INNOVATION PRINCIPLES AND THEIR
POSSIBLE APPLICATION IN SOCIAL DESIGN
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INNOVATION PRINCIPLES AND THEIR POSSIBLE APPLICATION IN SOCIAL DESIGN

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ABSTRACT

INNOVATION PRINCIPLES AND THEIR POSSIBLE APPLICATION IN SOCIAL DESIGN

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Anadolu University, Graduate School of Sciences, December, 2017

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This work examines the concepts of stressor (i.e. challenging conditions given by the environment, resources and knowledge level), antifragility, cumulative experience, context, simplicity, emergent platforms among others, as well as its possible application in product design, intended to solve or mitigate the effect of social problems. The document is divided into five chapters, being the first one devoted to the theoretical review of literature from four knowledge areas: Cultural, Scientific, Experimental and Logistic. In the second chapter, ideas and concepts from the different literature resources and knowledge areas are combined in the so-called Theoretical Triangulation Process, whose final aim is to generate statements based on the bibliographic review. The third chapter includes a further development of the statements reached in chapter two and from them, it is proposed a set of principles extracted from the literature review to promote technical innovation in social design. Chapter four includes a comparison between the suggested principles and those already developed in the existing design-related literature, identifying similarities, differences and opportunities so that a richest framework of innovation in social design conducted by institutions or organizations can be created. Finally, the fifth chapter presents the conclusions, challenges and possible opportunities for its application.

Keywords: Innovation, stressors, emergent platforms, antifragile, Design, social design, co-creation, participatory design.

ÖZET

İNOVASYON İLKELERİNİN VE SOSYAL TASARIMDAKİ OLASİ
UYGULAMALARİ

Diego Alejandro BARRETO DAZA

Endüstriyel Sanatlar Anabilim/Anasanat Dalı

Anadolu Üniversitesi, Fen Bilimleri Enstitüsü, 12, 2017

Danışman: Yrd. Doç. Nazmiye ÖZTÜRK

Bu çalışma, sosyal problemleri çözmesi veya azaltması amaçlanan ürün tasarımındaki olası uygulamalarla beraber stres faktörünün konseptlerini (yani çevre, kaynak ve bilgi düzeyi tarafından sebep olunan zorlayıcı koşullar), kırılmazlık, biriken tecrübe, bağlam ve diğer konseptlerden çıkan platformları inceler. Belge, beş bölüme ayrılmıştır. İlk bölüm Kültürel, Bilimsel, Deneysel ve Lojistikt olan dört bilgi alanından literatürün teorik olarak incelenmesiyle ilişkilidir. İkinci bölümde, farklı literatür kaynakları ve bilgi alanlarından gelen fikirler ve kavramlar, nihai amacı bibliyografik incelemeye dayalı ifadeler üretmek olan üçgenleme yöntemi ile birleştirilmiştir. Üçüncü bölüm, ikinci bölümde değinilen ifadelerin daha da geliştirilmesini içermektedir ve bu ifadelerden sosyal tasarımda yeniliği teşvik etmek için literatür incelemesinden çıkartılan bir dizi ilke önerilmektedir. Dördüncü bölüm, önerilen ilkeler ile mevcut tasarımla ilgili literatürdeki benzerlikler, farklılıklar ve fırsatları tanımlayan bir karşılaştırmayı içermektedir. Böylelikle kurumlar ya da kuruluşlar tarafından yürütülen sosyal tasarımda en zengin olan yenilik çerçevesi yaratılabilecektir. Son olarak beşinci bölümde sonuçlar, zorluklar ve uygulamanın olası fırsatları sunulmaktadır.

Anahtar Sözcükler: Yenilik, stres yaratıcılar, ortaya çıkan platformlar, antifragajik, tasarım, sosyal tasarım, ortak yaratım, katılımcı tasarım.

STATEMENT OF COMPLIANCE WITH ETHICAL PRINCIPLES AND RULES

I hereby truthfully declare that this thesis is an original work prepared by me; that I have behaved in accordance with the scientific ethical principles and rules throughout the stages of preparation, data collection, analysis and presentation of my work; that I have cited the sources of all the data and information that could be obtained within the scope of this study, and included these sources in the references section; and that this study has been scanned for plagiarism with "scientific plagiarism detection program" used by Anadolu University, and that "it does not have any plagiarism" whatsoever. I also declare that, if a case contrary to my declaration is detected in my work at any time, I hereby express my consent to all the ethical and legal consequences that are involved.

....

Diego Alejandro Barreto Daza

FOREWORD

"Compare yourself to who you were yesterday, not to who someone else is today"
Jordan Peterson.

The writing of this work would not be possible without the financial support of Turkish Scholarship, thanks to whom I found myself in a completely different country, working on an unfamiliar topic for me, to graduate from a master quite different from my previous background.

Thanks to all of those whose critics and advices promoted the serendipitous moments leading to the final result of this work, especially Dr. António J. Cruz Rodrigues who guided me in the first and most difficult phase. Also thanks to the support of professor Nazmiye Öztürk who despite the communication barriers, tried her best to guide my thesis. Finally to Dr. Engin Kapkın, whose suggestions and critics allowed me to give the final steps to conclude this process.

Diego Alejandro Barreto Daza

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1.   INTRODUCTION

Innovation, a key term in all fields of Design has recently been set as the main component of design intended to solve or mitigate social problems. However, when dealing with such a complex system as a targeted community who in the end will define whether the solution suits or not for them, understanding where to focus the innovation on might become a hard issue to cover.

This is the paradox of function versus form. Which one to prioritize and where should designers focus their attention on? Authors like Victor Papanek and Victor Margolin have made a critic to this disconnection of many designers with social problems, prioritizing many times form and putting their efforts on just a small proportion of the so called *real* problems of the world. According to Papanek, the designer is powerful enough to affect all men's tools and the environment, which at the same time implies great moral and social responsibilities (Papanek, 1971). The ideas of Papanek marked the beginning of a whole new design movement called Social Design, which changes the traditional idea of product design, as design for the market, generated by a manufacturer and directed to a consumer (Margolin & Margolin, 2002). Since *Design for the Real World* (1972), where Victor Papanek made a call for the social responsibility of industrial designers, different authors such as Julian Bicknell and Liz McQuiston, with *Design for Need: The Social Contribution of Design* (Oxford: Pergamon Press, 1977), have promoted the merge of design programs targeting social needs of the aged, the poor and the disable. (Margolin & Margolin, 2002).

In educational environments, social issues such as disaster relief, homelessness, hunger, poverty and associated topics such as sheltering, pedagogic resources, healthcare systems or even water supply for vulnerable communities might be used to trigger students' creativity, but the fact is that most of their proposals might finish as innovative ideas but hardly or impossible to be implemented due to its disconnection with the reality of the problem context. This problem is well recognized by Margolin when expresses that there is a lack of knowledge regarding the "understanding of how design for social need might be commissioned, supported and implemented" as well as the necessary changes in "the education of product designers that might prepare them to design for populations in need rather than for the market alone" (Margolin & Margolin, 2002).

This work pretends to bring a different approach for innovation in Social Design, from a non-purely design perspective, paying attention to the common elements that lead

to innovation, not only in some of the most important developments of our time, but also in traditional societies, considering the complexity of social systems as well. The aim of this work, is to bring a theoretical research that can complement current approaches on the topic, such as the ones developed by IDEO.org (2015) and The Young Foundation (Mulgan, Caulier-Grice, & Murray, 2010) so that the solutions developed can have a greater impact on society.

Finally, along this work, products will be understood as part of innovation systems which are complex to the extent that they can multiply and replicate, thus capable to be classified as antifragile ones. It is assumed that we create products, tools and in general technology and those artefacts build us back, in the measure that they can influence our ideas and behaviour, eventually, creating changes on our social systems. Products more than human-made compositions, are part of the social system and can have a big influence on other social units, like humans and their environment.

1.1. Term Definitions

Antifragile. "That which benefits from stressors, volatility, randomness, and other elements that should be avoided in case of fragility". Organic systems are the clearest example (Taleb, 2012).

Co-creation. "A business strategy focusing on customer experience and interactive relationships". (http-7).

Design. "To design is to devise courses of action aimed at changing existing situations into preferred ones"- Herbert Simon.

Emergent platforms. Cumulative levels of knowledge, resources, experience and tools (Johnson, 2010).

Human-centred design. Methodology to create new ideas which can be used to create innovations in social design. "Human-centred design offers problem solvers of any stripe a chance to design with communities, to deeply understand the people they're looking to serve, to dream up scores of ideas, and to create innovative new solutions rooted in people's actual needs" (IDEO.org, 2015).

Innovation. "(The use of) a new idea or method" (http-8)**.**

Juxtaposition. "The arrangement of seemingly unrelated elements such as tools, environments, thoughts and ideas to create ecosystems where new connections of ideas can happen" (Silva, 2014).

Product. "Any kind of artefact, material or immaterial created by means of a process, intended to overcome a challenge" (http-8)**.**

Social design. "The design of platforms and processes that leads to people participating and contributing in creating an output that is greater than the individual input, where its solutions become better the more people use them and depends on the activity of social actors" (http-9).

Stressor. "Any kind of challenging condition such as environmental conditions, resources availability, etc, that creates stress". (Taleb, 2012).

Triangulation. "The combination of data sources, investigators, methodologic approaches, theoretical perspectives (Denzin, 1970; Kimchi, Polivka, & Stevenson, 1991), or analytical methods (Kimchi et al., 1991) within the same study" (Thurmond, 2001). The use of Theoretical Triangulation process aims to reduce the likelihood of unbiased bibliographical sources by combining different perspectives.

1.2. Problem

"Design for many not for money" Victor Papanek (1972)

Design has been usually considered as products that accomplish specific tasks and images that communicate certain messages. Since the first industrial revolution, most of the designed solutions had been done to accomplish marketing and industry goals. The clear majority of products are made to be merchandised and the vast majority of visuals are made to communicate the offer.

Socially conscious design also known titled as Social Design or part of what is called Social Innovation is a growing stream of thought. It considers, that designing only to sell or persuade increases the problems faced by humanity; the previously existent problems are not eliminated with this approach. Those who think that more can be done from Design, call for practices approaching the general problems that affect human societies. One example is Berman (2009), who calls for designers to do good through their practices by being a power for change. It requires tackling what Rittel & Webber (1973) identified as "*wicked problems*"; which are problems that require solutions based on the complexity of its multiple origins and obstacles (such as famine).

The current social issues are not new problems; they are the same problems that have accompanied humanity along history and are already studied and structured by other professionals such as economists, anthropologists, sociologists, lawyers, educators, and

many more. But, they are now of the interest of designers, who see them as an opportunity to practice their own knowledges and techniques, by generating solutions that could lead to general welfare and better relations among individuals. Undoubtedly, it requires an approximation to social sciences, and the recognition of the human condition in a more holistic way. It is already being done by designers applying anthropologic research techniques to feed their design processes; yet, it is usually done without impacting the system that allows the prevalence of the condition they wish to change.

Margolin & Margolin (2002), proposed the creation of a social model for Design. This, would help designers working for people in conditions of vulnerability. The term social in its broad sense, requires moving the focus of attention from the poor and underserved, to the system keeping them in those conditions. The change on focus, also requires paying attention to aspects that are not in the frameworks of markets.

Solutions that are centred in one aspect and present a product as a solution are part of the problem. Designers should be moving their interests towards human-systems instead of focusing only on material-systems (Buchanan, 2001, p. 12). The relation of design and social systems is not a strange one; if it is considered that for every technical system there is a social system that supports its existence, it shouldn't be weird for designers to bring both aspects into their practices. Thus, being able to manage social and technical complexities.

An example of the relation between social and technical aspects can be accounted with a simple common product: the monobloc chair. This chair, made of polypropylene, might seem as an object empty of significance, but it is a product that can be found virtually anywhere in the world; and for a wide majority of the human population, it is the main sitting object used. Furthermore, it is very cheap, and solves the problems of sitting and distribution with ease, but it does not solve the problems faced by people in poverty, even though, it is a product that is mainly used by the poorest people. Some good question designers could make to themselves, is if social solutions are as attainable as technical solutions. And it requires for them to consider first what they are approaching as "social".

Some critics about the ways in which designers are enacting social solutions can be found. Janzer & Weinstein (2014) see a lack of social research techniques in the work developed by many designers; and consider it to be a form of contemporary colonialism. Being it, the result of the designer working from a position taken from outside the

community they intend to benefit. Kiem (2011) also criticizes the inclusion of designers when it is done without considering the political dimension. Some of the solutions might come as an imposition, which in the end, might result in solutions that are rejected by the people who are supposed to be benefited.

LifeStraw water filter illustrates the disconnection between a social design approach and the context where the solution pretends to be implemented. This artefact, originally created to benefit poor people without access to clean and drinkable water, received strong critics due to its original idea of how to be used. Figure 1.1 shows how LifeStraw had an original approach in which the "poor" person had to drink from a puddle, having to rely on their smelling sense to detect if the water was appropriate or not, and then drink directly from the source. After receiving critics mainly focusing on its unnatural usability and the social segmentation that such a product would create on vulnerable communities, their creators had to change their targeted market and focus on adventure seekers, making LifeStraw a camping and emergency product. Finally, for the product's usage, a more human-like approach was implemented by adding a container to carry the water instead of drinking directly from the puddle. Is that disconnection what leaded to the present work. Approaching social issues from a purely usability-based perspective in which the affected people is considered only as physical processors, with attributes such as strength, height, etc., forgets what Sanders (Sanders & Jan Stappers, 2008) calls a pleasure-based perspective, in which people is understood as cognitive processors with attributes such as memory, attention and expectations.

1.3. Hypothesis

A richest framework to promote innovation in social design can be reached by including during the design process a wider participation of the potential users, as well as analysing the whole design challenge as an antifragile system.

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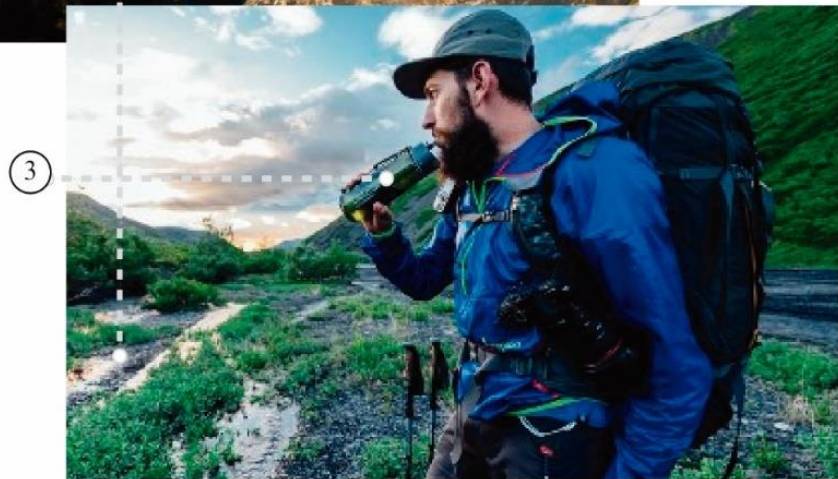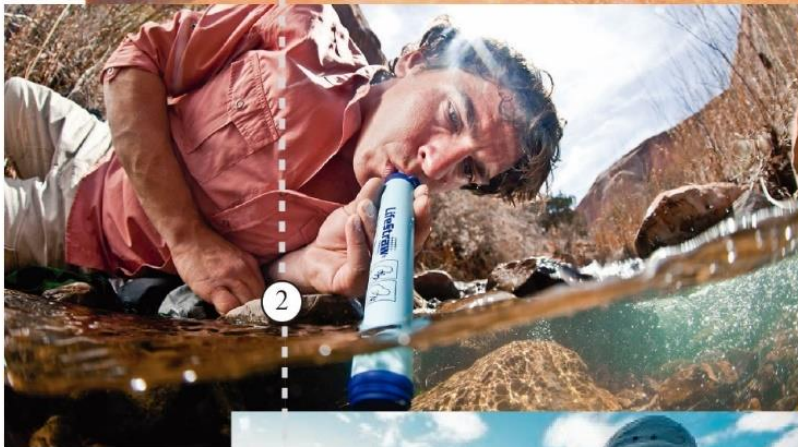
Figure 1.1. *LifeStraw, disconnection between context and social design, (http-1).*

1.4.Structure

To understand this document and follow it in an easier way, a brief explanation of its structure is presented so that the reader can identify sections of his interest and skip those which are not. Figure 1.2 shows how in the first phase of this work different bibliographical sources are reviewed to generate the theoretical knowledge from which to start.
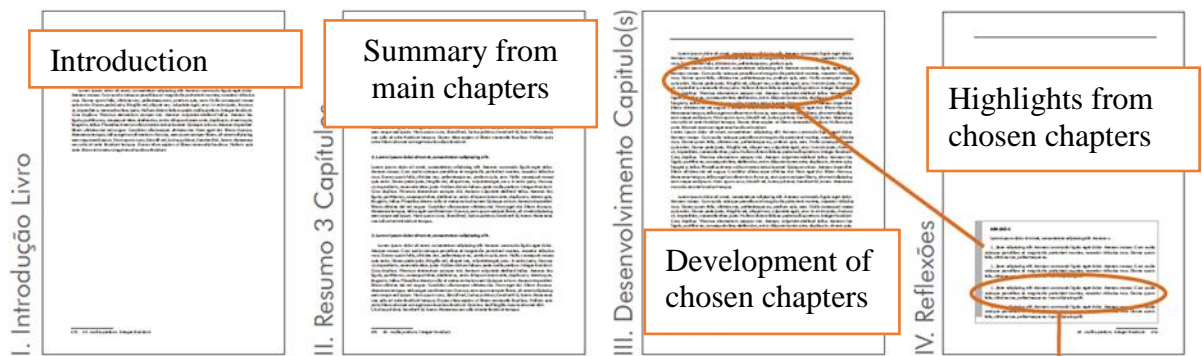
Figure 1.2. *Structure phase 1: Knowledge, (Cruz Rodrigues & Cunha, 2017).*

In the original structure proposed by (Cruz Rodrigues & Cunha, 2017), for each one of the sources, there are four sections: 1) introduction of the book; 2) summary of the main chapters; 3) Develompent of the most relevant chapters, which consists on a further explanation of the concepts and ideas presented there; 4) Highlights from the chosen chapters, which are the key quotations that will be used during the Theoretical Triangulation Process. In this work, in order to simplify and make the document easier to read, the summary of the main chapters was omitted in most of the sources, giving still place to their explanation in the chapters development section.

In the second part of this work, some of the ideas or highlights from the selected sources are combined in the Theoretical Triangulation process, from which in the end, for each triangulation, a statement summarizing the main idea, a graphical representation about which sources were combined to come to that statement and an example of the idea using images is presented (see Figure 1.3).
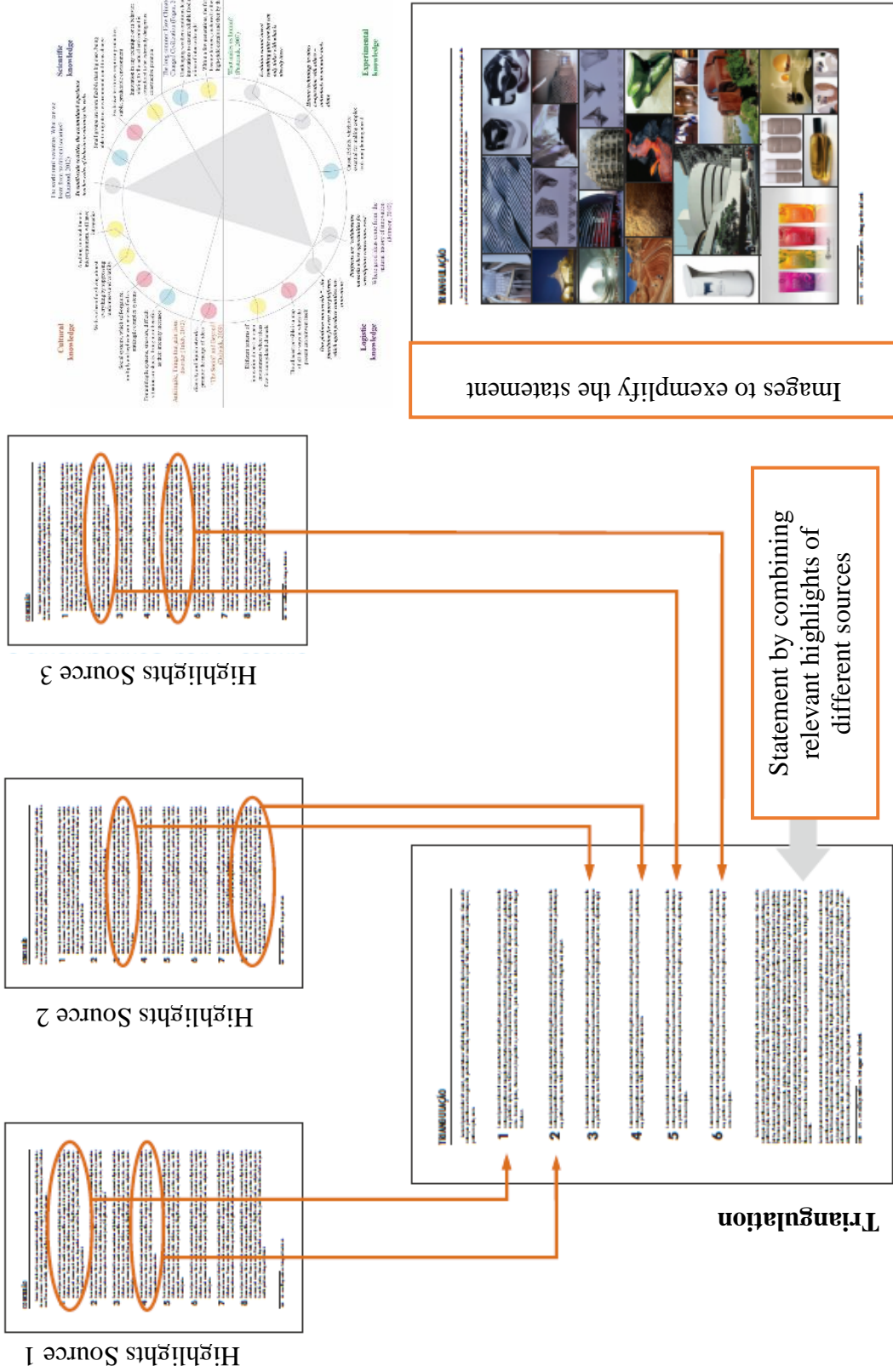
Figure 1.3. *Structure phase 2: Triangulations, (Cruz Rodrigues & Cunha, 2017).*

2. METHODOLOGY

The methodology follows the master thesis framework suggested by Professor Dr. Antonio da Cruz Rodrigues, director of the Master of Design Management and Product and Space Design at Universidade Europeia in Lisbon, Portugal (Cruz Rodrigues & Cunha, 2017). It follows a Theoretical Triangulation process, which can be understood as "…the use of multiple theories or hypotheses when examining a phenomenon (Denzin, 1970). The intent is to conduct the study with multiple lenses and questions in mind, to lend support to or refute findings. In theoretical triangulation, the perspectives or hypotheses used in the study may be related or have opposing viewpoints, depending on what the researcher hopes to accomplish (Denzin, 1970)" (Thurmond, 2001).

Thurmond (2001) cites: "having rival hypotheses also challenges researchers to look beyond the obvious explanations. Multiple perspectives can help rule out competing hypotheses, prevent premature acceptance of plausible explanations, and increase confidence in developing concepts or constructs in theory development (Banik, 1993)".

The main purpose of this work, consists of getting unbiased perspectives from theoretical reviews, covering a variety of authors and perspectives ranging from idea generation to climate change and its effects on human evolution. Those topics were chosen to create an alternative approach to current developments in the state of art regarding Social Design.

