or no one idea" is the proof of how the process as it is structured with its tools make clear the centrality of users and the need to always take them into consideration. The confrontation helps the students and the designer be aligned with the customers. No misunderstandings are allowed. It is not enough understand which are the users' needs: designers need to talk the same language of users to catch latent thought. Only through a confrontation with them is possible to understand how to behave in order to collect as more useful information as possible. *"We were focused on our objective and we talked our language. Once confronted with a disable we understood he was talking another language from us. Continuing to keep the same attitude would have bring us to no results. Confrontation had help us to change the way to approach our users. Thanks to this we obtained information."*

- Constant feedbacks release

The initial phases might be the fundamental ones but without the following, the process could not be completed. When the process gets into its heart, the result is a prototype that needs to be tested. In fact, a designer cannot stop himself to the knowledge of users' needs. It is the starting point because the interaction with users needs to continue until the test of the idea. The most important contribution people play in the last phases of the process is the release of feedbacks that help students be on point because *"If a product does not completely satisfy the customer it makes no sense to continue"*.

The importance of feedback and so of users' centrality confirms the Liedtka's thesis about the reduction of the endowment effect. In fact, when designers understand that an idea they have does not fit the users' need, they make no difficulties in giving up it.

In fact, a guy working for the project of social lighting explains that *"At the beginning the idea was to develop a mobile app to interact with street lamp. Consumers said us that they would never download an app and then make us think about a totem"*.

2. A second code is the one that talks about multidisciplinary groups. It is well known that multidisciplinary teams foster the innovation because a point of view of a person with a background different from the personal one can integrate and implement personal point of view. All of this enhance the creation of innovative ideas. This is the principal reason why multidisciplinary team are implemented in the design thinking approach.

A related research finds out and validate all the possible benefits of multidisciplinary teams: improvement of communication abilities, fostering of collaboration skills, improvement of sense of achievement and professional abilities. Moreover, multidisciplinary works gives members the opportunity to be acquainted with the process development and to complete the personal vision with others' one.¹⁰⁰

Also if it has not been always simple as someone confirms sustaining "*the personality of the members have prevailed over the method*" the results confirm the necessity of multidisciplinary team. There have been three evidences.

- Join different backgrounds stimulates debates and enjoy new points of view

When dealing with people with the same background always it happens to give some idea or information for granted. Entering in a multidisciplinary team where members have knowledges different from the personal ones throws people. As this girl saying "*I was coming from a humanistic master degree and I had to deal with people obsessed with economic and managerial topics. My extravagant ideas made me feel sheepish*". It is not always easy but it permits to work better.

Within the six weeks of laboratory however, each group has found its balance because each personality compensated others and no one felt superior to others.

It happens quite the opposite. The best pro of the multidisciplinary students highlight in fact, is the opportunity to find out and enjoy points of view different from the personal's one because "*there is always a the necessity to learn more*" and "*I give up my idea because others were better and I preferred to embrace them*".

The theoretical view on the achievement of a better work through a team that have multiple and diverse knowledge is then confirmed in different interviews. Multidisciplinary needs to be a rule without exceptions. A person sustains that "*there is the necessity of a schematic person and a creative one, but also of someone mediate the parties*".

It is a topic of interest for different students the heterogeneity of the group: someone sustains that there is the necessity of a bit of luck because the characters need to fit together, someone supports the need but highlight the importance of meet the team-mates before the beginning of the laboratory.

¹⁰⁰ Tang, H. H., & Hsiao, E. (2013). *The advantages and disadvantages of multidisciplinary collaboration in design education*.

- Necessity to proceed unanimously

"Everyone thinks to have the most brilliant, ingenious, beautiful and infallible idea. Then you start discussing about it with others and a pair of contradictions makes it lie."

Often people fail to recognize the potential of personal ideas. They believe they are unbeatable just because it satisfies a certain need in a phantasmagorical way.

