Fablabs : the new real utopias of humanitarianism

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FABLABS

THE NEW REAL UTOPIAS OF HUMANITARIANISM.

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ACRONYMS

ALNAP	**Active Learning Network for Accountability and Performance**
CNC	**Computer Numerical Control**
DIY	**Do it Yourself**
Fablab	**Fabrication Laboratory**
FacLab	**Faculty Laboratory**
GHL	**Global Humanitarian Laboratory**
HI	**Handicap International**
ICRC	**International Committee of the Red Cross**
IOM	**International Organization for Migration**
MIT	**Massachussets Institute of Technology**
MSF	**Médecins Sans Frontières**
NGO	**Non Gouvernemental Organization**
RIF	**Resilience Innovation Facilities**
TCP/IP	**Transmission Control Protocol/Internet Protocol**
Tdh	**Terre des hommes**
UN	**United Nations**
UNHCR	**United Nations High Commissioner for Refugees**
UNOPS	**United Nations Office for Project Services**
WFP	**World Food Program**

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ABSTRACT

Hackerspaces and Fablabs have started to pop up around the world. They echo the recent hacker and maker movements, which themselves echo ancient movements. Through these spaces and the technologies and approaches they disseminate, anyone should be able to build "almost anything", anyone could become an entrepreneur, the means of production would finally be liberated, and power would be returned to the people. The defenders of these movements announce nothing less than a new industrial revolution, where everyone would be empowered thanks to the new digital fabrication technologies. These thundering announcements reached the ears and eyes of humanitarians in 2015. Since then, a whole series of initiatives around humanitarian Fablabs have emerged with limited success. These initiatives are mainly led by visionaries of innovation and technology, with utopian leanings. This research work is therefore interested in the origin, motivations and promises of the humanitarian Fablabs.

To carry out this research, qualitative surveys were conducted with the main initiators of the exploration and experimentation of humanitarian Fablabs. The study examines the genealogy of hackerspaces and Fablabs, as well as their introduction and development in the humanitarian environment. It also examines the many challenges that these spaces have faced and continue to face, drawing attention to the limitations of the humanitarian ecosystem at the global level. Overall, this research seeks to clarify the misunderstood phenomenon of humanitarian Fablabs and reveals some strategic directions for humanitarian organizations considering the creation of humanitarian Fablabs in the future.

1. INTRODUCTION

At the dawn of the new millennium, discussions about the future of our societies have gained in importance. Questions about the future of our political and economic systems have again been raised. We have witnessed alarming speeches about the end of work to wonderful predictions about the liberation of the means of production (Gehrsenfeld, 2007) (Anderson, 2012). Hackerspaces and Fablabs, which emerged in the last decades, echo this social body concerned with issues of progress, employment, institutional transformation, and the relationship between the individual and the collective. In this sense, some argue that hackerspaces and Fablabs are places of social transformation, able to influence the course of things. Others consider that they contribute directly to the new industrial revolution in progress, thanks to their fundamental characteristics. Hackerspaces and Fablabs welcome people using digital tools and machines to design and prototype new products. They share a cultural norm with open source that aims to share and collaborate with others online as well as in person. They use common standards for design files that aim to ease the transition from idea to entrepreneurship (Anderson, 2012). Thus, by combining social issues, actors, norms, resources, technologies, and a conception of individual and society, hackerspaces and Fablabs are forged in the hacking, making, Do It Yourself (DIY), and fabrication movement to become spaces of individual, collective, and technological empowerment (Lallement, 2015) (Berrebi-Hoffmann , Bureau, & Lallement, 2018). With all this promise and potential, the number of hackerspaces and Fablabs has continued to grow in recent years, and the humanitarian sector has not remained unaffected by this development. While hackerspaces and Fablabs allow non-expert users to use both high- and low-tech tools, humanitarian actors see them as co-creation spaces that can empower people to meet their own needs and those of their communities (Corsini & Moultrie, 2018). By defining new rules of the game, humanitarian Fablabs thus break away from the most traditional forms of organization and adopt very organic forms, evolving according to the most varied and sometimes incompatible contexts, targets and activities (Interviewee 3, 2022). They thus offer "a kind of absolute break with traditional time" (Foucault, 2019).

1.1 CONTEXT OF THIS RESEARCH

My experience at Terre des hommes Foundation Lausanne, where I have been working for over 3 years, is the main reason why I became interested in these spaces. After an internship in fundraising, I joined the Innovation Unit in the summer of 2018, where I was able to closely witness the development of the Humanitarian Fablab initiative that we will discover in this research. I met and was able to work with the main carriers of this initiative and those who followed. I also contributed directly to the deployment of these spaces and participated in strategic reflections on their evolution. My privileged position in different innovation positions at Terre des hommes has allowed me to observe the enthusiasm, faith and conviction of some for these spaces, as well as the mistrust, doubt and incomprehension of others. While it is still difficult to say whether these spaces can bring change and demonstrate impact, they do not leave people indifferent. Humanitarian Fablabs, though their name have evolved since the beginning (called the Resilience Innovation Facilities now), continue to gravitate to Tdh and its partners. Despite this, few people know the origins and motivations of these spaces. Out of personal interest, as well as for the organization where I work, I decided to take a closer look at this topic to define the challenges and limits of these spaces.

1.2 PROBLEMATIC

As we will see in this thesis, some of the major players in the humanitarian world began to take an interest in Fablabs in the middle of the last decade. Since then, several large global initiatives have been launched by major humanitarian actors. This is how Fablabs started to emerge to try to support and empower beneficiaries. These spaces have aroused both a lot of interest (given the means made available) but also a lot of mistrust. Initiatives continued, several organizations joined or left these initiatives, and pilot projects were launched around the world. On the one hand, these initiatives never lived up to their promises or worse, disappeared quickly as we will see in the case of the Global Humanitarian Lab. On the other hand, new spaces continue to emerge, and organizations continue to support them. The research done in this thesis aims to understand the origin of these spaces, the movements they have brought about and their promises. It also aims to understand how these spaces have interested the humanitarian world, who are the people who support them and their

intentions. More concretely, the aim of this research is to understand the real relevance of these spaces in the humanitarian world.

The objectives are, among others, to:

- Define the ins and outs of the hacker and maker movements
- Define the purpose and potential of hackerspaces and Fablabs
- Unfold the genesis of these spaces in the humanitarian field and identify the motivations of the people behind them
- Define some of the contributions and limits of these spaces

The problematic addressed in this thesis can be summarized as follows:

What are the tenets and outcomes of humanitarian Fablabs carried by NGOs? Are they new forms of utopia?

1.3 STRUCTURE OF THIS RESEARCH

This study first starts with the explanation of the methodology. Then, before jumping into the issue of humanitarian Fablabs, this work first addresses the history of the sociology of utopias, as hackerspaces and Fablabs seem to have revived contemporary utopias when they were thought to have disappeared (Bosqué, Noor, & Ricard, 2014) (Lallement, 2015) (Gwiazdzinski, 2016) (Liefooghe, 2018). The third chapter is thus dedicated to the history of utopian consciousness in order to understand whether the advocates of humanitarian Fablabs are somewhat in line with Fourrier, Godin, and consort (Gauchet, 2003)(Lallement, 2009). The fourth chapter is devoted to the origins and evolution of hackerspaces and Fablabs. The aim here is to understand the roots of these spaces through the hacker and maker movements, and then to study their forms and functions, as well as the promises made in their name. The fifth chapter is devoted to the motivations and application of these spaces in the humanitarian environment. The purpose of this chapter is to understand where the idea of deploying these spaces in humanitarian contexts came from, who the people behind these movements are, and how these spaces have evolved over time. Chapter six seeks to critically analyze the development of those spaces.

2. METHODOLOGY

Choosing an appropriate research method is a crucial step in the research process and must meet the specific needs of the study. A qualitative methodology aims to understand the complex and elusive in a systematic way rather than to establish causal relationships between multiple variables (Raza & Sanjay, 2018). Qualitative research focuses on processes and meanings that are not rigorously measured in terms of quantity, intensity, or frequency (Silverman, 2021). Qualitative research thus offers a holistic understanding of an issue and is sensitive to the context of the phenomenon (Raza & Sanjay, 2018).

In the context of this thesis, a qualitative approach was therefore selected in order to conduct a socio-historical study of Fablabs in the humanitarian environment. The qualitative approach should allow to answer the research question. To do so, the data was collected through interviews. These interviews allowed for a reliable collection, processing and analysis of the data, and reflect the reasons, forms, objectives and realities of humanitarian Fablabs. It was decided to use "autobiographical" interviews related to humanitarianism in order to capture the trajectories and life paths of key actors in relation to those spaces and thus place humanitarian Fablabs in a broader context of understanding. Through these narratives, prepared in advance and constructed according to a pre-established plan, the study sought to observe the norms, values and representations of the culture of innovation, hacking and making within the humanitarian sector, as well as to understand the underlying social processes and practical knowledge (Sauvayre, 2013) (Paillé, 2006). The interviews provided insight into the relationships and trajectories of the interviewees in relation to the following.

- Humanitarianism
- Innovation
- Technology
- Hacker and maker movements
- Fablabs

The interviews sought to evoke, describe, and reflect on periods in the lives of the interviewees that were marked by humanitarian Fablabs. Several questions were asked in order

to understand the trajectory of the interviewees and to invite them to deepen the situations experienced with the development of these spaces and to express numerous details and reflections on their relevance. Prior to these qualitative interviews, a literature review was conducted on the hacker and maker movements, on the spaces they occupy and the promises they hold. A second literature review was conducted on innovation and the use of Fablabs in the humanitarian environment. These two literature reviews allowed us to understand the roots and challenges of Fablabs in the humanitarian sector. Finally, in view of the utopian nature of these spaces, a third literature review was conducted on the history of utopian consciousness in order to define whether the people running humanitarian Fablabs fit into similar streams of thought.

In summary, the implementation of the proposed methodology was based on the following simultaneous phases:

- Review of the literature on the hacker and maker movements, as well as the spaces they occupy
- Literature review on innovation and the use of Fablabs in humanitarian work
- Literature review on utopian consciousness
- Consultation with key actors in humanitarian Fablabs via autobiographical interviews
- Compilation and analysis of the data collected
- Drafting, correction, and finalization of the study

3. A SOCIOLOGY OF UTOPIAS AND IDEAS

With his book “Utopia, sive de optimo republicae statu”, Thomas More created a literary and philosophical genre capable of thinking about social organization differently (More, 2021). However, Utopia does not suggest a pre-social state, without work or property, but rather an ambitious society perceived and harmonized in a different way. Elsewhere, geographically, and temporally, utopia is the description of an imaginary world with different principles (Gauchet, 2003). It thus differs from the novel dealing with the ordinary world and the tale aiming to transform the mind through a different vision of nature. Nor is utopia quite the same as myth, which is concerned with the origin of techniques and arts, rather than the opportunities they offer. Utopia, after all, is a call to action (Raymond, 1950). Through the imagination, it seeks to break with the world as it is. *"Utopia can be understood as a singular language that serves to think about and develop the lives of women and men differently"* (Lallement, 2009). Many utopian stories have advanced social thinking and contributed to religious, political and societal projects (Lallement & Ramos, Reinventing Time, 2010). Etymologically, utopia means a place "without a place". Nowadays, in everyday language, utopia represents a perfect, ideal reality that is difficult to achieve. This perfection implies that something is disqualified and considered utopian. Indeed, utopian thinking is often criticized for its unrealism and its quest for the perfect man in a smooth society. Thus, seeking to overturn the hold of the actual on the possible, utopia is in opposition to ideology. Utopia projects the possible, tends towards invention and stands as a critical alternative to what exists, whereas ideology legitimizes the real, promotes conversation and preserves the identity of individuals or groups (Gwiazdzinski, 2016). Although fictional, Utopia brings the concrete functioning of an alternative society into the present.