The original methodology (Cruz Rodrigues & Cunha, 2017) is divided into three phases presented in Figure 2.1:
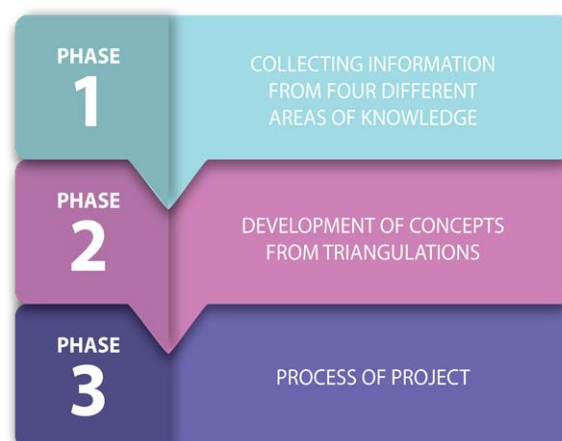
Figure 2.1. *Phases of a thesis work, (Cruz Rodrigues & Cunha, 2017).*

A fourth phase was included and denoted as Evaluation by the current work. In this part, the developed work is theoretically evaluated by contrasting him against current

theories of design, to identify complementation opportunities for a richest framework. All the four phases are explained in detail below.

2.1. Phase 1. Knowledge

In this phase, the pertinent bibliographical information in our access is reviewed and organized. The main objective is to amplify the knowledge, seeking a broader view that allows a free reflection of the current problem.

In this phase, the theoretical framework is separated into four knowledge areas as suggested by (Cruz Rodrigues & Cunha, 2017): Cultural, Scientific, Experiential and Logistic (see Figure 2.2). The reason of selecting books from various areas of knowledge, is to obtain information from different scopes which helps to extend the perspective of mind. For each knowledge area, there were chosen different books judging by their group membership, as well as their relevance regarding innovation, solutions for social needs and social systems. Publication year was another factor influencing their selection, giving priority to the most recent publications.

At the end of each knowledge area, a resume of the main ideas collected in the bibliography is presented, synthesizing information. To conclude this section, general concepts, important for the understanding of the whole work are listed and explained.
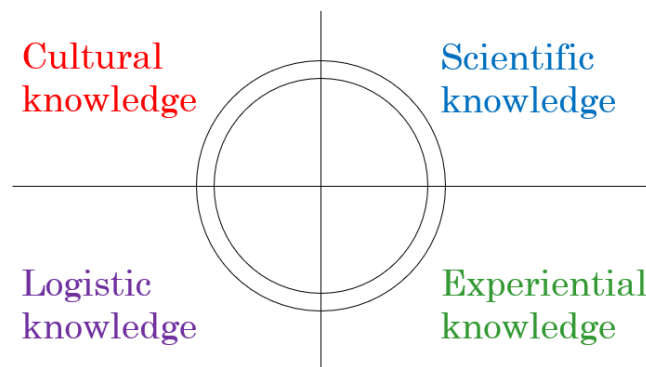
Figure 2.2. *Knowledge areas - Theoretical Triangulation Process, (Cruz Rodrigues & Cunha, 2017).*

1. The **cultural knowledge**, brings us back to common sense. It portrays beliefs, arts, moral, laws, costumes, behaviours and habits of human beings. In this area, the selected books were: Antifragile, Things that gain from disorder (Taleb, 2012) and 'The Social' and Beyond: Introducing Actor-Network Theory (Dolwick, 2009).

2. **Scientific knowledge** explores facts, whose analysis do not depend on the viewer's interpretation. The facts are presented in a systematic way thus that they can be verified, by using processes of observation, research, experimentation and validation.

The books reviewed for this area are: The world until yesterday (Diamond, 2012) and The Long Summer: How Climate Changed Civilization (Fagan M. B., 2005).

3. **Experiential knowledge**, involves all that knowledge resulting from observation processes, analysis and experimentation having as object of interest the nature, societies and man. This area differs from the scientific knowledge in the fact that it might not replicated but stills is the result of a specific experimentation. For this area, the chosen book is What makes us human? (Pasternak, 2007).

4. **Logistic knowledge** includes the procedures and necessary steps to create ideas, knowledge or products. It presents guiding contents for the execution of tasks, practices of procedures and analysis of activities. The main representative of this area is Steven Johnson, with his book Where good ideas come from: the natural history of innovation (2010).

2.2. Phase 2. Concepts

In the second phase, the work concepts are developed, through the triangulation of the ideas previously selected from the review of each knowledge area (see Figure 2.3).

Thus, each triangulation consists in the combination of at least three citations, creating a work concept, expressed in one preposition. The purpose of this process, and the reason why at least three sources should be combined, is to reach wider unbiased ideas, as the more diverse the sources are, the less likely to reach to the same ideas. For example, if only two sources were cited, possibly one of them will be like the other one, but by increasing the number of sources, this problem is tried to be overwhelmed. Figure 2.3 illustrates the Theoretical Triangulation process. Sources from each one of the four knowledge areas are combined to create a triangulation, in this case represented by a polygon, from which a statement generates. By combining those statements, the final work will be reached, which graphically could be interpreted as the intersection of the polygons that represent each triangulation.

2.3. Phase 3. Work

In the third phase, by combining the four triangulations developed in the second phase, a theoretical approach for innovation in Social Design, from a non-purely design perspective, is developed.

2.4. Phase 4. Evaluation

In this phase, a comparison between the proposed principles and those already existing in the design-related literature is made, looking for similarities and possible complementary aspects, such that a richest framework for practitioners interested on innovation in social design can be made. The benchmarked authors were selected judging by the application of their ideas on solving or mitigating social issues as well as their popularity on search engines regarding Social Design.
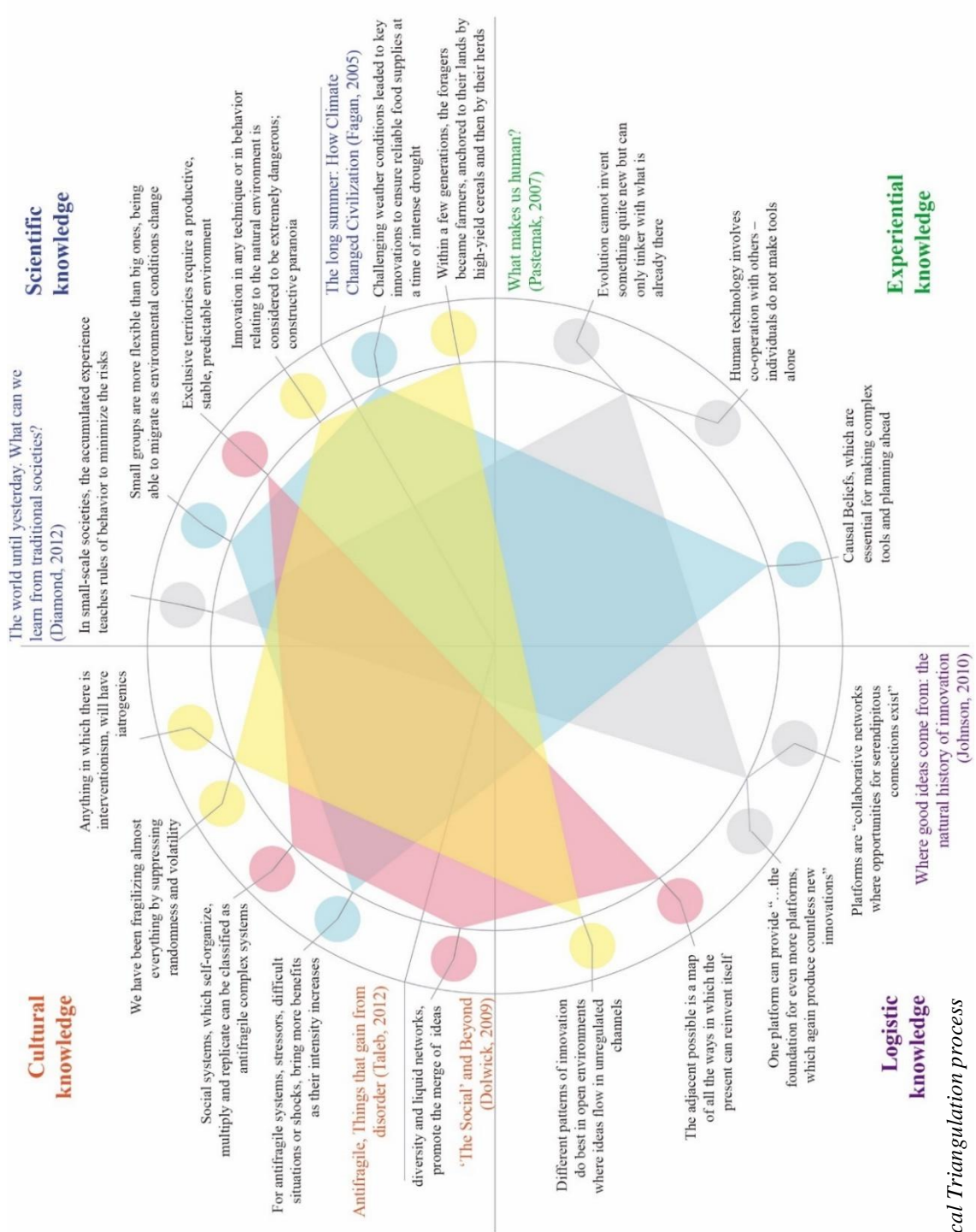
Figure 2.3. *Theoretical Triangulation process*

3. FIRST PHASE: KNOWLEDGE

3.1. Book: Where Good Ideas Come From - Steven Johnson (2010)

3.1.1. Overview

This book presents a series of elements which are common during the innovation process leading to some of the greatest ideas in the world. Those elements constitute a sufficient but not necessary condition, as there are many cases in which good innovations appeared without following any pattern.

The author Steven Johnson (2010) expresses that:

> "In the language of complexity theory, these patterns of innovation and creativity are fractal: they reappear in recognizable form as you zoom in and out, from molecule to neuron to pixel to sidewalk. Whether you're looking at the original innovations of carbon-based life, or the explosion of new software tools on the Web, the same shapes keep turning up. When life gets creative, it has a tendency to gravitate toward certain recurring patterns, whether those patterns are emergent and self-organizing, or whether they are deliberately crafted by human agents". (Johnson, 2010, p. 30)

According to Johnson (2010), watching ideas spark on different scales reveals patterns that single-scale observations easily miss or undervalue. That's what he calls the long zoom (See Figure 3.1):
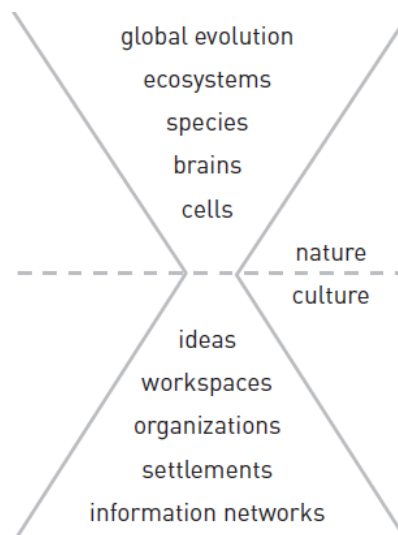
Figure 3.1. *Long zoom: Innovation both in nature and in culture is characterized by similar patterns of creativity at multiple scales simultaneously, (Johnson, 2010, p. 32).*

In the seven first chapters, the author presents a series of elements which promote the emerge of ideas and innovation, such as the *adjacent possible*, which refers to the challenges or opportunities that can be found in the environment; *liquid networks*, understood as the connections created with others to enhance information flow and

exchange; *the slow hunch*, which basically explains how many of the greatest ideas, are forming slowly as a hunch, waiting silently for the missing piece to connect thoughts and become a real idea. The next four chapters introduce respectively the importance of three concepts: *Serendipity*, a lucky moment when unexpectedly the answer comes up; *error*, an essential element which forces us to look for new alternatives; *exaptation[1]*, which is a clear example of how many times ideas are applied in contexts completely different to those for which they were thought originally and *platforms*, referring to all the resources and support that allows a thinker not to start from zero.

3.1.2. Summary of chapters

3.1.2.1. *The adjacent possible*

According to Steven Johnson, "the adjacent possible is a kind of shadow future, hovering on the edges of the present state of things, a map of all the ways in which the present can reinvent itself" (http-16).

As an example of its importance in innovation, Johnson presents the Neo Nurture incubator's case, a machine created taking into account the opportunities and challenges given in a specific context which proved its effectiveness and was recognized as one of the greatest innovation by the time. Based on the idea that incubators for third world countries where high technology standard machines would break out in less than 5 years without possibility to be repaired by the locals, due to the lack of technology, components or even the language to understand the instruction manuals, gave birth to the first incubator created using automobile parts which were abundant in those regions.

3.1.2.2. *Liquid networks*

In order an idea to become clear, it is necessary to create the connection of thoughts that many times reside not in the head of only one person but might require a whole proper environment to happen. As mentioned by Steven Johnson, in order to push your brain toward those more creative networks, "…you have to place it inside environments that share that same network signature: networks of ideas or people that mimic the neural networks of a mind exploring the boundaries of the adjacent possible" (Johnson, 2010, p. 47).

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[1] Exaptation: a process in which a feature acquires a function that was not acquired through natural selection. (http-20).

Jansen (2013) exemplifies the importance of certain environments such as cities to create liquid networks where ideas can be diffused and combined in novel ways. That appears to be one reason why there are more innovations in cities than smaller towns. However, "today though the greatest such creative network is not a city at all, but the World Wide Web, creating, connecting and diffusing ideas more effectively than any network before it" (http-13).

3.1.2.3. *The slow hunch*

Hunches as well as ideas, need a liquid network to connect with other hunches and complete ideas. Johnson uses the term 'slow', as the hunches normally require time to become something clear. "They start with a vague, hard-to-describe sense that there's an interesting solution to a problem that hasn't yet been proposed, and they linger in the shadows of the mind, sometimes for decades, assembling new connections and gaining strength. And then one day they are transformed into something more substantial: sometimes jolted out by some newly discovered trove of information, or by another hunch lingering in another mind, or by an internal association that finally completes the thought" (Johnson, 2010, p. 77).

The author mentions the importance of keeping record of the hunches but not to categorize them as it imposes borders. Initiatives such as "the 15 percent rule" by 3M or "Innovation time off" by Google are models intended to promote those hunches that many times are abandoned due to lack of time or resources (Johnson, 2010, p. 93).

3.1.2.4. *Serendipity*

According to Jhonson (2010), the work of dream although is chaotic, is a productive way to explore the adjacent possible, facilitating the "serendipitous[2] collision of creative insights". (Johnson, 2010, p. 200).

It's also mentioned how internet and specially the search engines with their efficient algorithms make us direct searchers, constraining the possibility of serendipity, as it happened when looking for a topic in a library, where you can find other books about other topics that catch your attention. Other information that was not searched for, such as the posts on social networks constitute group-think rather than serendipity, as it is filtrated and provided according to a pattern of preferences (Johnson, 2010, p. 118).

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[2] Serendipitous: occurring or discovered by chance in a happy or beneficial way, (http-20).

Although traditional organizations keep their serendipity for close-door innovations developed only inside their R&D departments with the aim of creating patents and receive profits from their ideas, nowadays more companies such as Nike, P&G and IBM are sharing their ideas to be used and improved by other actors. For example, Nike with the web-based marketplace called the GreenXchange, where releases patents that involve environmental friendly materials and technologies, allows other firms to improve those innovations and apply them in other sectors (Johnson, 2010, p. 125). Tools like databases for hunches that can be shared by different people from organizations can spread the fulfilling of ideas and serendipity.

Brain storming is also mentioned as a good tool for serendipity but also it is suggested that the leader of the group should not start the intervention first as can influence the ideas of others.

3.1.2.5. *Error*

Error, an element for long depreciated and avoided when developing a problem solution, by itself do not unlocks new doors in the adjacent possible, but it really works by pushing ourselves to finds new alternatives. Johnson mentions clear examples of innovation result of error: "radiography, vulcanized rubber, and plastic all depended on generative mistakes that were generative precisely because they connected to slow hunches in the minds of their creators." (Johnson, 2010, p. 136).

Innovation in nature, also is affected by error. Mutation in some species of bacteria, shows how when circumstances are difficult, the error in their DNA increases making the risk involved in mutation affordable, which is not the case when the environment is appropriate for their current strategies. That strategy is like the oscillation between sexual and asexual reproduction applied by some water fleas, depending on how hostile the environment is (Johnson, 2010, p. 147).

3.1.2.6. *Exaptation*

There are many examples in history about how some inventions served in the end to completely different purposes to those for what they were designed originally. For instance, "Lee de Forest created the Audion with one clear aim: to create a device that would detect electromagnetic signals and amplify them. It never occurred to him that the triode architecture could just as easily be applied to the problem of building a hydrogen bomb" (Johnson, 2010, p. 157).

The World Wide Web, intended first to share academic information would never have an original purpose of serving as the biggest invent to spread pornography and other questionable contents that would have astounded Berners-Lee when he created his first HTML-based directories in the early nineties.

Johnson (2010) mentions again the important role that cities, and especially dense city centres where fertile interactions occur between subcultures, generating ideas, interests and skills that affect other groups, facilitating exaptation.

Apple is presented as a counter-example of the importance of fluid networks. As everybody knows, their news prototypes are far away from being shared to increase innovation, but still they are leading many segments of the market due to their innovation. The traditional approach consists of a chain starting by the "designers who come up with a basic look and feature set and then pass it on to the engineers, who figure out how to actually make it work. And then it gets passed along to the manufacturing folks, who figure out how to build it in large numbers—after which it gets sent to the marketing and sales people, who figure out how to persuade people to buy it." This cycle implies a modification in every step, which in the end, transforms completely the original idea. Instead, Apple relies on continuous meetings involving all the groups who participate through the product development cycle, "brainstorming, trading ideas and solutions, strategizing over the most pressing issues, and generally keeping the conversation open to a diverse group of perspectives" (Johnson, 2010, p. 170).

3.1.2.7. *Platforms*

Ecologists use the term ecosystem engineers to refer to keystone species which create the habitat for other organisms, building platforms that allows other creatures to live. Such an important role can be also found at cultural innovation stages, where ideas serve as platforms to other ideas to exist.

There is a generative power of open platforms, consisting on the promotion of ideas, by providing knowledge and tools previously developed by other thinkers. "The songbird doesn't carry the cost of drilling and felling because the knowledge of how to do those things was openly supplied by other species in the chain. She just needs to know how to tweet" (Johnson, 2010, p. 210).

Example of platforms is the Applied Physics Lab (APL) where Guier and Weiffenbach, found the inspiration, support and tools to convert their hunches into what

is called today Global Positioning System or GPS. They created an entire ecosystem of unexpected utility.

3.1.2.8. *Conclusion: The fourth quadrant*

The main conclusion from the book, is the important role of open environments for innovation. Such environments promote the existence of the other patterns of innovation mentioned in the book: liquid networks, slow hunches, serendipity, noise, exaptation and emergent platforms. Johnson (2010) expresses that "In more controlled environments, where the natural movement of ideas is tightly restrained, they suffocate. A slow hunch can't readily find its way to another hunch that might complete it if there's a tariff to be paid every time it tries to make a new serendipitous connection; exaptations can't readily occur across disciplinary lines if there are sentries guarding those borders. In open environments, however, those patterns of innovation can easily take hold and multiply" (Johnson, 2010, p. 244).

3.1.3. Chapters development

Once summarized the main ideas from the 8 chapters in the book Where good ideas come from, two chapters that best fit for this work and which contain two essential elements for innovation are deeper analysed below.

3.1.3.1. *Liquid networks*

Johnson express the importance of creating dynamic connections, such as the ones created by the atoms in liquid environments, which are not as chaotic and disperse as in the gas state, nor as compact joined and static as the solid state. A clear example is how people hundreds of years ago behaved as gas particles, being separated from each other and moving freely in small groups. However, when the population increased, they started to settle and live together, being able to interact with bigger groups of different people, forming liquid networks which gave place to new connections and a dramatic surge in societal innovation rate. High-density liquid networks make easier for ideas to spread and innovations to happen. The opposite side, called a solid state, could be represented by a person who works alone, isolated from the others, where all his ideas can be connected and understood in the same way, but which are essentially unable to flow to other individuals and get affected by external thoughts.

It is important to notice how the author emphasizes the role that populated environments such as cities play as creativity incubators where individuals can find inspiration, and connections with other ideas and '*complete*' their own thoughts. On the other hand, it is also presented another perspective developed by Arthur Koestler (1964) in his book The Act of Creation and cited by Johnson (2010, p. 59), in which the environment has little importance, emphasizing mainly the importance of collisions between different intellectual disciplines. Nevertheless, today the greatest place to create connections and find those intellectual collisions is internet.

3.1.3.2. *Platforms*

The context, the environment and the current circumstances that can be included in what is called the adjacent possible influence dramatically how an idea or innovation will be. However, another important element is the set of previous developments, knowledge, and resources that made that invention possible. That is what Johnson (2010, p. 177) refers as platforms. For example, Twitter could not be born until internet was created, and its popularity would not be the same if there were not such a proliferation of mobile devices accessible for almost everyone. That is the importance of the adjacent possible.

On the other hand, Twitter which was based on existing protocols on the Web, now works as platform for countless apps which have been designed on it, expanding the adjacent possible at every step. YouTube, Facebook and other social networks are creating the habitats for other firms and businesses based on them, such as the YouTube networks.

3.1.4. Highlights

The following is a list of the most essential ideas from the selected chapters that will be used and combined with other ideas from different knowledge areas, following the triangulation process mentioned at the beginning of this work.

3.1.4.1. *Liquid networks*

- "Both evolution and innovation thrive in collaborative networks where opportunities for serendipitous connections exist. Great discoveries often evolve as slow hunches, maturing and connecting to other ideas over time" (http-13).
- In order to conclude those slow hunches, and reach the serendipity moment, it is necessary to ensure the establishment of flexible connections that provide

feedback and ideas from different perspectives and backgrounds. The more diverse and huge the networks are, the more likely is to come up with new ideas.

- Populated environments such as cities act as creativity incubators where individuals can find inspiration, and have collisions between different intellectual disciplines, connections with other ideas and '*complete*' their own thoughts. "This is one of the reasons why cities are disproportionately more creative than smaller towns. Today though the greatest such creative network is not a city at all, but the World Wide Web, creating, connecting and diffusing ideas more effectively than any network before it" (http-13).

3.1.4.2. *Platforms and Conclusion*

- Evolution and innovation depend on the adjacent possible that involves the huge range of possibilities given by the environment, but also can be promoted by the platforms built by other species or ideas.

- "Platforms often stack on top of each other, meaning that one platform provides the foundation for even more platforms, which again produce countless new innovations" (http-13).

- There is a generative power of open platforms, consisting on the promotion of ideas, by providing knowledge and tools previously developed by other thinkers.

- All of the patterns of innovation we have observed in the previous chapters—liquid networks, slow hunches, serendipity, noise, exaptation, emergent platforms—do best in open environments where ideas flow in unregulated channels. In more controlled environments, where the natural movement of ideas is tightly restrained, they suffocate. A slow hunch can't readily find its way to another hunch that might complete it if there's a tariff to be paid every time it tries to make a new serendipitous connection; exaptations can't readily occur across disciplinary lines if there are sentries guarding those borders. In open environments, however, those patterns of innovation can easily take hold and multiply (Johnson, 2010, p. 244).

3.2. Book: Antifragile - Nassim Taleb (2012)

3.2.1. Overview

When it comes to analyse systems, predict responses regarding certain circumstances and create policies to counteract undesirable effects, terms like variability, randomness, unpredictability, risk and chaos are taken as the enemy against what it is necessary to act. Thus, the systems are assumed to be fragile and sentences such as the more stable and untouched they remain, the better they are, are taken as priority. However not every system should be classified as fragile, moreover, there is no term to express exactly the opposite of fragility.

Robust, strong, resilient, are some of the terms mistakenly assumed as antonym of fragile. However, something robust, or resilient at most remain at its original state after exposed to stressors. That's the central idea presented by Nassim Taleb, in what he calls antifragile, what gets better after being affected by some kind of stress.

Organic systems are the clearest example of antifragility. Those complex systems can recover and become stronger after the effect of stressors. Our bodies become stronger as we exercise them, and that is a kind of stress that breaks muscular or even bone cells which regenerate making the whole system stronger and more resistant against such a circumstance. Small amounts of variability have a direct correlation with performance, and that correlation also affects other elements in a bidirectional sense. For example, aging creates loss of bone density but also loss of bone density due to lack of stressors, accelerate aging.

The author presents a series of examples and cases from organic systems to social systems such as banking and governments where the principles of antifragility can be faced.

3.2.2. Chapters development

3.2.2.1. *The Antifragile, an introduction*

The concept of antifragile is a missing piece to understand the world and decide the strategies to be taken regarding different kind of systems. Nassim Taleb presents antifragility as something beyond resilience or robustness, and completely opposite to fragility (that what avoids variability, randomness or other kind of stressors). What is antifragile, on the contrary benefits from some amount of stress.