However, it happens only on those minds because when they have to explain the concept it loses all its magic. In fact if someone moves a critique that the designer has not thought about the enthusiasm tone down. The confrontation with the group is useful to pursuing good results that are feasible, desirable for the customers and shared by the members of the group. If just one member of the group is not completely sure about the potential value of an idea there will be never the possibility that the outcome is great.

Obviously, when explaining personal ideas people need to *"find the right words to express a concept because having a different background a misunderstanding can easily happen and create turmoil with no reason."*

A girl that expresses the necessity to create in each week an opportunity for dialogue inviting also external people to participate offers another point of view on the favour of this topic.

- Groups mitigate moods and stances

At least the 80% of the interviewers when talking about how their moods influenced the work explain that the fact of work with other people mitigates, if not entirely wipes out people's personal mood. In fact, *"I may have had pissed or my thoughts but once entered in the lab they go away. I was not the protagonist, we were working for others and we need to do it at best of our possibilities"*.

If people mood was not completely annihilated, people make sure to explain that personal mood has never influenced outcomes. Maybe *"I was annoying them more than usual but the outcome did not suffer for it."*

Moreover, another point of view of this evidence highlight the mitigation of stances. It could happen in fact during six weeks of work that someone is totally convinced of his idea that do not want to listen to reasons. In this case, a single case of resistance happened: *"During the brainstorming, as the method asks, I and my group were diverging thinking about possible topic around which construct a brainstorming. The concept was a little bit strange but we were excited by the possible ideas that could have been generated. Unfortunately, a member of my group during the brainstorming resisted to take part because she was thinking*

we were exaggerate". In that case, the group did not stand a chance, but fortunately, it has been only an isolated case. In fact, as the previous point argues, thanks to confrontation people had been able to understand their idea was not so brilliant and stances cease.

The last perspective on the stances regards the perspective of a boy explaining the "*need of smart group: no prejudice can interfere with the creation of an idea. You cannot reject an idea just because it comes from a member that you do not like.*"

3. This is the last code that sustains the theory and it regards the 3 I. As Tim Brown explained in his paper Design Thinking for social innovation, and as the first chapter reported, the process is represented better by a system of interconnected spaces rather than a sequence of different steps coming orderly one after the other.¹⁰¹

- The necessity to move among the spaces has arisen in different interviews conducted. Students in fact, have recognized the necessity to be free to loop back at a previous phase or iterate some phases different times in order to deliver a product of which they were convinced. In a structured laboratory as it is the Active Learning Lab unfortunately, the timing is restricted and students need to complete their tasks within the six weeks following the five different phases. The timing's issue in fact have influenced negatively the process in the opinion of the students. However, turning back to the code, the research highlights the necessity to move as a confirmation of Brown's theory and so see the point as a positive one even if the students has reported it as an opportunity they needed but that was not available. It happens in different situations and here the research proposes the changes they would have like to implement during they process.

After the ideation phase for example, a group identifies the need to reiterate the interviews in order to be more focused in the questions to ask to respondents to gather more concrete opinion about their idea or discover new possible path with which implementing the idea. In a certain sense, it resembles the proposition of another student that thinks groups "*should done the brainstorming at the initial phase. I mean, with the two first phases, the research and the ideation you start thinking about a solution. In the third week when it is required to diverge another time, you already have an idea and you are blinded to it during the*

¹⁰¹ Brown, T., & Wyatt, J. (2010). *Design thinking for social innovation IDEO*. Development Outreach, 12(1), 29-31.

brainstorming, like it or not. I think one should have the possibility to carry out the brainstorming as the first activities and then proceed with other phases."

Another final opinion confirms the need to use Design Thinking as a system of overlapping spaces because the five different phases are too compartmentalized and sometimes it has been difficult the transposition between the different phases.

Now it comes the moment to face those results that contradict the theory. The arguments hit the Liedtka's propositions about the reduction of cognitive biases and the grounded theory of Tim Brown and followers that sustain that anyone can be a designer and design thinking is viable to everyone.

