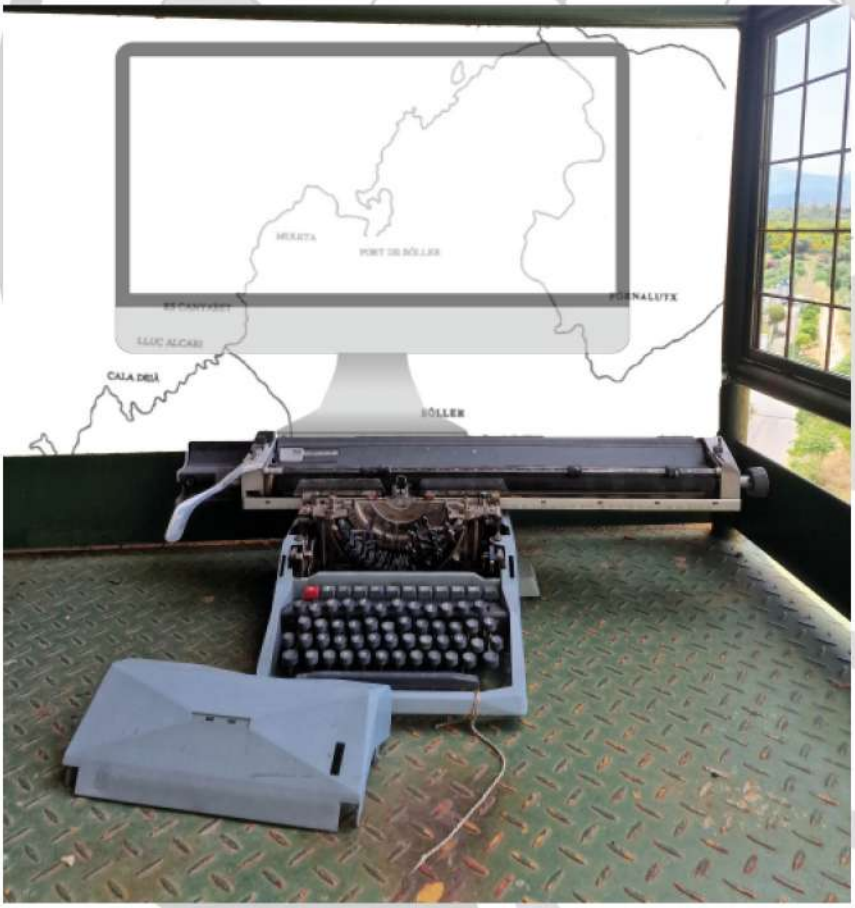
INFORMATION TECHNOLOGIES AND SOCIAL MEDIA: NEW SCIENTIFIC METHODS FOR THE ANTHROPOCENE

Gaetano Sabato, Joan Rosselló (Editors)



Preface by Javier Martín-Vide

IL Sileno Edizioni

Geographies of the Anthropocene

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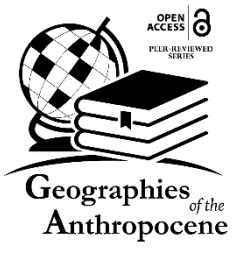

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Geographies of the Anthropocene

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Geographies of the Anthropocene

Open Access and Peer-Reviewed series

The book series "Geographies of the Anthropocene" edited by the International Scientific Publisher "Il Sileno" (Il Sileno Edizioni) will discuss the new processes of the Anthropocene epoch through the various worldviews

of geoscientists and humanists, intersecting disciplines of Geosciences, Geography, Geoethics, Philosophy, Socio-Anthropology, Sociology of Environment and Territory, Psychology, Economics, Environmental Humanities and cognate disciplines.

Geoethics focuses on how scientists (natural and social), arts and humanities scholars working in tandem can become more aware of their ethical responsibilities to guide society on matters related to public safety in the face of natural hazards, sustainable use of resources, climate change and protection of the environment. Furthermore, the integrated and multiple perspectives of the Environmental Humanities, can help to more fully understand the cultures of, and the cultures which frame the Anthropocene. Indeed, the focus of Geoethics and Environmental Humanities research, that is, the analysis of the way humans think and act for the purpose of advising and suggesting appropriate behaviors where human activities interact with the geosphere, is dialectically linked to the complex concept of Anthropocene.

The book series "Geographies of the Anthropocene" publishes online volumes, both collective volumes and monographs, which are set in the perspective of providing reflections, work materials and experimentation in the fields of research and education about the new geographies of the Anthropocene.

"Geographies of the Anthropocene" encourages proposals that address one or more themes, including case studies, but welcome all volumes related to the interdisciplinary context of the Anthropocene.
Published volumes are subject to a review process (**double blind peer review**) to ensure their scientific rigor.

The volume proposals can be presented in English, Italian, French or Spanish.

The choice of digital Open Access format is coherent with the flexible structure of the series, in order to facilitate the direct accessibility and usability by both authors and readers.

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Preface

Javier Martín-Vide[1]

Science is, with very few exceptions, the result of the systematic work and selfless dedication of those who pursue – both individually and as a team - the search for truth, by means of answering questions based on hypotheses or conjectures, contrasting, confirming or falsifying propositions, reproducing experiences, deducing laws or making predictions, thus following the scientific method, in a general process of advancing knowledge. It consists of a chain of links of progress in knowledge, forged by scientists in solidarity with their fellow men and women, because their work is for the benefit of all. Trained in the scientific method and in the use of precise terminology, they once relied on the specific field of earth sciences, on direct observation and the support of maps and hand-held instruments. Today they benefit from the so-called new technologies, such as remote sensing and geographic information systems, as well as from new methodological approaches, including collaborative approaches. In general, new technologies greatly facilitate observation and data acquisition, spatial and temporal resolution of the processes under study at very detailed scales, advanced statistical analysis, speed in the execution of calculation programmes and non-invasive intervention in medical operations, among many other examples. Such is the benefit provided by new technologies that it is sometimes forgotten that in order to use them to obtain a scientific progress or true advances in knowledge, it is necessary to follow the stages of the scientific method. If this is not the case, even though surprising results are achieved and often expressed through spectacular images, no new link in scientific knowledge will be produced. Indeed, it must be emphasised that the scientific method remains at the heart of the research process. If it is not followed, the results achieved will not be scientific, but mere elucubrations, guesswork or, at best, unverified or untested knowledge, or only apparent advances.

Apart from the aforementioned, technological evolution has undoubtedly changed the way of "doing" science. To give a few examples, a meteorologist - and even the common citizen - knows at any given moment where the cloudiness associated with a cold front is, where it is raining or where

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The translation from Spanish to English language of the preface was done by Joan Rosselló and Marina Palou.

lightning has struck, thanks to satellite remote sensing, radar or the lightning network. An astronomer does not need to stay up all night to make observations of the sky, but can automatically track the stars of his or her choice, as well as carry out the calculations involved. The most advanced medical technologies, such as nuclear medicine, make it possible to detect any dysfunction or even the tiniest anomaly in the body's tissues without the need of expensive surgery or invasive scans in the first place. Space exploration, which requires cutting-edge technology, has brought with it many technological advances that are already commonplace. Nanotechnology, which achieves the control and manipulation of matter at tiny dimensions, typically between 1 and 100 nanometres (nm) (1 nm is one billionth of a metre), allows the creation of new materials and systems with enormous potential applications. It is also interesting to note that its advances result from the disciplinary approach of chemistry, physics, molecular biology, medicine and computer science to mention a few.

New technologies could also be included among the defining elements of the Anthropocene, that leap in the history of humanity characterised by the fact that its footprint derived from the consumption of resources and the generation of waste has a planetary effect. The footprint is now visible in practically every corner of the Earth. The more than 7.8 billion humans, which will approach 10 billion by the middle of the current century, have already exceeded the physical limits of the planet, to a large extent due to the use of new technologies, especially those which allow massive exploitation of mineral, agricultural and ecological resources. The so-called Overshoot Day, which every year calculates the date by which humans will have already consumed all the resources and ecosystem services the Earth has to offer, is every time appearing earlier and earlier in the calendar. It is with the exception of 2020, due to the reduction of economic activity as a result of the COVID pandemic. In 2021 it was the 29th July, which means that we already need 1.7 planets to satisfy our consumption. By 30th June, we will need two planets. We are therefore producing an ecological debt, which our descendants will have to face.

This forces us to reflect from an ethical perspective. New technologies must also help us to manage a complex world that is constantly changing, and that is much more unpredictable than in past decades. They have facilitated knowledge of the world, and its exploitation, and should now be used to channel and resolve the problems of global change, including climate change, very probably the most important challenge we face in the 21st century. In doing so, new technologies must respect the three pillars of sustainable development, that is economic efficiency, social inclusion and environmental

friendliness. If new technologies have served massively for economic progress, they must also help to achieve equality between people, to eradicate poverty, hunger and injustice, and to achieve a more equitable world. In the same way, they must be applied to improving our relationship with nature, to preserving wildlife and the landscape, and to develop a sustainable use of resources.

New technologies can provide solutions of enormous importance in the area of energy transition. They can help along with the development, and also the reduction in the cost of energy production coming from solar energy of different types (solar thermal, photovoltaic), wind, tidal, geothermal, etc., as well as hydroelectric and, to a lesser extent, biomass. We will have to add, in the near future, that energy which is obtained from hydrogen and other possible innovations. Even so, it must be remembered that it is essential to reduce our energy consumption. The well-known three 'r's - reduce, reuse and recycle - still apply. And one more step, three 'i's: getting involved, innovating and imagining. Regarding the first, all actors, from public administrations and companies, especially the large multinationals in the energy sector, to groups and associations of different types and sizes, NGOs and ordinary citizens, do not get involved in solving the environmental and energy problem, we will be left with nothing more than well-intentioned words. Together with this, innovation is also vital in order to achieve technological advances that facilitate, if not solve, the various partial challenges. And finally, the third 'i', imagination, a uniquely human capacity. If we do not imagine a better world, we will not achieve it.

Another substantial change in the way science is done is the arrival of collaborative processes and, in particular, those of the so-called Citizen Science. Ordinary citizens can collaborate with "professional" science by providing information and data that, due to their nature or number, are difficult to obtain; they can participate in the methodological process by formulating questions, providing calculation memory with their personal computers, verifying on the ground what the technological platforms detect, etc. The term citizen scientist can therefore be used to describe someone who provides this assistance and knowledge voluntarily, without being a scientist specialised in the subject of study. A fundamental requirement for Citizen Science to be considered as such is that the results of the research return to the citizen, in many cases to improve their living conditions. Science has thus gone out from universities and research centres to become, in a way, "democratised".