3.1 DISCOVERING THE IMAGINARY

Utopian discourse took shape in Europe's inner questioning, following its discoveries and conquests around the world. Utopia also followed the evolution of thought at the beginning of the 16th century, marked by the revolution in the relationship to God. It is the heritage to reflections on the common good, politics, the necessity and legitimacy of laws. On this basis, Thomas More imagined political power as it could be, far from any existing "Cité" (Gauchet, 2003). With progress, utopia, which had so far sailed into unknown lands, suddenly turned towards the future, because it was now possible to envisage a new path

through history that had happened. Between 1815 and 1848, utopian socialism would first seek to effectively build the future "Cité". Utopias such as Charles Fourier's Phalanstery or Etienne Cabet's Icaria were imagined and acted as programs. The socialist utopia is halfway between the old representations of imaginary cities and the new possibilities promised by history (Lallement, 2009). The desire to win people's minds by example of the socialist utopians was strongly criticized by Marx and Engel during the 'scientific socialism' after 1848. Faced with a realistic vision of global social transformation, the utopians were accused of tending towards the unreal. It is true that utopian discourse can point to the destinations towards which history must tend, but it is incapable of defining the paths to reach them (Duveau, 1961). From that moment on, it was necessary to understand the social and material transformation that would take place in the world and to mobilize a sufficiently large political force to allow a total break with capitalism and the bourgeoisie. From then on, social destiny was no longer the concern of a limited number of utopians (Gauchet, 2003). However, historical consciousness will evoke a less determined future than utopian consciousness. At the dawn of the First World War, the scientific predictions of collectivist hopes are overturned by a new representation of the future. The utopian consciousness then took on a new form with the social revolution, which itself became utopian (Duveau, 1961). The mobilizing image of revolution was thus fueled by utopia in the 20th century. It marked the consequent gap between the dreamed-of revolution and the one that happened. The unimaginable post-revolution then became the unrepresentable future in general, following the crisis of the 1970s. The progression of societies in time was then called into question, while *"neither a return to a traditional and fundamental identity; nor a continuity guaranteed by progress; nor a rupture of the self-leading to self-possession, nor a tipping point in history leading to a prosperous and unimaginable end are now possible"* (Gauchet, 2003). Utopian consciousness has thus been driven out of the future.

3.2 DISAPPEARED, REALLY?

However, while it was thought to have disappeared, utopia has recently made a comeback, as way to read contemporary worlds (Gwiazdzinski, 2016). It has risen from its ashes in the upheaval of our societies, induced by globalization, crises, conflicts, and changing environment. Contemporary utopias serve to cope with doubts and uncertainty (Lallement & Ramos, Reinventing Time, 2010). They are present in reflections on social and political

togetherness and reflect the difficulties experienced by our societies in finding new forms of connection and modernity. Thinking about utopia today means dealing with socio-political issues (Trudel, 2010). They are reflected in experiments, mobilizations and occupations. They contribute to the transformation of today's world. They seek to think differently about the economy, ecology, and social ties (Gwiazdzinski, 2016). Heir to the counterculture and the Do-It-Yourself movement, they advocate the sharing economy, the circular, the proximity and the ordinary innovation. They champion individual ingenuity, the frugal, the modest, and "doing more with less" (Radjou, Prabhu, & Ahuja, 2012). The knowledge economy, and more particularly the internet, has given a new boost to third places, a concept originally developed by the sociologist Ray Oldenburg (1989) to describe the traditional places of conviviality that are essential for meeting and building social links, such as cafés, restaurants and other public places. Third places tended to diminish in the face of the economic and spatial sprawl of our societies, which has the effect of reducing sociability to the "first places" offered by the home and the "second places" offered by the factory, the office, the vehicle, etc. Some predict that this phenomenon will be accentuated with the advent of the internet. However, the internet revolution has also provided opportunities technologies have led to new forms of sociability through digital social networks. Shared knowledge and software have been created, such as knowledge sharing platforms, free software, free data, open and collaborative innovation and finally crowdfunding (Liefooghe, 2018). With digital machines and electronic components, digital fabrication could also be democratized (Anderson, 2012). Finally, smartphones, laptops and other digital tablets, by being connected to mobile networks or Wi-Fi, make it possible to reinforce the omnipresence of individuals, with a sociability that is a priori liberated from a physical place (Liefooghe, 2018). Michel Foucault (2009) declared that he dreamed of a science of 'heterotopias', of a knowledge of these counter-places where, at a distance from the dominant conventions, alternative models of life are developed. In the 2000s, new counter-places are emerging, taking advantage of the possibilities offered by digital tools, the free circulation of knowledge, the mobility of people and the desire to re-establish bonds of conviviality (Burret, 2015). Ray Oldenburg's (1989) concept is thus revisited in the digital age, where third places are collaborative spaces where project communities are empowered and build the world of tomorrow. Their common denominator is that they are places of sociability and exchange, with structures such as hackerspaces and Fablabs are currently emerging (Liefooghe, 2018).

4. HACKING, MAKING AND DO IT YOURSELF

Since the mid-2000s, a new philosophy of work, that of making, has been supported by a group of individuals. This collective enthusiasm is bringing craft activities, tinkering and Do-It-Yourself (DIY) back into fashion (Berrebi-Hoffmann, Bureau, & Lallement, 2018). The movement of "making" calls into question the productive practice that started over time to offer new kind of suffering and social devaluation. In the dynamics of the maker movement and DIY practices, the promoters of this movement are looking above all for means and spaces that allow work to regain meaning, and this *"without anyone imposing objectives, deadlines or constraints... Just the desire to do things for oneself"* (Lallement, 2015).

Hackers have played a major role in the dynamics that led to the emergence of the DIY movement, as they have from the beginning fought for the democratization and empowerment of technologies. Hacking can be seen as a practice that creates innovative things in the field of computers, networks and communication technologies. From the beginning, its promoters have used technology and especially programming in a playful and innocent way to change the world. By dissecting computers and other technological machines, hackers seek to understand how they work, hijack their functions and take advantage of them to advance society (Lallement, 2015). According to Steven Levy (2010), the first generation of hackers was born in MIT's Tech Model Railroad Club (TMRC). The students in this club built model trains and were interested in railroad circuits and how to control them. During their activities, they developed new expressions in connection with their experiments. This is how the term "hack" came about. A "hack" symbolizes the idea of studying a system to make it your own and creatively diverting the original use to meet a defined need. It also means a quick solution to circumvent any type of problem (Bosqué, Noor, & Ricard, 2014). This is how the world of hackers was born in the laboratories of MIT, where we find students spending their nights hacking the first generation of computers and professors betting that the computer will one day be able to reproduce the cognitive functions of the human brain thanks to artificial intelligence. The link between hacking and computers was thus established from the start (Lallement, 2015).

However, at that time, programming and computers were still at an early stage, tainted by suspicion. This bad reputation will gradually evolve with new technical progress influenced by the hacker ethic. First, a new generation of hackers, will give life to new purely playful

programs. Computer games became an integral part of hacker culture, with some games becoming legendary. Then, hardware was also the object of ingenious tinkering. This new form of hacking was the origin of the first microcomputer accessible to individuals, the Altair 8800, which in turn inspired Bill Gates and Paul Allen. They co-founded Microsoft, to develop a computer language adapted to the Altair 8800, the Altair Basic. The Altair 8000 was also the origin of the first hackerspace on Californian soil, precipitating a shift in the hacker center of gravity from the East to the West. Thus, the passion for electronic tinkering began to spread beyond the corporate world. Home computer assembly (often in garages) quickly became the preferred activity of hardware specialists. In the same period, Steve Wozniak, co-founder of Apple, invented the personal desktop computer. Steve Job would turn the hacking talent of Steve Wozniak into the successful and profitable brand that we know today (Lallement, 2015).

The Internet has in turn come to transform our lives. This new revolution originated in the military, with the American Advanced Project Agency creating the first packet data network in the 1960s. The first computer-to-computer connection, Arpanet, became operational in 1975, linking a series of American universities and military bases. During the same period, the TCP/IP protocol was created, which gave birth to the Internet. The history of the internet is also closely linked to hacking practices. The @ symbol that we use today for our e-mail addresses was not part of the Arpanet specifications but was a hack by Ray Tomlinson who initially hid it from his employers. The very first e-mails were thus exchanged "clandestinely" in 1971. The innovation has since changed the way we communicate (Lallement, 2015). The spirit of innovation of the hackers has affected the whole of Silicon Valley. The same cultural principles have inspired underground movements, anti-war protest, civil disobedience, and the return to nature on the one hand, and the invention of computers, the Internet, and American start-ups and multinationals on the other (Bosqué, Noor, & Ricard, 2014). Since then, hackers have been promoting a globalized world of horizontal organizations, where power must be decentralized and everyone must be able to live in full harmony with their environment, others and themselves. These ingredients have their origin in the hacker ethic. (Lallement, 2015).

4.1 An Ethic for the Empowerment of Machines and Humans

According to Steven Levy (2010), there are five fundamental principles in the revolutionary ethics of the hacker movement. First, all information must be free to foster collective creativity. Secondly, hackers distrust authority and advocate for decentralization and the free exchange of information. Third, hackers are judged solely based on their technical performance and not on their background, age, gender or race. Fourthly, hackers aim for art and beauty through computers. Finally, hackers have faith in the ability of computers to change people's lives, through the new services, capabilities, knowledge gains and knowledge transfers they provide. According to Pekka Himanen (2001), work in the hacker world is forged in passion. A routine life is avoided thanks to machines that allow time to be optimized and made more flexible. In the same vein, cooperation at work and the circulation of knowledge must not be impaired by bureaucracy. The ideal hacker regulation is the free exchange of information and co-production with and by peers. Freedom of expression, networked community spirit and respect for privacy form the values of hackers. This philosophy is present in Kenneth McKenzie's (2004) hacker manifesto. It is no longer so much about social struggles for land or capital but more about the struggle for information, with the rise of a new revolutionary class. Thanks to hacking, capitalism would have found a new youth. Most hackers have liberalism as their main ideology. They advocate individual autonomy without government control. While the computer was initially criticized as a new form of domination, privileging the elite and contributing to the dehumanization of our economies, the successive technological revolutions of computing have cleared up many misunderstandings. These technical feats have been largely influenced by the practices and ethics of hacking (Lallement, 2015).

4.2 The passion of the gesture and of the object, without constraints

Another important community of utopians, the makers, are the direct heirs of the multiform hacker movement. They carry forward the ethical and technical demands of the early hackers. Although they emerged in the 2000s, they also echo older movements that used DIY to confront the prevailing productive structure. One of the first communities to have undoubtedly influenced the subsequent trajectory of makers was that of the Shakers in the second half of the 18th century. Shaker communities were organized into cooperatives with the fundamental principles of alternating work tasks, self-consumption and common

ownership. They made fine craftsmanship a common "raison d'être" to fight against rationalization (Berrebi-Hoffmann, Bureau, & Lallement, 2018). At the end of the 19th century, the Art & Craft movement was formed to resist the growing industrialization and the consumer society that followed. One of its leaders, William Morris (1890), published a utopian account of the movement: News from Nowhere. He described a world free of industrial atrocities, with a system of artisanal production without any control. Anticipating machines that are highly superior to the past, William Morris (1890) imagined a world in which there are no longer any boundaries between art and craft, fine art and applied art. Together, the Shakers' experiment and the Art & Crafts movement represented communities of actors who advocated beautiful making and the critique of the social trajectory. They were concerned about the negative impacts of increasing urbanization and the harms of industrialization and sought to recreate connection and new forms of solidarity within societyBerrebi-Hoffmann, Bureau, & Lallement, 2018).