4. As the study was focused on the presence of cognitive biases in the design thinking process, this part represents the core of the research. The whole analysis has been conducted in order to try to find confirming or disconfirming data about Liedtka's propositions.

Recalling the results of the qualitative data, the answers showed up that just four questions in respect to the totality of 38 confirm the resistance of biases. The biases manifested were hot & cold, planning fallacy, hypothesis confirmation and egocentric empathy but only in determined circumstances. In fact, just within four specific situations the biases were confirmed. Due to this reason, it arose the necessity to confirm or less the resistance of biases to the process but in a general manner. The demands of the qualitative analysis in fact, at the contrary of that of the quantitative, had been not related to a specific moment of occurrence. This permit to investigate in a more efficient way the presence or less of biases. In fact, it could happen that a bias resisted in a certain situation but not in the one presented in the question as it happens in the quantitative analysis. This in a certain sense, biased the findings. In order to avoid the reliance only on that data, a further qualitative analysis occurred; what was missing before were the narration of the events and the moment of manifestation that had depended from one person to other.

Four fundamental evidences are the results that count as a response of the research.

- Preference of familiar information or idea

This first evidence represents the manifestation the availability bias. The authoress Jeanna Liedtka in her paper illustrates the bias as a threat for novel and breakthrough ideas. She sustained that the bias arose at failing the moment of the test the idea: when testing in fact, people tend to settle for ease and familiar idea and so for an innovation that will be incremental but will not shock the customers.

In her opinion in fact, the perfect tool to mitigate the bias is a mix of pre-experience where assumption are tested, followed by a deep reflection on results. The authoress sustained that collecting profound feedback from users and coupling them with ethnographic methods brings to a reduction of the bias through *"increasing the array of options considered and reducing the undervaluing of more novel alternatives"*¹⁰².

Interviews conduct to different results. The first thing that comes at hand is the misunderstanding created by classification made by the authoress: she puts the presence of the bias in the testing of idea, more than in its generation. In fact, responses highlight that the bias manifested itself greatly in idea generation rather than on the testing. This is the first point that contradicts Liedtka's proposition. The bias should be described as belonging to the first category, more than the second one. However, this would favour just a best comprehension; it has little to do with the theory.

Turning back to the results threatening the paper, a copious number of answers demonstrate that students tend to be unimaginative during the creation of innovative idea, preferring familiar information.

"We were dealing with the creation of an urban centre. It was an utopian project as utopian were the information gathered by customers". This quotes highlighted the necessity to start the analysis from information students already known because they had the need of initially protecting themselves from the external unknown environment.

In fact, even if the process of design thinking pushes toward divergence of thinking, it is a mechanisms of protection that trigger the manifestation of the bias.

In the idea's generation the availability bias had play its role newly. As a students reported *"It has been more easy to continuing with an idea that was easy and familiar, not surprising, that everyone could understood rather than convincing some members to changes to a more radical one"*. Even if it has happened only in one single group, this quotes is the demonstration that the bias occurs and it could be said that it is not so negative. In fact, a transversal view on the topic highlight the need to rely on familiar information in order to produce a solution otherwise missed. As it has explained before, it is just enough that a

¹⁰² Liedtka, J. (2015). *Perspective: Linking design thinking with innovation outcomes through cognitive bias reduction*. Journal of Product Innovation Management, 32(6), 925-938.

single member disagrees or does not follow the common idea to cause the failure of the group.

- Priority to personal point of view

This second evidence of the manifestation of cognitive biases represents the egocentric empathy gap. The bias impedes the development of the human centred process because the designer is trapped in its own preferences and does not develop empathy to understand users' needs. Sustaining that the bias affects the creation of novel idea, the authoress proposed that the process of design thinking mitigates the happening thanks to the tools of ethnography and perspective-taking that push the designers in the shoes of other persons. Obviously, not all the students have contradicts this theory because they tried to rely completely on the tools. They immerge in the context because it was asked. However, what is interested for the research are the conflicting and disconfirming data.