Getting back to our origins. The Earth, a planet of unremarkable size among those in the solar system, with an equatorial circumference of just over

40,000 km, has three unique elements: the abundance of water, visible from outer space; the richness of oxygen in its atmosphere, which accounts for 21% of the air we breathe; and the existence of a wide variety of life forms. And in the course of its approximately 4.5 billion years it has reached a crucial stage in its geological history, that of the domination of the planet by the current human species, equipped with a technology capable of modifying it in its entirety and even of destroying it. A technology that will allow them to establish permanent settlements on other stars in the solar system within a few decades. The use of the most advanced technologies must always be governed by the ethical principles of respect for life, for the benefit of all humans and other living beings, in an egalitarian and supportive manner, guided by the concept of one health, which harmoniously combines human health, animal health and environmental health. In this endeavour, education, culture and scientific knowledge are the key.

I am pleased that the contributions of this volume are aligned with that spirit of rigorous progress of knowledge, the results of which can benefit our fellow citizens, life as a whole and our own terrestrial cradle.

Introduction

Gaetano Sabato[1], Joan Rosselló [2]

The Anthropocene has been defined as a time when the world has undergone "the great acceleration". Acceleration in terms of population growth, increasing rates of urbanisation, the globalisation of the economy, the emergence of mass tourism, and other effects of the Anthropocene that have all had an impact on the world.

Many of the effects taking place during this epoch have negative connotations although there are positive elements and one of them is technological advances. According to Stoermer and Crutzen, technological improvements began in 1784 when James Watt perfected the steam engine and the industrial revolution began. Since then, a multitude of inventions has enabled the advancement of humanity up to the present day. Technology has had an impact on medicine, communications, people's daily lives and also on the way science is done.

However, it cannot be overlooked that the rapid and widespread diffusion of technology has consequences also on the epistemology of the various disciplines. From problems related to the collection and processing of data to ethics on their use, all of which constitutes an obstacle that researchers have to face more and more often. Hence the need for an honest and open reflection from different points of view and approaches that brings together a polyphony of voices in an attempt to understand "how much" and "what" use of technology we can (or we want to) let enter our research work.

It is in this sense that the volume presented here aims to show how different ways of doing science have changed thanks to technological advances. However, these chapters do this in the awareness that any use of technology poses problems of method until the necessary epistemological rethinking of models and practices occurs.

Our intention with the book is to consider how digital and IT technology and social media have affected scientific research in different fields, and this is reflected in the title: "Information Technologies and Social Media: New Scientific Methods for the Anthropocene". The received contributions come from various fields of study and offer different perspectives, from theoretical

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essays to practical applications and provide an overall vision about how technology has changed research dynamics.

The volume has been divided into four sections; the first is devoted to the use of social media as a research tool; the second is related to the application of technology within the humanities study field, while the third section shows the use of technology as a practical application for flood-related research. Finally, a fourth section offers a glimpse of multidisciplinary research in the Anthropocene.

Section one, titled "Social Media and Research" is made up of three chapters. The first, written by Gaetano Sabato, describes the ways in which it is possible to conduct online research from a cultural geography perspective into a Facebook group dedicated to the geo-historical reconstruction of urban spaces (Palermo, Italy) in a form of "participatory geography". Based on previous research conducted by the author, the chapter leads to a reflection on the method used, to discuss the possibilities and criticalities that social medias offer to researchers, making them an object of study but also a means of study. In the second chapter, Stefano Montes focuses on Facebook as a real and true form of fieldwork, to investigate the everyday and its digital connections. By questioning the traditional conceptions of place-based ethnography and turning to an on-and-off digital research, he highlights some important features belonging to fieldwork as a reflexive phenomenon. A primary concern in his paper is to show how the digital world, by impacting on ethnographic methods, has also had effects on some evolving notions such as simulation, technology, authorship and ethnography itself. The third chapter, written by Marianna Boero, addresses, from a semiotic perspective, another delicate question: the way in which scientific discourse is articulated today on various social media both in the mainstream and in those dedicated to researchers. Moreover, the scholar discusses the issues of the reliability of information sources and the role of the "experts" in the construction of the scientific discourse accessible to the public.

In section two, called "Humanities and technology", there are two chapters. The first one, from Antoni Quetglas, offers a vision of how historians can do research from their desk without physically accessing an archive, which is often located in another country. Such online archives are used to study a migration process affecting a small town of Mallorca, which is related to a current historical method, known as "microhistory". On the other hand, the chapter from Morey, Palou and Rosselló highlights the use of technology within the classroom in a secondary school in Palma de Mallorca. The authors explain how the COVID outbreak impacted the teaching structure and how both students and teaching staff had to adapt sooner rather than later to the

emergence of online courses and how this has changed the way to teach and learn.

Section three is titled "Practical application of technology" and includes two chapters. The one from Llasat and Llasat shows how a mobile phone application can help a flood-related research, allowing the app users to upload photos of events along with the geographical location of the flood. It is also an example of "social science", when user's data allow the researchers to improve their knowledge by receiving data that, sometimes, could be missed. The chapter from Stamataki and Kjeldsen offers another view of how technology has changed research. The use of digitalised data from archives helps to identify flood events along a catchment and a combination of statistics and "social science" allows the correct mapping of the distribution of flooded waters across the city of Bath in the United Kingdom.

Finally, section four is titled "Multidisciplinary research" and comprises three chapters. The one from Francesco Mele, Antonio Sorgente and Paolo Vanacore focuses on another wide-ranging topic for a multidisciplinary reflection: Artificial Intelligence. The authors study the manner in which AI has improved the methodological apparatus of the human, social and natural sciences, such as linguistics, cultural heritage, medicine and jurisprudence. More specifically, the chapter discusses the problem of technological unpredictability, some critical issues of AI systems, such as their unexpected results, without neglecting problems of regulation and opacity and finishes with a prediction of the future of these systems.

The second chapter, by Gian Luigi Corinto, using a geographical approach applied to the artistic field, starts from a grounded case (the painting exhibition *Raging Babies*, put to music by digital musicians) to show how studies on/with visual and musical artists who usually use the internet and ICT can shed new light on traditional geographical topics such as space/time and place/identity. Indeed, the author discusses the way in which the artists use ITC and the Internet to form collaborative networks, also reporting focused conversations with them and reflecting on the effects on geographical research undertaken by the scholar himself.

In the third chapter of this section, Alfonso Di Prospero, based on the fact that the pandemic period implied a large use of the digital technologies for communication, proposes a reflection from a philosophical perspective. Considering various cases and examples, the author investigates the underlying structure of a model of culture inside which the process of spreading the new forms of communication occurs in a more convenient way. Within the debate about the right use of new technologies, Di Prospero highlights how it is fundamental to focus on the structure of meaning that

forms the content of communication instead of the technical nature of the devices.

Those chapters contribute to spread the knowledge of how the use of technology improves the research in different scientific areas and the Editors hope they can help researchers to obtain a new vision of the possibilities of the advanced technology in their fields of study. The volume also offers to the readers some different approaches to do science which exist nowadays. These are often complementary points of view and approaches that underline the complexity of any "discourse" (in Foucault's terms) on technology and its use. This is a complexity that inevitably also poses profound epistemological problems, as fascinating as they are necessary, for a scientific meta-reflection, projected on both sides of the individual disciplinary outlooks.

In thanking all the authors who have partecipated with enthusiasm and commitment in this work, the wish that the editors address to readers is therefore to that they find interest in the many points of connection and perhaps even opposition in the intersection of perspectives that this book reveals; with the awareness that as soon as a problematic issue has been discussed, it gives way to another.

SECTION I

Social Media and Research

1. Participation, geography and social media. Discussing method

Gaetano Sabato[1]

Abstract

The chapter, from a cultural geographical perspective, offers a reflection on the research methodology used to study some social media. More particularly, starting from the case of the Facebook group "Palermo di una volta" ("Palermo of the past"), subject of a previous study, the results achieved through the analysis of the research process are retraced. The group, in fact, for the many members (hundreds of thousands) who are part of it, is an opportunity to reconstruct the geography of places in the city, both in their contemporaneity and in their historical context, in an intertwining of individual and collective narratives. Regardless of the formal correctness of the information the group members reach, free participation in this reconstruction produces shared knowledge, giving value to interactions, albeit mediated, within the social network. It is a form of spontaneous "participatory geography" which, however, poses an epistemological problem to the researcher: joining the same group to study it, making the social network an object of study but also a means of study. In this sense, it is described how becoming a member of the same online community is a useful option for observing the interactions that take place within it (posts, comments, etc.) and establish a first contact based on trust with the informing members. In this process we cannot forget the positioning of the researcher "in the field", even if virtual.

Keywords: Cultural Geography, Participatory Geography, Research Methods, Social Media, Space

1. Introduction

Starting from the Web 2.0 revolution which allowed a previously unimaginable level of interactions, social networks have contributed to the

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realization of a new idea of participation on the internet in the last decade. This participation is often based on the sharing of narratives (textual, musical, images, etc.), in a complex inlay of private and public elements that has even raised ethical, legal, political and economic problems. Of course, social media has also begun to be a prolific field of study for social science researchers. This interest has produced many studies on the use of social networks, their impact on daily life and, more generally, on the way they are used by people. Also for cultural geography, social networks (and, more generally social media) represent a particularly interesting field of investigation. Indeed, if as Lefebvre (1991), Foucault (1975 and 2004), de Certeau (1990), Harvey (1989), Soja (1996) and Hooper (1993) have shown, the construction of space is culturally and socially determined, then the study of social media can be counted among the most significant cultural products for the investigation of our daily life, in particular as regards the (re)production of spatialities in a virtual environment. Furthermore, a not insignificant issue is the fact that the study of social media implies an epistemological reflection on one's own positioning in the field. In fact, it is possible to study a social network "from the outside" or "from the inside". The latter means by joining it as a user (see the chapter written by Stefano Montes in this book). Both modalities imply a different arrangement, different methods but, at least, complementary outcomes. For instance, the interaction with other users may be active or even non-existent, but the social network itself will become a sort of "fieldwork" within which the scholar is involved, even if only as an observer. In this chapter I propose a reflection on these issues starting from a case study on which I focused with Giovanni Messina and published in Italian in 2018 (Messina & Sabato 2018). The study was centred on a public Facebook group in which users were invited to reconstruct the places and their (personal and collective) memory of the city of Palermo, Italy. The members of the group were freely invited to share and reconstruct the places of the city, starting from the past or from the present. By sharing various types of texts and documents (textual, photographic, drawings, etc.), users build spatialities that no longer exist, as well as spatialities of the present or they even compare multiple historical eras, placing the emphasis on the transformation of the city. In this way, present and past are reconstructed with many urban places (streets, squares, public gardens, etc.), buildings, commercial activities, public and private transport systems (included insights on cars, buses, trams, etc.). For these reasons, our object of study appeared to us to be a form of participatory geography (Kindon, Pain & Francis 2003; Kindon, Pain and Kesby 2007a), certainly not scientifically structured, and yet capable of offering many insights. In turn, to conduct that research from a cultural

geographical perspective it was necessary to enter the mechanism of the group, exploring the dynamics of sharing and participation. Furthermore, as researcher I have experienced the need for an approach and a method that act "inside", using the same internet platform as a "meeting space" with informants and their cultural products (their "texts" in a semiotic sense) capable of reproducing mental maps and senses of space. As a matter of fact, studying the narratives of places also allows us to reconstruct the way in which they "shape" the urban space through a complex semantization process. Indeed, as de Certeau wrote, «narrative structures have the status of spatial syntaxes» (de Certeau, 2002, p. 115)[2].