In the aftermath of the First World War, interest in DIY culture accelerated in Europe. It was then disseminated to educate mainly working-class men so that they could participate themselves in the reconstruction effort of Europe. A female segment in the post-war years also existed, mainly represented in the domestic space. These DIY activities allow workers and women to produce meaning and social dignity. Although the DIY practices of the early twentieth century were thus alternative practices to the dominant productive order of their time. In the 1970s, mass consumption was omnipresent, and tinkering was used in new territories that sought to allow individuals to break with the prevailing conformism. As a precursor to the open-source philosophy present today in the digital world, social design was the first to symbolize these values of autonomy and creativity. Artists such as Enzo Mari made plans and sketches of simple objects to be assembled freely available. Social design thus combined DIY with anti-industrial and anti-capitalist practices. At the same time, punk music conveyed similar values by seeking to become independent and emancipate itself from commercial practices (Berrebi-Hoffmann, Bureau, & Lallement, 2018).

From the 1980s and 1990s, making objects yourself started however to become less popular. Professional workshops started to diminish when the number of blue collars in the workforce started to shrink. Tools and machines have been replaced by keyboards and screen in companies with the advent of microcomputers. Handicraft classes has been gradually replaced by computer classes in school. The empowerment of women in society, with

better working possibilities and sex egality, has also removed domestic education from schools. Therefore, a new generation of children grew up surrounded by computers and video games, instead of tools. They became fascinated by software and the illimited things to create online, contributing directly to today's digital age. In thirty years, our societies would thus have gone from atoms to bits (Anderson, Makrers. The New Industrial Revolution , 2012). But in the 2000s, the maker movement has started to turn things around with the progress and proliferation of desktop fabrication tools. A new generation of enthusiasts is now confronted with the technics and practices of industrial design, as it was the case with desktop publishing. Nowadays makers are part of the web generation and share their creation online. By joining the culture and collaboration of the web to the process of making, they can together build things on a scale that previous makers could never have achieved. They echo the vision of people like Steve Jobs that saw the personal computer as a mean to not only do business but also change the world (Anderson, 2012). Just as Stewart Brand proclaimed, along with the early visionaries of Silicon Valley, that "computer liberation would do what drugs had failed to do, namely emancipate minds and talents. A realm of intimate, personal power is emerging. Power for the individual to educate themselves, to find their own inspiration, to shape their own environment and to share their adventure with those they care about" (Isaacson , 2011). The world would go from bits to atoms again (Anderson, 2012).

4.3 HACKERSPACES AND FABLABS…

Today's hackers and makers gather in spaces of a new kind. So-called hackerspaces and Fablabs allow people to have access to tools and resources to explore and build "Almost Anything" (Gehrsenfeld, 2007). These spaces are generally equipped with high-tech tools, such as versatile digital fabrication technologies, microelectronic and design software. There are also handicraft facilities and machine tools, echoing the early makers' movement. A fundamental feature of these spaces is that they are for the most part internationally networked, either formally through organization associations (i.e. Fabfoundation), and/or informally through common projects and interest forum. Participants are part of movement of making, hacking and fixing that goes beyond the spaces they occupy. In this way, they can share online ideas, experiences and designs, as well as machine instructions and practical help for the use and running of those spaces. Participants, organizers, and supporters

advocate for the open use of widely accessible technologies and the personal and social empowerment that this brings (Bosqué, Noor, & Ricard, 2014). Smith et al. (2017) consider hackerspaces and Fablabs as being part of a grassroots innovation movement because most of the initiatives take place outside of formal institutions and because their actors are committed to exploring the social opportunities of empowering people with high and low-tech tools. Some see hackerspaces and Fablabs, as vectors of a new industrial revolution (Anderson, 2012), others as particular spaces enabling social innovation, democratizing technology, or providing tools for more sustainable developments (Smith, Fressoli, Abrol, Around , & Ely , 2017).

Hackerspaces were created in the United States in the 1970s and then spread out to Europe and the rest of the world. From the outset, American hackerspaces have been characterized by a tension between a culture of sharing and free circulation of knowledge on the one hand, and a concern for recognition and market valuation on the other. In Europe, hackerspaces have other vocations. Indeed, some even make a distinction between hacklabs and hackerspaces. Located in squats, hacklabs are more closely linked to the anarchist movement. These spaces are used as places for political discussion where, sheltered from the state and the market, technology serves collective autonomy and social movements. Hackerspaces, on the other hand, are thought to have emerged later, following the development of personnal computing and digital fabrication. Hackerspaces are generally legal entities open to the greatest number. Less political, they convey a more playful vision of technology. A hackerspace is primarily a place to experiment and work. When you enter one, you can generally access equipment, training, and a community. In this regard, Hackerspaces can be seen as a social world, made up of individuals and groups organized around a main activity: "Hacking" (Lallement, 2015).

Fablabs also have their origins on the American East Coast. On the one hand, they stem from scientific research into the future of learning at the MIT Media Lab and, on the other, from the practices of inner-city communities in Boston. The term "FabLab", meaning fabrication laboratory, was coined in the early 2000s during the internal seminars of the Center of Bits and Atoms (CBA), founded in 2001 at MIT (Berrebi-Hoffmann, Bureau, & Lallement, 2018). A Fablab is a space equipped with digital fabrication machines, electronics, and other tools. Fablab users occupy the space to enjoy the machines, to learn, to share with others and to form a community of users. The Fablab is intended to be an instrument

for the democratization of fabrication, with production based on technique and collaborative learning (Bosqué, Noor, & Ricard, 2014). Neil Gershenfeld in the first Fablab at MIT will experiment with new forms of teaching in his course entitled "How to Make (Almost) Everything". In this course, students have access to CNC machines to carry out their fabrication projects (Gehrsenfeld, 2007). The fact that all these developments have taken place around MIT and not elsewhere is also explained by the Arts & Crafts and DIY practices that have marked Massachusetts, and Boston in particular, since the late 19th century. The Boston Arts & Crafts Society was strongly inspired by the ideas developed by William Morris and his acolytes in England, as we have seen above. These ideas were reinforced by the American aesthetic movement of the 1870s and 1880s, which valued manual craftsmanship. Since then, Boston has remained deeply influenced by the Arts & Crafts tradition, which largely inspired the creation of the MIT Media Lab in the mid-1980s and the Fab Foundation in 2009 (Berrebi-Hoffmann, Bureau, & Lallement, 2018). Today, the FabLab brand refers to collaborative spaces that follow the Fab Foundation's common charter. Thousands of Fablabs collaborate and exchange projects, plans, tutorials, and other experiences around the world (Lallement, 2015).

The principles of open hardware, open software, and peer production are fundamental elements of hackerspaces and Fablabs. All designs, instructions, and code should be freely available to all. Peer production based on the commons is aimed to be, *"decentralized, collaborative, and non-proprietary; based on the sharing of resources and results among widely distributed and loosely connected individuals who cooperate with each other without relying on market signals or management orders"* (Benkler & Nissenbaum, 2006). Hackerspaces and Fablabs also echo software development practices. Thus, projects bring together participants with diverse skills, knowledge and resources. Teams are organized horizontally and rely on voluntary collaboration. A form of technological citizenship arises from the possibilities offered by access, learning, control of tools and participation in activities and initiatives. There is no such thing as expert, non-expert, professional or amateur. In all these spaces, widespread access to the means of production is considered not only a right but also a necessity. A more democratic production is aimed at. Experimentation with new technologies and new social modes of design in hackerspaces and Fablabs has led to the emergence of niche forms of technical and social innovation (Dickel, Ferdinand, & Petschow, 2014). These spaces thus have the capacity to act as third places where ideas relevant to local communities can be explored in practice.

Access and new forms of training for skill exchange, learning, and co-creation are encouraged (Smith, Fressoli, Abrol, Around , & Ely , 2017).

Whether they are hackerspaces or Fablabs, the motivations vary from one space to another. Some aim at the creation of objects and custom manufacturing. Others go further and aim for entrepreneurial prototyping. Some spaces, like hackerspaces, advocate openness, study and transformation of technologies, or in the case of hacklabs, the political act of technological citizenship. On the contrary, hackerspaces and Fablabs aim at sustainable development thanks to their decentralized production and their social innovation models. Hackers and makers militate for the relocalization of production, in order to repair, recycle and reuse goods and services in a circular economy dynamic. Other spaces are more articulated around sociological causes, such as the relations of production, consumption and sociability. Within their walls, they seek to transform society, through new ways of making, consuming and exchanging objects. For Smith et al (2017), hackerspaces and Fablabs *"allow people to work together and share tacit knowledge about hacking and making, to feel part of a virtuous community and gain rewards, to educate and support each other, while expressing values and commitments to free culture and, in some cases, a critique of dominant models of ownership and control in design and production."* Hackerspaces and Fablabs have in common that they promote new practices and new identities based on the intelligence of doing, technologies and know-how and on being an actorof change. Hackerspaces and fablabs are today the two main organizational models of the world of makers and hackers. They combine social issues, actors, resources and a conception of the individual and society (Bosqué, Noor, & Ricard, 2014).

4.4 A NEW INDUSTRIAL REVOLUTION?

Several actors and observers of the hacker and maker movement believe that a new industrial revolution is taking shape with the development of the Internet of Things (Rifkin, 2015). Some call it the third (Anderson, 2012), others the fourth industrial revolution (Schwab, 2016). First, following the invention of the steam engine, the first industrial revolution is said to have begun in 1760, allowing the transition from agriculture and feudal society to new ways of manufacturing. The main energy source was coal, the main means of transport was the train, textiles and steel were the dominant industries. The invention of the combustion engine launched the second industrial revolution in 1900. This new era of rapid industrialization marked the beginning of mass production using electricity and oil.

The third industrial revolution is said to have started in 1960 with the automation of production through information technology and electronics. This is the digital and computer revolution, with the development of semiconductors, mainframe computing, the personal computer and the internet, we saw in the hacker movement (Schwab, 2016). Today, a fourth industrial revolution, building directly on the third industrial revolution, is being developed. This new industrial era would be possible thanks to computer-based product design and three-dimensional printing (3D). It is now possible to create 'Almost Anything' by building up successive layers of materials (Gehrsenfeld, 2007). According to Schwab (2016), it would also be characterized by smaller and more powerful sensors, a more ubiquitous and mobile internet, and machine learning and artificial intelligence. The fourth and distinct industrial revolution would be more than an extension of the third because of its speed, scope and impact on systems. It would disrupt all sectors of activity around the world, evolve at an exponential rather than linear rate and entire systems of production, management and governance would be profoundly changed (Schwab, 2016) (Min, Jeanne, & Suk Hi, 2018) (Rifkin, 2015).

Following the invention of personal computers, the internet would have democratized publishing, radio and communications. The long tail of bits would have increased the number and participation of participants in the digital world (Anderson, 2006). The manufacturing industry would have the same development with the long tail of things (Anderson, 2012). Previously, access to and variety of products in the music, film and literature sectors was limited by traditional distribution systems such as bookstores, cinemas and broadcasters. The internet would have enabled a long tail of micro-market, with "almost anybody" able to create their own music or audiovisual content (Anderson, 2006). The same would happen with physical products, allowing new manufacturers to find new markets for their goods. The web has thus enabled the development of a long tail of products that is set to rival that of digital products. In addition, there is a massive shift in consumption towards amateur and not necessarily professional content. For Anderson (2012), 3D printers and other digitally controlled machines have followed in the footsteps of cameras (for YouTube) and music editing tools (for soundcloud, spotify, etc.). They would allow anyone to create unique pieces for their own use or to market them. Thus, for advocates of the hacker and maker movement, the new industrial revolution would be partly the preserve of digital fabrication coupled with personal fabrication. In other words, it would be the industrialization

of the Maker movement. The digital transformation of object fabrication would not only improve the existing industry, but would also allow the industry to have more producers. This would give everyone the ability to become entrepreneurs, as was the case with the web. For Neil Gershenfeld (2007), *[...] "the killer app of digital manufacturing would be personal fabrication. It wouldn't be making what you can buy at Walmart but making what you can't buy at Walmart. It's exactly like the transition from mainframes to microcomputers. They weren't used for the same thing - microcomputers weren't there to manage inventory and make payrolls. They were used to do personal things, from email to video games. This will also be true for digital manufacturing."* This development would enable a transformative change of the same order as the beginnings of mass production. It can not only change the traditional way of making goods but can also work at scales as tiny as in the fields of biology or as large as in construction (Anderson, 2012).