"We had to deal with person disposed to spent 15.000 € for a sofa. They were quite impossible to find in short term and the firm did not helped us. We imagine with our preferences their needs".

This reason by which the bias has happened is clear. It is not always so easy enter in contact with the customer for which designers have to work. In fact, the needs that create the necessity towards niche markets as luxury products are very difficult to understand if there is not a customer that explain it. The starting point of the process becomes personal preferences. However, if this vision could be questioned because it has not been a choice but a necessity, the following surely not.

"I wear glasses and so I was part of the target. I used my personal preferences as sources of information".

This quote offers a reflection. She was thinking to doing the right things because who better than wear eyewear can understand the need of someone wearing eyewear? This is ok, but the bias arises when it becomes a matter of superficiality. In this situation in fact, the student in a certain sense justified herself with the excuse to be part of the target to not having entered in contact with customers. She failed in taking for granted that each other person wearing eyewear would have had her same needs. In fact, she would have identified different personas as users of eyewears. What it means is that in this specific case of eyewear, the needs of people wearing eyewear just for fashion are different from needs of people that suffer of infection and are visually impaired. Concentrating only on personal preferences

she completely eliminates the preferences and the needs of other users. This is the reason why working with target is not so useful. The necessity is to identify all the personas having interests.

- Necessity of personal characters

This is maybe the most difficult result to explain. In a certain sense it incorporates the occurrence of multiple biases in a single fact. Liedtka in the second part of the paper highlighted the importance of the accuracy in testing the hypothesis of idea. She sustains that designers lot of times are imperfect because of different reasons: optimism, unimaginative and passionate to personal ideas.

Let image a mix of the different biases. It could be difficult. However, it could happens. Gioia's method, by imposing the fact of having under control all the answers listed as factual elements not bind answers to the questions, made possible to identify this mix.

The results in fact challenge the discussion of the authoress.

Different people interviewed have shared this vision up to the point to define it as an evidence. The general opinion could be resumed by this proposition: A project completely objective and perfect becomes impersonal and could not be defined as creative.

The quote touches even if not openly, different points of discussion of the paper of reference. The demands that provided answers were focused each one on a specific bias. The result of the necessity of expression of each people's personal character find basis on the occurrence of the second category's biases. Students claimed the importance of optimism, attachment to personal ideas and their support as positive factors and do not believe that the happening of these biases had been counterproductive. Respectively, they talked about planning fallacy, endowment effect and hypothesis confirmation. Let proceed with order.

When concerned with the first bias, the planning fallacy, Liedtka sustained that being over-optimist about own projects can cause a counter effective role in discerning possible weaknesses of the idea. About the fact of have been optimistic or not, students reported different points of view. Basically, they sustained to have been optimistic in relation to the timing and the success of their proposals. The most expressive answer that display the need of optimism during the process reported "*Pessimism destroys creativity. You need to be excited and proactive to reach the objective*".

The other opinions about the risk of over-optimism stating "*Optimisms is never enough*" because "*positive thinking stimulates the cohesion of the group and it consequentially works*

better" confirm the necessity of working without paranoid. A fact supporting this vision lies in the nature of the Active Learning Lab.

Students work within the university field and they are prone to do not set any limit of behaviour. They need to experiment; the laboratory represents for them an opportunity to learn how the design thinking process works actively.

The Lab itself pushes students to extreme level of creativity and they are right when sustain that they need to explore fully the process not limiting in this case their optimism.

The second bias reported by the students was the endowment effect. The authoress describes as negative the attachment to the initial personal idea because it limits a creative vision. What comes by the interviews however, is not so negative. Obviously, the majority of the students supported the need to focus on customers' needs before developing an idea because the process taught them sustained it. In the case in which the personal idea developed before achieving users' knowledge does not fit these need it has not represented a difficulties for students giving it up.