2. Research and participatory geography: the case of Facebook group "Palermo di una volta"

The Facebook group "Palermo di una volta"[3], translatable in English as "Palermo of the past" or "The old Palermo" is a public not for profit group, created in 2008 by a private user. In 2018, when the aforementioned study was published, it counted about 59,000 members, but at the time of writing[4] the number of subscribers has almost doubled, numbering more than 117,000 members. A remarkable growth in about four years, also confirmed by the frequency of posts by its members. As can be seen from the title, the group aims to focus on the geographical and historical reconstruction of the ancient aspect of Palermo through the finding and sharing of period images and videos as well as "stories" that describe the past of the city. Besides, alongside the historical interest in the city, there is also a certain interest in the present, as evidenced by many posts and comments (see below in this section).

The tendency to create Facebook groups in which to reconstruct the past of one's city has a certain diffusion. As Van der Hoeven (2017, p. 303) writes, it is possible to «observe a wide range of grassroots initiatives that aim to document the urban past. Examples are Facebook groups where old photos of cities are shared, blogs with local memories, and online popular music archives. The local Facebook pages in particular are very popular. Nowadays, almost every city has at least one Facebook group with historical photos,

[2] In the original French text: «Les structures narratives ont valeur de syntaxes spatiales» (de Certeau, 1990, p. 170).
[3] What is described in this paragraph is partially taken from the study already published (Messina & Sabato, 2018) but the contents are adapted to the reflection on the method used for the research.
[4] May, 2022.

provoking reminiscences and nostalgia in the comment sections. Interestingly, these groups bring cultural heritage to the virtual spaces that people use on a daily basis. In so doing, they make the past of cities available on social media in an accessible manner».

Indeed, the purpose of the group is well described in the "Information" section. A sort of appeal to the members of the group that explicitly invite members to share pieces of memory: the aim is to recreate an ideal common archive that can reconstruct the appearance of Palermo as it was in the past. In the words of the founder:

> How many of you know what our city used to be like? Probably few. I was born in the 70s, so I experienced, even as a teenager, the great transformation (not to mention devastation) that Palermo underwent from the 60s to the early 90s.
>
> […] If you browse the photo albums, which we all have in the family, of our parents or grandparents, where you can see streets, clubs, pubs and old meeting places or everything that has now disappeared or changed (houses, villas, buildings, squares, hotels, restaurants, trees, etc ...) please post them, in order to try to create a large archive that will help us and future generations to get to know this beautiful city better.
>
> If you do not have photos, write what you remember, what is no longer there, or has been transformed.
>
> Thanks in advance to all those who join this group and want to share with me this great journey into the past!!
>
> ("Palermo di una volta" Facebook group – My translation)

The appeal relies on a "bottom-up" perspective, since its author declares his age and recalls his own life experience to involve group members more easily. This could be defined as an identification mechanism which calls into action a wide audience on the social network, willing to put their knowledge into play and, above all, willing to share it. Besides, in this way the members of the group are more encouraged to consult relatives, friends and those who may have documents and information useful for the reconstruction of a past that is becoming or has already become memory. Obviously, the functioning of an online social network is based precisely on the interaction that occurs through the publication and comments of what is published. As Hinton and Hjorth (2013) and Crawford (2010) stated, communication on social networks is made up of comments, status updates and private messages in the form of a question or, even, a statement that does not necessarily intend to provoke a return response, but rather to maintain a link between a user and other contacts reminding them of her/his presence. The latter modality assumes a «phatic» value, that is, the maintenance of communication and «communication channel verification» to use Jakobson's (1980) terms.

From a cultural geographical perspective, the "Palermo di una volta" group is a continuous intertwining of micro-geographies (Elmes, 2005) and micro-stories (Ginzburg 2009) because even minimal elements of one's daily life and elements of collective history and geography converge in a complex narrative available to all members. In this sense, as I have already stated in the previous section, this collective and shared construction of Palermo spatialities can be considered as a form of participatory geography. It is clear that the members of the Facebook group have no scientific intentions, nor do they use methods that are explicitly referable to disciplines such as geography or historiography. However, they contribute in various ways to a form of knowledge that could be defined "from below", both for the open participation of several users, and for the modalities of mutual aid in the reconstruction of the city's geography. Furthermore, group members often show some agentivity (Duranti, 2007, p. 89) in participating in shared knowledge. Indeed, we must also consider that some discussions originated from the post of an image, or a text have often become real virtual debates through which the members exchange important points of view on the current conditions of the city and its administration. In particular, as already explained in the founder's post cited above, references to the so-called "Sacco di Palermo" ("Sacking of Palermo") are frequent. This latter is the post-war building speculation which, between the 50s and 80s of the last century, greatly changed the urban landscape without adequate planning through thousands of concessions and public contracts to front companies or names, or entrepreneurs often linked to the mafia organization. The "building boom" led to the destruction of historic buildings and an important part of Palermo's Liberty-style (sometimes carried out in a single day to avoid constraints from cultural heritage)[5]: episodes that for many members of the group constitute a lived memory. The comments to a post on these issues, therefore, give rise to notations and stories relating to those years and the events that followed with citations from other online media (newspapers, blog) and books.

Kindon, Pain and Kesby showed how the «PAR [Partecipatory Action Research – ed.] [has the] potential to transform unequal power structures and relationships to research and knowledge production» (2007b: 18). If we consider the group "Palermo di una volta" as a narration that collects many other narratives and which presents itself as a geographic and historical document of free compilation, is it partially comparable to a PAR, even if lacking a real planning and conduction? The answer to this question is not

[5] On the theme of the "Sacco di Palermo" there is a near-endless bibliography, both in terms of non-fiction and chronicle. See at least Sisti, 2007.

obvious. What is missing is surely the most important element, that is, the scientific, organic intent to arrive at knowledge according to a disciplinary epistemology. On the other hand, there are many occasions when the debate on the most current issues of the city becomes predominant. In these cases, group members exchange views that even lead to open conflict. In this sense, the group becomes a sort of virtual *forum* where citizens confront each other on hot topics, building forms of collective critical knowledge.

3. The methods used to study the group

The research on the Facebook group was based on 15 interviews carried out with as many members: 8 women and 7 men. Interviews were conducted using the ethnographic method, with open dialogues organized around some guiding questions in order to avoid the rigid structure of a questionnaire. Below, Tables 1 and 2 show respectively the distribution of the ages of the interviewees and their composition based on their place of origin and residence:

Table 1- *Age distribution of respondents*

15 members interviewed of which	
20-30 years old	5
31-40 years old	6
50-60 years old	4

Table 2 - *Composition of interviewees by location*

15 members interviewed of which	
12 Italians	9 people born in Palermo (5 resident in Palermo; 2 in other Italian regions; 2 abroad)
	3 people born and resident in other Italian cities
3 Foreigners (Born abroad)	2 residents in Palermo 1 resident abroad

Specifying the origins of the interviewed group members is important to understand some dynamics. Indeed, from the composition of the interviewees

it can be deduced that the users are not only inhabitants of the city who want to know better the places and history of Palermo. The latter represent a third of the total, while less than half of the informants were born and lived in the Sicilian capital. The interviewees came from different locations, but the majority were Italians and, more in particular, Sicilians, with a minority of foreigners. About half of those who had lived part of their lives in Palermo from birth to the time of the interview had not lived in Sicily for years. Comparing these data with those obtained from the interviews, it seems that the members of the group use it for at least three different reasons: 1) learning more about the places and the past of their city (users originally from Palermo); 2) getting in touch with their origins, with their family members, historical or personal (Palermo users who no longer reside in Sicily); 3) learning about the geography and history of the city in which they have been residing for some years (foreign users).

Research on the group consisted of several phases. From the beginning it was considered more effective to study the group from the inside rather than from the outside. This opportunity seemed more suitable because in this way it would have been possible to study the dynamics of interaction. A first phase therefore consisted in observing the group. This was possible after a registration as a member. Various posts containing text and images, or videos were analyzed. The analysis also considered the interaction of users through posts in response to an initial question or observation.

In a second phase, I took part in some discussions already started to better understand the interactions with other members. For this purpose, I published posts in response to some requests for help by users who wanted to reconstruct historical places of the city. In effect, the contents most frequently published by users consist of one or more images accompanied by a short descriptive text. This becomes a caption for the published period photos (and therefore shared with other members) or it may contain a request for help (more or less explicit) addressed to members in order to reconstruct the places depicted in the image. This happens because the images often portray urban places in ways that are no longer recognizable in the present. Participation in this process was helpful in understanding what the priority was for several of the members who took part in the same discussion. In particular, a great curiosity and attention to the veracity of the information reported in the various reply posts emerged. Users paid particular attention to the answers in which expert sources were cited on the places photographed. This expertise was rarely supported by the direct citation of historiographical sources. However, more often the answers to requests for help in reconstructing a place drew on personal experience, personal knowledge of the places and the inlay between

stories reported or directly narrated. Considering many of the posts in the group, it is possible to detect a similar pattern of action: users find period images of Palermo online that portray landscapes, buildings, streets, passers-by or people intent on their traditional craft and, not having a caption for the images, they publish them on the group asking other members to help them recognize the subjects depicted in the photos. A typical request could be summarized as follows: «I found this photo on the Internet. Does anyone recognize this place?». Other times the question is accompanied by a different starting document: a family photo, or a recent photo taken by the users.