Manual workers used to produce most goods and services with their manual strength and skill, but now knowledge workers produce most goods and services with their minds. This would be due to the disjunction between design and production. New products can now be designed without worrying about the manufacturing process. It is no longer necessary to know the industrial process because computer-controlled machines take care of it themselves (Smith, Fressoli, Abrol, Around , & Ely , 2017). If these things can be done with a normal computer, they are within the reach of anyone for Anderson (2012). In addition, thanks to open source, it is easier access, modify and adapt designs. Makers can produce customized products digitally with new kinds of factories that offer to make things on demand via the web. A new category of creators can thus launch into production, transforming their prototype into a final product. Manufacturing would become 'a cloud service' like any other and global supply chains 'scale free' (Anderson, 2012) (Birtchnell & Hoyle, 2014).To become an inventor or entrepreneur, there would no longer be a need to invest in a manufacturing plant or sell market access to existing factories. Today's makers can theoretically invent their own products, create their own brand and sell the whole thing directly over the internet to end customers. Makers can also more easily engage in production and marketing through participatory funding and social media (Mota, 2011). For Smith et al (2017), widespread self-production may be an overstatement, but a new set of service activities are enabling more people to play a role in design and production. In short, the great revolution of the make movement is that it is both small and global, artisanal and innovative, high-tech and low-cost (Anderson, 2012). The make movement would facilitate

business creation, promoting innovation from below and facilitating shared research and development through open source. A real change of economic model would thus be underway. Entire markets could be called into question (Berrebi-Hoffmann, Bureau, & Lallement, 2018).

The maker movement would thus be in line with the predictions of André Gorz (2008): *"The high-tech tools that exist or are being developed [...] point to a future in which practically everything necessary and desirable can be produced in cooperative or communal workshops; in which production activities can be combined with learning and teaching, with experimentation and research, with the creation of new tastes, flavors and materials, with the invention of new forms and techniques of agriculture, construction, medicine, etc. The communal self-production workshops will be interconnected on a global scale and will be able to exchange or pool their experiences, inventions, ideas and discoveries. Work will be a producer of culture and self-production a mode of fulfilment"*. Capitalist domination and the exploitation of nature could be overcome through the citizen conquest of modes of production by makers (Lallement, 2015). For Anderson (2012), *"if Karl Marx was here today, his jaw would be on the floor. Talk about "controlling the tools of production": you (you!) can now set factories into motion with a mouse click"*. These new logistics and open production chains would be the equivalent of web publishing and e-commerce in the early 2000s. The web would first have revealed a long tail of demand for niche physical goods, then democratized production tools would have enabled a long tail of supply. Today's makers would offer a new way of working and consuming, through shared design, rapid prototyping and customized fabrication. The economics of traditional manufacturing would in fact be reversed by digital fabrication. *"In mass production, most of the costs are related to the initial tooling, and the more complicated the product and the more it is modified, the more it costs. But with digital manufacturing, it's the other way around: what is expensive in traditional manufacturing becomes free"* (Anderson, 2012).

4.5 REDISCOVERING JOY IN WORK, COLLABORATION AND SHARING

With the end of Fordism and Taylorism, companies and administrations are seeking to modernize work and work relations. Many innovations have already enabled workers to gain some autonomy. However, from the 1980s onwards, new issues have emerged in the world of work. *"In the 1980s and early 1990s, it was no longer a question of weariness or fatigue, but of stress and suffering"* (Lallement, 2015). However, according to Richard Sennett (2008), work can also be meaningful and empowering, if it is not deteriorated. Thus, alienation in and through work is not inevitable. Work would not be reducible to its vital function but rather a social

practice. Hackers and makers would invite us to reconsider the place and meaning of work in our contemporary societies, thanks to their new practices and techniques. They would even rethink our ways of living together. In hackerspaces and Fablabs, participants would weave social links, rediscovering the pleasures of free cooperation and autonomous work. These spaces would fight against the injunctions of a capitalism marked by the need for performance and creativity. According to Lallement (2015): *"making refers to a productive practice that finds its own end"*. As we saw earlier, hackers and makers promise new productive systems close to the raw material and with conviviality between co-producers. It would thus be another industry, an industry of sharing, collective, participatory, and mutual aid. For André Gorz (2008), the main issue is that citizens should be able to master the basic technologies that are useful for survival and allow them to emancipate themselves from the large organizations on which we depend for the objects of everyday life.The technical innovations, ethics and culture that hackers and makers convey also hold out the promise of a breakthrough in many other fields, such as law, art and design. Through copyleft (as opposed to copyright), authors give explicit permission to study, modify and disseminate their work, provided that the heirs of this permission grant it in turn. Free licenses can now be found in various tangible and intangible domains. *"By promoting non-standard objects, free objects, etc., the makers are paving the way for a new alternative at the expense of the long-dominant Fordist universe of industrial, standardized objects with predetermined uses, etc."* (Lallement, 2015). We now speak of digital craftsmanship, which consists of combining the creative use of digital tools with know-how and manual craftsmanship. Finally, hackers and makers invite us to rethink the very places of life and the ways in which we occupy them, by making available the techniques and ethics that allow us to re-compose art, culture and work (Lallement, 2015).

5. THE HACKER AND MAKER MOVEMENT IN THE HUMANITARIAN FIELD

As hackerspaces and Fablabs have begun to spread around the world, one sector will also take an interest in the hacker and maker movement: the humanitarian sector. In particular, the International Committee of the Red Cross (ICRC) will be conducting a broad exploration of the potential of digital fabrication and Fablabs for humanitarian action. This sudden interest in 2014 by one of the world's largest international organizations echoes a recent movement to use innovation theory in humanitarian and development practices (Scott-Smith, 2016). Many UN agencies and NGOs are seeking to rethink how they operate through innovation. Organizations seek to understand how the groups they serve engage with and shape their social and economic environment in order to provide more individualized, agent-based responses to their traditional beneficiaries (Bloom & Faulker, 2015). On the one hand, the major challenges facing the humanitarian system partly explain this new dynamic. Indeed, record numbers of people are displaced for longer periods of time due to protracted crises caused by armed conflict, natural disasters, or other causes (Corsini & Moultrie, 2019). On the other hand, humanitarian actors have identified partnerships (also with the private sector), new technologies and innovation approaches to understand and address problems more quickly and effectively. In addition, it is recognized that many humanitarian services and tools are no longer adapted to current problems and emergencies. Connectivity and access to information are now just as important as access to basic livelihoods. Although the operating environment has changed significantly, there has been little change in the way the humanitarian system operates (Betts & Bloom, 2014). Donors and target populations are increasing pressure on humanitarian organizations to provide services that can more effectively close the gap between marginalized populations and those with greater access to social and economic opportunities (Betts & Bloom, 2014). The humanitarian sector's new focus on innovation has led to the emergence of new ideas and methods to address the challenges facing the sector. There is a particular interest in using innovation to encourage, develop and support ideas and solutions from affected communities themselves (Betts & Bloom, 2014).

5.1 SALVATION MUST BE FOUND IN INNOVATION

At the end of the first decade of the 2000s, the new buzzword in the humanitarian sector was innovation. This enthusiasm informally began in 2009 with the Active Learning Network for Accountability and Performance in Humanitarian Action (ALNAP). At its 25th annual meeting, ALNAP presented 23 cases of successful innovation that have transformed the practice of humanitarian action. The concept of humanitarian innovation was then developed in an important paper and supported by the first Humanitarian Innovation Fund (Ramalingam, Scriven, & Foley, 2009). Theories of innovation quickly attracted the interest of United Nations agencies and numerous NGOs, including the ICRC (Scott-Smith, 2016). All of these organizations then began to dedicate staff to innovation, set up experimentation labs, organize ideation campaigns, or other initiatives to enable the development of new ways of working, solving problems, and adapting to a changing environment (Betts & Bloom, 2014). This new direction is significant and unprecedented. Linked to technology, it is infused with the entrepreneurial spirit of Silicon Valley, we saw in the hacker and maker movement (Scott-Smith, 2016) (Berrebi-Hoffmann, Bureau, & Lallement, 2018) (Lallement & Ramos, 2010) (Smith, Fressoli, Abrol, Around , & Ely , 2017). In 2016, "humanitarian innovation" reached maturity and asserted itself at the center of international policy when it was declared one of the four central themes of the World Humanitarian Summit in Istanbul WHS, 2016).

In the private sector, innovation has long been a necessity with the idea that if a company does not change its offer (products, services) and the way it creates and provides them (processes), its existence within a sector is threatened. Innovation is then used by companies to adapt and change constantly in the face of a changing environment. In the humanitarian sector, advocates of innovation believe that a similar logic can be applied. The sector is said to be undynamic, uncompetitive, unwieldy and unresponsive (Betts & Bloom, 2014). They seek to reform the backward, top-down nature of humanitarianism. Innovation is also seen as a matter of survival, but for different reasons. Large-scale threats and crises, as well as structural challenges to organizations in terms of funding and capacity, suggest that without innovation the humanitarian community is too rigid to function and will eventually become irrelevant (Betts & Bloom, 2014). For Smith-Scott (2016), "the humanitarian innovation movement is therefore best described as neophilic: it sees markets as a way to generate new ideas, new technologies, new ways of working and thinking, but it does not

advocate a complete transformation of the sector along market lines. The innovation movement is primarily driven by an idea of liberation, freedom from need, freedom from suffering, freedom from authority, freedom from bureaucracies and top-down management."

Humanitarian innovation would find its origin in the "Californian ideology" that has been impregnated by the hacker and maker movements (Barbrook & Cameron, 2001) (Berrebi-Hoffmann, Bureau, & Lallement, 2018) (Lallement, 2015). The principles combine radical individualism, individual revolt and a utopian technological determinism. It traces back to both the spirit of the New Left and the New Right and both the cultural bohemia of San Francisco and the high-tech industries of the Silicon Valley. The spirit of the New Left involves individual empowerment, a move away from old forms of authority, identity politics, and listening carefully to marginalized communities. The spirit of the New Right seeks more of a radical individualism driven by capitalist opportunity. These values would be formed, as we have seen with the hacker movement, by the opportunities offered by computers and the Internet (Lallement, 2015). On the one hand, technology would be a liberating force, allowing citizens to free themselves from traditional forms of social control and to express themselves. On the other hand, technology would be a great opportunity to be creative and enrich oneself. Filled with techno-utopianism, the Californian ideology imagined a world filled with powerfully emancipated humans who are masters of their destiny thanks to technology (Barbrook & Cameron, 2001). For Scott-Smith (2016), humanitarian innovation would clearly be influenced by this Californian ideology: "it also emphasizes the need to end people's suffering and free aid from top-down control. It embraces entrepreneurship to free productive citizens in refugee camps from aid dependency. It celebrates the new. This represents the New Right's legacy of humanitarian innovation: economic liberalism and a willingness to engage more with the private sector. The innovation movement also seeks an opportunity for social and political transformation in connection with the liberation narrative of the New Left."

Humanitarian innovation, however, would be different from the "new humanitarianism," which emerged from the student rebellions of 1968. The new humanitarianism wanted to help suffering people by liberating the Third World, opposing authority and advocating transnational activism (i.e. mouvement "sans-frontières"). This movement has its roots in the New Left, championing collective forms of decision-making and political struggle with cultural rebellion. For Scott-Smith (2016), humanitarian innovation would complement

"new humanitarianism" principles by adding ideas from the New Right. While humanitarianism has never hidden its liberal ideology, the new humanitarianism of the borderless movement would be more radical with its anti-authoritarianism and defense of self-expression, which would give it neoliberal leanings. This evolution of humanitarianism would in turn have influenced the innovation movement. Humanitarianism thus sought to help people help themselves: encouraging aid recipients to use modern technologies to become entrepreneurs and do business (Scott-Smith, 2016).