A clear example of antifragility can be seen in organic systems, which require some amount of volatility, variability, randomness, etc, to keep working, and to become stronger and better. An antifragile system is a complex one, formed by parts for which stressors represent the mean to transfer information with the environment. Our body is a clear example of how stressors, such as exposure to small doses of viruses make us stronger and even immune to other health problems in what is called hormesis.

3.2.2.2. *The antidote to the black swan*

The black swan theory is a metaphor that describes an atypical event that comes as a surprise, has a major effect, and is often inappropriately rationalized and retrospectively predicted after it has happened. The Black Swans (capitalized) are "large-scale unpredictable and irregular events of massive consequence" (Taleb, 2012, p. 20), which should not be attempted to be predicted, but controlled on its negative effects by building robustness to soften their impact and exploiting the positive effects, such as what happened with internet and other inventions that had an unexpected use beyond its original purpose.

3.2.2.3. *Between Damocles and Hydra*

According to the author, stressors are shown to be a key element for innovation. People innovate when faces a challenging situation and even more if they are in trouble. From here the idea that difficulty is what wakes up the genius.

3.2.2.4. *The cat and the washing machine*

Trying organic systems as material ones, or vice versa, is a big mistake especially regarding interventionism policies against stressors. Thinking organic systems and even social systems as inanimate ones which are fragile or at most robust, ignoring the benefit that certain amount of variability can create and on the contrary, avoiding any kind of stress, leads to weakness and lack of strategies to counteract unexpected circumstances, such as those called Black Swan events.

Social systems, and in general complex systems, those with interacting parts that communicate through stressors, behave more like biological systems, more to the side of the cat rather than the washing machine. They might be created by humans but grow, multiply and replicate on their own to reach some degree of self-organization. From here the idea that stressors are information.

The author explains how the correlation between some kind of stressors and their effects on complex antifragile systems, such as the human body has also a reverse correlation: For example, aging affects bone density but also, low bone density can create aging.

A system can become antifragile thanks to the fragility of its composing parts. Under stressors, those fragile parts are replaced by stronger ones, making the system stronger as a whole. However, the author also shows that in such a system, the remaining parts not necessarily become stronger and more prepared for further stressors, but rather the overall system strength increases as it gets rid of the weaker ones.

3.2.2.5. *Intervention and iatrogenics*

Naive interventionism understood as "the lack of awareness of the need to look for a break-even point between benefits and harm" (Taleb, 2012, p. 128), lead to what is called iatrogenics, any unexpected side effect from an intervention, which can be beneficial or prejudicial.

It is important to recall what Taleb presents as the best alternative to prevent interventionism and its consequent iatrogenics: "The best way to mitigate interventionism is to ration the supply of information, as naturalistically as possible" (Taleb, 2012, p. 144). Contrary to what is generally thought, the more data you have, doesn't mean higher understanding of the system but rather more noise that affects decision making.

3.2.2.6. *The nonlinear and the nonlinear*

The nonlinear behaviour of a function due to variability, which can be concave or convex, define whether a system is fragile or antifragile. The function can be in gains or losses which depend upon certain variable, which can be an unexpected event size, like a trouble or generally speaking a stressor.

Fragile systems present a concave shape that decreases rapidly when the event size increases. On the contrary, antifragile systems present a convex behaviour as the event size increases. It means that even though the event can generate losses at the beginning, on time it starts getting gains adapting to the change (See Figure 3.2).
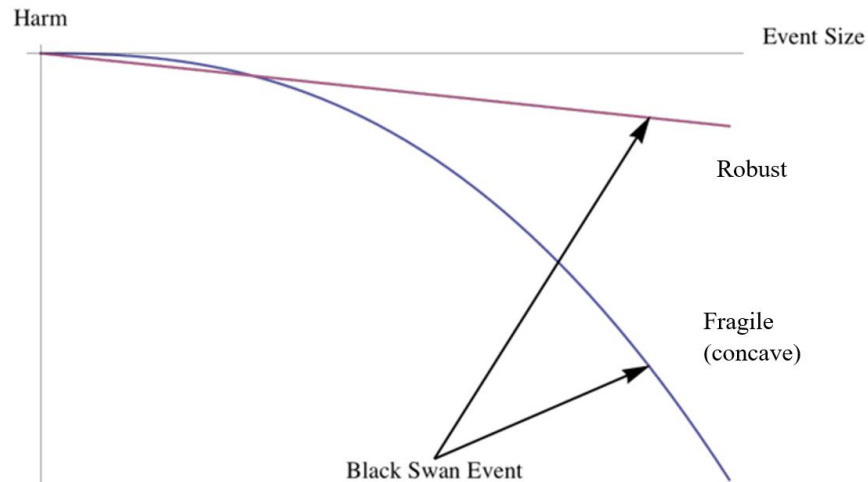
Figure 3.2. *Fragile vs. robust systems,* (http-15).

3.2.3. Highlights

3.2.3.1. *The Antifragile, an introduction*

- "Antifragility is beyond resilience or robustness. The resilient resists shocks and stays the same; the antifragile gets better. This property is behind everything that has changed with time" (Taleb, 2012, p. 17).

- "In every domain or area of application, we propose rules for moving from the fragile toward the antifragile, through reduction of fragility or harnessing antifragility" (Taleb, 2012, p. 18).

- "Fragility could be expressed as what does not like volatility, and that what does not like volatility does not like randomness, uncertainty, disorder, errors, stressors, etc" (Taleb, 2012).

- "On the left, in the fragile category, the mistakes are rare and large when they occur, hence irreversible; to the right the mistakes are small and benign, even reversible and quickly overcome. They are also rich in information. So, a certain system of tinkering and trial and error would have the attributes of antifragility" (Taleb, 2012, p. 35).

3.2.3.2. *The antidote to the black swan*

- "Black Swans (capitalized) are large-scale unpredictable and irregular events of massive consequence… Black Swans hijack our brains, making us feel we "sort of" or "almost" predicted them, because they are retrospectively explainable" (Taleb, 2012, p. 20).

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- "The fragilista (medical, economic, social planning) is one who makes you engage in policies and actions, all artificial, in which the benefits are small and visible, and the side effects potentially severe and invisible" (Taleb, 2012, p. 20).

3.2.3.3. *Between Damocles and Hydra*

- "Hormesis, a word coined by pharmacologists, is when a small dose of a harmful substance is actually beneficial for the organism, acting as medicine. A little bit of an otherwise offending substance, not too much, acts to benefit the organism and make it better overall as it triggers some overreaction" (Taleb, 2012, p. 50).

- "…innovation and sophistication spark from initial situations of necessity, in ways that go far beyond the satisfaction of such necessity (from the unintended side effects of, say, an initial invention or attempt at invention)" (Taleb, 2012, p. 55).

- "Undercompensation from the absence of a stressor, inverse hormesis, absence of challenge, degrades the best of the best" (Taleb, 2012, p. 57).

- "A system that overcompensates is necessarily in overshooting mode, building extra capacity and strength in anticipation of a worse outcome and in response to information about the possibility of a hazard" (Taleb, 2012, p. 58).

- "Lucretius problem, the so-called worst-case event, when it happened, exceeded the worst case at the time… nature repares for what has not happened before, assuming worse harm is possible" (Taleb, 2012, p. 58).

3.2.3.4. *The cat and the washing machine*

- "Inanimate—that is, non-living—material, typically, when subjected to stress, either undergoes material fatigue or breaks " (Taleb, 2012, p. 67).

- "…maladjustment for this author is the mismatch between one's design and the structure of the randomness of the environment (what I call more technically its "distributional or statistical properties")." (Taleb, 2012, p. 68).

- "Many things such as society, economic activities and markets, and cultural behaviour are apparently man-made but grow on their own to reach some kind of self-organization. They may not be strictly biological, but they resemble the biological in that, in a way, they multiply and replicate…They are closer to the cat than to the washing machine but tend to be mistaken for washing machines." (Taleb, 2012, p. 68).

- "…the crux of complex systems, those with interacting parts, is that they convey information to these component parts through stressors, or thanks to these stressors" (Taleb, 2012, p. 70).

- "What did not kill me did not make me stronger, but spared me because I am stronger than others; but it killed others and the average population is now stronger because the weak are gone… All we may be witnessing is that transfer of fragility (rather, antifragility) from the individual to the system." (Taleb, 2012, p. 91).

3.2.3.5. *Intervention and iatrogenics*

- Naive interventionism is the lack of awareness of the need to look for a break-even point between benefits and harm (Taleb, 2012, p. 128).

- "Iatrogenics is compounded by the "agency problem" or "principal-agent problem," which emerges when one party (the agent) has personal interests that are divorced from those of the one using his services (the principal)" (Taleb, 2012, p. 130).

- "…anything in which there is naive interventionism, nay, even just intervention, will have iatrogenics." (Taleb, 2012, p. 131).

- "Noise is a generalization beyond the actual sound to describe random information that is totally useless for any purpose, and that you need to clean up to make sense of what you are listening to" (Taleb, 2012, p. 141).

- "The best way to mitigate interventionism is to ration the supply of information, as naturalistically as possible…the more data you get, the less you know what's going on, and the more iatrogenics you will cause." (Taleb, 2012, p. 144).

3.2.3.6. *The nonlinear and the nonlinear*

- "Nonlinear means that the response is not straightforward and not a straight line, so if you double, say, the dose, you get a lot more or a lot less than double the effect. For the fragile, shocks bring higher harm as their intensity increases (up to a certain level)" (Taleb, 2012, p. 284).

- "For the fragile, the cumulative effect of small shocks is smaller than the single effect of an equivalent single large shock… For the antifragile, shocks bring more

benefits (equivalently, less harm) as their intensity increases (up to a point)" (Taleb, 2012, p. 286).

3.3. Book: The World Until Yesterday - Jared Diamond (2012)

3.3.1. Overview

Jared Diamond presents a detailed collection of behaviours, traditions and customs from traditional societies and how it differs from modern conceptions. Some of the solutions to daily problems given by the people forming those societies might appear strange or illogical from a western and modern point of view, but in fact it has a lot to teach.

The book begins explaining the simplest type of society, the so-called band, which is formed by a few dozens of people, where everyone knows each other and where decisions can be reached by face to face dialogues without needing any political leadership or economical specialization. Another stage of society, formed by thousands of individuals and centre of special attention in the book, is the tribe. Tribes are normally established in a specific territory which is protected by its members, people who work together following a basic political system, and are organized according to weak economic specializations.

Chiefdom follows the tribe, but here its members share ideologies, political and religious identities. In this kind of society, there is a leader, the chief who makes decisions and has the power to claim the use of force to ensure the order. The final stage is the state, a more complex version of the chiefdom, with thousands of members, often very diverse, with a political system in charge of controlling the harmony inside the state and its interaction with neighbours, with more bureaucrats, urbanization and greater economic specialization.

Some of the topics analysed in the book which are related mainly on tribes and chiefdoms are: dangers and child-rearing (individuals), treatment of elderly, languages, and health-promoting lifestyles, peaceful dispute resolution, religion, warfare, human social studies including art, cognition, behaviour, cuisine, dance etc.

From all those topics, there is one specially interesting and denominated by the author as Constructive Paranoia, which is the possible explanation for some strange behaviours inside traditional societies, especially related to risk taking. A seemingly

harmless action, for a person who repeats it hundreds of times could be very dangerous, leading to an apparent paranoia which in fact is essential for her survival.

Overall, the book shows interesting behaviours and strategies implemented by traditional societies that contrast significantly with what is common in modern ones. Some of those examples, might serve to analyse our own societies and implement or made the necessary changes to improve, without falling into the idealization of traditional societies as full of peace and happiness.

3.3.2. Chapters development

3.3.2.1. *Friends, Enemies, Strangers, and Traders*

Traditional and modern societies have a wide range of differences but also similarities, especially in terms of economical and trading behaviour. For example, for traditional societies, land partition determines groups' segregation and resources availability defines whether a group stablishes their territory in a defined place. Their interaction with other groups sometimes is restricted to the nearest neighbours, however alike modern societies, even if they have the capacity to produce all the necessary goods to survive, they tend to trade with other communities.

Those transactions are quite different in terms of the payment methods and interaction between parts. In traditional societies, the payment is not a defined obligation that should be completed either immediately or in a specific period of time but rather can be a non-defined gift from a similar value behalf the other part given at any time.

Nevertheless, the kind of products that can be involved on those transactions, alike modern markets, can be necessities or luxuries without implying that the latter does not have a functional value. Luxuries can also have a functionality as necessities do but involve some sort of elements that make it more valuable such as materials or decoration.

3.3.2.2. *Constructive Paranoia*

Constructive paranoia, a crucial identifier of people living in traditional societies, serves as a strategy to prevent being significantly affected by some kind of hazards which when counted separately, have low probability to happen but when accumulated can reduce considerably life expectancy.

Modern societies are characterized by fearing quite unexpected hazards rather than those that due to its cumulative occurrence could affect them more likely. According to the author, you cannot measure the seriousness of a hazard by counting the number of deaths. On the contrary, it should be considered what the number of deaths would be if you are not careful. There is an underestimation of the hazards that lie beyond our control, like daily life activities such as driving a car, crossing a street or taking a shower. Conversely, we overestimate the hazards of things about we have no choice and may kill many people, such as plane accidents or terrorist attacks. As an example, it is said that "Americans are more afraid of terrorism than they are of guns, even though guns are 3,210 times more likely to kill them." (http-10). That is something we can learn from traditional societies, for whom repetitive low probable risks, become serious hazards when considering the cumulative probability of affecting us.

3.3.2.3. *Lions and Other Dangers*

The types of danger vary from society to society, and what might seem a very dangerous hazard for a tribe or a chiefdom, most probably is underestimated by the population from a state. For example, for Nigerian tribes, the danger was associated with natural elements, such as animals, weather, trees falling, and all kind of hazards that can be found in a wild environment. In modern societies, the dangers are associated to crimes, car accidents, and other possible events that happen in cities or towns.

However, if we consider life spam, the risk to die due to a hazard, seems to be lower in modern societies where people tend to live up to 80 years, compared with around 40 years in traditional societies. An important factor for this to happen, is the capability to deal with accidents. In the modern world, if you break your leg you can easily receive treatment and after a couple of months you can continue with your life normally, but for the member of a tribe, a broken leg can lead to infections, incapability to work, hunt or perform daily and essential activities to survive.

3.3.2.4. *Bringing Up Children*

Diamond discusses and compares "Infant-adult contact" within modern industrial societies and traditional societies. On one hand, many western transporting devices for children provide no physical contact between the baby and the care-giver, while on the other hand, in many traditional societies, babies are transported tied to an adult, may times be facing backwards (Diamond, 2012, p. 125).

This behaviour is compared with the traditional carrying devices as simple as slings or holding a child on one's shoulders which allows the child to face forward, perceiving the world as from the care-giver's point of view, which according to the author stimulates more their neuro-motor development. (Diamond, 2012, p. 125)

Moreover, "Multi-age playgroups" is considered as a feature of small-scale societies. So that, in small-scale societies like in a typical hunter-gatherer society, there is one-room schoolhouses and it is impossible to assemble separate age-cohort playgroups, each with many children, as is characteristic of large societies. In a small-scale society, all children in the band form a single multi-age playgroup of both sexes, which promotes carrying and responsibility in the oldest ones and adaptability and maturity in the youngest ones by being socialized not only by adults but also by older children (Diamond, 2012, p. 134).

3.3.3. Highlights

3.3.3.1. *Friends, Enemies, Strangers, and Traders*

- "…exclusive territories require a productive, stable, predictable environment within which the territory-owners can count on usually finding most or all of their necessary resources, such that they rarely or never need to go outside their territory" (Diamond, 2012, p. 41).

- "…a few features of traditional trade would be familiar to modern shoppers, especially the high proportion of our purchases devoted to functionally useless or unnecessarily expensive status symbols, such as jewellery and designer clothes" (Diamond, 2012, p. 51).

- "…in both cases the objects traded cover a spectrum from materially essential ("necessities") to materially useless ("luxuries"). At one extreme are objects that facilitate or are indispensable for surviving, such as food, warm clothing, and tools and machines. At the opposite extreme are objects irrelevant to survival but prized as luxuries, as decorations, for entertainment, or for conferring status, such as jewellery and television sets…we shouldn't dismiss materially "useless" luxury items as useless: the status that they confer may bring huge material benefits, such as business opportunities or the wooing of prospective trophy wives and husbands" (Diamond, 2012, p. 52).

3.3.3.2. *Constructive Paranoia*

- "If you do something that involves a very low probability of killing a person—say, just once in a thousand times that you do that something—but you do it a hundred times per year, then you are likely to die in about 10 years, instead of living out your expected lifespan of 40 years…Their paranoia makes perfect sense. I now think of it as 'constructive paranoia.' …in the long run, that seeming paranoia is constructive: it's essential to surviving under traditional conditions" (Diamond, 2012, p. 160).

- "…the overall level of danger is much lower for us than for them: our average lifespan is double theirs, meaning that the average per-year risk that we face is only about half as great. The other significant difference is that the effects of many or most accidents that we Americans suffer can be repaired, whereas accidents in New Guinea are much more likely to prove crippling or fatal." (Diamond, 2012, p. 161).

3.3.3.3. *Lions and other dangers*

- "People in every society face dangers, but the particular dangers differ among societies. Our perceptions of both unfamiliar risks and familiar ones are often unrealistic" (Diamond, 2012, p. 180).

- "…traditional lifestyles are overall more dangerous than the Western lifestyle, as expressed in a much shorter lifespan" (Diamond, 2012, p. 181).

- "…the cumulative risk of accidental death is probably lower for modern societies, because we exert far more control over our environment even though it does contain new hazards of our own manufacture such as cars. The other difference is that, thanks to modern medicine, the damage caused by our accidents is much more often repaired before it kills us or inflicts life-long incapacity" (Diamond, 2012, p. 182).

- "In any dangerous environment, accumulated experience teaches rules of behaviour to minimize the risks, rules worth following even if an outsider considers it overreacting" (Diamond, 2012, p. 184).

- "Prevention of accidents is important, and the knowledge of how, when, and under what circumstances any particular endeavour should or should not be undertaken is necessary to personal success and survival. Significantly, innovation in any

technique or in behaviour relating to the natural environment is considered to be extremely dangerous" (Diamond, 2012, p. 184).

3.3.3.4. *Bringing Up Children*

- "…How much freedom children enjoy seems to depend partly on how dangerous the environment is or is perceived to be. Some environments are relatively safe for children, but others are dangerous because of either environmental hazards or else dangers from people." (Diamond, 2012, p. 133)

- "In such multi-age playgroups, both the older and the younger children gain from being together. The young children gain from being socialized not only by adults but also by older children, while the older children acquire experience in caring for younger children." (Diamond, 2012, p. 134)

- "American toy manufacturers heavily promote so-called educational toys to foster so-called creative play. American parents are taught to believe that manufactured store-bought toys are important to the development of their children. In contrast, traditional societies have few or no toys, and any toys that do exist are made either by the child itself or by the child's parents." (Diamond, 2012, p. 136)

- "In modern state societies, there is formal education: schools and after-hour classes, in which specially trained instructors teach children material set by school boards, as an activity separate from play. But education in small-scale societies is not a separate activity. Instead, children learn in the course of accompanying their parents and other adults, and of hearing stories told by adults and older children around the campfire." (Diamond, 2012, p. 136).

- "We could encourage self-invented play of children, rather than discourage it by constantly providing complicated so-called educational toys. We could arrange for multi-age child playgroups, rather than playgroups consisting of a uniform age cohort. We could maximize a child's freedom to explore, insofar as it is safe to do so." (Diamond, 2012, p. 138).

- "When food resources are few and concentrated in a few areas, people gather to live at those areas. at favourable times of year when resources are widely and uniformly distributed, people spread out over the landscape." (Diamond, 2012, p. 201).

3.4. Book: The Long Summer - (Fagan M. B., 2005)

3.4.1. Overview

After the Ice Age in which glaciers covered most of the world, temperature began to rise. The warm temperature started from 15,000 years ago, civilization and all recorded history occurred in this warm period. This era is known as the Holocene which is the long summer of the human species. This book describes the first detailed record of climate change from 15,000 years of warming, the climate-driven events that occurred during that period, and the effect they had in human civilization.

This book tries to deal with the question: "To what extend did these events shape the course of Stone Age life, early farming societies, and civilizations?" (Fagan M. B., 2005, p. 12).

Fagan (2005) exemplifies this situation with the following statement:

> "Ever since the beginnings of farming some 12000 years ago, people have lived at the mercy of cycles of cooler and wetter, warmer and drier climate… The sufficiency or insufficiency of food, whether confined to a single valley or affecting an entire region, was a powerful motivation of human action…Climate is, and always has been, a powerful catalyst in human history, a pebble cast in a pond whose triggered all manner of economic, political, and social changes." (Fagan M. B., 2005, p. 15).

Ancient people, lived in small groups and were able to adapt to climate changes. By that time, "survival depended on mobility and opportunism, on a flexibility of daily existence that allowed people to roll with the climatic punches (Fagan M. B., 2005, p. 20). However, as population increased, people started to settle in specific areas, creating civilizations, "the risk were higher, especially when communities expanded of their land… Humanity had stepped over a threshold of vulnerability onto a world where the costs of rolling with climatic shifts were infinitely higher." (Fagan M. B., 2005, p. 21).

This book indicates that, the key to survival had always been human flexibility, mobility, adaptability and technology that allowed people to change their habits overcoming the challenges related to climate.

3.4.2. Chapters development

3.4.2.1. *The late ice age orchestra 18,000 to 13,500 B.C.*

This chapter discuses a period which is the Late Ice Age in Europe. In this period Europe was surrounded by rubble-strewn desert and encircled by steppe/tundra further to

the south. Also, Cro-Magnons lived there hunting reindeer and waterfowl, fishing salmon, and they protected themselves from the cold with layered clothing sown with needle and thread. Late Ice Age Europe is known as a breathing continent, because it sucked animals and people into itself during warmer times and push them out in colder seasons.

3.4.2.2. *The Virgin Continent, 15,000 to 11,000 B.C.*

100,000 years ago, as the sea level fell by 90 meters, a land bridge – Central Beringia – had formed between Asia and America. Evidence indicates that, the first Americans came from northeast Asia around 13,500 BC, following a warming phase that had begun 1,500 years earlier. An ice-free corridor developed in what is now Canada east of the Rockies. It is demonstrated that, the key factors to survive by people in this period were, technology, flexibility and diet adjustment.

3.4.2.3. *The Cataclysm, 10,000 to 4000 B.C.*

In this period, due to the climate condition, when the warming resumed, the weather turned humid again, and agriculture was the staple of life. People became farmers and village communities became anchored to their land because plant cultivation and animal domestication resulted from the need to ensure reliable food supplies at a time of intense drought. Around 6,200 B.C. a cataclysm stroke again. Another lake burst in northern Canada, sending a massive outflow of meltwater to the Gulf of Mexico. Sea levels rose rapidly. After the short cold period, warming resumed, and sea levels rose further. And around 5,600 B.C. the water of the Mediterranean spilled over the Dardanelle Straight into what at the time was a lake and created the Black Sea. But, even during the flood, due to the flexibility of farmers, they had rapid movements, and leapfrogged on the shores of the new Black Sea or inland. The same thing happened to reach forests and rivers in Europe.

3.4.2.4. *Gifts of the Desert, 6000 to 3100 B.C.*

By 5,000 B.C. the major climatic shifts were largely over, and the long summer had established itself. The period to the present was not a period of stability and smaller climatic changes. It had tremendous impacts for settlements and civilizations. This chapter discusses a period, when the drying of the Sahara forced its inhabitants to live along the banks of the Nile which was a viable landscape for cattle herders if they were prepared to remain constantly on the move to search for pastures and water. Studies

indicates that, Badarian communities lived along the Nile. Their toolkits and vessels which are found in the place they settled, Nile Valley, reveal their personal status and social affiliation.

3.4.3. Highlights
3.4.3.1. *The cataclysm, 10,000 to 4000 B.C.*

- "Both plant cultivation and animal domestication resulted from the need to ensure reliable food supplies at a time of intense drought" (Fagan M. B., 2005, p. 102).