A third and last phase concerned the actual interviews. It was decided to propose open interviews to some users of the group using the same social network, in line with the desire to remain within the dynamics of the group. This choice turned out to be fruitful and allowed us to interview several informants who lived not in Palermo and who, therefore, it was difficult to meet personally. As mentioned, 15 informants completed the interview. However, it must be remembered that initially the interviews were offered to over double the number of users (32), but more than one in two refused to answer the questions. Users were initially contacted using the chat made available by the social network with some "filter questions". The reason for the request was explained to the users contacted, with some information about the research I was carrying out. At the same time, they were asked if they would like to freely participate in the research and, therefore, answer some stimulating questions. Furthermore, users were informed that the anonymity of the source would be maintained: no personal data would be disclosed, with the exception of age and origin (inhabitant of Palermo or not; Italian or foreign), since any other personal data would be useless for the purposes of the research. In refusing the interview, almost all users replied that they considered the research topic interesting, and in at least a dozen cases, the members of the group asked for some additional information about the study. The following reasons were given as reasons for refusing the interview, expressed on the basis of the number of responses: 1) lack of time; 2) little interest in participating. Instead, four informants gave no answer. On the contrary, those who accepted the interview freely answered some stimulus questions via the chat. Subsequently, the available informants were contacted outside the chat and social network for some more in-depth interviews.

The first approach to informants through the same channels of the social network made it possible to easily establish a first exchange. As researcher, I was also a member of the same group and had personally participated in some public discussions. Certainly, belonging to the same media platform was perceived as positive and allowed informants to accept the first contact.

However, the first chat interviews showed some limitations. The answers to the open questions were concise and only in some cases did the members express some opinions going beyond the questions posed to them. The subsequent interviews, on the other hand, carried out mostly by telephone and always through open-ended questions, gave more detailed results. In this manner, it was possible to understand better the value assigned by the members of the group to a sort of reconstruction of "truth", both in a geographical-spatial and historical sense. The attitude towards the correctness of the information found is sometimes ambivalent. And this ambiguity is not entirely deducible from the analysis of the posts: the interviews were the most useful source to explain this dynamic. Indeed, if it does not seem fundamental for many users of the group to arrive at a presumed "authenticity" of the narratives that are intended as objective as possible, nevertheless they manifest the desire to reach a "truthful" geographical and often historical (shared) knowledge of their origins. Rather, what matters seems to be the collective (re)construction of a "plausible narrative" (Messina & Sabato, 2018). This way of proceeding with the "reconstruction of the truth" uses a method similar to the contemporary historiographical one, as it is based on direct testimony (as well as on other sources), although this is not always available or verifiable. Furthermore, for more distant times, for example some images published date back to the first half of the nineteenth century – where direct testimony is now impossible – members based ideas on unverified and unverifiable hypotheses. A similar reasoning can be made with regard to the geographical reconstruction: the reliability of certain reconstructions is based precisely on the ability to recognize some places from the references present in the images, often marginal. The level of interactions seems to confirm this attribution (or negotiation) of meaning (Geertz, 1977) to the images and places to be reconstructed. Actually, during the interviews it emerged that almost all the informants in the group since their registration had responded to at least one post with a request for help in rebuilding a place. Additionally, group members usually continue to respond (or, at times, are prompted to do so by specific requests from others) to the initial post until the subject of the photo (often a place) and the source of its online retrieval can be established with some confidence. In this process, official historical sources are sometimes cited. On the contrary, the origin of the image that could include the photographer, the client, any paper publications are, in many cases, ignored or otherwise they fade into the background.

Moreover, exchanges and interactions between members of the group emphasize the fact that the city is in constant transformation, without a truly systemic vision of its changes being possible. As Amin and Thrift (2002, p.

8) well explained: «Contemporary cities are certainly not systems with their own internal coherence. The city's boundaries have become far too permeable and stretched, both geographically and socially, for it to be theorized as a whole. The city has no completeness, no center, no fixed parts. Instead, it is an amalgam of often disjointed processes and social heterogeneity, a place of near and far connections, a concatenation of rhythms; always edging in new directions».

4. Conclusions

In this chapter, through the case study of the Facebook group "Palermo di una volta" (Messina and Sabato 2018), I showed how it is possible to understand the construction of a shared knowledge based on the free participation of various users in the same virtual platform. In particular, I focused on the manners in which I conducted this research, considering that two of the three phases of the research indicated in the previous section were carried out entirely online. To better understand some internal dynamics to the group studied by Messina and myself, I became a "member" of the same virtual community. This allowed us not only to better observe how the various members interacted, but also to be able to interview our informants more easily. The complete interviews, as mentioned, were also carried out outside the social network, but the first approach with the members was facilitated by belonging to the same group. In this sense, the use of a digital resource has been both a research object and a method. The attention given to observation, interviews and the qualitative approach could place at least part of the methodology of this research in the riverbed of netnography (Kozinets, 2010, 2015; Kozinets & Gambetti; see also the chapter by Montes in this book) in a case of participatory geography. The reference to participatory geography needs to be clarified since it can be understood on two levels. The fact that the members of the group collaborate on a collective writing of the geography (and history) of the city is neither really organized, nor does it have a strictly scientific intent. The way of proceeding is almost always casual, spontaneous, animated by a generic intent of knowledge. However, when the research "on the group" began, having become an active member of the same group, having "observed by participating" as in the more structured ethnographic (or, if you like, netnographic) experiences, it passed to a different meaning attributable to participatory geography. Indeed, the meta-reflection on the group, on the members and their activities, the interactions between members and between the members and the researcher has opened a new perspective,

more organized and, at least partially, planned. Indeed, participatory geography has as one of its epistemological objective the awareness of the spaces for action and participation by citizens, for example. This awareness can also be articulated through one's participation in digital media. The "collective writing" of the city is a modality that even goes beyond the narration of the individual members to create a geography of space and time (Lefebvre, 1991; Lowenthal, 1985) and which implies a community agency, albeit mediated by the internet. About this, already in 2002 Amin and Thrift wrote that «in cities […] many […] communal bonds are no longer localized: they successfully persist at a distance, posing new tests of reciprocal resolution and commitment, constructing new forms of intentionality, building new types of presence» (Amin & Thrift, 2002, p. 43). From the point of view of the methodology applied to study the virtual community, it must also be said that even the first interviews carried out within the social network contribute to this process of the collective writing of the experience of the city. Actually, if the researcher is a member, like the others, of the same virtual group, he or she is involved in a process of knowledge that is both individual and collective, especially if – as in this case – the intentions and methods of the research are explained to the informants.

To conclude, the case study analyzed so far allows us to reflect even on another point. This regards the matter of how the methodology used to study, from the perspective of cultural geography, an online community that questions urban spaces and their history is a problem that fully pertains to (inter)disciplinary epistemology. This means that beyond the results obtained, it also concerns the agency and positioning of the researcher "in the field", even when this latter becomes "virtual".

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Sitography

Palermo di una volta Facebook group: https://www.facebook.com/groups/palermodiunavolta (last visit 7th May 2022)

2. Mediated subjects and interconnected days. Facebook as fieldwork

Stefano Montes[1]

Abstract

I investigate digital information and the everyday by primarily concentrating on Facebook and on the connections taking place between myself – a user who is also an anthropologist – and some other individuals on the net. I draw on my activities and I take into account the ethnographic aspects involved in these activities associating daily life and social media. I show how the digital world questions the traditional conception of place-based ethnography and tends to turn field research into a more reflexive phenomenon. In this perspective, I focus on Facebook considering it a field site resulting from the intersection of the human and the digital. Ultimately, I'll try to show how the digital world has impacted ethnographic methods of research and, at the same time, some essential concepts such as simulation, technology, interaction, identity, authorship and the everyday itself.

Keywords: ethnography, everyday, simulation, interaction, identity

1. Language and metalanguage as mediating concepts in information technology

Whether we like it or not, digital media and individual lives have become more and more interconnected. Individuals spend a considerable amount of time on social networks while at the same time living in what is the so-called real life: the passage from a social medium to real life – and *vice versa* – is nowadays not as discontinuous as it was in the past. The everyday has increasingly become less linear and the digital more embedded in our daily actions (Hine, 2015). The question to ask is how this happens, more particularly, in specific contexts, and how face-to-face interactions between people and digital technologies intermingle, then, by this resetting our ways of being at home in the world (Jackson, 1995). Here, I'll investigate digital

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technology and the everyday life by concentrating, above all, on Facebook and on the connections taking place between myself – a user who is also an anthropologist – and other individuals interacting with me. Given the requirements demanded by a short essay, I'll restrict myself to some examples covering a few representative aspects of a single day in my life, preliminarily discussing some important points concerning the intersection between language and metalanguage in information technology. Concretely, I'll draw on my activities and I'll consider the ethnographic aspects – the linguistic and metalinguistic functions of it – involved in these activities associating daily life and social media. Among other things, my purpose will be to show how the digital world questions traditional anthropological conceptions of place-based ethnography and how it tends to turn fieldwork into a more temporal and superposed phenomenon. I'll focus on agency and on the temporal aspects related to the use of Facebook by framing it as a conception of fieldwork that results from the intersection of the human and the digital, in order to draw attention to those aspects of exploration and method rather than a more conventional focus on alienation or recreation. Ultimately, I'll try to show how digital information and social media have impacted ethnographic methods of research and, in the meantime, essential concepts such as knowledge, interaction, simulation, daily life and technology itself.

First, I want to make an admission that is, in my perspective, also a metalinguistic formulation for future research: digital technology affects how we experience the world, how we change it and how we are changed by it. We cannot think anymore of a 'real' world totally separated from the digital; at the same time, we should be attentive to the ways in which digitization transforms our world and leads us to see reality in different ways. The matter in question is the very idea of change – what does 'change' mean? – in relation to information technology and in relation to understandings of the term 'human' (Turkle, 2009; Horst, Miller, 2012; Whitehead, Wesch, 2012). Anthropology must respond to these epistemological dimensions of digital life, apparently far from the classic exoticism that characterized the discipline, above all because – I believe – one of its most important duties is constantly resetting the boundaries that constitute 'the human' and welcoming those elements which, in many cases, had previously remained in the margins. This principle is obviously applicable, well beyond social media, in many other domains and has a wide-ranging intercultural validity. As Whitehead notes in more general terms: "it is not what makes us different from or the same as other animals

(non-humans) that is significant but rather what experiences we include or exclude as relevant to our attempts to live" (Whitehead, 2012, p. 226).