Humanitarian organizations now seek to be as free as possible from bureaucracy and the state, although they are still very dependent on the latter. The state is seen as timeless, inefficient and a source of dependency. In contrast, the private sector is seen as more progressive and creative. This can be explained by the fact that humanitarian crises often occur in a context of state fragility. Organizations then seek to offer appropriate autonomy when the state's infrastructure is deficient or absent. The objective of humanitarian organizations now seeks more to ensure that their beneficiaries can survive without the state. For Scott-Smith (2016), "today's humanitarianism is geared toward producing good neoliberal citizens: people affected by disasters who are connected to global markets and trained to see risk as an opportunity for enterprise and reinvention. The modernist emphasis on state-led progress has been replaced by a post-modern emphasis on fracture, instability, and the need for individuals to help themselves rather than rely on the state."

The humanitarian innovation debate was initially largely top-down, with humanitarian actors seeking to improve their own tools and practices. This top-down approach is usually project-specific, responds to predefined problems, and often uses solutions from external partners (Bloom & Faulker, 2015). In contrast, user-centered design, indigenous innovation, frugal, jugaad, and bottom-up approaches rely primarily on the capacities of affected populations (Betts & Bloom, Two Worlds of Humanitarian Innovation, 2014) (Betts & Bloom, Humanitarian Innovation: The State of the Art, 2014)(Radjou, Prabhu, & Ahuja, 2012) (Corsini, Dammicco, & Moultrie, 2020). This involves, on the one hand, understanding and recognizing the innovative capacity of affected people and, on the other, placing local communities and systems at the center of innovation processes (Interviewee 5, 2022). Although participatory approaches have long been used by the humanitarian sector, according to Bloom and Falker (2015), they do not produce breakthrough results because they focus more on gathering information than creating a solution. Combined with

participatory approaches, innovation processes could enhance the engagement of local populations. To encourage this bottom-up, participatory innovation, some organizations in the humanitarian sector have begun to look at different forms of innovation spaces (Bloom & Faulker, 2015).

5.2 ICRC EXPLORING DIGITAL FABRICATION AND THE MAKER MOVEMENT

The International Committee of the Red Cross started to be interested in the digital fabrication and the maker movement in the middle of the 2010s. Initially the idea came from an aspiring maker David Ott, then Business Analyst for the ICRC's Directorate General. Ott has been a tinkerer since his childhood, when he often accompanied his father to the workshop. As an early adopter, as he describes himself, Ott ordered a 3D printer and a drone kit in 2014 for his personal enjoyment. One day, his shower faucet broke, and he decided to repair it with his 3D printer. At ease with 3D modelling, the operation turned out to be a great success. More than just repairing his shower, David Ott had a trigger. *"It's interesting for the ICRC, which has a whole range of humanitarian logistics. It's amazing! 3D printing has the potential to change the game"* (Ott, 2022). Convinced of his idea, David Ott undertook further research into digital fabrication and decided to prepare a small presentation. Once he was ready, he went straight to the ICRC's management, and more precisely to Balthasar Staehelin, then deputy director general, saying: *"Look, I bought myself a 3D printer. It's great and has the potential to be disruptive to humanitarian logistics and other things"* (Ott, 2022). Balthasar Staehelin showed interest and gave him the opportunity to make an official presentation sometime later to the entire senior management, which was very enthusiastic about Ott's idea.

Delighted with the presentation, ICRC senior management gave Ott the opportunity to start an exploration of the benefits of digital fabrication. Ott also quickly became interested in the maker movement and the development of the FabLab concept around the world. After discussions with Professor David Schneider, a retired professor from the University of Geneva and an early user of the 3D printer, Ott wanted to adapt the FabLab model for humanitarian work and developed the RedLab concept for the ICRC (Ott, 2015). The concept appealed, but Ott then had to identify operational needs within the ICRC that the RedLab concept and digital fabrication could meet. *"At the beginning, I really saw 3D printing as helping logistics"* (Ott, 2022). His hypothesis was that humanitarian operations almost always

take place in remote areas that are difficult to access, in conflict or subject to social unrest. These areas lack essential infrastructure for electricity, communication, transport, water, food, health, etc. And when they are present, they are not always available or often fail. This makes humanitarian logistics complex, expensive and slow (Ott, 2019). Ott saw the advent of digital fabrication as an opportunity to address these challenges. Despite his enthusiasm, Ott quickly realized the difficulty of demonstrating the benefits of digital manufacturing and printing, which were still little known at the time. *"Today, it's not possible to make everything with a 3D printer. Back then, it was even less possible. The pieces of plastic that were produced were nothing like what printers do today"* (Ott, 2022). An ICRC technician wanting to repair a pump, for example, asked him once: "Can your printer, do it?" David Ott replies that it was not possible to repair a pump like that, with a piece of plastic. He explained him, however, that there were billions of other possible solutions that might require a 3D printer. *"It was a bit of a deaf speech actually. I was the quasi-evangelist saying, well, I've been given the green light, does your unit need it? I talked to different units about it. It was hard, it was not easy"* (Ott, 2022).

5.3 PROTOTYPES BUT NOTHING MORE

Despite initial reluctance, David Ott continued his internal exploration at the ICRC. Finally, by raising awareness among ICRC managers and demystifying digital fabrication, Ott managed to create some interest. The health and forensic units became interested. An inventory of their equipment and materials frequently taken on missions was then made. The selected items should have the capacity to be digitally fabricated on site and thus provide added value to the teams. The production of badges to record patients and bodies was chosen as a pilot project. The health team was also interested in producing bones for training doctors in the field. The production of objects useful to ICRC teams directly in the field should enable them to simplify and accelerate their logistics, lower their costs and reduce their environmental impact. *"There were some discussions. But in general, I was still getting the cold shoulder from operations"* (Ott, 2022). Despite the difficulties, David Ott was hired by the ICRC's new Innovation Unit as a Senior Innovation Analyst and was able to continue his exploration. David Ott completed his concept note at the beginning of 2015 and send it to Neil Gershenfeld, founder of the very first Fablab. Gershenfeld was very enthusiastic about Ott's project. *"So you go on the one hand, you're in an environment where they don't get it. And then on the other hand, you have people who are super enlightened, able to make connections"* (Ott, 2022). Gershenfeld

will start advising David on digital fabrication and Fablabs. He suggested him to contact the Casemate in Grenoble, one of the first French Fablabs, to help him in his exploration. *"He contacted Neil and Neil said go see the FabLab Casemate. He (the Fablab manager) can help you make objects and instead of talking about it, do some things, do some tests, try it, stop thinking and do something. So, David contacted me and said can we try to do something? We talked, we said well, let's try to make some training bones and he spent two or three days in Grenoble and we made this. It was a proof of concept"* (Interviewee 2, 2022). In Grenoble, Ott printed the three modelled parts of the training bone and tested how the assembly worked. The parts were successfully assembled to form a bone that could be drilled for training purposes. This was designed so that someone in the field could produce training bones themselves, for example for an upcoming training workshop for field surgeons (Interviewee 2, 2022). In Casemate, Ott made also a small series of prototypes for patient badges and handing them over to the health team for the first round of testing. Despite encouraging results, the prototypes didn't go beyond the proof-of-concept stage (Ott, 2019).

However, meetings with Neil Gehrschenfeld and prototyping in Casemate allowed David Ott to fully integrate the Fablab and the maker community. His RedLab project was of great interest to the community as it was labelled as an ICRC project (Ott, 2015). It was at this point that the exploration changed direction somewhat. *"The Fablab, yes, it's 3D printing, but it's not just that, it's a whole other thing really. And so, the RedLab project, little by little, evolved a little bit too. We started to say to ourselves, how can we do something beyond logistics? The others are the beneficiaries. What can they do with it? How can they benefit?"* (Ott, 2022) A project proposal was then developed with the Kenyan Red Cross Society to use a Fablab as a development and testing space for humanitarian innovation and as a means of engaging with communities. The goal was to train and sensitize refugees to new technologies and digital fabrication processes, as well as participatory design approaches to prototyping. Despite initial encouraging discussions, the Kenya Fablab project also never materialized (Ott, 2019).

David Ott again had great difficulty in generating enthusiasm for his project. Worse still, three months later, Ott learns that his post will be abolished at the end of the year. *"I was really excited about my project. I had a great job. The idea sounded great. I thought, 'How am I going to pivot? And then I changed one word, red, it became humanitarian. Still with the idea of the Fablab, innovation, humanitarianism, digital fabrication, but this time focused on the beneficiaries"* (Ott, 2022). With this new concept in mind, David Ott went back to the management and approached the ICRC president, Peter

Mauer. A sum of CHF 100,000 was found within the ICRC Foundation. However, the Directorate General asked David Ott to approach other organizations to support the project, as the ICRC had difficulty in supporting it internally (Ott, 2022).

5.4 THE RISE AND THE FALL OF THE GLOBAL HUMANITARIAN LAB

As demanded by the president of ICRC, David Ott approached other organizations in the humanitarian system to develop the humanitarian Fablab project. This is where he met Olivier Delarue, who oversaw the Innovation Unit at United Nations High Commissioner for Refugees (UNHCR) at the time. David told him about his humanitarian Fablab project and immediately aroused his interest. *"I approached him about the idea and that's when Olivier and I got together. We took this idea of a humanitarian Fablab and extended it to not just a Fablab but to become a humanitarian Lab, where innovation can take place in one way or another, and so on. So the Fablab became a focus"* (Ott, 2022). While David wanted to host the Humanitarian Fablab project within a foundation or association, the arrival of Olivier Delarue changed his initial plan. The latter wanted to launch a more ambitious initiative and sought direct support from the United Nations. This is how the Global Humanitarian Lab came into being. The GHL was hosted by UNOPS and joined by other founding organizations, including Handicap International (HI), Terre des hommes (Tdh), the World Food Programme (WFP), Médecins Sans Frontières (MSF) and founding governments (Switzerland and Australia). This ambitious gathering of organizations aimed to pool knowledge, skills and tools for the benefit of people affected by humanitarian crises. The approach sought to be holistic, open and user driven. It was intended to form partnerships inside and outside the humanitarian sector to incubate, make and accelerate innovation to meet humanitarian needs (Global Humanitarian Lab, 2016). In particular, the GHL aimed to foster humanitarian innovation through digital networks and digital fabrication technologies. This trademark was intended to empower communities on the one hand and support humanitarian operations on the other (ndlr. the original ideas of David Ott) (Global Humanitarian Lab, 2016).

The presence of Tdh within the GHL would later be decisive for the concept of the Humanitarian Fablab. Like the ICRC, Tdh was following the humanitarian sector's orientation towards innovation. Within the GHL, Tdh was the organization (perhaps the only one) which took a strong interest in the Fablab concept, as confirmed by David Ott (2022): *"The humanitarian Fablab, the project, was thanks to Terre des hommes, which adopted it as a solution to a need they*

had. [...] And it is specifically thanks to and because of the partnership with Terre des hommes that it was one of the projects that worked well" (Ott, 2022). But what interested Tdh was not the digital fabrication function for logistics, but rather the spirit of the Fablab with its community, its practices, its ethics, as a senior innovation manager of Tdh explains: *"My previous job was in Burkina Faso. I tried to enrich our hopeful points (spaces developed by Tdh to support child and youth on the move) with more varied activities, particularly artistic ones, and I could see the importance of having a place where young people could meet every week. […] And I could see the value of technology in bringing young people in. […] And the more I got interested in the subject, the more I saw the connections and the interest for us in terms of working methods, in fact"* (Interviewee 1, 2022). With its modern technologies and its vocation for creativity and learning, the Fablab designed for Tdh was intended to be attractive to children and vulnerable young people (Interviewee 5, 2022). Tdh was particularly interested in the target group of refugees who are often stuck in camps for a long time. Uncertainty, waiting, and boredom undermine the morale of refugees and the humanitarian Fablab was seen to break this negative spiral. The hypothesis was that the introduction to tools and machines but also to fabrication and innovation practices, had the potential to bridge the digital divide and foster change in the target populations. The non-formal education offered in the Fablab was seen also as an opportunity to reach and support children and youth on the margins of society. Users were to be able to use the machines and tools to create things and find solutions to their own and their community's problems, thus empowering themselves. Eventually, for those who had a taste for entrepreneurship, the Fablab was to encourage and support users to develop income-generating projects (Ott, 2019).