- "We have seen how the Cro-Magnons and their successors, and the hunter-gatherers of southwestern Asia, adapted effortlessly to major climatic shifts by virtue of their mobility and effortless opportunism. The vulnerability equation began to change when mobility gave way to sedentarism… but even then, people adjusted to the severe droughts of the Younger Dryas by the simple expedient of deliberately cultivating wild cereals" (Fagan M. B., 2005, p. 124).

- "When the Mediterranean Sea inundated the Euxine Lake, hundreds of sedentary farming communities along the lakeshore moved rapidly inland, up the Danube and other rivers, bringing with them their simple farming methods and cushioning the disaster by relying heavily on the wild foods that were always there for the taking. They surely suffered hunger and death, but the sheer flexibility of the early farming adaptation permitted rapid movement, whether on the shores of the new Black Sea or inland" (Fagan M. B., 2005, p. 124).

3.5. Book: What Makes Us Human? - Charles Pasternak (2007)

3.5.1. Overview

The question of what distinguishes humans from other creatures, which of our abilities or talents makes us unique, whether it is our ability to think rationally, our language ability or our capacity to create artefacts and solutions to overcome our physical constraints, is targeted in this book, collecting the ideas presented by a further ten experts, ranging across anthropology, biochemistry, medicine, neuroscience, philosophy, psychology, and religion.

According to the author, there are plenty of ways, such as our language, the use of fire or our cooking ability, in which humans differ from other living creatures, moreover,

all of them have their roots in our cognitive ability. "While a human's capacity for cognition is likely a result of genetics, we can't assume that genes alone are responsible. Our cognitive prowess has many by-products, such as musical and mathematical abilities, which can't be explained genetically, because they aren't a direct result of natural selection, the prime engine of evolution. Culture can shape cognitive characteristics, too. For instance, a baby born to an isolated tribe in the Amazonian jungle would think and act like a westerner, if raised in a typical British home" (http-6).

Susan Blackmore, one of the authors contributing to this book, affirms that the fact that we are *meme machines*, makes unique. Memes are understood as ideas, skills, habits or behaviours passed by person to person by non-genetic means, which in contrast with to other animals who pass skills such as nest building or hunting strategies through genes. (http-6).

Another important element is memory, which can be categorized into declarative, referring to memories that can be consciously recalled and described using language, and nondeclarative, which are the opposite. Declarative memory, can also be divided into *semantic memory*, or the memory of facts and *episodic memory*, the memory of events. "Declarative memories allow us to imagine different alternative actions in a scenario, choosing one that is best suited to anticipate future situations or deal with the ones at hand" (http-6).

Imagination also distinguish us from other animals. We can create in our minds possible alternatives or answers to what happens around us. Our imagination also leads to what is called theory of mind, which is the ability to imagine another individual's state of mind. "Theory of mind stats with *second-order intentionality*, or the ability to say, 'I am aware that I believe that another individual believes something'" (http-6).

Finally, our capacity to understand oneself in relation to the world, or better called as human consciousness, which joined with our ability to change thought patterns and behaviour as well as our curiosity, also distinguish us from other living creatures. All of those characteristics are partly explained by our larger brain, which enabled our ancestors to survive amid harsh climatic conditions. "In fact, records show that each new human ancestral species that emerged following an icy period had a larger grain than ones before" (http-6).

3.5.2. Summary of chapters

3.5.2.1. *What Makes Us Human? – Our Ancestors and the Weather*

This chapter argues how we survived worsening climate during the ice ages. Also, the factors which make humans have bigger brains are mentioned. It is believed that as we needed bigger brain sizes to deal with extreme weather, behavioural adaptations ended up with physical adaptations. In addition, it can be seen that a few genetic alterations brought a huge growth of functional potential in the human brain, like the language development.

3.5.2.2. *Curiosity and Quest*

In This Chapter, the author argues that human beings possess a unique combination of characteristics that allows us to search more avidly than other creatures. These features are: an upright gait, a mobile thumb, a voice box capable of speech, and a brain that contains three times as many neurons as that of a chimpanzee. The exploratory drive of humans, their search for new lands on earth, is particularly striking.

3.5.2.3. *Causal Belief Makes Us Human*

This Chapter discuss causal belief which is a belief in physical cause and effects. Other mammals, including non-human primates, lack this ability. In addition, the author argues that "without such beliefs it would not have been possible for technology, which is the main driver of human evolution, to develop." (Pasternak, 2007, p. 180)

Also, it is believed that causal beliefs are essential for making complex tools and planning. Furthermore, it is proposed that "…the evolution of causal thinking was essential for the development of tool use as it is not possible to make a complex tool without understanding cause and effect. The evolution of language may have been linked to the same process" (Pasternak, 2007, p. 164).

3.5.3. Chapters development

3.5.3.1. *What makes us human? -our ancestors and the weather*

This chapter discusses some factors that made humans in the past survive in the extreme climate-dry, cold or hot weather. Humans adapted themselves behaviourally and physically in a way that, larger brains were needed in order to tackle the worsening climate:

"The needs of our increasingly exploratory and adaptive behaviour have fed back into the size of the organ responsible for that behaviour, our brain, and its virtual client our complex language ability." (Pasternak, 2007, p. 94)

It is believed that the need of big brains during the ice ages leaded to behavioural adaptations which precede the physical adaptations that ended up with progressively larger human brains. "Over the period from 2.5 to 1.5 million years ago, the average hominid brain size more than doubled, from 400 cm^3 to 900 cm^3." (Pasternak, 2007, pp. 99-100).

However, surprisingly, there has been an overall decline in brain volume in modern humans over the past 150,000 years. Also, the author indicates that, rapidly increasing brain size was considered as a key feature that set humans apart from the walking apes that lived before 2.5 million years ago. Since then our brains have trebled in volume (Pasternak, 2007, p. 103).

Hence, with the knowledge that just a few genetic alterations caused a huge growth of functional potential in the human brain, it can be claimed that "language" drove that rapid growth 2.5 million years ago. Anthropologist believe that language was the unique behaviour that enabled Homo and Paranthropus 2.5 million years ago being the latter who survived the ice epoch.

3.5.3.2. *Curiosity and Quest*

In this chapter Pasternak argues the reasons why no animal has come close to humans what are. The first is the upright gait, the freeing of hands has an equally, the flexible thumb, leading to an agile hand, then, is the second human attribute that is key to human quest. The third attribute is the human voice box (or larynx) which allows our speech. And the fourth attribute that allows us to exercise our superior quality of quest is, of course, the brain (Pasternak, 2007, pp. 118-119).

Furthermore, it is the combination of all three – hand, speech and brain – that allows humans to search more avidly than other creatures. As mentioned earlier, the human brain has increased some three-fold over the last 2 million years. However, the size of the chimpanzee brain has remained pretty constant for 6 million years.

It is believed that, what makes us human is our innate curiosity and our never-ceasing quest. Researches demonstrate that, thousands of years ago people searched, on average, as avidly as they do today. But cultural, non-genetic, changes also affect our way of life.

3.5.4. Highlights

3.5.4.1. *Casual belief makes us human*

- "Humans, unlike other primates, have a belief in physical cause and effect which enables the acquisition of new interactions, and led to technology" (Pasternak, 2007, p. 164).

- "There are of course cognitive similarities between human and mammalian and especially primate cognition: primates remember their local environment, take novel detours, follow object movement, recognise similarities and have some insight into problem solving. However, they do not view the world in terms of underlying 'forces' that are fundamental to human thinking. They do not understand the world in intentional or causal terms." (Pasternak, 2007, p. 168).

- "…primates like chimpanzees do not have concepts of variable causes to explain interaction between objects. One might have thought that Wolfgang Kohler's experiments with chimpanzees showed just the opposite. His chimpanzees, some eighty years ago, could sometimes, perhaps with some training, stack boxes on top of each other to get a banana nailed to the ceiling. But Kohler himself acknowledged that the chimpanzees had no knowledge of the forces involved. For example, they would try to place one box on another along its diagonal edge; and if stones were placed on the ground so that the box toppled over, they never removed the stones" (Pasternak, 2007, pp. 168-169).

- "However, the chimpanzee Kanzi, a bonobo ape, showed remarkable skills. It learned to create and use stone tools to gain access to food to cut a rope and it could make stone flakes and evaluate them after observing a human striking two rocks together" (Pasternak, 2007, p. 169).

- "All the above evidence makes clear that while primates and some birds use simple tools there is an almost total absence of causal beliefs in animals other than humans. In no case of stone tool use is there evidence that individual animals modified the structure of the stone in order to improve the tool's function" (Pasternak, 2007, pp. 170-171).

- "Tool use was probably the most important adaptation in human evolution. There is even evidence that specific regions of the human brain are associated with tool use. Tomasello (1999) believes that the normal processes of biological evolution – genetic variation and natural selection – could have created one by one each of

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the cognitive skills necessary for complex tool use, language and complex social organisation" (Pasternak, 2007, pp. 171-172).

- "The human hand differs from apes in that it has a longer thumb and less curved finger bones. It is capable of both a power grip and a precision one…Of course, freeing the hands from walking, with the evolution of bipedalism was a crucial step. It is also important to recognize that it is not just the shape of hands that matters, but the ability of the brain to control their complex movements" (Pasternak, 2007, p. 174).

- "A strong case can be made that a key step in human evolution that made *Homo sapiens* different from other primates was the acquisition of causal beliefs. Without such beliefs, it would not have been possible for technology, which is the main driver of human evolution, to develop. Causal beliefs are essential for making complex tools and planning ahead, and all other mammals, including non-human primates, lack these abilities" (Pasternak, 2007, p. 180).

3.5.4.2. *Causal Belief Makes Us Human*

- "It is proposed that the evolution of causal thinking was essential for the development of tool use as it is not possible to make a complex tool without understanding cause and effect. The evolution of language may have been linked to the same process. It has been technology that resulted from causal beliefs that has made us human, not social interaction" (Pasternak, 2007, p. 164).

- "Human technology involves co-operation with others – individuals do not make tools alone… Language may have had its origins in motor control. Evolution cannot invent something quite new but can only tinker with what is already there" (Pasternak, 2007, p. 177).

3.6. Other Conceptual Topics

In order to contextualize some of the topics that will be developed in the following sections, a deeper explanation of some apparently basic topics, will be presented below.

3.6.1. The social

In general terms, social means association. However, there are different interpretations of who are the actors which perform that association to be understood as 'social'.

An initial approach shows that the interactions and connections that are associated with the concept of social, include not only humans but other living beings and material artefacts, being all of them relational effects. "When it is used this way, the meaning of the concept is left open to include anything and everything that may be associated together" (Dolwick, 2009, p. 21).

Another approach, understands 'social' as a concept referred primarily to humans, making them a social half of the world, separated from the natural-material half due to inner characteristics such as discourse, intersubjectivity, and meaning making, involving mainly the use of language and symbols in micro-scale, face-to-face contexts (Dolwick, 2009).

According to Dolwick (2009), a narrowest approach encapsulates social into social structures and social facts, referring "primarily to macro-scale forces, which are supposed to exist independently of microscale interactions". Those macro-scale forces determine the actions of individual subjects.

For the author, there are 4 dimensions in which the concept of social can be located according to the different author's perspective, without implying that one concept is uniquely categorized in only one of them but rather, they can be mixed.

- Purify, referring to homogeneity. This dimension includes the social concepts that "have only one active ingredient (e.g. humans)" (Dolwick, 2009)
- Hybridity, which involves heterogeneity and ambivalence, giving place also to nonhuman actors and their interactions or mixtures with humans.
- Order which is associated with the perceptions of stable/predictable/organized.
- Chaos "…refers to inconsistency and destabilization" (Dolwick, 2009). Concepts that reveal action as (potentially) chaotic/unpredictable/disordered are involved in this label.
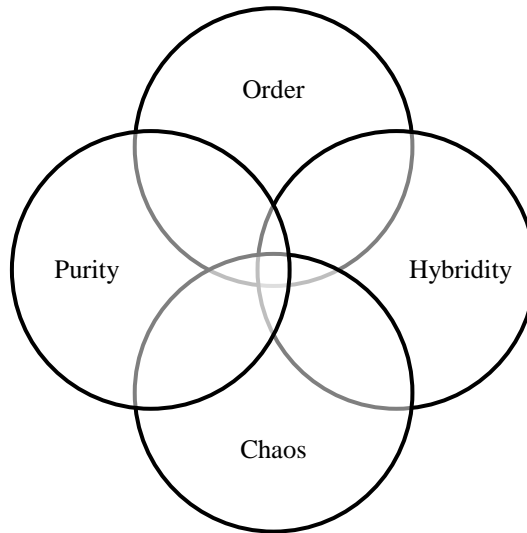
Figure 3.3. *Dimensions of the concept of 'social', (Dolwick, 2009, p. 33).*

One representative interpretation of the purity side of 'social', is the one given by Niklas Luhmann cited by (Dolwick, 2009), which consider that communication composed by information, utterance and understanding is essential to consider the existence of social, thus it's constrained to humans giving only minor roles to physical-material artefacts. "An individual, is considered 'social' to the extent that he or she communicates" (King and Thornhill, 2003 cited by Dolwick, 2009).

On the other hand, for Gilles Deleuze and Fe´lix Guattari (D&G) (e.g. 1972/2000, 1980) cited by (Dolwick, 2009), in their idea of social flow, "social units tend to be fusions, or couplings of 'people-groups-things-ideas.'…instead of limiting the social world to 'individual agents' and 'social structures,' they are able to shift the boundaries and add different units (even 'natural' and 'material' ones). In fact, the social world itself is regarded as an interactive assemblage, an open creative process of connections, exchanges and divergences." (Dolwick, 2009, p. 33). They also state that most of what could be associated to social, is the result of assembled bodies, parts, materials, ideologies and other socio-economic and cultural elements that work and produce and whose composing parts are something completely different when assembled together and which flow and change over time (Dolwick, 2009, p. 34).

Thus, Deleuze and Guattari, are some of the few authors mentioning the active status of material objects (artefacts) within social theory. For most of the authors classified in the 'purity side of social' by (Dolwick, 2009) such as Durkheim and Bourdieu, objects are symbols or forms of capital which have sense by humans who interact merely on them but "not with, though, or in response to them".

3.6.2. Four questions about design

3.6.2.1. *What is design? misunderstanding design*

Design is not just about creating beauty. "Despite all the years of evolution away from these early form-focused beginnings, the image of beautification still accompanies the popular notion of design" (Dorst, 2015, p. 42).

*Design is not all about ideas. "*When creativity techniques like brainstorming are used in a professional design context, it is always in a very specific manner, to explore solution possibilities within a constrained setting… Professional designers do not focus on the generation of "the idea": they approach problems in a very strategic, deliberate, and thoughtful way" (Dorst, 2015, p. 43).

*Design is not irrational. "*Designers create proposed solutions that can be judged on a sliding scale of better or worse relative to the needs of stakeholders… To quote Nigel Cross, paraphrasing Hamlet: 'Yes, they are quite mad—but there is method to their madness' (Cross 1996)" (Dorst, 2015, p. 43).

Design is not mysterious. There is actually a robust body of knowledge about design, the activities it consists of, the sequences in which those activities often take place, the abilities needed to be a good designer, and paths of development of these abilities (Dorst, 2015, p. 43).

Not all design is good design. As any profession, there are examples of superficiality and mediocrity in design. (Dorst, 2015, p. 44). Here, it is worth to mention the idea of Papanek, for whom only few professions other than designers, can create such impact on society (Papanek, 1971). A good designer can create an artefact to supply vital resources to a given community or can create an artefact to destroy them.

3.6.2.2. *What is the place of design in the greater scheme of things?*

Dorst (2015) compares four basic ways of reasoning: deduction, induction, (normal) abduction, and design abduction.

Deduction—solid reasoning from cause to effect. At the start of a process of deduction, we know the "elements" (the "what") in the situation, and we know "how" (pattern of relationships) they will interact together. Then by reasoning it can be reached an outcome. This especially applies for elements, objects which interact following physical laws. The result of that interaction can be predicted and observed in the end (Dorst, 2015, p. 45).

Induction—discovering patterns. At the start of the reasoning process, we know the elements, and the outcome of their interactions, but we do not know the pattern of relationships (how) that leads to that result. Normally, hypothesis are formulated using this form of reasoning (Dorst, 2015, p. 46).

"Deduction and induction are the two forms of reasoning that we have at our disposal to predict and explain real-world phenomena, and they have driven our understanding of the world immensely. But deduction and induction are not enough if we want to make something. If we want to create valuable new "things," as in design and the other productive professions, the basic pattern of reasoning is called "abduction." In abduction, we set out to create a new "what"—a new "element" for the problem situation—so that the interactions in the system lead to a desired outcome. Abduction comes in two forms. In both forms, we already know at the beginning of the process something about the outcome of the equation; that is, we have an idea about the value we aim to achieve with the creation of the outcome." (Dorst, 2015, p. 48).

Normal abduction—solid problem-solving, based on experience. "In normal abduction, we know the result, the value we want to achieve through the desired outcome, and also the "how," a pattern of relationships that will help achieve the value we seek. The missing element is a "what" (an object, a service, a system), which still needs to be created… In this type of abduction, the degree of innovation will be limited because the problem-solving process doesn't question the "how," and therefore excludes the creation of new scenarios" (Dorst, 2015, p. 49).

Design abduction—two unknowns lead to a process of creative exploration. In this kind of reasoning and the most often observed in design profession, the starting point is some knowledge about the outcome, the desired value to be achieved but no idea about "what" new elements to create, neither their possible pattern of relationships. This type of reasoning requires the parallel development of "what" and "how" as well as the testing of both in conjunction (Dorst, 2015, p. 49).

3.6.2.3. *What makes design hard? problems and paradoxes*

According to the Dorst (2015), a problem occurs only when either we do not know how to proceed, or the chosen way shows no progress. Dealing with paradoxes caused by conflicting values and needs on the problem side, many times dependent on conflicting interests from the stakeholders, are the kind of challenges of designers.

3.6.2.4. *How do designers approach a paradox? on framing*

Dorst (2015, p. 55) presents framing as the way to solve the paradoxes they have to face when starting their design process. According to him, framing the problem from a context wider than the original one from which the problem was formulated, allow designers to think on something new.

3.6.3. Design and Social Sciences

In order to understand the role of design when covering social challenges, it is necessary to review the strategies in which Design and Social Sciences cooperate to solve specific challenges, which could not be well-addressed by any of them apart. In the following lines, some of the main approaches that combine design and social sciences will be explained:

3.6.3.1. *Design for experiencing*

Its aim is to design users' experiences of things, events and places. By making user experiences (past, current and potential), the source of inspiration, a better design for experience can be done. Frascara (2002, p. 3) suggests that to learn from people's memories, current and ideal experiences, it is necessary to (Figure 3.4):

- Listen what people say

- Interpret what people express and make inferences about what they think

- Watch what people do

- Observe what people use

- Uncover what people know

- Reach toward understanding what people feel

- Appreciate what people dream

According to Frascana (2002), in order to create empathy with the people who use products and information systems, it's necessary to explore simultaneously what people say, do and make. "The different ways of accessing experience have evolved over time. Traditional design research methods were focused primarily on observational research (i.e. looking at what people do and use). Traditional market research methods, on the other hand, have been focused more on what people say and think (through focus groups, interviews and questionnaires). The new tools are focused on what people make, i.e. what

they create from the toolkits we provide for them to use in expressing their thoughts, feelings and dreams" (B.-N.Sanders, 2002, p. 4).
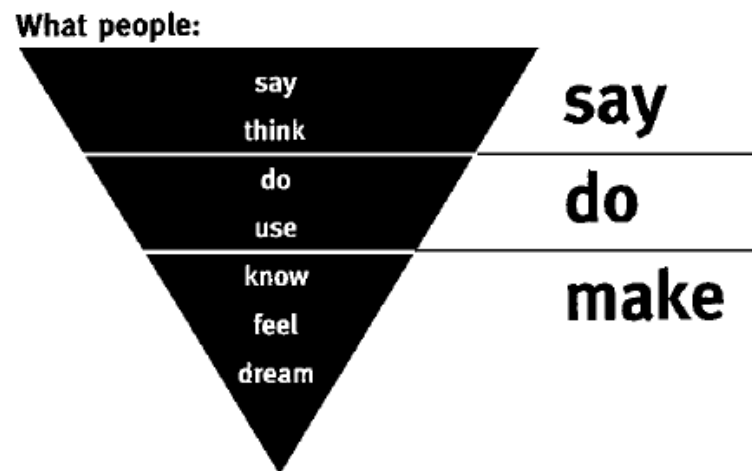
Figure 3.4. *Accessing experience: what people do, say and make, (B.-N.Sanders, 2002, p. 4).*

3.6.3.2. *The Make Tools*

The "emotional toolkits", intended to create artefacts such as collages or diaries, reveal feelings, dreams and aspirations. "Cognitive toolkits" with which people make artefacts such as maps, 3D models, flowcharts and diagrams of relationships, tell how people understand and misunderstand things, events and places. Both of them are part of what is called Make Toolkits which purpose is to show what people know, feel and dream. This is the design language of users (B.-N.Sanders, 2002, p. 5). This kind of tools to better understand the user, are developed by designers and social scientists, the latter, who bring frameworks for the understanding of user experience, and the former, by synthetizing and embodying ideas and opportunities.

This trend of understanding and empathizing with the people who experience artefacts, interfaces, systems and spaces, by providing a visual language that can be used by different kinds of people to express themselves is called Postdesign or co-design*.* It is participatory, as it enhances the direct and active participation of all stakeholders in the design development process, making the deliverables of design, more meaningful to the people who will ultimately benefit from them (B.-N.Sanders, 2002, p. 5).

3.6.3.3. *Hierarchy of user needs—functionality, usability and pleasure*

Jordan (2002) mentions that looking at pleasure with products is a natural progression from usability-based approaches, which consider humans as physical processors, "…with attributes such as strength, height and weight, and cognitive

processors with attributes such as memory, attention and expectations" (Jordan, 2002, p. 16). Products can be part of the Maslow's hierarch of needs according to which "even if basic needs such as physiological needs and safety have been met, people will still meet with frustration if their higher goals are not met" Jordan (Jordan, 2002, p. 13).

Applying that hierarchy to human factors, Jordan (1999) developed a hierarchy of user needs: (1) functionality; (2) usability; (3) pleasure. The first one, refers to the functions necessary to perform the tasks for which the artefact was intended. To fulfil this level, it is necessary to understand what the product will be used for, as well as the context and environment in which it will be used. Once the functionality is covered, people look for products that can be easily used. Finally, apart from functionality and usability, products can also provide emotional benefits. To reach this level, it is necessary to understand people as far beyond just physical and cognitive processors, but "as emotional beings with values, tastes, hopes and fears" (Jordan, 2002, p. 14).

Jordan (2002) summarises the types of pleasures developed by the anthropologist Lionel Tiger adding some examples of how they can be perceived in products:

- *Physio-pleasure*: pleasures derived from the sensory organs. For example, the tactile pleasures when holding and touching a product during interaction.

- *Socio-pleasure:* enjoyment derived from the company of others. Spaces to facilitate social interaction are examples of how products can create this kind of pleasurable experience.

- *Psycho-pleasure*: satisfaction gained from accomplishing a task. The functionality and usability of a product can define how satisfied the user is.

- *Ideo-pleasure:* "refers to the pleasures derived from "theoretical" entities such as books, music and art. In the context of products, it would relate to, for example, the aesthetics of a product and the values that a product embodies" (Jordan, 2002, p. 15).

3.6.4. Co-creation

In the current market, costumers no longer look for what is produced, but rather are looking for personalization at affordable prices. The concept of mass customization, is a clear example of how the end user has been getting a more critical role in the product design process.

The term co-creation has been evolving over the past six decades, covering ideas of more participative design approaches like participatory design and co-design as well. In

general terms, co-creation suggests a swift between a traditional user-centred approach to what is called co-designing. The key concepts to understand what that change, or evolution means, are explained in the following lines.

3.6.4.1. *User-centred design*

The design team focuses on the "thing being designed (the object, communication, space, interface, service, etc.) looking for ways to ensure that it meets the needs of the user" (B.-N.Sanders, 2002, p. 1). It involves "an 'expert perspective' in which trained researchers observe and/or interview largely passive users, whose contribution is to perform instructed tasks and/or to give their opinions about product concepts that were generated by others" (Sanders & Jan Stappers, 2008, p. 6).