The digital is a matter of intellectual reflection and, simultaneously, it represents an integrated level of daily life lived through personal experiences and stories. As a matter of fact, the digital reconceptualizes most of our notions and practices. Experience itself, often thought as a first-hand tool to apprehend reality, cannot be conceived in the same terms as it was in the past; symmetrically, bodies are dematerialized through media and, therefore, seen in a more unusual and fragmented way. The peculiar fact is that social scientists use the digital – as much as peers in any other profession – but they are also asked to work, in theory and in practice, on the mechanisms founding and formulating these spheres of social life. Actually, even "work practices are instances of social virtuality" (Garsten & Wulff, 2003, p. 5). At the same time, any social virtuality demands a scientific exploration of parallel practices, contributing – I hope – to "a science of singularity; that is to say, a science of the relationship that links everyday pursuits to particular circumstances" (de Certeau, 1984, p. 9). Independently from one's own profession, it is difficult today to avoid the digital. In concrete terms, no matter the practice or activity, we are all – some more, some less – immersed in a virtual world superimposed upon daily life. Let's face it: the digital world influences people's decisions, individual agencies, and even collective emotions. People can see each other, interact, and exchange viewpoints both on-line and in the material world, uninterruptedly passing from one level to another or even superposing them. Daily life is so permeated with the digital that it would be extremely difficult to live, nowadays, in the same way we do if we were compelled to give up digitization altogether: the conception itself of daily life has changed overall and produced cultural tendencies, over the years, that are important to take into account theoretically by several disciplines and scholars. We are 'always on' and, as a consequence, we are entitled to ask what kind of individuals we are going to become in the future and what the real cost of being constantly online is (Baron, 2008).

Media are pervasive in daily life: this is a fact. Not only, then, do people socialize through social media but they also work, shop and pay their bills online, in which daily individual and social interactions change depending on the context. Ordinary and extraordinary, as well as linguistic and metalinguistic levels of life, in short, are associated through the digital. We watch movies and listen to music on-line, taking for granted that we have computer games, use cameras and cell phones, switching from one tool to another without even thinking of separating these activities and implicitly

accepting the fact that digital technology is part of 'what we are': an essential and integrated layer of intrinsic human living, implying a different conception of old notions and producing new ones. In short, we are mediated subjects through mediated objects and reformulated concepts. Even the idea of community itself – once thought as a concrete and visible aggregation of people living on a circumscribed space – is, in our present time, transformed by the information technology in a more imaginary and virtual entity. What is implicitly targeted, through the media revolution, is not only the language of common actions and the concrete actions that we accomplish daily, but also the metalanguages usually utilized by scholars to define theoretically their disciplines dealing with media studies. How can we possibly speak, for example, of context or simulation and even of the very notion of technology in the terms brought forward by the media revolution? This is a field of comparative research that will seriously engage scholars in the following years and, among others, linguistic anthropologists working (i) on the interrelations established in some disciplines between languages and metalanguages and (ii) on the reformulation of metalanguages implicitly adopted everyday by common people.

On this aspect, Jakobson's remark is clear: "A distinction has been made in modern logic between two levels of language, 'object language' speaking of objects and 'metalanguage' speaking of language. But metalanguage is not only a necessary scientific tool utilized by logicians and linguists; it plays also an important role in everyday language […] we practice metalanguage without realizing the metalingual character of our operations" (Jakobson, 1960, p. 356). The metalingual function orients the addressee toward the code both in specialized languages and in ordinary expressions, and this has to be taken into account in media studies. In practical terms and in the everyday, having the possibility to resort to different media and various technological tools is an advantage that cannot be denied. What is often said by various scholars, in contrast, is that information technology sucks up energy and draws the attention of individuals disproportionately, leading to alienation and detachment from material reality. They are not only talking about an unstable relationship established between digital world and material life. The problem is, above all, the apparent neutrality of the media and the Internet. The initial idea, in fact, was that the Internet and social media would simplify access of information to the public and would result in a greater democratization of knowledge. According to Hindman, on the contrary, the information giants – among others, Google and Facebook – control the time spent online and also make large profits, enriching themselves at the expense of users: their survival depends on stickiness (the

ability to seduce users and to keep them glued to the screen for a long time). According to Hindman, the Internet holds the potential to restructure political life, one with merely a semblance of democratic engagement: "the digital attention economy increasingly shapes public life, including what content is produced, where audiences go, and ultimately which news and democratic information citizens see" (Hindman, 2018, p. 5). The immediacy of the information can be misleading, therefore, with respect to the actual agency that the users would have and with respect to their insufficient ability to choices between the range of proposed information. In other words, people devote their attention to media in a passive way, seduced by the system, without having a real choice as the information giants structure messages in such a way as to create a sort of addiction. Furthermore, to make matters worse, the immediacy of the information and the ease with which we can obtain it, however positive it may seem at first glance, often become an obstacle if one wants to verify its reliability and avoid the circulation of false news.

These are important issues, not to be overlooked in any case, on which we – anthropologists, among others – will have to continue to reflect over time in order to observe the evolution of the various types of information, to keep pace with the main paradigms and to escape from a manipulative logic exerted from above. From my point of view, a point remains central concerning information and manipulation: much of its influence depends on the amount of time users spend on social media and on the social pedagogy that should accompany it to prevent any excess and to avoid the 'stickiness effect'. Regardless of whether it is online or *in vivo*, information is imbued with persuasion to the point that one of the most important functions identified by Jakobson, in his time, in his well-known communication scheme, is precisely the conative function: a function that focuses on the recipient of the message to convince him of the goodness of the message. Jakobson is very careful to clarify the idea that the different functions in his communication scheme – including the conative one underlying the persuasive mechanism – are mixed in various ways in actual messages; the variety and composition of functions should be, therefore, a starting point for any good pedagogy concerned with learning online communication in a proper way. As Jakobson recalls: "Although we distinguish six basic aspects of language, we could, however, hardly find verbal messages that would fulfill only one function. The diversity lies not in a monopoly of some one of these several functions but in a different hierarchical order of functions" (Jakobson, 1960, p. 353). In essence, the dangers concerning the alienation from reality and the dangers concerning the circulation of false news online

pre-exist the internet and information technology. Instead, they should be connected to enduring issues of human linguistic capacity. These dangers are obviously more exasperated now due to the fast increase in digitization and to the accelerated circulation of messages online; that said, a common ground remains: the importance of teaching and learning information technology to discern the variety and strength of the different communication functions and to recognize manipulative effects latently working in different messages.

Just to give a concrete example regarding gaming in my personal life, as a young man I spent a certain amount of time in the game rooms which, currently, are frantically replaced by online games: in both cases, much depended – and still does depend – on the amount of time devoted to recreation and games. Whether it is an in-person game or an online game, little changes from this perspective, showing that the question of information must be faced by taking into account the persuasive power contained in the messages and on the basis of the rhetoric that often accompanies it in a surreptitious and manipulative way. As for the circulation of fake news, the danger is always present, obviously, and many people can fall into the trap of manipulation. Today, however, the positive side is undoubtedly the ease with which scientific information can be found; until a few years ago, in fact, it was impossible to have all this amount of information in ordinary circuits. The more general result is that, on the one hand, the danger is alienation or unwitting acceptance of false news; on the other hand, there is instead an extraordinary possibility of interaction through social media that was impossible, in the past, in the light of old technology. If it is true, then, that different forms of recreation are available online today, favoring the possibility of falling into the manipulation of attention, it is equally true that recreation – even in the form of a simple individual game – can take the unprecedented form of positive knowledge: constructive, more interactive and educational. What shall we do then? An answer could be the implementation of constant education – at school, in university and in other places dedicated to collective learning – in social media and information technology. Just as one learns to write at an early age, so one should be able to learn, from the beginning of his education, to grapple with information technology and social media.

As simple as this solution may seem, it is still an important decision with radical potential for institutions today, especially if information technology is going to be taught, productively, as the study of the interconnected aspects relating (i) to the communication of various languages and registers, (ii) to the manipulative force inherent in messages and (iii) to the

construction of shared as well as situated knowledge. In short, to understand the role played by social platforms and media, and favor their correct learning, a decisive step forward should be the implementation of their use in educational institutions, accompanied by metalinguistic analyses in different perspectives (Kent & Leaver, 2014; Cohen, 2002). A parallel, albeit essential, step to take should consist in facing media realities through the prism of the language and metalingual functions not only to better defuse the potential dangers implied by manipulative messages, but also to concentrate on emerging forms of conceptualization in everyday and scientific discourses.

As stressed by Hine in her original research on systematics: "communication is constitutive of the scientific endeavor, and yet the diversity of disciplines means that each may operationalize its communication in a quite different way" (Hine, 2008, p. 151). That's why, while giving so much importance to the various functions summarized by Jakobson in his communication scheme, I finish this section by emphasizing the importance of the metalingual function. As I previously wrote, with regard to Jakobson, all functions are essential to varying degrees, not least the conative function which sums up, precisely, the persuasive orientation exerted on the addressee. On the long run, however, in order to better understand the issues relating to the reformulation of concepts, still underway following the media revolution, I believe it is a priority – also with respect to ethical and interpersonal issues (Ploug, 2009) – to focus on the metalingual function both in scientific and everyday discourses.

2. Simulation as a positive and negative element

Information technology has certainly placed a strong emphasis on simulation, perhaps a less central phenomenon in the past, which actually deserves close theoretical attention now because of its extensive and intercrossed usage. Of course, simulation was an integral part of daily life in the past and was involved, for better or for worse, in the most common interactions. Someone who simulates is, most simply, an individual who does not tell the truth but, simultaneously, is also someone who reconstructs, somehow, an absent context that can be useful and even recreational: two opposite meanings, then, are inevitably and perhaps inextricably associated in the same concept. To simulate means to imitate and reproduce, but also to pretend and lie. The question is consequently complicated and has always accompanied man's abstract thinking

concerning the relationship to be established between the model and its realization or between the plan and the corresponding action: whether it is art, cinema, philosophy, or the more specific imagination of an individual, simulation remains anyway central. Even in the most banal daily life, people make projects and try to carry them out, making implicit connections between various forms of planning and practical implementation, between general models taken as guiding principles and concrete acts realizing the model. With the advent of information technology, this aspect – the possibilities offered by simulation in relation to personal and collective agency – has become even more important, particularly amplified, and the subject of criticism by some scholars or, on the contrary, of praise by many others. Fundamentally, the reason for the criticism is that simulation, thanks to digitization, allows people to create such an important reality effect that it seems to transport the individual into the *in vivo* context. We are all so immersed in the technological simulation that, in some cases, we are no longer able to effectively distance ourselves from it or distinguish between different levels of emerging reality: not only do we mix them, but we are also caught in the circle of messages that suck our attention and blunt our will.