Based on this conceptual framework, Tdh chose Greece against the backdrop of the Syrian crisis for a first pilot FabLab. The GHL, and more specifically David Ott, oversaw the setting up of the FabLab. Specifically, Tdh wanted to develop three key aspects of this first FabLab (Ott, 2019):

- Education - improving the digital literacy and creativity of vulnerable children and youth, and their access to formal education, including tertiary education, etc.
- Livelihoods - by improving the entrepreneurial skills and employability of children and youth, to support their access to the digital economy.
- Protection - improving access to protection services for children and young people and their integration into host populations.

After a reconnaissance mission by David Ott, Tdh is implementing its first humanitarian Fablab for Syrian refugee populations in Greece in 2017 (Ott & Papalexandridou, 2018). This enthusiasm and willingness to move forward with the Fablab concept was in stark contrast to the rest of the GHL organizations, as mentioned by a senior Tdh manager: *"That is to say, in the case of the GHL, I was disappointed to see that no other organization was interested. […] No one saw any interest in the Fablab. Not even the ICRC, which was behind it, because the person who was carrying it came from the ICRC, David Ott. Nobody saw any interest in the Fablab. Everyone saw it as a gadget. [...] Not only no interest, but they even used it to denigrate the GHL. [...] Although it was a gamble, they were not at all in the spirit of trying things out."* (Interviewee 1, 2022).. The GHL was, in fact, from the beginning subject to internal struggles that will hasten its end, after two years. *"The GHL was a stillborn baby because no actor outside Terre des hommes accepted the rules of the game from the start. Nobody wanted, was convinced of the GHL and nobody proposed anything else. There was no alternative"* (Interviewee 1, 2022). Critics of the GHL say that the initiative was not structured well enough, that it lacked tools to steer it and that there was no clear vision of where to go. In fact, the GHL had a classic UN governance system that clashed with the innovative spirit of the initiative. Paradoxically, while the GHL advocated experimentation as a humanitarian laboratory, its constituent organizations were not at all in the frame of mind to experiment, as a Tdh senior manager confirmed. *"There was an approach, […], which was much more empirical, which was to say let's create first, let's discover through pilot projects and other instruments. Let's experiment with working together on innovations and let's build together, let's set up a machine behind it, as we did at Terre des hommes with innovation funds, ideation campaigns and so on. To be able to scale up, to be able to open up the game"* (Interviewee 1, 2022).

Apart from the setting up of a humanitarian Fablab for Tdh, the GHL never seems to have really started. The GHL initiative was intended to be ambitious (perhaps too ambitious) with a whole team dedicated to developing its projects. Without really showing any impact, GHL used all its resources (mainly for salaries), in just two years. According to a Tdh senior manager: *"They were burning cash, to put in place a roadmap, but we couldn't agree on the roadmap. [...] The others were like that, sitting around every month analyzing. But when do we start? But we have started, guys. […] So the others came out with nothing. So the only ones who benefited from the GHL were us. All the others spent two years discussing the rules of the game and in the end the donors got bored"* (Interviewee 1, 2022).

Despite the implosion of the GHL, Tdh will continue its Fablab experiment (Tdh, 2018). The pilot project in Greece is then replicated for children working in gold mines in Burkina Faso, vulnerable and marginalized children in Gaza (Ott, 2018), for children affected by the

conflict in Ukraine, and for children and youth from disadvantaged communities in Hungary. Humanitarian and Fablab experts are recruited to develop the Humanitarian Fablab initiative directly at Tdh. A community of practice is then set up with all Tdh Fablabs. Several proposals for new Fablabs were submitted and Fablabs began to be recognized as an important innovation within Tdh. But a new wrinkle loomed over the Humanitarian Fablabs initiative. This time, the problem was to be found at Tdh directly, as explained by one of the Humanitarian Fablab Initiative responsible at Tdh: *"And then the crisis came. Sixty percent of the staff was fired. And afterwards, it was a very complicated, very stressful period because there were people in tears in the corridors, there was a lot of anger, not much vision for the future"* (Interviewee 2, 2022). The NGO was caught in an unprecedented financial crisis due to a poorly controlled growth strategy that has put the Foundation in peril. In 2018, it revealed that it had recorded a deficit of 14.5 million francs in its 2018 accounts, out of a budget of 113 million, i.e. double the projected deficit. About fifty people will be made redundant at the headquarters (Bussard, 2019). While several pilot projects were underway, this new misadventure had seriously damaged the Humanitarian FabLab project. The post of Humanitarian FabLab project manager was even cut and the FabLab teams in the field had to fend for themselves for a while (Interviewee 2, 2022).

5.5 THE RESILIENCE COLLECTIVE: NEW INITIATIVE, DIFFERENT ORGANIZATIONS, BUT SAME PEOPLE

To relaunch the Humanitarian Fablab initiative, Tdh decided to try again to support the humanitarian Fablab development with a collective initiative. At the end of 2019, Tdh launched a new initiative, the Resilience Collective, with the International Organization for Migration (IOM), the University of Geneva, InZone, the FabFoundation and Meraki Lab. The organizations were certainly different from those of the GHL, but the actors behind them were not. Indeed, the same people are still involved in this initiative, but in different positions. Secondly, after the catastrophic experience of the GHL, the governance of the Resilience Collective is much more informal and flexible. The Resilience Collective does not have a legal basis. It is just a group of organizations ready to collaborate in the form of a 'gentleman's agreement' (Lavanchy, 2020). A Memorandum of Understanding (MoU) will nevertheless be signed between the International Organization of Migration (IOM) and Tdh to set up a FabLab in Djibouti (Murphy, 2019). Thirdly, we no longer want to talk about Fablab but about Resilience Innovation Facilities (RIF), as mentioned by a member

of the Steering Committee: *"That is to say, at a certain point, we realized that there was a trap. It was that the Fablab was historically the starting point. It's what allowed us to enter the digital world, in fact. But bringing this idea back to the FabLab alone, we were a bit prisoner of what we can do in a FabLab. And above all, that summarizes this project as a technological project. But our intention has never been technological. The intention has always been to create a space to protect children. That's the aim of Terre des hommes. And technology was just a means, but I wouldn't say it's just a means like any other, because the particularity is digital, it's the digital transformation. [...] And more than digital, it's this idea of fabrication, this idea at the methodological level, i.e. it's spaces where young people manufacture things, whether tangible or intangible, projects, etc. It's spaces where we can make things. These are spaces where we can materialize what we call empowerment. […] So the Fablab is not just an anecdote, but what we tried to do was to bring the reflection back to what is the final intention? The intention is to give young people the means to take charge, to make things themselves, to be actors, in a dynamic of collaboration, in logics where they work together. All connected. Connected with external resources, connected with peers"* (Interviewee 1, 2022).

The members of the Resilience Collective organized a design sprint bootcamp, 100% online in June 2020 to develop the RIF concept itself (Lavanchy, 2020). The bootcamp, which brought together around 50 people including partners, resulted in several proposed solutions. However, the development of the solutions required funding. A work of capitalization is then carried out and the ideas are then ready to be tested in the form of prototypes or pilot projects (Lavanchy, 2020) (Nimkar, 2020). A working group is formed within the Resilience Collective to look for funding to implement the RIFs and test the solutions resulting from the bootcamp. Once again, this proved to be a difficult task and, as in the case of the GHL, the reluctance came primarily from the member organizations of the Resilience Collective. For different reasons, the members of the Resilience Collective's steering committee were unable to bring the initiative internally. The steering committee is also struggling to find external support. This financial uncertainty once again undermined the governance of the project. Several organizations then withdrew from the Resilience Collective steering committee (Interviewee 2, 2022) (Interviewee 3, 2022).

However, despite the withdrawals, the RIFs can be tested under real conditions. Once again, Tdh is the driving force in developing two RIFs in Africa. The idea this time is to develop RIFs on migration routes. Guinea (Conakry) is chosen as the country of departure and Morocco (Oujda) as the country of destination (Lavanchy & Kanté, 2021). The very first RIFs are officially launched at the end of 2021 and should work closely together. They are also connected to the Resilience Collective community of practice. Terre des hommes

is also looking to develop the Fablabs into RIFs to strengthen the protection and empowerment component. The initiative is not without difficulty coordinated by the headquarters. As for the Resilience Collective, the initiative still exists, with new organizations joining the initiative. The Collective seeks on the one hand to develop new RIFs in common but also to develop the product as such. An initial idea of Ott is taken up, in order to develop a RIF/Fablab in the box (Balwant & Amara , 2022). This minimalist concept should allow to reach remote places and offer a completely autonomous space, in terms of hardware, energy, content and connectivity. More recently, an unexpected phenomenon has put wind in the sails of the RIFs at Tdh. Indeed, the war in Ukraine has launched a craze for the development of RIFs in Europe in the areas of intervention of Terre des hommes (Hungary, Moldova and Romania). What is interesting this time is that the initiative does not come from above but from below. Several mini-RIFs will be developed in response to the Ukrainian crisis. We thought that the utopia of digitalized spaces was disappearing at Tdh, but in fact it is still very much alive. New research on these spaces should be done on the new wave of humanitarian Fablabs at Tdh.

6. UTOPIA, FAILURE OR IMPACT IN THE MAKING FOR HUMANITARIAN FABLABS?

As we have seen previously, humanitarian actors have started to take an interest in the hacker and maker movements. It was first in a logistical perspective that digital fabrication and Fablabs have been explored, to support the teams on the field. However, this orientation never materialized, due to the lack of interest and proper needs of the field teams. Fablabs were then used by Tdh to protect, occupy and develop beneficiaries and support the creative resolution of their problems (Interviewee 5, 2022). This interest came from Tdh's long experience in developing third-party spaces such as safe spaces or "hope points". What the practices of hackers and makers have added to these spaces are the faith in digital technology, the culture and ethics of openness and co-creation, as well as an access to a global network, as confirmer by a Tdh protection expert: *"In the humanitarian field and for a long time, we used mainly for children what we call "child finding spaces", which are safe spaces and which were seen in particular in humanitarian emergencies as spaces allowing parents to gather children in a place where they would be safe while parents were dealing with emergencies, i.e. to go and find food, shelter and manage the crisis that was there. […] It took a few years, but after a while, everyone said that it would be interesting to do the same thing for young people because we realized that young people were the target group that was least taken care of, accompanied and affected by humanitarian emergency responses. [...] I saw a natural shift in fact, which took place between these two worlds. We started to set up spaces like that where we could bring young people and others, a space that allowed, via the new technology, people to meet, to work on common projects and moreover to be in the idea of sharing, that is to say that even between the different spaces that can exist in the world, there is the idea of sharing knowledge and that is also very much linked with the new technologies in a general way. At some point, it seemed natural to me to think about this and also to see that in the humanitarian field, we also had challenges, sometimes to see how to mobilize, in conditions of emergency or displacement, young people who may feel useless, who are not necessarily motivated to do activities together. Indeed, at a given moment, it made sense to have this aspect, to use the new technologies to engage and attract young people, but also to allow them, thanks to the tool itself, to open up, to have access to knowledge, to experience, to share experience, etc. "* (Interviewee 5, 2022).