3.6.4.2. *Co-creation*

Sanders & Jan Stappenrs (2008), present co-creation as "…any act of collective creativity, i.e. creativity that is shared by two or more people." (Sanders & Jan Stappers, 2008, p. 6)

3.6.4.3. *Co-design*

"Collective creativity as it is applied across the whole span of a design process…the creativity of designers and people not trained in design working together in the design development process" (Sanders & Jan Stappers, 2008, p. 6). "Co-designing requires creative initiative on the part of the entire team: researchers, designers, clients and the people who will ultimately benefit from the co-designing experience" (Sanders & Jan Stappers, 2008, p. 9).

Table 3.1 presents some of the main traditional and emerging design practices, which approaches differ on the final purpose of the design process. On one hand, traditional design disciplines seek on products, to solve or cover a specific need, while emerging design disciplines, pretend to tackle a problem, either if the final solution is a product, service or initiative.

According to Sanders & Jan Stappers (2008), "Co-creation is by now being touted at all points along the product development process, particularly in the later stages. Websites such as www.NIKEiD.com allow people to customize their own shoes, for example, by choosing colours and detailing. For many, co-creation is the latest trend in marketing and brand development. It is the latest of ways to get new products and services into an already overcrowded marketplace" (Sanders & Jan Stappers, 2008, p. 8).

Table 3.1. *A snapshot in time of traditional and emerging design practices, (Sanders & Jan Stappers, 2008, p. 11).*

The traditional design disciplines focus on the **designing of** 'products' …	… while the emerging design disciplines focus on **designing for** a purpose
visual communication design	design for experiencing
interior space design	design for emotion
product design	design for interacting
information design	design for sustainability
architecture	design for serving
planning	design for transforming

Additionally, Sanders & Stappers (2008) express the complexity of the design process as designers get closed to the final users of their designs (see Figure 3.5), which is what happens in co-design.

> "…in co-design… the roles get mixed up: the person who will eventually be served through the design process is given the position of 'expert of his/her experience', and plays a large role in knowledge development, idea generation and concept development. In generating insights, the researcher supports the 'expert of his/her experience' by providing tools for ideation and expression. The designer and the researcher collaborate on the tools for ideation because design skills are very important in the development of the tools. The designer and researcher may, in fact, be the same person. The designer still plays a critical role in giving form to the ideas" (Sanders & Jan Stappers, 2008, p. 12).

Figure 3.5 shows that the closer designers get to the final users, the wider and fuzzier the front end of the design process is, meaning more difficulties when summarizing ideas and concepts generation. Additionally, the fact that "participatory design has been seen as academic endeavour with little or no relevance for the competitive marketplace… in many parts of industry, investment in research is looked upon as a non-obvious step, investment in user studies a big and expensive step, and user participation a radical step into the unknown" (Sanders & Jan Stappers, 2008, p. 10) has prevented a greater expansion and application of co-creation in industry.
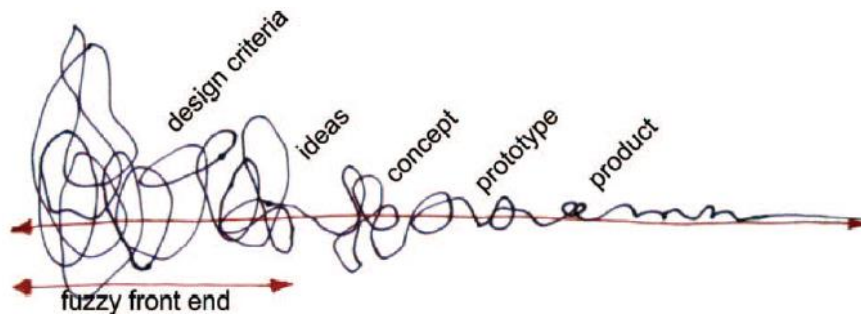
Figure 3.5. *The front end of the design process has been growing as designers move closer to the future users of what they design, (Sanders & Jan Stappers, 2008, p. 6).*

The application of co-creation implies the assumption that all the actors who will be involved in the product development, from designers to final users, are creative being necessary to recognize different levels (see Table 3.2) of creativity and identifying the challenges and tools to combine them into a useful set of ideas.

Table 3.2. *Levels of creativity, (Sanders & Jan Stappers, 2008, p. 11).*

Level	Type	Motivated by	Purpose	Example
4	Creating	Inspiration	'express my creativity'	Dreaming up a new dish
3	Making	Asserting my ability or skill	'make with my own hands'	Cooking with a recipe
2	Adapting	Appropriation	'make things my own'	Embellishing a ready-made meal
1	Doing	Productivity	'getting something done'	Organising my herbs and spices

Sanders & Jan Stappers stand that "Users can become part of the design team as 'expert of their experiences' (Sleeswijk Visser et al. 2005), but for them to take on this role, they must be given appropriate tools for expressing themselves." (Sanders & Jan Stappers, 2008, p. 12). They also present a list of challenges to make all those types of creativity to converge:

> "Lead people who are on the 'doing' level of creativity, guide those who are at the 'adapting' level, provide scaffolds that support creative expressions at the 'making' level, and offer a clean slate for those at the 'creating' level" (Sanders & Jan Stappers, 2008, p. 12).

4. SECOND PHASE: CONCEPTS

4.1. First Triangulation

The first Theoretical Triangulation, result of combining the key ideas summarized in Table 4.1 and presented as a diagram in figure 4.2 is explained below:

"Emergent platforms and cumulative experience provide the basis for innovation".

Emergent platforms which are cumulative levels of knowledge, experience, tools and all the possible elements previously developed, facilitate innovation, by giving a basis from which to start. Steven Johnson cited by Niklas Jansen well recognizes platforms as an important element which enhances the effect of "*collaborative networks where opportunities for serendipitous connections exist*" (http-13). Additionally, the fact that one platform can provide *"...the foundation for even more platforms, which again produce countless new innovations"* (http-13) demonstrate its important role in any kind of system. Charles Pasternak reinforces this idea by expressing that "*evolution cannot invent something quite new but can only tinker with what is already there*" (Pasternak, 2007, p. 177) meaning that innovation is in fact the reshaping of cumulative previous experiences.   In the case of *small-scale societies*, platforms are based on the experience transferred throughout generations. Thus, *children learn in the course of accompanying their parents and other adults* (Diamond, 2012, p. 136). The *accumulated experience teaches rules of behaviour to minimize the risks* (Diamond, 2012, p. 184), but also, the necessary techniques to create tools and solutions in community as expressed by Pasternak when says that "*Human technology involves co-operation with others – individuals do not make tools alone*" (Pasternak, 2007, p. 177).

Figure 4.2 illustrates the logic in the first triangulation. It shows how emergent platforms, i.e. cumulative levels of knowledge, resources, experience and tools, are essential for innovation. The three scenarios shown above, exemplify how the more experience and platforms exist, the more innovative the solution can be. Scenario 1 is the most basic one, in which a person has to use his physical capacity to solve the problem. In scenario 2, the person makes use of an existing tool previously developed by others with the same purpose of transporting loads, being able to provide the same solution in less time, i.e. more efficient. Finally, in scenario 3, the person combines two tools, his knowledge about them, and even though one of them (the unicycle) is not intended to

transport loads, it is effective to commute faster from one point to another. This innovative solution means the same job in less time.

Table 4.1. *Key citations – first triangulation*

SOURCE	KEY CITATIONS
The key lessons from "Where Good Ideas Come From" by Steven Johnson (http-13)	"Both evolution and *innovation thrive in collaborative networks where opportunities for serendipitous connections exist.* Great discoveries often evolve as slow hunches, maturing and connecting to other ideas over time"
	"Platforms often stack on top of each other, meaning that *one platform provides the foundation for even more platforms, which again produce countless new innovations*"
	"Genres are the platforms and paradigms of the creative world. They are almost never willed into existence by a single pioneering work. Instead, they fade into view, through a complicated set of shared signals passed between artists, each contributing different elements to the mix"
The world until yesterday. What can we learn from traditional societies? (Diamond, 2012, p. 184)	"In any dangerous environment, *accumulated experience teaches rules of behaviour to minimize the risks*, rules worth following even if an outsider considers it overreacting"
The world until yesterday. What can we learn from traditional societies? (Diamond, 2012, p. 136)	"In modern state societies, there is formal education: schools and after-hour classes, in which specially trained instructors teach children material set by school boards, as an activity separate from play. But education *in small-scale societies* is not a separate activity. Instead, *children learn in the course of accompanying their parents and other adults,* and of hearing stories told by adults and older children around the campfire."
What makes us human? (Pasternak, 2007, p. 177)	"*Human technology involves co-operation with others – individuals do not make tools alone…* Language may have had its origins in motor control. *Evolution cannot invent something quite new but can only tinker with what is already there.*"

Figure 4.1. *First Triangulation*
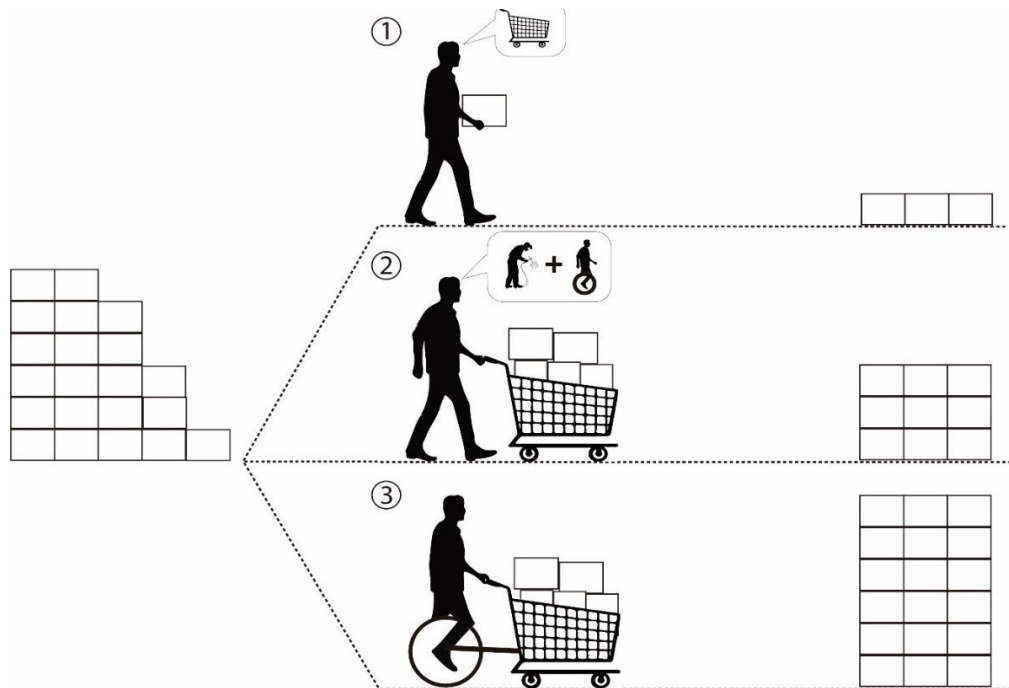
Figure 4.2. *Emergent platforms and cumulative experience provide the basis for innovation*

Figure 4.3 exemplifies the first triangulation. To prevent soil-transmitted diseases and parasites that affect poor children who cannot afford changing their shoes at the same rate as their feet grow and taking into account the experience of locals at designing their traditional shoes, plus the existence of materials which last longer and offer the required comfort, the so-called "shoe that grows" was designed.

According to their creators, it is "a shoe that grows five sizes and lasts for years... It was developed with the help of multiple shoe design firms inspired by feedback from those who need them." (http-2). However, although this product combines platforms (i.e. materials, manufacturing processes, etc.) and cumulative experience (how natives design their own shoes, colours, etc.), it could be argued that the ideo-pleasure need (the aesthetics and values that the product embodies) of the final users was not completely considered. Locals might have been questioned how they traditionally do their own shoes, but probably it was not explored what they really appreciated as beauty and whether a shoe that lasts for many years, would have social implications such as segregation.

THREE MAIN PLACES

Sources:
1) pixabay.com/es/photos/black%20feet/
2) theshoethatgrows.org
3) commons.wikimedia.org/wiki/File:Maasai_sandals
4) http://antikleidi.com/wp-content/uploads/2015/04/boy-growth-development.jpg
5) http://static.boredpanda.com/blog/wp-content/uploads/2015/04/adjustable-sandal-poor-children-the-shoe-that-grows-kenton-lee-4

Figure 4.3. *The shoe that grows, (http-2).*

Other examples worth to mention are the Global Positioning System (GPS), originally developed for military use, it has now spurned countless innovations from GPS trackers to location-based services and advertising, and YouTube which if launched in the 1990s, it would have flopped, since neither the fast internet connections nor the software required to view videos was available at that time (http-13).

4.2. Second Triangulation

The second Theoretical Triangulation, result of combining the key ideas summarized in table 4.2 and presented as a diagram in figure 4.5 is explained below:

"Innovation and sophistication spark from difficult situations".

In the evolution of human kind, and still in traditional societies it is shown how small groups are more flexible than big ones, being able to migrate as environmental conditions change (Diamond, 2012, p. 201), but as their numbers increase, they are forced to settle in specific areas, having to adapt and innovate to counteract challenges. This ability can be associated with a unique human characteristic: *Causal Beliefs, which are essential for making complex tools and planning ahead* (Pasternak, 2007, p. 180). The evolution of human civilizations, where challenging weather conditions leaded to key innovations in human kind such as plant cultivation and animal domestication to *ensure reliable food supplies at a time of intense drought* (Fagan M. B., 2005, p. 102) is a clear example of this forced innovation and sophistication. Human societies, can be seen as antifragile systems, for which stressors, difficult situations or *shocks, bring more benefits as their intensity increases* (Taleb, 2012, p. 286)*.*

In Figure 4.4, it is shown an example about how innovation, the result of a complex system of thoughts, benefits from stressors, such as environmental conditions. The easier a situation is, the less innovative a solution will be. In the image, it is shown how climate situations, and resources availability leaded to different levels of innovation in tropical regions where weather and temperatures are relatively stable, compared with Nordic areas where cold temperatures and lack of resources leaded to complex structures for both transportation and housing.

Table 4.2. *Key citations - Second triangulation*

SOURCE	KEY CITATIONS
Antifragile: Things that gain from disorder (Taleb, 2012, p. 55)	"…*innovation and sophistication spark from initial situations of necessity*, in ways that go far beyond the satisfaction of such necessity (from the unintended side effects of, say, an initial invention or attempt at invention)"
Antifragile: Things that gain from disorder (Taleb, 2012, p. 58)	Lucretius problem: "the so-called worst-case event, when it happened, exceeded the worst case at the time… *nature repares for what has not happened before, assuming worse harm is possible*."
Antifragile: Things that gain from disorder (Taleb, 2012, p. 286)	"For the fragile, the cumulative effect of small shocks is smaller than the single effect of an equivalent single large shock… For the antifragile, shocks bring more benefits (equivalently, less harm) as their intensity increases (up to a point)."
The world until yesterday. What can we learn from traditional societies? (Diamond, 2012, p. 201)	"When food resources are few and concentrated in a few areas, people gather to live at those areas. At favourable times of year when resources are widely and uniformly distributed, people spread out over the landscape."
The Long Summer, How Climate Changed Civilization (Fagan M. B., 2005, pág. 102)	"Both plant cultivation and animal domestication resulted from the need to *ensure reliable food supplies at a time of intense drought*. And as village populations rose, the pressure on gazelle and other game increased, to the point that many communities acquired domesticated animals to ensure a dependable source of meat and other products."
What makes us human? (Pasternak, 2007, p. 180)	"…a key step in human evolution that made *Homo sapiens* different from other primates was the acquisition of causal beliefs. Without such beliefs, it would not have been possible for technology, which is the main driver of human evolution, to develop. *Causal beliefs are essential for making complex tools and planning ahead*, and all other mammals, including non-human primates, lack these abilities".
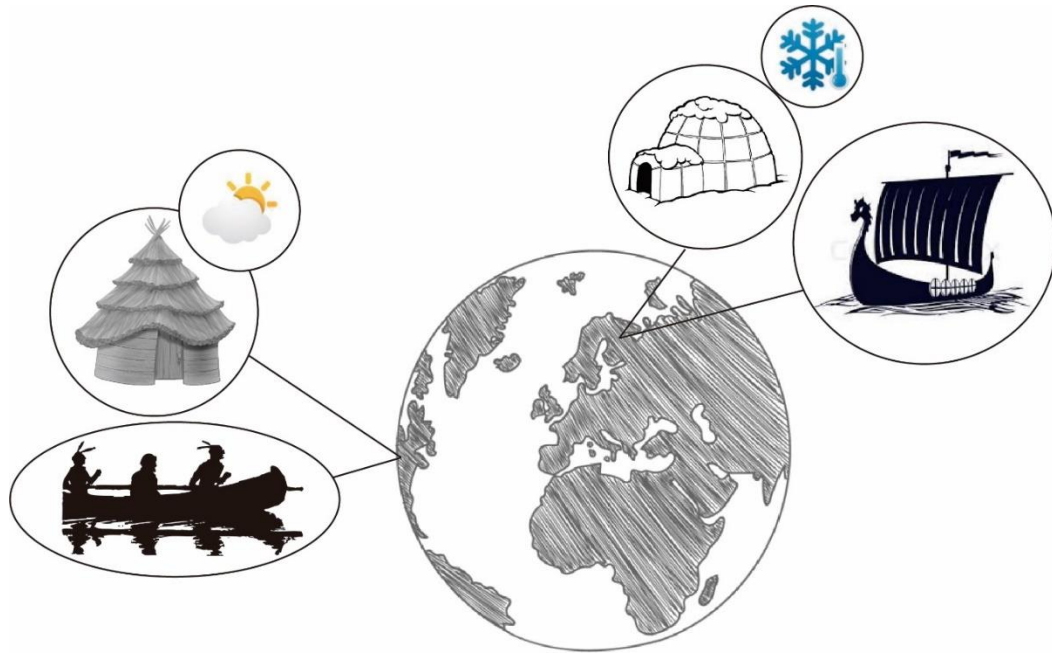
Figure 4.4. *Innovation and sophistication spark from difficult situations*

Figure 4.6 presents a clear example of how a critical situation (in this case, children dying due to lack of incubators), combined with an understanding of the local context, including knowledge and resources available, can be used to create a solution. In many developing countries, with limited resources and inexperience stuff, high-tech medical equipment like incubators result to be useless after a short period of time, as they cannot be repaired by locals when breaking down. However, there are still some artefacts that due to their essential role in daily life, like trucks, are kept working thanks to the availability of pieces and components, plus the technical experience of locals.

NeoNurture designers, make use of local information, plus technical knowledge, to overcome the challenges of complex high-technological incubators developed for first world countries, and solving the critical situation of child premature mortality. As its creators explain, "the incubator uses sealed-beam headlights as a heating element, a dashboard fan for convective heat circulation, signal lights and a door chime serve as alarms, and a motorcycle battery and car cigarette lighter provide backup power during incubator transport and power outages" (http-3, 2017).
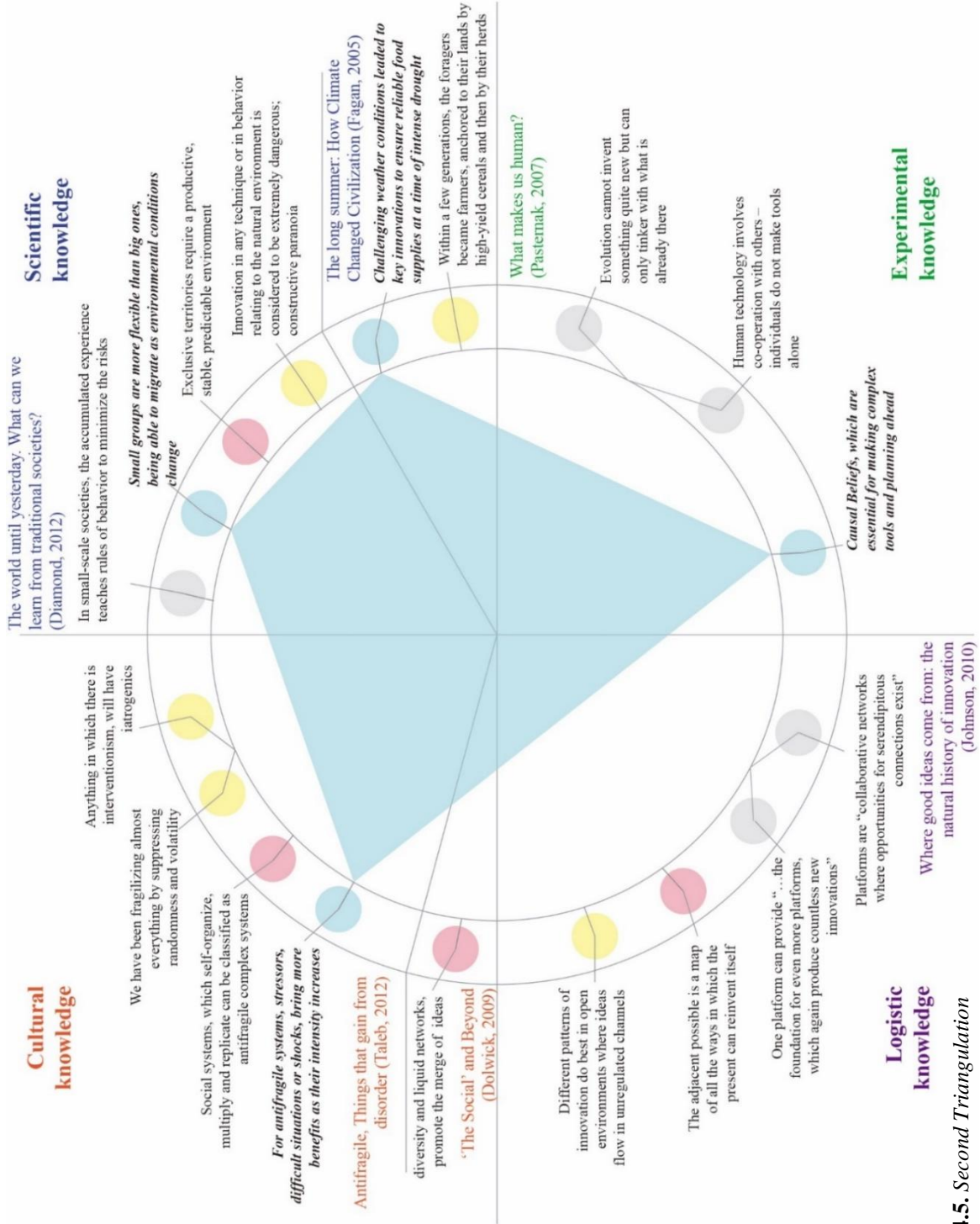
Figure 4.5. *Second Triangulation*

Sources:
1) pixabay.com
2) pixabay.com/es/mano-mecánico-carburador-707699/
3 - 4) designthatmatters.org/neonurture/
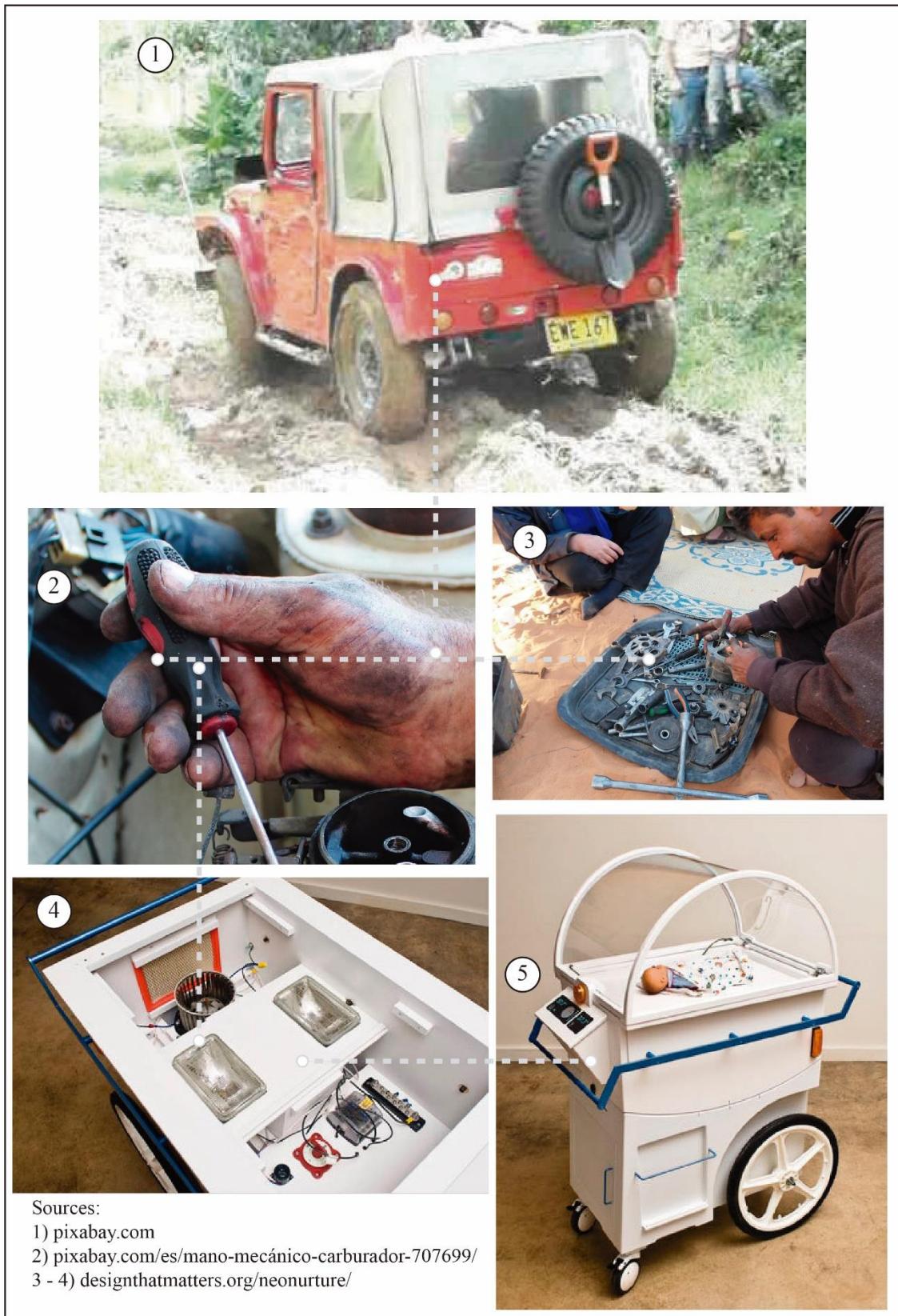
Figure 4.6. *NeoNurture, incubator made with vehicle parts, (http-3).*

Other examples of the second triangulation are, 1) Shokti Doi: a high nutritional yogurt developed by Grameen Danone Foods Ltda., thought to supply the basic nutritional requirements of children living in poor areas of India and Bangladesh, as a solution for the high rate of undernourished children who were unable to receive basic nutrients to guarantee the correct development of brain, affecting their learning ability, and 2) Basf-Grameen Insecticidal nets: developed by BASF Grameen Ltda., to counteract the number of people suffering from diseases such as Malaria, transferred by mosquitos in Bangladesh. (http-19). Both products are produced using local supplies, in factories inside the core problem area, to bring job opportunities to the people living in the affected communities and sold at affordable prices (http-11).