At this stage, one of the questions to ask is whether we shall continue to distinguish the ways through which reality presents itself to us, at different levels, or we shall adapt ourselves to the mixed flow of information without paying attention to its mixing, giving therefore undisputed attention to the market offers. Answers, from different specialists, apparently differ. From an anthropological point of view, it can be said that simulation involves an adhesion based on implicit belief and on a suspension of knowledge of people who become less attentive to the construction of messages. Basically, the immersion in technological simulation allows us many advantages – for example a better possibility to interact with others on the long distance – but it is also considered, too often nowadays, as a sort of normal substitute for reality and accepted as such, even when one should instead maintain a level of attention aroused towards various types of manipulative information. In this regard, there are conflicting and various opinions; some of them are important to be taken into account, more analytically, for several reasons, not least to better concentrate on their reformulation of metalanguages: such as, for example, simulation or technology. In her studies on media technology and anthropology, a scholar who has kept a careful but wary attitude is Sherry Turkle. Over time, her volumes on technology and its relations with human beings have taken into consideration various aspects of the problem allowing her to maintain an

epistemological distance, but at the same time allowing her to immerse herself in the subject thanks to interviews, theoretically suggesting a more attentive use of information technology. In *The Second Self*, Turkle clearly shows that the computer is not, as we might naively think at first glance, a mere tool; more than this, it is a constitutive element of our life and imagination. A computer serves not only to do something quickly, but also to define how we think and act in the world by imagining ourselves and the others, our feelings and intersubjective relationships.

The result of Turkle's anthropological work reveals what, in the first instance, might seem surprising: users consider the computer as an object that is unstably placed between the animate and the inanimate: if, on the one hand, users claim to know that the computer is an object, on the other hand they intuitively assign it meanings that place it in close relationship with their feelings and, therefore, allow them to consider it an animated extension of their own Self. In other words, the computer is not seen so much as an object as a real part of an individual, with a humanity core connecting it to society. This means that people attribute values to the computer that are projections of their own way of seeing and that these projections are integral part of their personality acquired by closely coming to grips with technological objects: "the advent of the computer has taken our relationships with technology to a new level. Computers, with their reactivity and interactivity, stand in a novel and evocative relationship between the living and the inanimate. They make it increasingly tempting to project our feelings onto objects and to treat things as though they were people" (Turkle, 1984, p. 287). She reaches the conclusion that digital technology affects how we experience our world and how we consider ourselves and, more importantly, some objects as mediated subjects. As a result, agency and self-awareness become less closely interconnected while the distance between subjects and objects is reduced.

In *Alone together*, Turkle focuses again on the relationships existing between technology and humans, insisting on the importance taken in recent times by connectivity and its capability in terms of accessing virtual interactions. Notwithstanding this positive side, Turkle shows people's dissatisfaction with virtual relations and the better convenience of real and true interactions. Turkle's thesis is that even though cell-phone technology has become more and more refined over the years and social media are proliferating all over the world, ironically people are alone and socially disconnected from each other, further manifesting their unsolved vulnerability. Turkle's conclusion is a clear warning against the tensions introduced by technology: "Online, we easily find 'company' but are

exhausted by the pressures of performance. We enjoy continual connection but rarely have each other's full attention. We can have instant audiences but flatten out what we say to each other in new reductive genres of abbreviation. We like it that the Web 'knows' us, but this is only possible because we compromise our privacy, leaving electronic bread crumbs that can be easily exploited, both politically and commercially" (Turkle, 2011, p. 280). On this basis, although fascinated by technology, we should always keep a watchful eye on its concrete achievements and on its counterproductive, or even deleterious in some cases, effects that come to the surface in the long run. The whole matter can be summarized as follows: trust in technology has to be great but it shouldn't be blind.

It is undisputable that new technological devices seem to be a promise of positive change in our daily lives. The question to ask is whether this is the norm in general. The promise does not always turn out to be a happy fulfillment because "there are all kinds of circumstances that capture and overtake technical interventions" (Greenfield, 2017, p. 326). In *Radical Technologies*, Greenfield takes into consideration different forms of technical innovations to show the advantages and disadvantages of their concrete contribution. In his conclusion, he takes as a paradoxical example the tetrapods – concrete breakwaters – that the Japanese have deposited on the coast of Niigata to stop the erosion of beaches. Over time, the tetrapods have proved a failure because they accelerate the erosion of the coast but continue, however, to be produced because they represent a sort of subsidy that the Japanese state has been granting to the concrete industry for years. Greenfield warns against the gap existing "between technoutopian claims about what some emergent innovation 'might' or 'could' give rise to, on the one hand, and anything it has actually been seen to do on the other" (Greenfield, 2017, p. 328). Basically, it could be said that it is good to rely on technology and on the promise of future prospects; at the same time, it is equally important to take into account the political and economic factors that are closely related to the technological dimension and which, in turn, orient it one way or another.

It is, then, a question of looking at technology without dissociating it from the political and economic orientations that accompany it in a sometimes disguised way. In addition, one more reason to look at the mixture of technology and political orientations without dissociating them is the fact that digital platforms produce enormous amounts of capital that is accumulated and managed by a few platform owners. In this regard, Ji overtly speaks of platform imperialism (Ji, 2015). In short, simulation brings forward several multi-layered matters – it has a metalinguistic function –

that are important to discuss in one way or another, above all comparing perspectives and disciplines. A central point is that technology cannot be considered as a neutral factor, independent from any political perspective. Simulation itself, in addition, is an open concept that can lead towards neutral immersion or, inversely towards political and disguised interferences. In this sense, a wary attitude is important: "Simulation demands immersion and immersion makes it hard to doubt simulation" (Turkle, 2009, p. 8). Even though watchful towards some aspects concerning immersive simulation, we cannot deny either the advantages coming along with technology and social platforms. On opening the volume summarizing the comparative results of field research on social media carried by his whole group, Miller points out that the intent of their work is not taking into account platforms but their contents analyzed and faced with a positive attitude. Miller's perspective is therefore different from the ones embraced by the aforementioned scholars.

Miller doesn't think that "face to face communication is richer or less mediated than communication employing digital technology, or that we are losing cognitive abilities such as long-term attention spans […] There is no such thing as unmediated, pre- or non-cultural sociality or communication. Instead, we should recognize that whatever we do with new technologies must be latent in our humanity […] This theory does not claim to adjudicate on whether any new capacity to send memes or selfies through social media, for example, is either good or bad. It just acknowledges that this has now become simply part of what human beings can do, as has driving a car" (Miller, 2016, p. 8). Human features, of course, are changing in time and are the result of the variation of cultures, contexts, and even technology. This point made by Miller has to be sharply stressed: societies are in movement and even anthropology has to be considered as a dynamic discipline. Rather, an objection that could be made to his viewpoint is that driving a car – the somewhat metaphorical example given by Miller – is also the result of political and economic factors allowing people to do so on roads where signs are in use and where respect is imposed by rules that can also be transgressed. All these aspects cannot be ignored: what has become, over the years, a habit is not necessarily a positive acquisition or a transparent means devoid of ideology or manipulative constraints coming from a dominant group. To end this section, I think that different perspectives should be combined to study information technology and these perspectives need to be fruitfully compared and usefully integrated. What is also undeniable is that, thanks to social media, people are able to communicate and socialize but also to question somebody else's ideas, affirm their own

ideas, circulate false news, and build economic empires on the shoulders of others who are certainly more vulnerable than rich and powerful people. Socialization is just one aspect manifested in the interaction taking place in social media; other aspects are equally important: disagreement, offence, conviviality, intimacy, and so on. The digital world is interesting to me for all these conflicting, but also converging and debatable, features. My interest is also more general, applicable to other fields – strictly speaking even outside social media – having to do with "the way in which we construct, wittingly or unwittingly, horizons that determine what we experience and how we interpret what we experience" (Crapanzano, 2004, p. 2).

That said, social media can be a stimulating subject of reflection and an appealing way of conducting fieldwork in a hybrid way, one neither classical or obsolete. Analyses, theoretical applications and even short field research addressing simulation in order to better frame our lives should be welcome. Isn't simulation a multiple horizon projecting ourselves in the experience lived in the immersive and fleeting present, but also demanding a level of interpretation used to recover what has been experienced and already become part of our past? Immersion in the present is indebted to what we did in the past and to the projects we plan to carry out in the future. In social media, maybe even more than in other fields, the "user interacts across differentiated temporalities, and inhabits various temporal regimes" (Barker, 2012, p. 195). What is relevant, generally speaking, is this moving back and forth in time that is constitutive of specific processes but, more essentially, also of the way knowledge and subjectivities actually take place.

3. Media realities and reflexive research

Summarized and briefly discussed a few central points – advantages and disadvantages – concerning the digital world, it is now useful to further investigate the question by taking as a reference a few examples from my real life and from the interconnections established by myself with other individuals on Facebook, a social media site that I turned into a real and true ethnographic field site. This demands a preliminary section, albeit integral in my perspective, to reflect on some epistemological aspects related to (i) anthropology and a subfield named auto-ethnography and to (ii) fieldwork and its different conceptions. Reflecting on these aspects is also important to better focus on the notion of subject and its investment – Turkle would say, talking about social media, of immersion – in contemporary anthropology.

Regarding the first point, the question to ask is to what extent an individual has the right to speak in the first person, referring to himself and to his own life history, without losing sight of the collective scope of his question, by writing an auto-ethnography that touches on the relationships existing between notions such as identity and otherness. The question is delicate and has to be faced while keeping in mind that, in anthropology, there are different orientations depending on theoretical belongings and personal inclinations. A good starting point is made by Augé: the "thing that interests the ethnologist most is the relationship. In the first place, for him, there are at least two subjects who meet, not just one" (Augé, 2018, p. 19). In a reflexive and auto-ethnographic stance, above all dealing with social media, this statement can be amplified and subjects multiplied: besides two subjects who meet and interact in flesh and blood (the anthropologist and his other, as recalled by Augé), the anthropologist also interacts with his own perspective, eventually reformulating it as if it was in a mirror, at the same time reformulating the virtual alter-ego possibly implemented through social media. Social media, in short, are a sort of mirror through which an anthropologist can observe himself and the same time the others who, in turn, observe themselves and the anthropologist. Dealing with media, in fact, people's subjectivity is more fragmented and multiplied: subjects narrate various stories to each other, implicitly recounting the relationships established over time with themselves and with others. If anthropology "is about raising awareness" (Hastrup, 1995, p. 181), this multiplication of identities and stories can certainly be usefully decentering.