Today, the Resilience Innovation Facilities (RIFs) of Tdh and the Resilience Collective aim to be safe, recreational and inclusive hybrid digital learning spaces that can be adapted to different contexts. Their tools, services and links with the community are supposed to be built for and with the beneficiaries. They aim to be co-creative spaces, designed to make, tinker, learn, explore and share. They seek to take advantage of tools and new participatory and innovative pedagogical approaches to enable project development. Ultimately, these

spaces should contribute to the creativity, self-esteem, critical thinking and ingenuity of the beneficiaries and promote their socio-economic integration and change (Bray, Campelo , Lavanchy , & Kanté, 2021). However, the ambitions of these spaces are more difficult to achieve. There are several reasons for this.

6.1 SAME AS IN THE NORTH?

Within Fablabs, humanitarian actors want users to be able to benefit from recreational, developmental and socialization experiences at the same time. For this, NGOs propose a diversity of forms, places and practices according to the resources and the context (Bray, Campelo , Lavanchy , & Kanté, 2021). There is a lot of hope that these spaces can benefit from the open, global, collaborative and playful movements of hackers and makers. Like in the Silicon Valley, advocates for these spaces in the humanitarian community are convinced of the emancipatory power of giving tools to the beneficiaries (Interviewee 5, 2022) (Interviewee 1, 2022) (Interviewee 2, 2022) (Ott, 2022). However, bringing tools to beneficiaries requires skillful development as well as design and fabrication skills (Smith, Fressoli, Abrol, Around , & Ely , 2017). Here lies the first difficulty of humanitarian Fablabs. On the one hand, it is difficult to recruit the right profiles to accompany the beneficiaries. The people in charge of these spaces often must combine roles and expertise in complex environments with vulnerable or very vulnerable users (Betts & Bloom, 2014). As a result, NGOs such as Tdh often have difficulty recruiting and retaining the right people (Lavanchy, 2022). On the other hand, users being vulnerable, they cannot exploit these spaces to the extent advocated by the great enthusiasts of the hacker and maker movements. Indeed, users are often young, illiterate, disconnected, and sometimes physically or mentally impaired. All this has the effect that the technologies offered in these spaces are often too advanced, while some users already have difficulties using a simple smartphone or computer. Often the beneficiaries will find it more useful to have access to the internet than to use a 3D printer for their needs (Lavanchy, 2022) (Choplin & Lozivit, 2019). Neil Gehrshenfeld's concept that anyone can build "almost anything" is already limited in this sense (Gehrsenfeld, 2007).

Some enthusiasts of humanitarian Fablabs see these spaces to awake the entrepreneurial creativity of beneficiaries and to rescale and relocate production (Betts & Bloom, 2014). Many Fablabs around the world seek now to focus on cultivating entrepreneurship, skills,

and creativity for business (Dougherty, 2012). However, in the difficult Southern contexts in which NGOs operate, it is not enough to have access to digital tools and machines, be creative, and set up a crowdfunding to become an entrepreneur (this argument also finds its limits in the North) (Berrebi-Hoffmann, Bureau, & Lallement, 2018). With limited infrastructure and endemic poverty, it is not so easy to acquire raw materials (even for 3D printers), find producers, and find end customers (Choplin & Lozivit, 2019). While Chris Anderson says that all you need to become an entrepreneurial maker is a computer and a credit card, most people visiting humanitarian Fablabs have neither. California-style entrepreneurship thus seems a long way off (Anderson, 2012) (Scott-Smith, 2016) (Barbrook & Cameron, 2001). However, it remains true that the ability of beneficiaries to adapt and survive makes them very creative and resourceful, like hackers and makers (Radjou, Prabhu, & Ahuja, 2012) (Betts & Bloom, 2014) (Interviewee 5, 2022) (Corsini, Dammicco, & Moultrie, 2020). Nevertheless, even if creative, users of humanitarian Fablabs need support, resources and time to be able to solve problems and carry out their projects (Lavanchy, 2022). The unstructured experimentation possibilities of Fablabs in the North do not seem entirely adequate for humanitarian contexts (Corsini & Moultrie, Humanitarian makerspaces in crisis-affected communities, 2019) (Interviewee 5, 2022). Furthermore, many hope that the open and collaborative culture of hackers and makers will allow concepts to be developed and disseminated from the North to the South and vice versa, through global collaboration. Prototype files of objects would be shared, new identities would be created, and new ideas would be conveyed (Smith, Fressoli, Abrol, Around , & Ely , 2017). However, the vulnerability of users prevents their direct involvement. Language barriers or illiteracy, for example, prevent them from interacting with peers online or accessing content on their own (Choplin & Lozivit, 2019). Members of the Resilience Collective are trying to work around this by offering training for educators in these spaces. This is a partial answer to the problem, and direct involvement of the beneficiaries in the global hacker and maker movement is simply not possible as it stands (Lavanchy, 2022).

In addition, in humanitarian Fablabs there is a great emphasis on playing with technology, doing cool projects, and being creative (Corsini & Moultrie, Humanitarian makerspaces in crisis-affected communities, 2019). The belief in the emancipatory power of simply giving people tools leads some humanitarian actors to not focus enough on what those tools might be intended for. Directing people in certain directions actually runs counter to the spirit of

openness, access, participation, and autonomy that is intended to be advocated in these spaces (Smith, Fressoli, Abrol, Around , & Ely , 2017). However, given the needs and limitations at the local level, NGOs would do well to further focus the purpose of activities. When setting up new humanitarian Fablabs, actors often overestimate the purpose and the machines (Lavanchy, 2022).

For this to happen, it is important that humanitarian Fablabs such as the Resilience Collective's RIFs be representative in their design, deployment, and effects. Although it may seem like a given in these spaces, humanitarian Fablabs must ensure the maximum participation, inclusion and involvement of beneficiary communities (Benkler & Nissenbaum, 2006) (Interviewee 5, 2022). As mentioned by a Tdh protection expert: *"I think that it is also quite central, this whole movement which was at a given moment to no longer be in a passive support by the international organizations but really to try to put the people in the center of the accompaniment as themselves, the key actors of their own future. Indeed, all these approaches where we do, we give the means, it is always the same thing. It's not giving a fishing rod, it's learning how to fish and so the idea is really to be able to say how we can accompany these young people to have a vision of what's going on, a vision of the needs, a possible analysis of the needs and even to act for that and therefore with very small projects"* (Interviewee 5, 2022). The "bottom-up innovation" or "human-centered design" of humanitarian Fablabs must not be merely theoretical but effective. However, too many humanitarian Fablabs suffer from a crisis of representation, in which aid workers do little or nothing to involve local people before deploying the spaces, which can be problematic for their acceptability, appropriateness and local ownership (Interviewee 5, 2022). This is confirmed by a Tdh protection expert: *"Once again, it is an approach that has been copied and pasted, in fact a little bit like we have done for many things and I wonder to what extent there is really a reflection on the adaptations, the appropriation, and then the relevance at the cultural level, because you know, there is this whole movement at the moment which is very interesting, which is on the question of aid. It's called humanitarian colonialism and we're questioning what we've done and what we're doing and what we're still trying to do in a very colonial approach, especially the use of children's rights in work contexts which is very top down. There is a whole current that is there to reflect and to question itself and to talk again about the notions of power and decision, et cetera"* (Interviewee 5, 2022). To avoid this, humanitarian Fablabs need to be spaces that people can trust, that people can rely on, something where they can get useful services, where they have control and they feel like they can engage in direct (Interviewee 5, 2022) (Interviewee 3, 2022). For a former member of the Resilience Collective, by assuring this, it would *"break a lot of the cultural barriers that make us so bad and inefficient because we are top-down, we are colonial (referring to humanitarians). We are all these things and the Fablab*

approach is a way of turning our community on its head" (Interviewee 3, 2022). This is confirmed by the Tdh protection expert: *"But if we think that in the long term, something of the order of the use of the digital, of the new technologies of these spaces can indeed be something conductive, of co-creation and of space like that to be privileged, it is necessary to be able to assure you that it is going to correspond to the needs, to the context, et cetera. It takes time. And that's what we don't have, time and an approach where we are really in accompaniment and not in intervention"* (Interviewee 5, 2022).

6.2 CONTRIBUTING TO CHANGE, YES, BUT WHICH ONE?

Like Fablabs of the North, those of the humanitarian sector can have difficult convergences. Many changes can and want to be achieved for social, economic or political empowerment. To achieve these changes, various agendas, models and strategies are developed (Corsini & Moultrie, 2019). Humanitarian actors seek to position their spaces for innovation and entrepreneurship, to engage with people, to educate, raise awareness, and train people in technologies and as a resource for communities and social development. A former member of the Resilience Collective sees two areas of intervention that can interest donors and have impact at the same time. One is business impact (despite the limitations we have identified before), and the other is systems impact. For business impact, thanks to the tools and innovative approaches, users can develop ideas and turn some of them in small businesses and *in fine* build their livelihood (Interviewee 3, 2022). For systems change, it is to link humanitarian Fablabs to a cause like for example climate change, COVID 19 (Corsini, Dammicco, Bowker-Lonnecker, & Blythe, 2019)or to help people with disabilities: *"If you were to, say, build a Fablab around an issue like that. Then again, you have a chance to say I make a change in the system. I'm addressing a problem that's otherwise under addressed. I'm doing something that's called concrete"* (Interviewee 3, 2022). Without specifying the nature of the change, Tdh believes that these spaces must be at the service of empowerment, with a program that can help young people use these spaces to achieve their personal objectives (Interviewee 5, 2022) (Interviewee 1, 2022). However, this is where the shoe pinches, because NGOs like Tdh often have difficulty formalizing such programs, as mentioned by a former innovation manager of Tdh: *"Tdh cannot formalize programs, training programs. [...] Because Tdh is always running after budgets, contracts, donors, and we always do something tailor-made, case by case, ad hoc, it requires an investment, it requires an investment of the institution, to put people, to put means to build programs and then to deploy them"* (Interviewee 1, 2022). According to him, humanitarian Fablabs would have more impact if NGOs like Tdh were able to integrate their expertise (WASH, Protection, Justice, etc.) with

the practices of makers and hackers (Interviewee 1, 2022). This problem that many NGOs have, has the effect of dispersing the activities, of pushing organizations to launch new projects at all costs, and of scaling up too early. For a former manager of the Humanitarian Fablabs: *"A lot of the layers of things that don't go into humanitarianism is because the programming is corrupted. This programming that doesn't reach people. There are programs that just do things. It is at the level of outputs, not outcomes. There is programming that is not sustainable, like bad programming"* (Interviewee 3, 2022). One way to improve humanitarian Fablabs seems to be to improve strategic orientation and strengthen alignment with causes such as climate change or support the agency and empowerment of beneficiaries. For this to happen, however, a cultural change within the organizations of the Resilience Collective and the humanitarian sector seems necessary (Corsini, Dammicco, & Moultrie, 2020) (Corsini, Dammicco, Bowker-Lonnecker, & Blythe, 2019) (Interviewee 3, 2022).