4.3. Third Triangulation

The ideas used for the third theoretical triangulation are summarized in Table 4.3 and presented as a diagram in figure 4.8. The statement found in this triangulation and the connection of ideas leading to it, is presented below:

"In social systems, diversity, and collaboration in liquid networks are essential to promote creativity".

Adopting the idea of Gilles Deleuze and Fe´lix Guattari for whom *social units are fusions, or couplings of 'people-groups-things-ideas'* in what is called *social flow* (Dolwick, 2009), social systems, which *self-organize, multiply and replicate* with the necessary elements to be classified as antifragile complex systems (Taleb, 2012, p. 68), require *diversity and liquid networks*, to promote the merge of different ideas and perspectives, giving place to serendipity moments where innovation and creativity appears (Dolwick, 2009). Under those conditions, *the adjacent possible*, the set of alternatives to deal with specific challenges is wider than those of *productive, stable and predictable environments* within which the social flow happens without stressors (Diamond, 2012, p. 41).

Table 4.3. *Key citations -Third Triangulation*

SOURCE	KEY CITATIONS
The key lessons from "Where Good Ideas Come From" by Steven Johnson (http-13).	"…cities are disproportionately more creative than smaller towns. Today though the greatest such creative network is not a city at all, but the World Wide Web, creating, connecting and diffusing ideas more effectively than any network before it."
The adjacent possible (http-16).	"The *adjacent possible* is a kind of shadow future, hovering on the edges of the present state of things, a map of all the ways in which the present can reinvent itself."
'The Social' and Beyond: Introducing Actor-Network Theory (Dolwick, 2009, p. 33).	Gilles Deleuze and Feˊlix Guattari in their idea of *social flow*, *present the social units as fusions, or couplings of 'people-groups-things-ideas'* where instead of limiting the social world to 'individual agents' and 'social structures,' they are able to shift the boundaries and add different units (even 'natural' and 'material' ones). In fact, the social world itself is regarded as an interactive assemblage, an open creative process of connections, exchanges and divergences.
Antifragile: Things that gain from disorder (Taleb, 2012, p. 68).	"Many things such as society, economic activities and markets, and cultural behaviour are apparently man-made but grow on their own to reach some kind of self-organization. They may not be strictly biological, but they resemble the biological in that, in a way, *they multiply and replicate*…They are closer to the cat than to the washing machine but tend to be mistaken for washing machines."
Antifragile: Things that gain from disorder (Taleb, 2012, p. 70).	"…the crux of complex systems, those with interacting parts, is that they convey information to these component parts through stressors, or thanks to these stressors."
The world until yesterday. What can we learn from traditional societies? (Diamond, 2012, p. 41).	"…exclusive territories require a productive, stable, predictable environment within which the territory-owners can count on usually finding most or all of their necessary resources, such that they rarely or never need to go outside their territory"
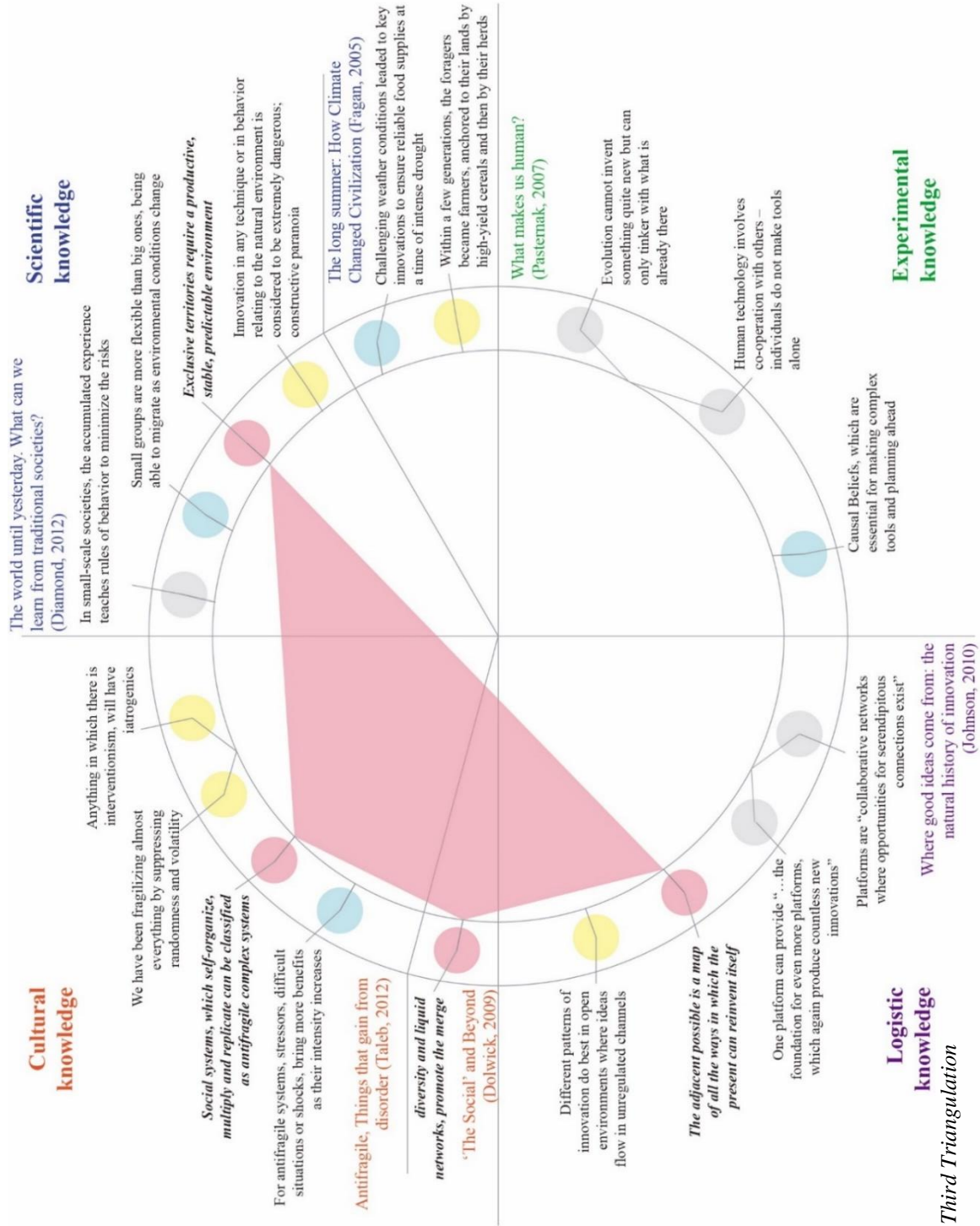
Figure 4.7. *Third Triangulation*

Figure 4.8 presents diversity and liquid networks, as a catalyst of innovation. On the left side, homogeneity of thoughts ends up in the same ideas while on the right side, different perspectives, promote creative ideas.
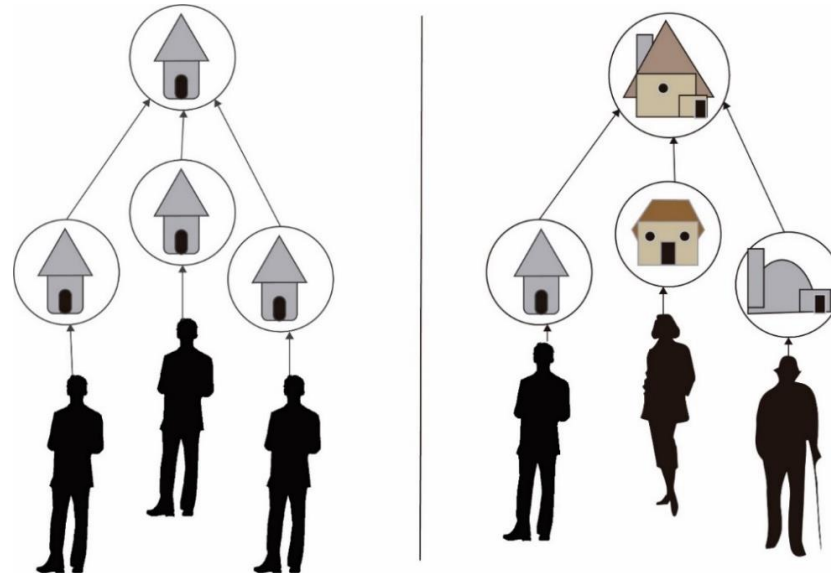
Figure 4.8. *In social systems, diversity, and collaboration in liquid networks promote creativity*

Figure 4.9 presents a clear example where participation and collaboration of different actors created a so-called liquid network where an innovative idea was born. By involving designers, technical staff, doctors and mothers, the organization Designthatmatters.org, created an effective new-born phototherapy device for low-resource hospitals. It is called Firefly New-born Phototherapy.

According to its creators from designthatmatters.org the following are the advantages of this device:

> "Firefly provides high-intensity phototherapy that is 'hard to use wrong'- in other words, the device eliminates the most common sources of product failure...Through research it became apparent to our design team that existing phototherapy devices are easy to misuse, resulting in many cases where jaundice is not treated effectively… The device fits one infant instead of many to reduce the risk of cross infection and reducing ineffective doses of phototherapy for infants treated. By integrating the infant bed into the overall design and placing the lights at a non-adjustable, fixed distance, Firefly prevents users from providing ineffective doses of phototherapy to the infant and prevents hospitals from placing multiple infants in the device." (http-21, 2017).

Figure 4.9. *Firefly new-born phototherapy, (http-21).*

Other examples are: World Wide Web: "the world wide web by Tim Berners-Lee following his employment by CERN in 1982. The www was started as a hobby to keep track of the people and projects there, but it took until the late 1980s for the initial hunch to be remixed with other platforms and to build on the developing internet. There was something in the research environment at CERN that allowed the idea to mature and be kept alive until the world was ready for it" (http-12).

Multipurpose jacket: A jacket that works also as a bag and a blanket for homeless people, designed by a group of 17 students from different backgrounds ranging from architecture to law, exemplifies how without following an specific framework, defined material or brand philosophy, but rather following only a final purpose of creating an element to help homeless people in Bogotá, Colombia, an innovative idea arose (http-18).

4.4. Fourth Triangulation

The ideas used for the third theoretical triangulation are summarized in Table 4.4 and presented as a diagram in figure 4.11. The statement found in this triangulation and the connection of ideas leading to it, is presented below:

"In controlled environments where randomness is reduced, there is less place for serendipity moments, thus less innovation".

Constructive paranoia is essential for the members of traditional societies to survive. For them, *innovation in any technique or in behaviour relating to the natural environment is considered to be extremely dangerous* (Diamond, 2012, p. 184). However, in the case of modern societies, cumulative risk of accidental death is lower, because *we exert far more control over our environment* (Diamond, 2012, p. 182). This kind of environments might suit for fragile systems, but in the case of antifragile ones, efforts to *eliminate randomness* will only intensify their vulnerability towards unexpected hazards, as well as prevent the possibility of serendipity moments (Taleb, 2012, p. 18). Additionally, anything in which there is *interventionism*, *will have iatrogenics* (Taleb, 2012, p. 131), i.e. non-intended side effects, such as the prevention from new and different ideas to appear. According to Steven Johnson, different patterns of innovation such as liquid networks, slow hunches, serendipity, noise, exaptation and emergent platforms, *do best in open environments where ideas flow in unregulated channels* (Johnson, 2010, p. 244). Brian Fagan exemplifies the advantages that challenging and unpredictable environments had on human innovation over thousands of years, forcing people to adapt,

and create a wide range of solutions ranging from agriculture, to water supply systems (Fagan M. B., 2005, pág. 124).

Table 4.4. *Key citations - Fourth Triangulation*

SOURCE	KEY CITATIONS
Where good ideas come from: The natural history of innovation (Johnson, 2010, p. 244).	"All of the patterns of *innovation…*—liquid networks, slow hunches, serendipity, noise, exaptation, emergent platforms—*do best in open environments where ideas flow in unregulated channels. In more controlled environments,* where the natural movement of ideas is tightly restrained, *they suffocate.* A slow hunch can't readily find its way to another hunch that might complete it if there's a tariff to be paid every time it tries to make a new serendipitous connection; exaptations can't readily occur across disciplinary lines if there are sentries guarding those borders. In open environments, however, those patterns of innovation can easily take hold and multiply".
Antifragile: Things that gain from disorder (Taleb, 2012, p. 17).	"Antifragility is beyond resilience or robustness. The resilient resists shocks and stays the same; the antifragile gets better. This property is behind everything that has changed with time"
Antifragile: Things that gain from disorder (Taleb, 2012, p. 18)	"In every domain or area of application, we propose rules for moving from the fragile toward the antifragile, through *reduction of fragility or harnessing antifragility.*"
Antifragile: Things that gain from disorder (Taleb, 2012, p. 18)	". . . if antifragility is the property of all those natural (and complex) systems that have survived, depriving these systems of volatility, randomness, and stressors will harm them. They will weaken, die, or blow up. We have been fragilizing the economy, our health, political life, education, almost everything . . . *by suppressing randomness and volatility.*"

Table 4.4. (Continued) *Key citations - Fourth Triangulation*

Antifragile: Things that gain from disorder (Taleb, 2012, p. 57).	"Undercompensation from the absence of a stressor, *inverse hormesis, absence of challenge, degrades the best of the best*"
Antifragile: Things that gain from disorder (Taleb, 2012, p. 68).	"…maladjustment for this author is the mismatch between one's design and the structure of the randomness of the environment (what I call more technically its "distributional or statistical properties")."
Antifragile: Things that gain from disorder (Taleb, 2012, p. 131).	"…anything in which there is *naive interventionism*, nay, even just intervention, *will have iatrogenics*."
Antifragile: Things that gain from disorder (Taleb, 2012, p. 144).	"The best way to mitigate interventionism is to ration the supply of information, as naturalistically as possible…the more data you get, the less you know what's going on, and the more iatrogenics you will cause."
The world until yesterday. What can we learn from traditional societies? (Diamond, 2012, p. 160).	"If you do something that involves a very low probability of killing a person—say, just once in a thousand times that you do that something—but you do it a hundred times per year, then you are likely to die in about 10 years, instead of living out your expected lifespan of 40 years…Their paranoia makes perfect sense. I now think of it as 'constructive paranoia.' …in the long run, that seeming *paranoia is constructive: it's essential to surviving under traditional conditions*"
The world until yesterday. What can we learn from traditional societies? (Diamond, 2012, p. 182).	"…the cumulative risk of accidental death is probably lower for modern societies, because *we exert far more control over our environment* even though it does contain new hazards of our own manufacture such as cars. The other difference is that, thanks to modern medicine, the damage caused by our accidents is much more often repaired before it kills us or inflicts life-long incapacity"

Table 4.4. (Continued) *Key citations - Fourth Triangulation*

The world until yesterday. What can we learn from traditional societies? (Diamond, 2012, p. 184).	"Prevention of accidents is important, and the knowledge of how, when, and under what circumstances any particular endeavour should or should not be undertaken is necessary to personal success and survival. Significantly, *innovation in any technique or in behaviour relating to the natural environment is considered to be extremely dangerous*"
The Long Summer, How Climate Changed Civilization (Fagan M. B., 2005, pág. 124)	"We have seen how the Cro-Magnons and their successors, and the hunter-gatherers of southwestern Asia, *adapted effortlessly to major climatic shifts* by virtue of their mobility and effortless opportunism. *The vulnerability equation began to change when mobility gave way to sedentism* in the oak and pistachio forests of the Levant; but even then, people adjusted to the severe droughts of the Younger Dryas by the simple expedient of deliberately cultivating wild cereals. Within a few generations, the foragers became farmers, anchored to their lands by high-yield cereals and then by their herds"

Figure 4.10 shows how randomness, variability and in general all the kind of stressors that should be avoided in fragile systems, in the case of innovative spaces which could be analysed as antifragile systems, are actually necessary elements that benefits the system, making its outcomes more diverse and innovative.

Figure 4.10. *In controlled environments where randomness is reduced, there is less place for serendipity moments, thus less innovation.*

Figure 4.11. *Fourth Triangulation*

The long summer: How Climate Changed Civilization (Fagan, 2005)

Challenging weather conditions leaded to key innovations to ensure reliable food supplies at a time of intense drought

Within a few generations, the foragers became farmers, anchored to their lands by high-yield cereals and then by their herds

Scientific knowledge

Small groups are more flexible than big ones, being able to migrate as environmental conditions change

Exclusive territories require a productive, stable, predictable environment

Innovation in any technique or in behavior relating to the natural environment is considered to be extremely dangerous; constructive paranoia

The world until yesterday. What can we learn from traditional societies? (Diamond, 2012)

In small-scale societies, the accumulated experience teaches rules of behavior to minimize the risks

What makes us human? (Pasternak, 2007)

Evolution cannot invent something quite new but can only tinker with what is already there

Human technology involves co-operation with others – individuals do not make tools alone

Experimental knowledge

Causal Beliefs, which are essential for making complex tools and planning ahead

Cultural knowledge

Anything in which there is interventionism, will have iatrogenics

We have been fragilizing almost everything by suppressing randomness and volatility

Social systems, which self-organize, multiply and replicate can be classified as antifragile complex systems

For antifragile systems, stressors, difficult situations or shocks, bring more benefits as their intensity increases

Antifragile, Things that gain from disorder (Taleb, 2012)

diversity and liquid networks, promote the merge of ideas

'The Social' and Beyond (Dolwick, 2009)

Different patterns of innovation do best in open environments where ideas flow in unregulated channels

The adjacent possible is a map of all the ways in which the present can reinvent itself

One platform can provide "…the foundation for even more platforms, which again produce countless new innovations"

Platforms are "collaborative networks where opportunities for serendipitous connections exist"

Where good ideas come from: the natural history of innovation (Johnson, 2010)

Logistic knowledge

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5. THIRD PHASE: PROPOSAL

In this phase, by combining the four triangulations, a set of principles to improve effective innovation in social design, highlighting the role of elements such as stressors (i.e. environmental conditions, tools and knowledge level), cumulative experience and emergent platforms during the design process is presented.

## 5.1. Principles for Innovation in Social Design

"Necessity may be the mother of invention" Geoff Mulgan

The following set of proposed principles, obtained by considering the Theoretical Triangulations developed before, rises as a complement to other methods regarding social design and social innovation developed by organizations such as IDEO.org and The Young Foundation. In this case, strong attention is given to the role that the final users have during the design process in order to create feasible and sustainable solutions that can be spread to other communities facing similar problems. The following list of principles evolve around four key elements: actors, tools, place and local context. Those principles are presented as necessary but not sufficient ingredients to promote innovation in social design.

It is worth to mention that in this work, products are seen as part of innovation systems, complex by definition, to the extent that they can multiply and replicate, thus capable to be classified as antifragile ones. Products are also an active part of social systems which can influence people and their environment.

5.1.1. Consider the problem context, opportunities and limitations

The best catalyser of innovation is a problem, but to make an innovative idea, useful, feasible and sustainable, it should be developed the nearest possible to the core problem. As shown in Figure 5.1, this means analysing the local constraints, stressors, tools, resources, state of knowledge from their locals, and any other element regarding opportunities and threats, necessary to guarantee the solution's continuity, replication and improvement once implemented.
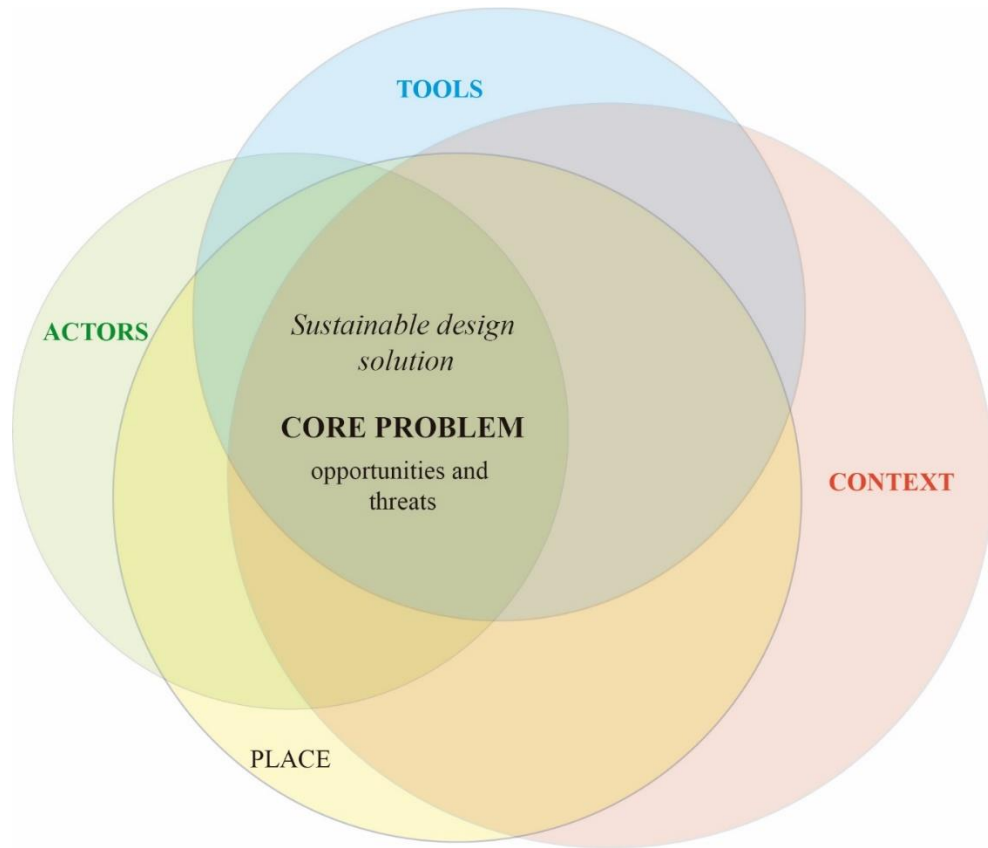
Figure 5.1. *Principle 1, develop a solution inside the core problem, considering context, place, actors and tools*

5.1.2. Stick to simple rules

According to Taleb (2012) and cited by (http-17), "Complex systems do not require complicated rules – in fact, the simpler the rules the better. We must resist the temptation to respond to complexity with complex rules – they have a disturbing tendency to produce cascades of unintended consequences." Also, simpler rules, can be better explained to different community targets, thus improving the possibility that the idea can be adopted and spread.