From my point of view, fully agreeing with Augé, the scientific nature of a work does not fail if an individual speaks in the first person, staging his own existence and relationships with different subjects and perspectives. Difference in perspectives and descriptions is anyway more valuable in anthropology than homogeneity and conformity. As recalled by Bateson: "Two diverse descriptions are always better than one" (Bateson, 1979, p. 156). This is a suitable step to take in order to reveal the – often implicit – assumptions relating to the adoption of a point of view which, in the final analysis, always has to do with the enunciation of the Self and the inclination of an individual during his decentering research and existence. In other words, we must ask ourselves if we can trust an 'I' that shows himself without veils and claims to be included in his own research both as a subject and an object who accept to be decentered or multiplied. I think so! Here, above all, the problem concerns the – obsolete – way in which we sometimes consider the 'I'. Some scholars think that the 'I' is represented by an individual who, from a sort of balcony, observes the world that passes

in front of him, under his eyes, and becomes an objective spectacle; in reality, the 'I' is also what is behind the balcony, even embodied in the observer. As Lévi-Strauss points out, "in a science in which the observer is of the same nature, as his object of study, the observer himself is a part of his observation" (Lévi-Strauss, 1987, p. 29). Lévi-Strauss is not alone in suggesting this inclusive perspective. It is particularly interesting here to mention the various ethnographies of daily life written by Marc Augé. Over the years, many of his ethnographies have had to do with the exploration of the subjectivity of the anthropologist in everyday life, grappling with his objects of study and with himself at the same time.

Just to give some examples and show the breadth of the subjects touched upon in a reflexive key by Augé, one should think of the metro, the homeless, and old age: *In the Metro*, Augé mixes autobiography, memory and analysis of a place in order to show the different layers composing daily life (Augé, 1986); in *Journal d'un SDF*, he imagines the life of a homeless to take into account notions such as identity, being and relationship (Augé, 2011); in *Everyone dies young*, he studies old age as a physical burden and time as an element that can be squandered in life. These are just some examples showing the variety of themes taken into consideration by Augé. But beyond the themes themselves, and their importance in each specific case, what really matters is that Augé considers the exploration of these themes as an opportunity to reflect on the subjectivity of the anthropologist and to question the ways in which an individual can observe reality without keeping himself outside of it, observing himself in the developing action and inside it. A central point, therefore, is the analysis of oneself and the relationship established with the other, whoever that other may be: this becomes extremely important, in media studies, if we think of the possibility of multiplied and invented selves interacting online and offline. Reflecting on the conditions delimiting the representativeness of anthropological work and its objects to study, Augé proposes a possible direction of research, toward ethno-self-analysis: "We cannot rule out the possibility that the anthropologist, following Freud's example, might care to consider himself as indigenous to his own culture – a privileged informant, so to speak – and risk a few attempts at ethno-self-analysis" (Augé, 1995, p. 39). Unlike Freud, however, the ethno-self-analysis proposed by Augé is based on a diversity of spaces that reconfigure methodology in time and culture: the Freudian space, thought of as a sort of a 'generalized sofa', is replaced – in Augé's perspective – by several spaces producing meaning in different cultural contexts.

To summarize the hypotheses formulated by Lévi-Strauss and Augé, and amplify their scope, if one claims that anthropologists must study life in its entirety, that must include themselves as subjects who observe and become the objects of their own dynamic observation: they must study 'their outside' and 'their inside', the process and the result of their research, regardless of the exoticism of the place where the research is carried out. For anthropologists, in a way, focusing on the (existential) becoming should always be essential. As far as life is concerned, a typical 'Western' perspective tends to see it as a series of objectives to be achieved, neglecting the becoming itself and the more specific aspects linked to process. Instead, "life is not confined to fixed points or locations but lived along lines, and that as they go along together these lines – rather like melodies in musical counterpoint – continually differentiate themselves from within the texture of their polyphony" (Ingold, 2022, p. 6). More than lines, maybe, I would prefer thinking of intertwining stories and experiences, as well as encounters of memories and textualizations producing plots. Whatever the metaphorical support used is (lines or plots), the fact remains that it is important to take into account a perspective focusing on becoming and on counterpoints, especially if one observes the place occupied nowadays by the media in our life: we are constantly immersed in the media while the simulation processes connected to them constantly mix, for better or for worse, with everyday reality. Paraphrasing Merleau-Ponty (Merleau-Ponty, 1945), it could be said that the 'I' is also embodied by the media – through the media – and by the relationships created by media communications: the most important consequence is that the subject is less centralized nowadays and more and more intermediated by online and offline interactions. Through our interconnected days, we become intermediated subjects while our roles are substantiated by social media which allow communication but also construct identities and subjectivities.

All this, in a nutshell, applies to the first point: the right of the individual – and of the anthropologist as a dynamic and multi-perspective subject – to speak about themself in the first person, also transforming his own life into an auto-ethnography taking into account interactions with other individuals offline and online. The other point to consider here concerns the way of conceiving fieldwork in relation to one or more places. What is fieldwork? How and where should this be done? Should it be made in a distant and exotic place? Or should we, on the contrary, focus more on the everyday (Stewart, 2007; Das, 2020)? My answer is that fieldwork should be done, everywhere, without neglecting the life of the anthropologist itself, their movements, their interactions offline and online, 'here' and 'elsewhere',

from the inside and from the outside. In the past, a central dichotomy – built though spatial categories – was instead the following: the house (where one returned) and the exotic place (where one did research). As Sontag effectively points out: "For the anthropologist, the world is professionally divided into 'home' and 'out there', the domestic and the exotic, the urban academic world and the tropics" (Sontag, 1966, p. 56). It is no longer possible to think of fieldwork in dichotomic terms: the division conceived between life (lived at home without research) and the exotic place (where research is carried out).

Even more radically than Sontag, Clifford, closer to us in time, deconstructs this dichotomy – taken for granted by some scholars – by reflecting on the journey and its epistemological importance in anthropology: "Dwelling was understood to be the local ground of collective life, travel a supplement; roots always precede routes. But what would happen, I began to ask, if travel were untethered, seen as a complex and pervasive spectrum of human experiences? Practices of displacement might emerge as constitutive of cultural meanings rather than as their simple transfer or extension" (Clifford, 1997, p. 3). According to Clifford, Malinowskian-type field research (departure, arrival at the exotic place where research is done; return home, after research, where anthropological work stops) turns out to be an epistemological model based on the elision of journey. I believe, following Clifford's example, that the discontinuity established between travel (a displacement) and home (a familiar place) must disappear and life must become a dynamic subject of anthropological research in its entirety, in any place, regardless of the exoticism or familiarity concerning the place. Life is itself a fieldwork. Life is a field of continuous observation and interaction at home and elsewhere: in a street, on a sidewalk, at the supermarket, in a waiting room, on an airplane, and so on. Furthermore, to better investigate life, it is necessary to integrate more and more, in anthropology, interactions taking place online and offline, in one's own mind and in real and true communication. In short, we resolutely need to move from fieldwork (meant as a delimited place) to travel – as already pointed out by Clifford – and from travel to the joint hybridization of life and information technology. To be inclusive and effective, an ethnography cannot ignore anymore the impact of technological culture and social media. In this perspective, taking a social medium as an object of study is undoubtedly important to better deepen knowledge of daily life and, at the same time, to discuss the ways in which anthropology can be poured into this, with its specific methodologies and perspectives.

As far as I'm concerned, I've been dealing with Facebook for quite a while (Montes, 2019). I opened an account to better understand the interactions taking place online and the processes associated with knowledge creation concerning information technology. Facebook is a platform with multiple possible uses. There is a lot to say about it and I am enthusiastic about the possibility concerning the production and reception of meanings: "This is what is so valuable about Facebook: the indeterminate meaning of so much of what it is, and what it does. This indeterminacy allows us users plenty of space to make things mean what we want them to. If there's anything humans are good at, it's creating meaning through social interactions" (Wittkower, 2010, p. 22). In the next section, I will give a few examples taken from my personal use of Facebook, highlighting above all the power of production of syncretic texts allowed by this platform and the effect that these texts have on the idea of interaction, as well as on the presupposed principles that should define interaction and the individuals taking part in it. I agree with most scholars hypothesizing that digital media constantly transform the sense of some concepts such as, for example, everyday life, communication, participation, reception and identity. Is this so bad anyway? From my point of view, the becoming of concepts in time and space is unavoidable. We should accept it and discuss it, scientifically, focusing on the relationships being established between the different metalanguages used, in the past and in the present, both by scholars and ordinary people.

Nobody has a privileged perspective that is able to apprehend a total universe and every point of view is subject to the dynamism of time. As Bateson writes: "data are not events or objects but always records or descriptions or memories of events or objects. Always there is a transformation or recoding of the raw event which intervenes between the scientist and his object […] Moreover, always and inevitably, there is a selection of data because the total universe, past and present, is not subject to observation from any given observer's position" (Bateson, 1972, p. 15). If we keep in mind this aspect, brilliantly stressed by Bateson, any research – independently from the specific topic tackled – is autoethnographic: it inevitably focus on the process of transformation and selection brought forward by the subject observing and participating.

4. The everyday and Facebook

The auto-ethnographic aspect of this paper begins when I created a Facebook account, some years ago, to share information primarily regarding seminars and conferences. Later, realizing the influence that Facebook might have on myself as an anthropologist, I began to take a closer interest in this social platform and its users, by posting both written texts and photos, with the aim of understanding which forms of specific interaction could take place among interlocutors, as well as between written and visual texts. Little by little, my occasional practice became a sort of personal diary and turned, afterwards, into proper field research that focused on both the everyday and social media. But before I could turn my attention to social media, my primary interest now, my time on Facebook had already been taken up by the everyday: an everyday intended not so much as a boring routine as a tangle of actions and thinking to focus upon. How do we think and act in our daily life? And how is the cognitive dimension specifically associated to the pragmatic dimension? Unfortunately, the everyday has not always been a central field of study in anthropology, and answers are difficult to give in any case, maybe due to the fact that we are so immersed in the temporal flow that it is difficult to capture the everyday's fleeting and ordinary dynamics. But isn't precisely for its elusiveness that it is interesting to immerse oneself in its challenging exploration? It is obviously easier to observe what is exotic or flashy than what is hidden by habits and routine. Nowadays, what's worse, it is even more demanding to accomplish a thorough anthropological exploration of the everyday because of social media: social media are integral part of the everyday, contributing to transform it into an interactive and immersive entity. Like it or not, digital media and persons have gotten closely intertwined in recent years. People live online and, simultaneously, in the so-called daily life: we are so much included in this invisible intertwining that, often, we don't realize how rapidly our everyday is conceptually transformed and how much strength digital media have acquired, technologically, in our present time. This applies to me both as an anthropologist and common person: even though I try, in an ethnographic key, to observe Facebook as an objective medium, I am myself included in its transforming and immersive network.