6.3 A CULTURAL SHIFT IS NEEDED

An important issue in the development of humanitarian Fablabs is the culture clash between the top-down cultures of donors and NGOs and the bottom-up culture of the maker and hacker movement (Corsini & Moultrie, 2019) (Bloom & Faulker, 2015). The hacker and maker movements advocate autonomy, openness, freedom and creativity (Berrebi-Hoffmann, Bureau, & Lallement, 2018). However, as we have seen in the Global Humanitarian Lab, this is in tension with the structures and practices of humanitarian stakeholders, notably large organizations and donors. Funding is provided to NGOs with certain assumptions and objectives built into their criteria (Interviewee 1, 2022). Fablabs' team are asked to set expectations and indicators to assess impact. Surveys and research are then conducted to be able to meet these requirements. In that regard, humanitarian sector would be a world apart:

"We tell you, where you're going, so we as the international community tell you the beneficiaries where you're going. You should now be empowered. You should now start a savings group. You should now do this. There's very little room for the agency of individual people in what we do. It's very regimented in segmented". […] The greatest opportunity of a Fablab is its culture. But the greatest challenge to it ever being implemented is the culture. So, it's operating you an opportunity to empower beneficiaries, yes, and to give them agency. But we as a humanitarian system are stuck. We keep on saying we need to reach X people. We need to do thing AP&C. We have very concrete quantitative results always. So, to translate, I'm going to buy a whole bunch of expensive machines and let kids have that to donor world is close to impossible" (Interviewee 3, 2022)

As we have seen above, this has been particularly problematic in the Global Humanitarian Lab as well as in the Resilience Collective. The member organizations targeted large institutional donors and sought to be housed at the United Nations in the case of the former initiative (Interviewee 2, 2022). This certainly brought a lot of resources at the outset, but also high expectations and evidence. Each Fablab or RIF had to quickly show evidence of success, or risk not being funded. So, many Fablabs have had to close after a certain time. This is confirmed by a former manager of the humanitarian Fablabs at Tdh: *"Tdh would benefit from a focus because the big cultural problem of Tdh in all this has been that it has gone too far. It has targeted global donors rather than local donors. Geographically, it has gone everywhere"* (Interviewee 3, 2022). According to her, this has been particularly problematic because the global donors are the ones who manage all the compliance issues and expect things to be done a certain way (Interviewee 3, 2022).

The solution would be to build a strong evidence base. However, this is difficult in these spaces because humanitarian actors are dealing with issues as sensitive and abstract as empowerment (Interviewee 3, 2022) (Interviewee 5, 2022). Evidences are difficulty because the spaces are multisectoral, and the approaches varied and unlimited. For this reason, it is important to conduct qualitative evaluations to demonstrate impact because it is very difficult to compete with numbers in these spaces (Interviewee 1, 2022) (Interviewee 3, 2022). Moreover, Fablabs in general are not cost-efficient compared to traditional humanitarian activities. Given the flexible and failure-prone nature of the work of humanitarian Fablabs, monitoring impact against the traditional criteria often used in bureaucratic organizations poses challenges for NGOs such as Terre des hommes. This is normal and it is necessary that the way of evaluation is different, more specific and qualitative. It is therefore necessary that NGOs integrate this type of evaluation in the deployment of their spaces and that they have the resources and time to do so (Interviewee 3, 2022). Humanitarian Fablabs must figure out how to respond to donor requests in a culture at odds with the hacker and maker movements. It seems that the Global Humanitarian Lab and Resilience Collective spaces may have ignored these framings too much and seek to pursue the path of autonomous spaces for emancipation through technological tools. However, if the spaces of Tdh et consort are to truly realize the transformative potential of their frameworks, it is essential that they engage with these broader interests and approach the cultural clash systematically in a strategic manner. In a sense, those working in Fablabs are forced to innovate in the way

they measure impact and learn from their work. This is due to the nature of the projects they follow, which involve techniques, equipment, and actors that are new to humanitarian work (Corsini & Moultrie, 2019) (Smith, Fressoli, Abrol, Around , & Ely 2017).

NGOs such as Tdh are also too top-down. Decisions are mostly taken at headquarters and initiatives such as Humanitarian Fablabs or the RIFs are imposed from above on the different missions or delegations, even though they have not expressed the need or interest (Interviewee 5, 2022). This is confirmed by one of the former persons in charge of Humanitarian Fablabs at Tdh: *"And I remember having a meeting with someone who was in charge of the MENA region (Middle East and North Africa) and who was therefore responsible for the Fablab project in Gaza. And there, I discovered that in fact it had been created without his agreement. It was kind of pushed from above and I was seen as someone who forced people to do things they didn't really want to do. [...] But I realized that in fact already the communication between the innovative projects we were trying to implement and the teams on the ground who should be doing them, was non-existent or at best bad"* (Interviewee 2, 2022). This is particularly problematic in an organization like Tdh, which is essentially very decentralized. Indeed, the missions and delegations at Terre des hommes have a lot of autonomy, despite the programmatic approach that has been put in place since 2016. This has the effect of creating a lot of tension and difficulty when spaces are somehow "imposed" from above on the field (Lavanchy, 2022). This is confirmed by another former Humanitarian Fablab manager: *"But you can only do it if the country is driving it. At Tdh, it's always the global that has let go"* (Interviewee 3, 2022). The way Tdh and most of the organizations that have been active in the Global Humanitarian Lab or the Collectif Resilience operate goes against the Fab Foundation's system, which accepts that as much agency as possible should be given to each individual Fablab (Interviewee 3, 2022)(Interviewee 3, 2022).

Finally, as we have observed in the Global Humanitarian Lab and the Resilience Collective, another problem lies in the gap between the personal interests of the people who support initiatives such as humanitarian Fablabs and the real needs of local populations and the changes that need to be made. A former Fablab leader told us during interviews that: "*But like my problem with humanitarian work as a whole is that it's about a clash between individual incentives for where you're going personally and what you want for the communities, you're doing things with"* (Interviewee 3, 2022). The people behind the Humanitarian Fablab movement, whether in the Global Humanitarian Lab or now in the Resilience Collective, have a good grasp of the big picture but find it difficult to give operational teams the means to achieve it. The heads of the humanitarian

Fablabs would somewhat forget the time and resources required to elaborate, set up, manage and develop these spaces, as our expert on humanitarian Fablabs testifies: *"I do think the possibility of shifting culture is super cool. But he (a former member of GHL) missed those two things to make it grasp. And the ability to focus a little bit on either sectors or geographic areas. But it reforms at the same thing. He's got a big sense of the bigger picture, not a sense of the small things that damages stuff. In that it damages capacity to buy in. And that's despite him being great in other ways"* (Interviewee 3, 2022). This testimony echoes somewhat the criticisms of Marx et al. on the socialist utopians. Bourgeois thinking the world from their offices, unable to feel the real needs of the people. Thinkers imagining ideal and perfect worlds, without giving the details and the way to reach them (Duveau, 1961) (Gauchet, 2003). Of course, they are not bourgeois, and this is an exaggerated caricature. Nevertheless, despite their good intentions, it seems necessary that more power and autonomy is given at the bottom. It is important that the will and the initiatives come from below. The initiatives behind humanitarian Fablabs should be limited to connecting organizations with different competencies to support the spaces and enable synergies between them. It is important, however, to note that the Resilience Collective is a clear improvement over the Global Humanitarian Lab. The non-formal structure of the Initiative means that member organizations are freer in their actions and must only refer to their own donors. The effort is now at the level of the member organizations themselves. Indeed, more autonomy and ownership may still need to be given to the missions and delegations in the development and management of the spaces. Greater autonomy of the spaces does not mean their abandonment. As we have seen, these spaces need to approach their work strategically. NGOs like Tdh and their expertise at the local level can support humanitarian Fablabs to become contextualized, sustainable, and impactful (Interviewee 5, 2022).

7. CONCLUSION

This research work has allowed us to see that hacker spaces and Fablabs echo ancient movements, which have used the latest techniques of their time to emancipate themselves and fight against the evils of conformism, industrialization, and more recently work. The recent hacker and maker movements seem to have gained visibility and importance thanks to the development of computers, the internet and digital fabrication. The last generations of hackers and makers have themselves contributed considerably to some of the major inventions that our societies have discovered in the last decades and that we continue to use today. Recent leading advocates of these movements herald a new industrial revolution (Schwab, 2016), whether through the ability to build "almost anything" in a connected and more efficient way (Gehrsenfeld, 2007) or through unlimited entrepreneurship through digital tools, freeing up the means of production, open source or networked collaboration (Anderson, 2012). Although a certain skepticism already resided in the North, these promises reached the doors of humanitarianism. David Ott has been a key driver in exploring the potential of these movements for humanitarianism. Initially interested in the technical side of this potential industrial revolution, David Ott explored digital manufacturing for the ICRC to help with humanitarian logistics. Despite his efforts, he encountered a lot of misunderstanding and disinterest. However, his determination allowed him to generate interest in another promise of the hacker and maker movements, as well as the Californian Ideology: the emancipatory power of technology and machines. “But no one being a prophet in his own country”, David Ott has aroused less interest among his own people than among other organizations. It took the enthusiasm of others convinced of the potential of technology and innovation outside the ICRC for Fablabs to be launched in the humanitarian field. Visionaries, the people who have led or are leading the hacker and maker movement in the humanitarian field at the global level, have a utopian trait that materializes in their limits to demonstrate the way to reach their "perfect city" and their promises. They are in some way part of the long history of utopian consciousness. Some of them may also have been blinded by overwhelming personal ambition. This has had the effect of complicating the development of these spaces, with some initiatives turning out to be disastrous. However, it is important to note that the complications also lay in the system and rigidity of the Humanitarian Organizations, which ran counter to the values and culture of hackers and makers. This caused a real culture clash between two worlds that did not understand each other and

may not understand each other yet. In spite of all these difficulties, it is important to note that these spaces are still alive and that new interests arise here and there. It seems that this time this interest comes less from above and more from below, more in the essence and spirit of the hacker and maker movements. Humanitarian Fablabs are therefore concrete utopias that continue to be realized. For this, we must salute the visionary side of the first people who brought these spaces to humanitarianism. Thanks to their vision, the history of humanitarian Fablabs is still alive. For these spaces to evolve over time, many barriers still need to be removed and limitations taken into account. It seems that these spaces need to be built more for and with local populations. The approach to their deployment also needs to be much more strategic and linked to local needs. Simply leaving them autonomous makes them too dependent on the profiles and skills of the people who run them, as well as too dependent on the institutional logic of the organizations that support them. Indeed, although they are increasingly local initiatives, these spaces continue to be supported by large donors that do not always offer the flexibility and space desired. For this reason, it is important that humanitarian actors developing these spaces remain cautious about the structural changes that can be made. For now, humanitarian Fablabs offer people the opportunity to access technology and explore new social possibilities through these tools. However, the changes are not yet decisive enough to allow the most radical promises to be realized. The question remains as to how basic experimentation with technologies in humanitarian Fablabs can further contribute to structural change agendas. More than technologies, it is also the culture and social organization of these spaces that needs to be strengthened, more in the sense of third places. Not all contexts and needs require advanced tools and machines. In this regard, the actors behind humanitarian Fablabs must avoid falling into what Scott-Smith (2015) calls "uncontrolled neophilia: a love of novelty for its own sake." However, it must be recognized that the humanitarian Fablabs have been reducing their inventory of machines and this is important because many things can be done without high-tech machines. On balance, the greatest potential in these spaces lies perhaps more in the culture and approach than in the tools and machines. Finally, entrepreneurship may be an avenue to explore, but we must recognize its limits and the many barriers to be removed. Small entrepreneurial projects can be born, but it will not be as easy and revolutionary as Anderson (2012) predicts. Not everyone has a credit card and can install a 3D printer in his kitchen and print objects in a factory, somewhere in the world. To develop these different

initiatives, it seems necessary that NGOs like Tdh be less centralized. Less present in the decision-making power but more in support of local initiatives. This is the path that the Resilience Collective (perhaps unintentionally) and its members seem to be taking, working more on creating partnerships and content to support the community of practice of the spaces and less on the top-down deployment of these spaces.

7.1 LIMITATIONS OF THE RESEARCH

This research work focused mainly on the origin and promises of the makers and hackers movements. Then, their exploration and experimentation in the humanitarian environment was studied. The people interviewed all had a global rather than a local role. Their views and opinions only partially reflect those of people active in the field and within these spaces. In addition, despite the attempt, not all the people approached responded favorably to the interview request. The main limitation is that we also have only a partial version of the exploration and development of Fablabs, particularly within the ICRC and the Global Humanitarian Lab.

7.2 FUTURE RESEARCH ON HUMANITARIAN FABLABS

This work has focused primarily on the origins, motivations, potential and some limitations of humanitarian Fablabs. Future research should focus more on the relevance of these spaces and their organization. Further studies in the field and at headquarters, as well as with other stakeholders (beneficiaries, donors, local populations) should be conducted.

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