However, students that have lived the occurrence of a personal view and an attachment to it not so negatively provide an opposite vision. Most of them sustain that "*being human, it is normal to have a certain idea about something,*" arguing that the need to be attached to personal ideas comes from the need of the establishment of own personality. It means that a person that does not sustain its own idea until possible, changing idea according to the different points of view of the other members or customers is a person not sure of himself and this bring to an uncertain result. Moreover, the attachment to the first idea is seen by students as the necessity to make an own mark on the project. Ideas coming solely from the users' need identification for the students are something that lack of personality.

To avoid conflict within the group, pursuing good results and deal with all of this for six weeks lot of groups explained that their final ideas was a combination of the different initial ideas. "*We had been able to find points of interaction between all the different ideas of the member and we implement the assembling of them*".

At this point it could be easier to understand the initial vision of students that stand for a creative laboratory where they can express themselves.

The topic takes into consideration in a certain sense the theoretical proposition of Brown that highlight as everybody can join the process because it relies on the personal way of problem solving. However, the interviews and the result obtained by the students of the

laboratory presented to their referred firms make clear that the scope of problem solving is reachable even if different biases occur during the process.

The result sustain that their happening is not experienced as negative as the theory want to represent.

- • Difficulties in relying on the process: the necessity of predisposition

As it could be noticed from the summary initial graph and by the two coloured points, this evidence is a dual value evidence. In fact, it finds application in two different fields that combat the theory.

In the first case, it represents the conclusion of the part of work relative to the analysis of biases' occurrence. It rearranges the manifestation of different biases and provides the principal reason behind the manifestation itself: people do not rely on the process.

While in the second case, it questions the veracity of Brown's proposition that the process is viable to anyone highlighting the necessity to be predisposed to the process.

Even if the field of application is double, what matters for the purpose of the research, it is the common point between the two field. Theories highlighted the necessity to believe completely in the process and in the tools offered because only in this way people achieve the success. Unfortunately, theories fail in taking for granted that the reliance on the process and its tools happens without any snags. In the reality, things go different. Opening the mind to a divergent thinking is not so quick and painless. It requires considerable efforts by the designers to start understanding the functioning of the techniques and further efforts to employ them as best as they can.

"The process represents a fantastic tool for innovation. It is a support, employing it you cannot get lost but it needs people that are predisposed". The reason behind this quote lies in the bad experience this girl lived within the laboratory. Admitting she had been firmly convinced or her ideas because she was working with disable children, as was the business for which they worked, she found teammates that on principle rejected all her ideas as solutions because they interpret her stance as an imposed schoolteacher. These facts influenced negatively the group work: she diminishes her contribution and others were stuck in their prejudices. In fact, she sustained her thought explaining that when deciding to take part of the laboratory each one needs to look inside himself in order to understand if an activity fits or not his personal character. Moreover, in favour of this vision of the

predisposition another quote explains that *"Groups need to be smart. Biases occurs also because people are not dispose to compromise and give up."*

All the propositions, highlighting the difficulties in relying on a process that is abstract and structured at the same time brings to the evidence of the necessity to be predisposed.

Not everyone can enjoy design thinking. Result show off how that the theory of Brown is doubtful: personal problem solving abilities had been demonstrate to not being sufficient as a requisite to start using the method.

5. The final code, started in the previous code's session because of an element in common, advances in part a counter theory directed to the theory of Tim Brown. As it has been repeated different times, he sustained that the use of method is available to anyone claiming that everyone can be a designer. However, in respect to the previous evidence that was grounded on theory, these two final evidence are just challenging propositions about the effectiveness in promoting a project as viable to anyone. Two further evidences cannot advance a certain weakness in the vision of the CEO of IDEO, but offer a suggestion for further analysis to be completed.

- Necessity of experts

The theory does not clearly recommended whether and in which measure there is the need of the presence of experts during the process. During the Active Learning Lab as the laboratory is structured, students have the possibility to rely on the expertise of a product designer two times per week for four hours and a facilitator available by telephone whenever they want. However, it has not seem to be sufficient for students. In fact, they highlight the need to rely on expert when they were effectively conducting the different practical activities as the creation of personas, the drafting of the interviews' questions and the brainstorming. The help of the expert only for the explanation of the techniques and the review only once the work had been done make them feel lost during the week and insecure in applying concretely the method.