5.1.3. Design by layers

The antifragility of a solution increases when it can get feedback from layers, that is, previous ideas that might seem unfeasible when confronted against stressors (i.e. hard conditions, context, etc). In this principle, dividing the design idea into parts, and evaluate them when subject to stressors, then iterate the same process repeatedly, might help to define whether the solutions are suitable for the whole system or not.

Figure 5.2 shows how given a set of approaches to the design challenge, after confronting each one of them to the possible stressors that might appear, a new layer of

options results after filtering those previous designs that were unable to overcome the first set of stressors. The process is repeated again, considering other possible stressors, until a set of stronger design options can be reached. Prototyping serves as an example about how this iteration process can be done.
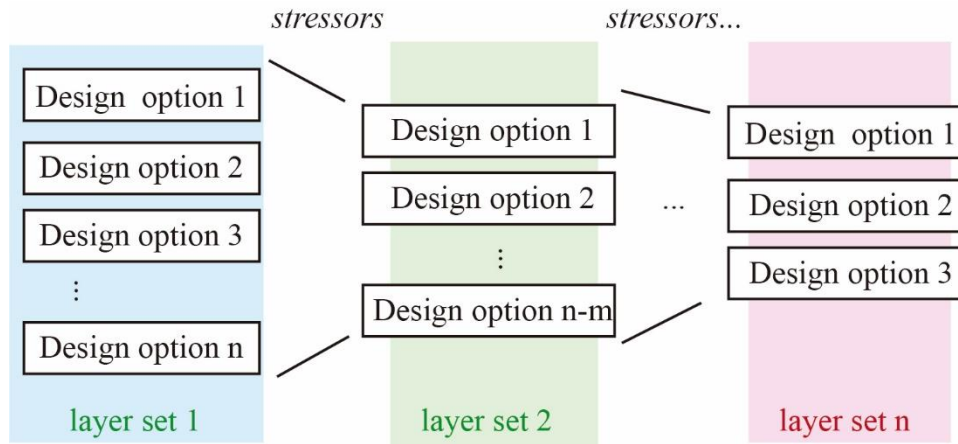
Figure 5.2. *Principle 3, By using layer sets including different design options that are evaluated against constraints and stressors, the surviving options will be better in that given context*

5.1.4. Build in redundancy and overcompensation

This principle focuses on the role of overcompensation and redundancy not just as a matter of safety that should be applied in the same measure to all the elements of a design system, but part of a selective process that gives priority to the most critical ones.

Nature is the best example of how redundancy is a key element to survive in situations that exceed the so-called worst-case event. "Nature repairs for what has not happened before, assuming worse harm is possible." (Taleb, 2012, p. 58). That is the reason why we have two kidneys instead of only one. Thinking the design solution as a system, consisting of interrelated parts, those which seem to be more fragile, the so-called bottlenecks, should be provided with overcompensation exceeding the worst-case event, so that the whole system can survive in case of any disruption.

Figure 5.3 presents a clear example of how a relatively simple system, such as a manufacturing line formed by interconnected processes, depends on the weakest link in the chain (bottleneck) which in the end will define the overall performance. Here, it is worth to recall the ideas of Goldratt and his Theory of Constraints (Goldratt, 1990), mainly applied to manufacturing and management processes. Overall, Goldratt suggests a five-step algorithm, which first step is identifying the constraints in the system, it is the most fragile echelon, secondly, decide how to exploit it, i.e., how to ensure the system's

overall performance in case of a situation that affects the bottleneck. The third step is to subordinate all the other decisions to that critical one, fourth, provide the necessary buffer (capacity, time, resources, etc.) to the bottleneck and finally, in the second step, it is necessary to evaluate the new bottlenecks that might appear in the system, starting the cycle again.
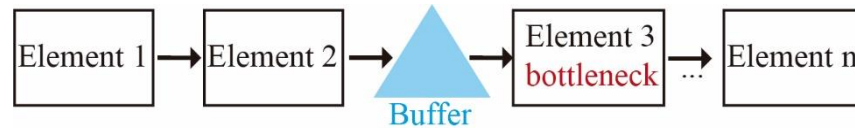
Figure 5.3. *Principle 4, Buffers of redundancy, either of capacity, resources, etc., especially in the critical elements of a system, also called bottlenecks, ensures the its continuity under hard conditions*

5.1.5. Resist the urge to suppress randomness

Taleb (2012) expresses that for complex systems which can be classified as antifragiles, efforts to eliminate volatility, randomness, and stressors will only create undercompensation, intensifying the vulnerability of systems to damage from disruption, especially those related to unpredicted events or so called Black Swans.

Without randomness, there cannot be serendipity. "…innovation and sophistication spark from initial situations of necessity, in ways that go far beyond the satisfaction of such necessity (from the unintended side effects of, say, an initial invention or attempt at invention)" (Taleb, 2012, p. 55).

5.1.6. Give importance to practitioners rather than only theoreticians

To provide a contextualized solution and guarantee its continuity in the core of the problem, it is necessary to feed ideas with the cumulative experience, knowledge about specific constrains, resources, and in general, about the problem context that can only be reached by involving the affected community, into the design process.

The affected group, in the end, are the people who essentially will face the effects of the provided solution and who will reproduce, improve and spread it in the future. Taleb (2012) cited by (http-17) mentions that "practitioners are too busy doing, so they don't have the time to write their own story".

5.1.7. Co-create with actors from different generations and backgrounds

The more diverse the involved group is, the more perspectives will feed the idea, thus, the more chances for liquid networks to happen. Diversity promotes the merge of different ideas and perspectives, giving place to serendipity moments where innovation

and creativity appears (Dolwick, 2009). Under those conditions, the adjacent possible, the set of alternatives to deal with specific challenges is wider than those of productive, stable and predictable environments constrained to only certain group of participants, who by having similar knowledge and backgrounds, more likely will come up with similar ideas.

Such a co-creation process, is intended to cover the four levels of creativity: Doing, adapting, making, creating. According to Sanders & Jan Stappers (2008), users can become part of the design team as 'expert of their experiences', as long as they are provided appropriate tools for expressing themselves. (Sanders & Jan Stappers, 2008, p. 12). Those tools should lead to:

- Lead people who are on the 'doing' level of creativity,
- Guide those who are at the 'adapting' level,
- Provide scaffolds that support and serve peoples' need for creative expression at the 'making' level, and
- Offer a clean slate for those at the 'creating' level.

5.1.8. Make use of diverse emergent platforms

Emergent platforms, that is the previous ideas, tools, developments and innovations generated by other individuals, to handle other similar or different challenges, are essential to start from a basis. Additionally, knowledge diversity in terms of approaches, backgrounds and contexts provide opportunities for serendipitous connections to exist.

Figure 5.4 shows how for this principle, tools take a decisive role, as they can define the method to be used. Providing and/or suppressing tools and technologies, can lead to more adaptable solutions, that can easily be replicated and transformed on time.
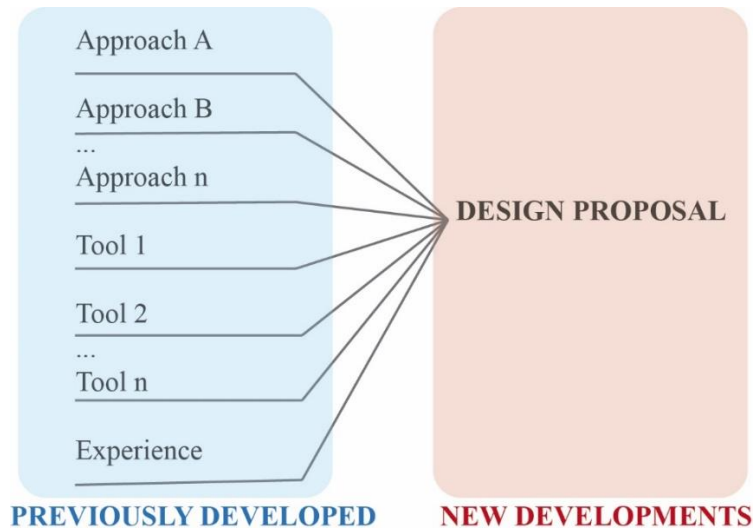
Figure 5.4. *Principle 8, emergent platforms, which are the set of previous developments including ideas, tools and experiences, provide the basis for new designs*

5.1.9. Avoid interventionism

Steven Johnson (2010) explains how different patterns of innovation such as liquid networks, slow hunches, serendipity, noise, exaptation and emergent platforms, do best in open environments where ideas flow in unregulated channels (Johnson, 2010, p. 244). Interventionism, even the naive one, such as a methodology proposal, tools supply or work area organization, can lead to iatrogenics, and can influence ideas, preventing them to evolve unconstrained.

To illustrate, wood craft work, is in general characterized by apparently disorganized work areas, that allow the crafters to create without constraints. If a method or a tool is restricted to a specific purpose, there is no place for exaptations, i.e., finding a new function apart from its original one.

Additionally, to prevent the undesired effects of interventionism, Taleb (2012) suggests reducing the supply of data, giving less place to noise and biased decisions. It is known how the more information a person receives, the more difficult is to take decisions, for example when choosing for the desired ice cream and having hundreds of flavours under disposal. Figure 5.5 pretends to illustrate how by regulating the flow of data, decision making can be based more on real information and not on noise. This breaks with the current belief that the more data the better.
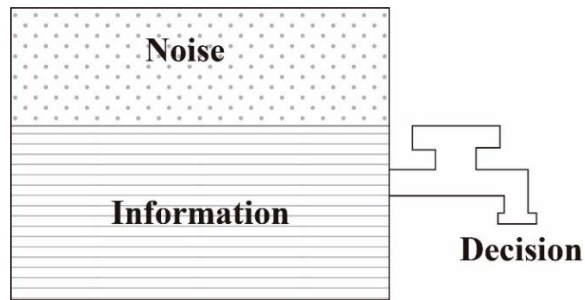
Figure 5.5. *Information-based decisions. By rationing the information income, the decision process is less likely to be affected by noise*

5.1.10. Design in environments full of juxtapositions

Creative spaces, to promote serendipity (moments of unexpected relevance, in which ideas are generated without looking for them), should involve juxtaposition, that is the arrangement of seemingly unrelated elements such as tools, environments, thoughts and ideas to create ecosystems where new connections of ideas can happen (See Figure 5.6).
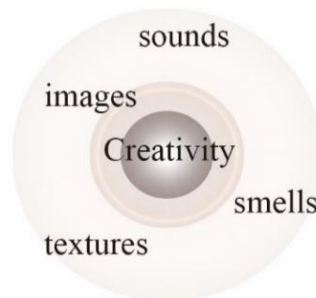
Figure 5.6. *Principle 10, promote juxtapositions by using stimulus-rich work spaces, including all sources of sensor stimulus*

Silva (2014) cites from (Davis, 2003): "Juxtaposition is revelated as the basic formal operation of synchronicity, as two apparently unrelated events or elements suddenly form a secret link that strikes in the mind of the perceiver, an evanescent lightning bolt of meaning"

Silva also exemplifies how creative environments can be enhanced by programming the designer's mind using Psycho-Cybernetics, a way to program one's brain to seek out some patterns to solve a given problem. Examples of psych-cybernetics are writing down the idea to be deeper developed and check it before going to sleep.

Then, the next day, review that idea and immerse oneself in an environment with juxtapositions. It can lead to see new patterns that eventually could complete the idea.

6.   FOURTH PHASE: EVALUATION

6.1. Benchmarked methodologies and strategies

In this phase, a comparison between the principles evolved from the literature by following a theoretical triangulation process and some of those already existing in the specialized literature is made, to identify differences and similarities that lead to a richest framework for practitioners interested on innovation in social design. The benchmarked works were selected judging by their popularity in the given context, and their successful application cases around the world.

It is necessary to clarify the difference between two concepts, which might be easily confused: design for social innovation and innovation for social design.

Social innovation can be understood as "a new idea that works in meeting social goals, …a process of change emerging from the creative re-combination of existing assets (from social capital to historical heritage, from traditional craftmanship to accessible advanced technology), the aim of which is to achieve socially recognized goals in a new way" (Manzini, 2013). This definition agrees with that provided by The Young Foundation for whom "Social innovations can be understood as new solutions (products, services, models, markets, processes etc.) that simultaneously meet a social need (more efficiently and effectively than existing solutions) and lead to new or improved capabilities, assets and/or relationships. In other words, social innovations are both good for society and enhance society's capacity to act." (Pulford, Hackett, & Daste, 2014).

To illustrate how social innovation works, a real project developed in London called Homeshare is presented. The main idea of the project is to match homeowners, generally elder people who might be at risk of isolation with young people looking for an affordable place to live. The young person lives in the elder's home on return for an extremely low rent and a commitment to spend time every week helping with household tasks. "It's an ongoing issue about high rents in London and also people being isolated in their homes, not being able to get out to do things like the shopping." (Julie Simon, 2014).

On the other hand, *social design* is defined as "The design of platforms and processes that leads to people participating and contributing in creating an output that is greater than the individual input, where its solutions become better the more people use them and depends on the activity of social actors" (http-9, 2017). *Innovation in social design*, involves new ideas and ways to approach social design, where methodologies and

strategies such as the so-called human-centred design (IDEO.org, 2015) developed by IDEO.org can be implemented to generate innovations.

As a case study of human-centred design applied to create innovations, IDEO.org presents Asili, a sustainable community-owned health, agricultural, and water business in the Democratic Republic of the Congo. The proposal was developed by a design team from IDEO.org and was implemented with the community, who eventually continued running it to make it a sustainable solution to their local problem.

Creative methods such as the ones mentioned by Nigel Cross (2000) can be implemented as well to create innovations in social contexts: Brainstorming, which main objective is to generate a large number of ideas; Synectics, which differs from the former one by the goal of making the group work collectively towards a particular solution, using the so-called analogical thinking or bisociation of ideas allowing the transfer or juxtaposition of concepts from one concept to another; and Enlarging the search space, by providing random inputs to start working on an idea (Cross, 2000, p. 51).

In the following lines, a summary of some of the most recent and representative thoughts regarding both social innovation and innovation in social design will be presented, concluding the chapter with a comparison between those ideas and the proposed principles in this work.

6.1.1. Frame creation model – (Dorst, 2015)

Dorst (2015) describes what he considers the key design practices to deal with open, complex, dynamic, and networked problem situations, in what is called the frame creation model.

In his book Frame Innovation – Create New Thinking by Design, Dost (2015) explains what for him are the main lessons from design that should be considering before implementing the frame creation model:

- *Coevolution.* According to Dorst (2015), design experts do not come up with an idea immediately but rather, they develop and refine both the formulation of a problem and the ideas for a possible solution in a process called coevolution. He does not believe in the so-called light bulb moment or "AHA!" moment. For him, "…a creative event occurs when a bridge is built between the problem space and the solution space by the identification of a key concept" (Dorst, 2015, p. 59).

- *Developing problem situations.* Dorst (2015) also explains that a significant reframing of a problem happens during the free-flowing design practice, where expert designers essentially develop the problem situation itself. Designers have to manoeuvre from playing the role of "technician", (the client knows exactly what is needed, which the designer then carries out) to that of a "facilitator" (the client knows what is needed but not what is required to achieve it) and finally an "expert" (the client has a partially formed idea, and the designer must use his or her expertise to negotiate a workable formulation of the brief) (Dorst, 2015, p. 61).

  In the case of product designers, Dorst (2015) cited the approach developed by Hekkert and van Dijk (2011), to shift the definition of the problem by highlighting a future context: "The first step of their model involves critically weighing the assumptions that lie behind the initial brief. To be able to create newness, the designer has to know the thought process that led to the design of current products and to the current problem situation. The designer then proceeds by questioning the importance of those fundamental variables and their current state. The next step is to create an image of the future context as it will develop. Once this has been agreed upon, the proper design process can begin, creating an outcome that will suit the future context. The client organization, which has been closely involved in envisioning the future context, will see the proposed design in light of this fresh context rather than the original one—this view makes it easier to accept quite radical designs". (Dorst, 2015, p. 62).

  Abstraction is the other major strategy that expert designers use to develop the problem situation and involves establishing a completely new context after abstracting from the current one, going back to the core values that must be attained. (Dorst, 2015, p. 62).
- *Handling frames.* Frames, different approaches to understand a problem, are essential to get to suitable outcomes or solutions. In the case of team working, Dorst presents the importance of creating "a frame by encouraging the others to arrive at the same frame idea themselves. Through these vague hints of a frame, the designer bypasses the adoption problem: people will usually adopt their own ideas much more eagerly, actively, and fully than those of others" (Dorst, 2015, p. 64).
- *Exploring themes.* The author mentions the important of themes to understand a situation and create something for it. He criticises how many designers want to "get

close" to the situation, the importance of getting "first-hand experience" of the problem situation in order to create "empathy". However, there is no clear idea of what to do there. For him, the importance of this immersion into the problem context is that it brings clues that could lead to themes which eventually can lead to create response to the problem and fulfil the ultimate goal of design, the creation of a "something" for "somebody" (Dorst, 2015, p. 68).

- *Fostering a discourse.* The author presents the case of an architecture company, whose designers "oversee the building and continuous development of the themes and repertoire of frames that together make up the discourse of the firm. This includes approaches to problems, strategies, particular knowledge, special skills, and a range of possible solutions that are all part of the common heritage. It contains strategic statements on the kinds of knowledge and abilities that must be brought together by the management to set the scene for projects, ensuring that they are in line with the company's 'philosophy'." (Dorst, 2015, p. 71).

- *An anatomy of design practices.* The author presents a spectrum of the main design activities as follows: (1) Formulating, understanding, identifying, framing; (2) representing, externalizing, conversing, using multiple representations; (3) Moving, creating primary generators, moving the problem; Evaluating, objective / subjective reflecting-in-action; (4) managing, reflecting on action, briefing, pursuing parallel lines. (Dorst, 2015, p. 56).

Finally, to implement the so-called Frame Creation Model, Dorst (2015) proposes a set of principles, called the ten golden rules, summarized below:

6.1.1.1. *Attack the context*

Every problem and its formulation have their own specific context that should be evaluated and altered before the problem can be attacked. According to Dorst (2015), if the designer simply approaches the problem as it is originally presented, it will be hard to move beyond the symptoms to root causes.

6.1.1.2. *Suspend Judgment*

The idea is not to criticize the stakeholders regarding the way they have been approaching the problem, but rather take their practices as givens which might be worked in or worked around. Judgment should be used once the new frames, solution directions and value propositions are made (Dorst, 2015, p. 102).

6.1.1.3. *Embrace complexity*

Avoid simplification. The problem should be approached and framed with all the complexities it has and even make it more complex by considering other stakeholders and possible roots. Only in that way, new frames can be created.

6.1.1.4. *Zoom out, expand, and concentrate*

The frame creation process, proposes a movement of zooming out and zooming in: first widening the problem scope, considering other actors that have been involved in the problem situation before, trying to understand the actions already taken and those that might be taken in the future. From those speculations, new possibilities of action can be found. The zooming in, comes next.

6.1.1.5. *Search for partners*

According to Dorst (2015), frame creation is a practice based on pattern recognition, especially patterns of behaviour, concentrating on facts and actions, instead of words. This is critical to identify possible actors who can even innocently be a root of the problem without meaning that.

6.1.1.6. *Deepen themes*

A deep understanding of the themes involved in the problem and those found when widening the problem situation, is essential for the creation of new frames.

6.1.1.7. *Sharpen the frames*

A clear frame that can be understood and pictured by all the major stakeholders. It can be achieved by combining different frame ideas. A very specific frame, can lead to solutions that then would be applied to a wider frame.

6.1.1.8. *Be prepared*

Dorst (2015) states that the frame creation model normally fits to problems where there are conflicting aims, with no obvious solution, which can be extended to broader contexts, where there must be at least an open-minded owner willing to take new approaches. Once the problem fits to those conditions, there is still a long process of getting to know the problem, approaching stakeholders, motivating them, etc (Dorst, 2015, p. 107).

6.1.1.9. *Create the moment*

Dorst (2015) proposes frame creation sessions, workshops where participants are strategically chosen for the different skills, experiences, and approaches they can bring. In those sessions there should be also content specialists who have a broad knowledge of the problem and are able to feed information to the participants as questions arise. It is also suggested to perform those sessions in environments rich in inspiration and conductive reflection.

6.1.1.10. *Follow Though*

The frame creation sessions should be done frequently, and it is necessary to support the owner when trying to apply the frames obtained as they might disturb organizational cultures, processes and structures.

6.1.2. The field guide to human-centred design – (IDEO.org, 2015)

IDEO.org presents a detailed guide for design intended to solve social problems, in what they have called human-centred design. It is founded on the following mindsets: Empathy, Optimism, Iteration, Creative Confidence, Making, Embracing Ambiguity, and Learning from Failure. In the field guide to human-centred design (IDEO.org, 2015), those mindsets are developed along three phases: inspiration, ideation and implementation (See Figure 6.1).

Though no two human-centred design projects are alike, at IDEO they use the same kit of tools for each of them: In order to generate empathy, they conduct interviews with the people they are trying to serve. To maintain creativity and energy, they always work in teams and by making tangible prototypes they keep their thinking generative sharp (IDEO.org, 2015).

The final purpose of this methodology is to create real impact, by designing solutions that are desirable (by starting with the needs, hopes and fears of the community), technically feasible and financially viable.

Figure 6.1. *Human-centred design phases, (http-4).*

IDEO.org defines a series of phases with defined steps and participants, which most of the time are the design team.

6.1.2.1. *Inspiration*

- **Frame your design challenge:** At IDEO, they suggest to ask oneself: "Does my challenge drive toward ultimate impact, allow for a variety of solutions, and take into account context? Dial those in, and then refine it until it's the challenge you're excited to tackle." (IDEO.org, 2015, p. 31). Some of the steps are: write the design challenge; articulate the challenge with the constraints and context; make it narrow enough to know where to start, but broadly enough to explore creative solutions; iterate till you find five possible solutions.

- **Create a project plan:** A plan allows to think about all the logistics of a project, time, space, staff, budget, skills, and other elements that might be needed.

- **Build a team:** an interdisciplinary mix of thinkers, makers and doers is the right combination to tackle a design challenge. "You won't get unexpected solutions with an expected team". (IDEO.org, 2015, p. 35)

- **Recruiting tools:** In this step, the importance of choosing the right people to be interviewed is highlighted. It involves taking into account a variety of factors: age, gender, ethnicity, class, social position.

- **Secondary research:** A firm foundation of knowledge not only from the interviews, which might be subjective, but also from a serious research in different sources, is the best place from which to tackle a design challenge. Once identified the design challenge, IDEO.org suggest exploring what has been done in the field.
- **Interview**: Interviews are key in the inspiration phase. IDEO.org suggests conducting the interview in the person's space in order to understand their real context. There should be no more than three research team members in a single interview. Start by asking broad questions about the person's life, values, and habits, before asking more specific questions that relate directly to the challenge. Writing down exactly what the person says is very important as it can be contrasted with the body language and surroundings. IDEO emphasizes the need of taking photos.
- Something important to notice in this method, is that here is the first step where not only the design team participates, but also the person they are designing for. Also, an interview guide is provided.
- **Group interview:** It allows the design team to see how a large set of the community operates. The place where the interview is conducted should be accessible for people of all ages, races and genders. It also allows to identify who the team should be working deeper in a Co-creation session.
- **Expert interview:** Experts can give a systems-level view of the project area, inform about recent innovations, and technical advices.
- **Define the audience:** The attention should not be put only on the people to design for, but also it is necessary to consider other actors, like governments, NGOs, other businesses, or competitors.
- **Conversation starters:** "The idea here is to suggest a bunch of ideas around a central theme to the people you're designing for and then see how they react. The ideas you generate for your Conversation Starters are totally sacrificial, so if they don't work, drop them and move on. The goal here is to encourage creativity and outside-the-box thinking from the people you're designing for" (IDEO.org, 2015, p. 45).
- **Extremes and mainstreams:** A design solution that works for everyone should consider both extreme users and those in the middle of the target audience.