"Obviously the facilitator was available by telephone but it would have been completely different to apply the method under control of an expert that help the group to carry out the different activities as they need to be done and not conduct them in the least bad way."

This vision furthermore, brings out a fear of failure that could compromise successful results. Fear of failure is not accepted in the process. Designers shall not resist employing at the maximum capacity their skills just because they feel insecure. They need to explore the

method. This proposition advance a kind of job: if in the educational sphere where experts two times per week follow the students and they still manifested difficulties in organizing the work on their own, what could be the situation in a business where the expert's disposal is more limited? Really, does anyone can undertake the process?

Maybe it is not so true that anyone can be a designer.

- Business not open to radical changes

This last evidence provides another point of reflection. The Active Learning Lab is structured in the following way: members of Azzurro Digitale and Fondazione Ca' Foscari identify which firms on the territory that are disposed to take part on the project. It is assumed that no one would waste the possibility of an innovative and fresh consultancy for solving existing problems affecting own business.

During the meeting that precede the beginning of the Lab, the firm tell its story, its situation and proposed some areas of improvement they are trying to deal with. The designer then, having the state of art under control defines the design challenge to entrust the students.

As in the previous evidence, this case does not contradict the theory but it offers a challenging view about the viability of the process for each kind of business.

As students need to be open minded the same it is true for the business. In fact, during the process students reported difficulties in dealing the close mind of the firm that did not accepted breakthrough ideas. Firms have the possibility once a week to talk with the students and release them feedbacks about what students ideated. *"Our idea satisfied at all customers' needs, we were excited to present it to the firm. Unfortunately, they demolished it because it was too radical to be implemented in their business"*.

Is Tim Brown sure that each business is adapt to undertake the process? Are there any risks in applying the method in a reluctant firm?

This final provocation should be analysed elsewhere.

Conclusions

It is the moment to sum up with results of the analyses conducted. Has been Liedtka right in sustaining the reduction of cognitive bias through the process of Design Thinking?

The answer cannot be represented by a yes or no. There is the need of detailed results. Proceeding with order, the first analysis, the quantitative one, demonstrates that over 38 questions just four of them confirmed the resistance of cognitive biases to the process. The biases confirmed were related to the attachment to the first idea and its support, easy ideas and influence played by personal moods. It is a good starting point for the confirmation of the authoress thesis.

However, the qualitative analysis has led to most interesting results.

People for the great majority confirm that the design thinking thanks to its structured method and the tools proposed helps designers staying focused on customers and on the project. In this way, the cognitive biases connected with the centrality of the designer as against that one of users' seem to be solved. Until this point in fact, the assumption of the reduction of cognitive biases would seem confirmed. Instead, different interviews and the following analysis with Gioia method led to this incredible result: cognitive biases resisted the process due to some reasons.

The first category of reasons is identified by the unavailability of people to rely on the process, consciously or not. The fact of preferring personal preferences rather than customers' ones or being focused of determined attributes is the demonstration that people do not rely on the human centred characteristic of the approach. It usually happens consciously: students act in that way because of egoism and self-absorption and tend to justify themselves explaining that they are impulsive. This labile reason of behaving consciously in a biased way leads to other reasons more abstract and unconscious. The process is not viable to anyone. Students highlight the need of predisposition to take part of the process. They should not be afraid of be wrong or fail, to put oneself on the line and go outside of the box. Most of the times however, a person thinks to have all the necessary characteristics but his failure is due just to his biased cognition.

The second category instead regards definitely unexpected reasons.

In fact, results described those biases as useful for designers to success.

In the specific case related to the availability bias for example, going forward the process with easy ideas permits the group to find the balance and being able to work without

problems. Students argued that it has been better proceed in that way rather than undertaking the project with a one less member. In fact, students clarify that in order to succeed the most important thing is to work in a positive environment.

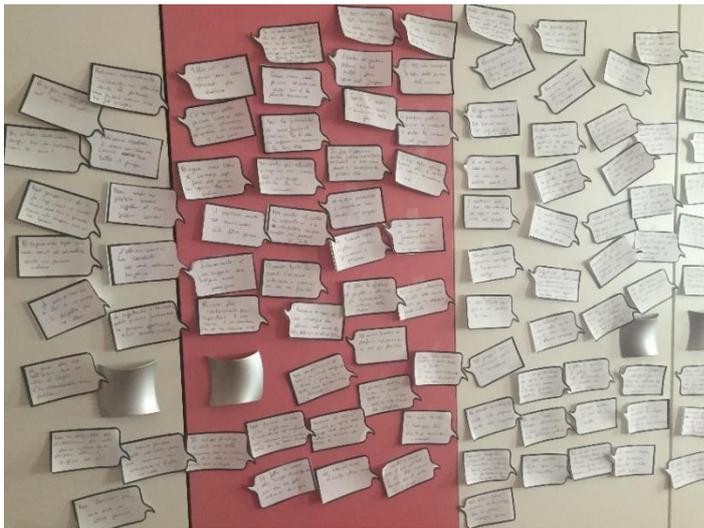
Positivity highlights a connection with another confirmed bias, the planning fallacy. This bias is related to the over optimism and a rosy view of the future. Students strongly believe that optimism, even if excessive helped themselves to never give up during the process also in difficult situations.

The research has deepened Liedtka's thesis, concluding that the process of design thinking is useful to reduce cognitive biases if people are disposed to rely completely on the process. However, cognitive biases should not be seen only as occurrences influencing negatively innovation processes. Cognitive biases in fact, play also a positive impact on processes. This is the most important thing to be noticed. Analysis has demonstrated that combating the bias would result in a worst situation in respect to the one where the bias manifested itself.

This research represents just the initial point in the conception of cognitive biases as positive occurrences in an innovation process.

To have deeper understanding of the topic of design thinking related to the positivity of cognitive biases, further dedicated analyses need to be conducted.

Appendix 1

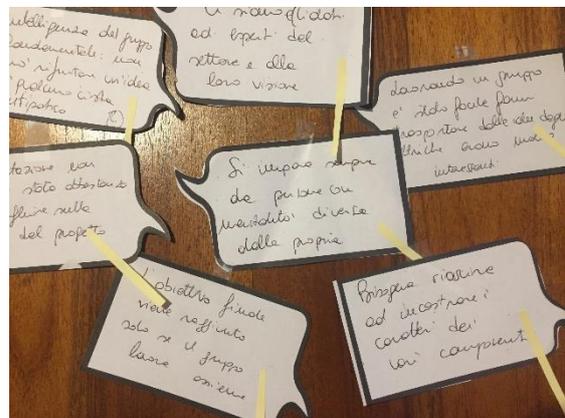
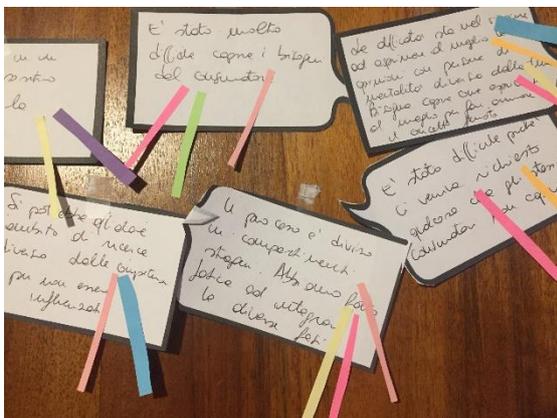


First of all, all the quotes have been transcribed in some Post-it™ without references to the interviewed and the question related.

Then different categories have been proposed and for each quote, it has been added a clipping of a coloured Post-it™ that identified the category



Different quotes bring to an evidence. It could happen with quotes related to a mix of categories or related just to a specific category.



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