- **Immersion:** The project plan should consider the time and money necessary to send team members into the field to spend time with the people they are designing for.
- **Analogous inspiration:** Analogous settings can help the team isolate elements of an experience, interaction, or product, and then apply them to whatever design challenge they are working on.
- **Card sort:** An exercise to identify the priorities of the people to targeted people. It consists of putting a deck of cards, each with a word or image, which should be organized in order of preference and eventually change scenarios to see people's responses.
- **Peers observing peers:** According to IDEO.org, "By bringing the people you're designing for in as partners in your research and giving them the tools to capture their own attitudes and hopes, you'll learn more than you ever could on your own." (IDEO.org, 2015, p. 60). This implies for example, involving community members as interviewers, providing them with the tools and other necessary supplies.
- **Collage:** This is an activity performed by the targeted people to identify their values and thought process.
- **Guided tour:** This is a method to get a deeper understanding of people's context by visiting their home, workplace or daily activities. Details such as the rituals in that place, what is on the walls, who uses it and how and why things are organized in a certain way, are key pieces of information. (IDEO.org, 2015, p. 64).
- **Draw it:** This step involves not only the design team but also the people they are designing for, looking precisely for it, to make the latter to express in an easier way their ideas. "When you want the person you're designing for to draw something, give them a clear idea of what you're after. A map of their daily route? A timeline of their annual income? What percentage of their fields are dedicated to a certain crop?" (IDEO.org, 2015, p. 65).
- **Resource flow:** This activity tries to identify how a person or family spends money, how it comes in, how it goes out and opportunities to make that flow more efficient.

6.1.2.2. *Ideation*

In this phase, the team share among the members, what they have learned, trying to analyse the data, generate and discard ideas, build prototypes of those ideas which are kept, and then share them with the people they are designing for, to get feedback.

- **Download your learnings:** In this step, each member organizes and shares his ideas with the rest of the team. IDEO.org suggests using post-its to describe who they met, what was seen, the gathered facts, and impressions of the experience. It works better right after the interviews as the ideas are still fresh.

- **Share inspiring stories:** Share the best stories with the team.

- **Top five:** It helps to prioritize, communicate and strategize with the teammates. Each team member should expose his top 5 ideas or themes and cluster the similar ones with the other teammates. Repeat the exercise in different time frames, like top five per day, per week, etc.

- **Find themes:** By analysing with the teammates what are the most concurrent topics, and challenges, cluster the ideas until all the members agree about the richness of opportunities for design.

- **Create insight statements:** This step consists of filtering the themes, by rephrasing them as short statements, which then are contrasted with the design challenges so that only those which are more related, remain.

- **Explore your hunch:** Those ideas that could have emerged before or during the project run, should be shared with the teammates, to see if there are similar ideas among them and find ways to evaluate the hunch.

- **How might we:** Translate the insight statements into opportunities for design. "…a good How Might We should give you both a narrow enough frame to let you know where to start your Brainstorm, but also enough breadth to give you room to explore wild ideas" (IDEO.org, 2015, p. 85).

- **Create frameworks:** IDEO.org defines a framework as "a visual representation of a system and a great way to make sense of data" (IDEO.org, 2015, p. 89), used to highlight key relationships and develop strategies. One example is the 2x2 graph, which consists of plotting ideas along two separate axes, so that patterns can be identified.

- **Brainstorm:** In this step, it is suggested to promote the participation of not only the design team, but also partners and the community, always seeking out

openness, lots of ideas, and creativity over immediate feasibility. IDEO.org suggests seven rules for brainstorming: defer judgement, encourage wild ideas, build on the ideas of others ("yes, and…" instead of "but"), stay focused on the topic, one conversation at a time, be visual, go for quantity.

- **Bundle ideas:** Putting the best parts of several ideas to create more complex concepts.
- **Get visual:** incorporate drawing, sculpting and building into the ideation phase.
- **Mash-ups:** Combine two existing brands or concepts to explore new ideas. A way to do it, is by layering a real-world example of the quality needed, onto the design.
- **Design principles:** Those vary from project to project, and are top level dictums, that "…define the tone, voice and approach of the campaign and instruct anyone iterating on or adding to it what their work should look like" (IDEO.org, 2015, p. 106).
- **Create a concept:** From the bunch of ideas generated in the previous steps, a concept is developed, such that it can be presented to the community, and starts looking like an answer to the design challenge.
- **Co-creation sessions:** in this step, members of the community are involved not as interviewees but rather as designers.
- **Gut check:** The gut check exercise, pretends to look at ideas through a more critical lens and filter those which are no worth enough to put more efforts on.
- **Determine what to prototype:** building simple prototypes saves time and allows testing just the critical elements.
- **Storyboard:** plot visually design elements, to identify not only what the idea is, but also who will use it, where and how.
- **Role playing:** The idea is to test by means of a prototype the idea, experience or product in front of others that will play the role of community members.
- **Rapid prototyping:** it allows to make ideas tangible and get a quick feedback to continue improving.
- **Business model Canvas:** This model asks key questions like what is the revenue stream?, what are the key partnerships needed to forge as well as the resources necessary to operate?

- **Get feedback:** Collecting feedback from potential users might guarantee that the design solution will be adopted by the people. Honest and even negative feedback should be promoted.
- **Integrate feedback and iterate:** Let the feedback guide the next iteration of the design solution.

6.1.2.3. *Implementation*

In this last phase, partnerships are built, the business model is improved, the idea is tested and eventually brought to market.

- **Live prototyping:** it aims to give an understanding of the feasibility and viability of the idea, by implementing it for a couple of weeks in the market place.
- **Roadmap:** In the roadmap, the key stakeholders in the project. Their responsibilities and the timeline are stablished as well.
- **Resource assessment:** Brainstorm what is needed in different categories, for example, distribution, activities, capabilities and responsibilities.
- **Build partnerships:** The Business Model Canvas and Resource Assessment, allow to identify which partners are necessary to make the idea real.
- **Ways to grow framework:** This framework consists of two axes, the vertical one represents the novelty of the solution, and the horizontal one, its users. Totally new offerings land above the horizontal axis and existing ones land below. New users fall to the right and existing to the left.
- **Staff your project:** unlike the inspiration phase, in which a multi-disciplinary team was useful for arriving at unexpected ideas and novel solutions, in the implementation phase, it is necessary to recruit specialized know-how, technical capacity, outside partners and funding.
- **Funding strategy:** This is a short-term financial approach. Here it is advised to consider crowdfunding platforms like Kickstarter or Indiegogo as funding sources.
- **Pilot:** it consists of a longer-term test of the design solution before going finally to the market. Unlike a Live Prototype, in a pilot the entire system is tested and not just a specific idea.
- **Define success:** The Roadmap shows key delivery dates and milestones. One indicator might be how accurately those dates are respected. Evaluate what is

success in terms of the organizational operations and the community planned to be served.

- **Keep iterating:** testing, getting feedback and iterating again.
- **Create a pitch:** This communication strategy is intended for showing to the community and potential partners how the solution works, why it counts and who it benefits trying to be clear and unambiguous without focusing on details.
- **Sustainable revenue:** Unlike the Funding Strategy, the Sustainable Revenue is the long-term revenue strategy to have maximum impact.
- **Monitor and evaluate:** It is necessary to identify who are the more suitable people to perform the evaluation and combine not only quantitative but also qualitative measures.
- **Keep getting feedback:** Continue performing interviews and group interviews in a constant basis.

6.1.3. The Open Book of Social Innovation- (Mulgan, C & M, 2010)

According to Mulgan, Caulier-Grice, & Murray (2010), there are six stages of social innovation (Mulgan, Caulier-Grice, & Murray, 2010):

6.1.3.1. *Coevolution Prompts, inspirations and diagnoses*

Diagnosing the problem to find the root causes of the problem, considering factors which highlight the need for innovation (crisis, public spending cuts, poor performance, strategy) as well as the inspirations for it.

In this stage, the authors mention the importance of communities researching themselves, using for example "user-led and peer research, based on the premise that people are best placed to identify their own needs and express their own ideas or solutions. User-led research has especially developed amongst long term users of health and social care services. Service users are responsible for all stages of the research process – from design, recruitment, ethics and data collection to data analysis, writing up, and dissemination" (Mulgan, Caulier-Grice, & Murray, 2010, p. 18).

They also agree with other authors on the importance of Ethnographic research techniques, based on the idea "that people's actions and thoughts are dependent on a vast range of factors, and what they say and do in one context is not necessarily what they actually do in another. To fully understand peoples' behaviour, opinions and decision-making processes, a researcher must therefore spend time with them in their various

physical and social environments" (Mulgan, Caulier-Grice, & Murray, The Open Book of Social Innovation, 2010, p. 20).

Moreover, creative spaces are no longer confined to a place. The Young Foundation recognizes the importance of walking as it gives an opportunity to walkers (design team) and locals to share and reflect on innovative practice (Mulgan, Caulier-Grice, & Murray, The Open Book of Social Innovation, 2010, p. 26).

6.1.3.2. *Proposals and ideas*

Idea generation, which can involve formal methods such as design or creativity methods to widen the menu of options available. Many of the methods help to draw in insights and experiences from a wide range of sources.

Co-design, and user-led design are recognized as examples of how different actors can participate in the design process. Another interesting example, is the so-called Proprietary Knowledge applied to social issues, such as what has been implemented by Mohammad Yunus and his organization Grameen which in partnership with leading companies, make use of the know-how and technology stored up in private firms to develop innovative solutions to problems related to poverty.

6.1.3.3. *Prototyping and pilots*

In order to test ideas in practice through simply trying things out, or through more formal pilots, prototypes and randomised controlled trials. In this stage, trial and error is very important.

6.1.3.4. *Sustaining*

Involves sharpening ideas and identifying income streams to ensure the long term financial sustainability of the firm, social enterprise or charity, that will carry the innovation forward.

The authors mention the potential role that collaborative technologies might play in the sustainability of a social venture. A clear example is "The Grameen-Danone partnership that developed micro yoghurt plants (in spite of the initial scepticism of the machine designers) that enabled easy access to the women distributing the yoghurt to the villagers, and avoided the high costs of refrigeration" (Mulgan, Caulier-Grice, & Murray, The Open Book of Social Innovation, 2010, p. 71).

6.1.3.5. *Scaling and diffusion*

The aim of this stage is to grow and spread an innovation – from organisational growth, through licensing and franchising to federations and looser diffusion.

In this stage, innovations rather than being kept for a private benefit as occur with those developed in the private economy, for the social economy, should be shared so that the benefit reaches more and more social issues. "This is one reason why the social economy has less compulsion to organisational growth and more towards collaborative networking as a way of sharing innovation" (Mulgan, Caulier-Grice, & Murray, The Open Book of Social Innovation, 2010, p. 81).

The successful diffusion of an innovation depends on how well the idea is presented to others as a necessary thing to adopt. It is called effective supply, i.e. evidence to show that the innovation really works. This should be balanced with what the authors call effective demand, i.e., convincing people or organizations to invest in the idea.

The importance of simplicity when it comes to spread an idea, is also presented by the authors. Platforms is another topic mentioned in this stage, referring to the supply of tools and resources that people need to organize themselves. An example is the website nesquared.org in which people can take part as "collaborators, co-producers, consumers, activists, and/or funders in new projects" (Mulgan, Caulier-Grice, & Murray, The Open Book of Social Innovation, 2010, p. 95).

The promotion of a social innovation depends on how its benefit can be shown to the interested actors. However, most of the approaches used to evaluate the impact of an innovation, focus on the cost-effectiveness and the benefit that will produce to the investors.

6.1.3.6. *Systemic change*

Involves the interaction of many elements: social movements, business models, laws and regulations, data and infrastructures, and entirely new ways of thinking and doing. Systemic innovation commonly involves changes in the public sector, private sector, grant economy and household sector, usually in the long term.

6.2. Comparisons between the proposed principles and some existing methodologies and strategies

Once described three of the most recent methodologies and strategies, a qualitative comparison is made against the proposed principles, considering three main topics: Detail

level, which involves how easily it can be understood and followed by a beginner in social design topics; stakeholders, which considers the number of stakeholders participating into the design process and finally, user's participation, considering how much the final users, which can be community members who in the end will benefit directly with the design, and will ensure its continuity and possible spread among other groups. The qualitative scores were subjectively given in a scale from 0 to 5, being 0 the lowest score and 5 the maximum.

Those results are only to show a possible comparison between the ideas presented but still are subject to revision and further improvement by involving other scoring criteria, more methodologies to compare with and considering not only qualitative and but also qualitative methods. A summary of the key points regarding each one of the methodologies and strategies to be compared is presented:

Proposed principles. The proposed principles aim to promote innovation in design contexts where the generation of new ideas appears to be critical but where repetitive solutions continue being applied. That is the case of designs intended to tackle social issues, such as those faced by communities in developing countries where traditional products and approaches might not be appropriate. Special attention is payed to the active role that the community can play during the whole design process and implementation, reason why the tools, and methods should be simple and easy to understand by people from different backgrounds and knowledge. The co-creation between direct affected actors, experts, and members of the design team, is presented as a proper environment for serendipity moments to happen, where new and even crazy ideas can be created. Understanding the social problems as antifragile systems, where certain level of uncertainty and randomness might be helpful to make adaptable solutions, is another important contribution to the state of art.

Dorst: Frame Creation Model. Framing is presented as an important step to counteract a paradox, it means, looking at problems from broader contexts and not only the one from which it was originated. Dorst describes how ideas generate in a process called coevolution, for which it is necessary to identify key concepts that lead to building a bridge between the problem space and the solution space. Also, the importance of developing problem spaces by shifting the definition of the problem, highlighting a future context. To innovate, it is necessary to weigh the assumptions leading to an original solution. It is also suggested to guide others to arrive to a definite frame, rather than

suggesting a new frame directly, as the former one will lead to their desired solution and not an imposed one. Themes are also presented as key information sources to create something for someone, and getting immerse into the problem context, is suggested to bring clues to find those themes that led to a better understanding of what is really needed.

Dorst (2015) present a set of ten principles for frame creation model, which consist of a zooming out and zooming in process, bringing a broader coverage to the original problem in order to include other players and reach new themes and frames, as well as zooming in to specific frames or ideas, from which ideas can be replicated in a wider context. Simplifying and judgement should be avoided, especially in the first steps of the process.

IDEO.org: Human-Centered Design framework. During the inspiration phase, interviews, both individual and as a group are a essential tool to understand people's hopes and desires. A deep involvement of the design team with the daily life of the community is advised. The ideation phase is characterized by a co-creation process involving some representative individuals from the community to work jointly with the design team, as well as other partners. Prototyping plays an important role to get feedback. Finally, the implementation phase makes emphasis on the feasibility and sustainability of the solution, by ensuring resources and performance measures. IDEO.org provides detailed materials like interview forms and diagrams samples to perform step by step the design project.

Young Foundation: Ways to design, develop and grow social innovation. In the first stage, the importance of critical situations as catalysed or innovation is presented. Once there is such a situation that justify an innovation, as well as the inspirations for it, the community should participate actively in the whole design and implementation process. Alike IDEO.org, the Young Foundation recognizes the importance of Ethnographic Research Techniques and the involvement of the researcher in the daily life of people, to identify what they really need and want. The authors also agree with the proposed principles, regarding the importance of alternative creative spaces to generate ideas. In this case, walking in the targeted area is suggested. For the second stage and the fourth, they suggest the use of Proprietary Knowledge applied to social issues, such as the Grameen associations. In the third stage, trial and error as well as prototyping are suggested. Effective supply and demand of the innovation, is essential for its scaling and diffusion. Ideas should be also simple to reach a greater scope.

Figure 6.2 shows a graphical comparison between the four set of ideas given the qualitative scores. In table 6.1, it is also presented the same comparison adding a list of the main elements composing each one of the methodologies or strategies.
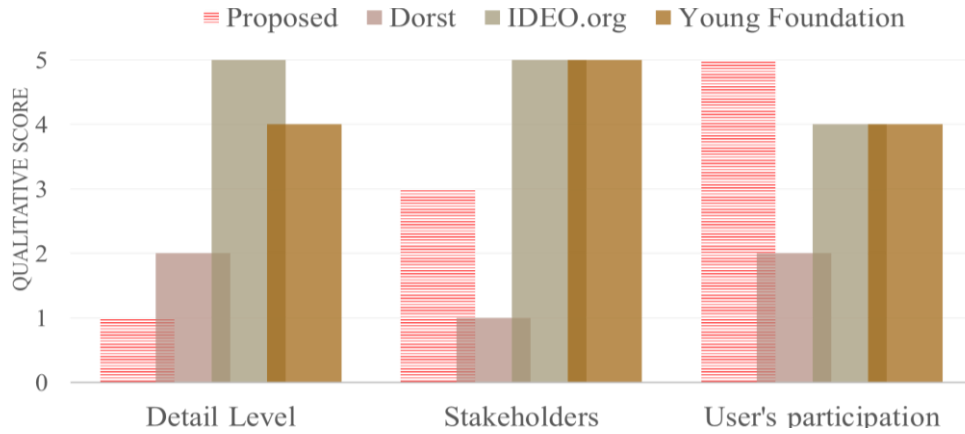
Figure 6.2. *Proposed principles vs. some of the existing methodologies and strategies on social design*

Regarding detail level, the best ranked is the methodology proposed by IDEO.org, as gives a full list of steps that should be followed, complemented with real examples and toolkits and other resources to implement many of the steps. The proposed principles, were scored as 1, considering that involve only a theoretical approach, which has not been evaluated in a real context thus lacking the basis for detailed instructions to be implemented. In the Stakeholders field, both IDEO.org and The Young Foundation are the best racked, as they mention the participation of the design team (which is not only compound of designers but also other professionals such as social scientists), targeted people, partners and investors, which is not mentioned neither in Dorst's strategies nor in the proposed principles.

Finally, in User's participation, although both IDEO.org and The Young Foundation emphasize on the importance of the final users into the design process, they are only involved as input sources in given stages of the process, such as at the inspiration and diagnosis stages where the professionals belonging to the design team apply different techniques to try to understand what the community desires, does and thinks, as well as inviting some representatives to participate in co-creation and prototyping sessions, in order to enrich the design with their feedback and ideas. On the other hand, the proposed principles look for a wider participation of the users during the whole design process, which can be only obtained by evaluating the ownership of the design projects.

Table 6.1. *Comparison between existing theories and the proposed design principles*

COMPARISON OF METHODOLOGIES AND STRATEGIES				
Elements	**Proposed principles**	**Dorst: Frame Creation Model**	**IDEO.org: Human-Centered Design framework**	**Young Foundation: Ways to design, develop and grow social innovation**
	1. Consider the problem context, opportunities and limitations 2. Stick to simple rules 3. Design by layers 4. Build in redundancy and overcompensation 5. Resist the urge to suppress randomness 6. Give importance to practitioners rather than only theoreticians 7. Co-create with actors from different generations and 8. Make use of diverse emergent platforms 9. Avoid interventionism 10. Design in environments full of juxtapositions	Principles: 1. Attack the context 2. Suspend Judgment 3. Embrace complexity 4. Zoom out, expand, and concentrate 5. Search for partners 6. Deepen themes 7. Sharpen the frames 8. Be prepared 9. Create the moment 10. Follow Though	Mindsets: 1. Creative Confidence 2. Make it 3. Learn from failure 4. Empathy 5. Embrace ambiguity 6. Optimism 7. Iterate, iterate, iterate Phases: 1. Inspiration 2. Ideation 3. Implementation	Stages of social innovation: 1. Coevolution Prompts, inspirations and diagnoses 2. Proposals and ideas 3. Prototyping and pilots 4. Sustaining 5. Scaling and diffusion 6. Systemic change
Detail level	1 (1) Low	2 (2) Medium-Low	5 (5) High	4 (4) Medium-High
Stakeholders	3 (3) Medium: Design team, targeted people	1 (1) Low: Design team	5 (5) High: Design team, targeted people, partners, investors	5 (5) High: Design team, targeted people, partners, investors
User's participants	5 (5) High	2 (2) Medium-Low	4 (4) Medium-High	4 (4) Medium-High

7. DISCUSSION

The primary purpose of this study was to present a set of principles to promote innovation in social design, based on a non-purely design perspective, by reviewing literature on different areas, and ultimately compare and contrast it with some of the main current research on the topic, focusing on those organizations that have had the chance to implement and test their ideas.

To come up with the main ideas of this work, a Theoretical Triangulation process was implemented combining statements from different authors belonging to different knowledge areas. However, one of the disadvantages of the so-called Theoretical Triangulation process, is that the sources selected might fail on subjectivity as there is a huge range of possibilities to choose from.

During the theoretical triangulation process, the selected authors, although were based mainly in the suggestion of an academician and practitioner on design who has a critical view to the approaches some authors give to social design, it was also considered other criteria such as books written in last 10 years, authors who are academicians but also practitioners and who are not designers, so that the result can differ and be contrasted with the general state of art regarding social design and social innovation. However, a different set of authors, would most probably end up in a different set of principles. Additionally, the ideas chosen from each author to create the triangulations, were subjective, seeking for supporting a hunch regarding the covered problem.

Finally, measuring the effectiveness of the proposed work, even if it involves a practical application, is hard, considering that there are not standardized performance measures or also called KPI's (key performance indicators) for innovation in social design or social innovation based on other than the profits generation. Also, the impact of an innovation intended to cover a social issue, depends on its continuity, adaptation and replication, which requires time and might depend on many factors that vary from context to context.

8. CONCLUSION

- The proposed principles extracted from the theoretical review can serve as a complement for other frameworks or guides to promote innovation in product design pursuing the solution or mitigation of social problems such as disaster relief, homelessness, hunger, poverty and associated topics such as sheltering, pedagogic resources, healthcare systems or even water supply for vulnerable communities.

- Promote innovation not only in the design team but also in the community members who in the end are the ones who implement, give continuity and improve the solutions to social challenges. Innovation is the key aspect that should be provided to the communities. Innovative communities can create products seeking not only for functionality and usability but also to reach pleasure in any of its conceptions.

- Simplicity, is both recognized in the proposed principles, as well as by the Young Foundation (2010) as one of the necessary elements to guarantee the spread of an innovation. The simpler an idea, the easier it can be presented to the different actors or stakeholders involved, from the community itself, till organizations or governments interested on supporting and promoting it.

- Understanding the context where the problem situations evolves, as recognized by Dorst (2015), IDEO.org (2015) and The Young Foundation (2010), is essential to create a "something" for "someone" rather than simply replicated what was created for others. By immersing into the problem context, more than simply creating empathy, a better understanding of the situation themes can be reached, thus a feasible solution can be created.

- Although many of the principles developed in this work were previously developed by other authors, some in more detail, and others in different words, it is worth to highlight how starting from a different perspective regarding innovation and its role in human evolution, allowed a similar set of ideas. Organizations such as IDEO.org or The Young Foundation which have developed practical projects allowing them to test and improve their assumptions, have created a full set of strategies to guide design teams to create and implement good solutions to social issues. However, the community's role remains in both methodologies as a source of input during some phases of the whole design process.

- This work suggests a more active participation of community members into the design process of initiatives to mitigate or solve social problems by redefining the property

model to be used in this kind of projects, being the affected people not only the beneficiaries of the solution but also the owners of it. The community, the real practitioners are in the end the ones who will define whether the idea continues or not. Now it is time for those and other organizations to test the proposed assumptions in a real context.

9.   SUGGESTIONS

* An applied design project should be performed to evaluate the suggested principles.

* A standard definition of what social design is and involves, should be created, so that practitioners aiming to actively participate in the solution of social issues can take specific approaches. For design practitioners, the definition of the concept "social" defines the approaches to be taken, thus, changing what is delivered. In this context, the considerations taken by the designer to define what makes a solution of social value is an aspect of primary importance, as it could involve many aspects, such as culture, economy, quality of life, gender issues, human interaction, power and democracy, among others, and they will be dependent on the approach.

* The proposed principles focus on solutions aimed at people in situations of vulnerability, and a further exploration should consider the impact Design can have on the broader definition of the concept social, by considering its capacity to change interactions, and systems that go far beyond products.

* More research regarding performance measure or KPIs (key performance indicators) to evaluate innovation in social design should be performed, as traditional measures based solely on the profit generation might lack many aspects such as continuity and replication, which are also important to evaluate the solution.

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