I have several research interests – difficult to say what is only contained in the sphere of anthropology and what is strictly personal – combining the everyday and social media: the interweaving of individual will and cultural orientation, the translation of direct experience into texts, the connection between writing and image, the relation between literature and its

conceptualization. These interests are, more generally, connected to the meanings people give to life. In order to better grasp the meaning of life, in my opinion, research has also to be oriented towards the study of everyday practices, by emphasizing the ways in which, in life, chance and projects meet or collide and are carried out by single individuals. I think that a partial displacement from an anthropology focusing on culture to an anthropology focusing on life/existence would be fruitful. That said, a point is certain: it is easier for the extraordinary events to catch scholars' attention; ordinary events, instead, tend to be easily overlooked and taken for granted. Another point of friction is that anthropology has been more concentrated on exotic peoples and places since its beginnings. Needless to say, there are good reasons to focus, today, on our own societies. As Perec recalled in his own time, an endotic anthropology would be pertinent to give weight to the usually neglected common things of the everyday and look at our way of life in a different perspective: "We sleep through our lives in a dreamless sleep. But where is our life? Where is our body? Where is our space? How are we to speak of these 'common things' […] What's needed perhaps is finally to found our own anthropology, one that will speak about us, will look in ourselves for what for so long we've been pillaging from others. Not the exotic anymore, but the endotic" (Perec, 1997, p. 210). Therefore, a first step should consist in studying, without prejudices, ordinary events and everyday life for their own richness displacing attention from faraway people (Bégout, 2018; Sheringham, 2006).

In the past, in anthropology, the tendency was to focus on the notion of culture taken as a conceptual gate for the analysis and interpretation of faraway societies. The field of daily existence and the meanings produced by people, for this reason, were often overlooked to the advantage of a more generalized whole meant to be culture. Of course, there are important exceptions, more recent in time, concerning anthropologists foregrounding persons and their existence independently from their geographic belonging (Piette, 1992; Jackson, 2005; Jackson, Piette, 2015). Besides more recent studies, a less visible anthropological line of thought has crossed the story of the discipline with respect to the notion of existence. For example, a remarkable scholar who comes to mind, back in time, is Van Gennep and his *Rites of passage*. In his conclusions, Van Gennep explained that, by studying rituals, his intent consisted precisely in grasping the meaning of life: "life itself means to separate and to be reunited, to change form and condition, to die and to be reborn. It is to act and to cease, to wait and rest, and then to begin acting again, but in a different way. And there are always new thresholds to cross" (Van Gennep, 1960, p. 189). I am specifically

referring to Van Gennep because his original text belongs to the foundations of modern anthropology and he is primarily known for his theory on ritual, but much less for his effort to define the meaning of life. This means, in short, that there has been an attention, since its beginnings in anthropology, to the notions of existence and life, but more implicitly and sporadically. Other examples could be given, but what counts is that an implicit attention to this subject has never been transformed, in the past, into a persistent and coherent subject to focus upon. A text which, more than others, deserves a place of its own – setting a precise direction in the study of existence in its ordinary aspects – is *The Practice of Everyday Life* by de Certeau.

In this text, de Certeau opposes the tactics of humble people and the strategies of the powerful. He considers the everyday as the basis for a social transformation brought forward by common people and their creative tactics. He makes a distinction between tactics and strategies: tactics are the daily actions through which the weak manifests his autonomy from the dominant forces; strategies, instead, operate through the system, imposing rules onto the common man. What is extremely interesting is that tactics are creative and represent the basis for a transformation of the daily life of common people. This is even more interesting if we consider that, at the time in which de Certeau lived and wrote, information technology had not yet had this great diffusion and many social media did not even exist. Above all, when de Certeau was doing his research, there was no such amplified intersection between the everyday and media practices. Since de Certeau's time, then, a new horizon of studies has opened up, but his research still remains an example for at least two reasons. Firstly, because he advanced the idea that daily practices have a creative level that can also be a way to evade and even fight impositions from above: in his volume, alluded, more specifically, to different and common practices such as walking, talking, reading, residing, cooking, shopping. Secondly, de Certeau also remains a good example for the weight he gives to the everyday hero, to his elusive and yet inventive practices, capable of removing the force of orthodoxy. In this regard, just to give an example, it is useful to pay attention to what de Certeau says concerning the practice of reading: "Reading is thus situated at the point where social stratification (class relationships) and poetic operations (the practitioner's constructions of a text) intersect: a social hierarchization seeks to make the reader conform to the 'information' distributed by an elite (or semi-elite); reading operations manipulate the reader by insinuating their inventiveness into the cracks in a cultural orthodoxy" (de Certeau, 1984, p. 172). What applies to the practice of

reading, also applies to the other practices already considered by de Certeau in his research, such as, for example, walking or cooking.

The main point to stress today, while keeping in mind social media as a focus, is that, in order to understand and even produce culture, it is also necessary to 'make room' for the common person in his many – online and offline – ordinary activities. Isn't, then, Facebook an opportunity to concentrate on the common man and on the present daily life? In his own time, de Certeau's research already reformulated daily life: he praised the common man opposing to power and he focused on apparently less meaningful activities. Nowadays, social media and information technology give a new impulse to this research more based on the ordinary than the extraordinary and the exotic. There are many ways to take Facebook into account and different perspectives are obviously desirable to understand such a complex tool as a social platform. Maybe one of the anthropologists who has worked the most in this field, in recent years, in an ethnographic perspective, is Daniel Miller. His research on Facebook has been carried out alone or with other scholars. More particularly, Miller focused on the specific uses of Facebook in Trinidad (Miller, 2011). Miller also adopted a comparative perspective – involving several field researchers, operating in different countries – in order to analyze the reception of Facebook in several societies (Miller *et al*., 2016). Miller also took into consideration the images posted on Facebook to better understand the function they perform in different cultures, showing that, more than a generalized referential effect, the image often fulfills the role of communicating the users' subjective experiences (Miller & Sinanan, 2017). As far as I'm concerned, instead, I privilege the investigation in the first person, observing and participating in a more auto-ethnographic key, by taking into account the Self has a fundamental element for the success of research (Coffey, 1999; Collins & Gallinat, 2010).

The first thing to stress is that I am a mediated subject and anthropologist. I mean, by this, that I have recourse to social media but, at the same time, I am a subject whose agency is the result of my being also acted by social media: I carry out my role as a subject and I am substantiated by social media and by the different roles taken in my interaction with other people. In my perspective, it is not a pure question of communication or sole socialization, but also of processes of constructing identities and subjectivities. To put it simply, the 'I am' and the 'I do' are closely intertwined with the 'I think' and 'I feel' in a process of dynamic becoming and interacting with other people. This has advantages and disadvantages: I am myself an insider in Facebook with first-hand

information concerning myself, obviously, but I also have to construct my own changing field site, adapting to it (Gupta, Ferguson, 1997). In a way, I am freer than an ethnographer being compelled to work in a specific circumscribed space; at the same time, my role, depending on circumstances and interactions, is more unstable and more subject, for better or for worse, to different contexts: I am home and it is a field site; I am outside, walking, and this is also a field site where I have the possibility to connect myself independently from specific spaces, while the everyday itself is also within reach any time. Every moment is the right moment to observe and participate. One only needs to be willing to do it. Today, for example, I got up, had a coffee and casually glanced at Facebook. I began to scroll through the pages and, all of a sudden, I saw a photo I posted some time ago: someone shared it without my authorization. I'm glad that someone – PG – shared it on Facebook in his group specifically created to circulate beautiful photos. What is, then, the problem? My name is not shown: the name of the author. This isn't the first time this user shared my picture without attaching my name. I asked PG – a friend on Facebook – why she didn't care to put the names of the authors on the photos she shared. The answer was: it would be a further waste of time and energy. In some respects, she is not wrong: in the group she created, what counts is the beauty of the photos – the reception by other people – and not the attribution of the photos to a specific author. It is as if PG said: let's get to the point, to what interests us, leaving the author's production and intentions in the background.

It's not the first time that this happened. Some time ago, a photo of mine was chosen by an online artist as a model for her watercolor. In this case, my name was expressly associated with it and I was delighted to see 'my art' recognized. It remains that, by allowing sharing, Facebook creates a circle of references in which, for the most part, the author is not central or, anyhow, is not a connecting element between production, product and reception. More generally, these are two examples – among others – confirming the existence, on social platforms, of a paradigm of thinking based on the modification of the relationship we usually have with works in terms of reception and production in real life: on Facebook, basically, it is not so much the author who is the origin of the creation process that matters as much as the circulation of images and messages. These examples have a close connection with another interesting debate that took place in anthropology concerning the place to be assigned to the author-anthropologist in the production of his works. More particularly, Geertz dedicated a work to this topic: how anthropologists write and what persuasive power their writings possess (Geertz, 1988). Geertz remarked

that the anthropologist who writes conveys a content – his experiences in the field, the interactions he had with natives and his resulting ideas – but also a capacity to persuade the reader. This persuasive force exerted by the anthropologist on the reader is the result of the anthropologist having been directly on location and having had direct experience of the facts he narrates. In what, then, more exactly, lies the authenticity of the anthropologist's story? In his being the author of a text that tells his lived experience proving it. The specific analyses made by Geertz of various anthropologists refer to Foucault's hypothesis according to which the author, in the history of Western culture, is not always present in his writings – regardless of whether it is literature or science – and, consequently, is not given a fixed value of origin and authenticity for what he produces (Foucault, 1969). For Foucault, more precisely, the author is a discursive function and not a stable element that would invariably produce authenticity in every culture and time.

Foucault's hypothesis is also applicable to Facebook, a social platform in which the tendency is to blunt the effect of authenticity – or artistry – of works circulating on the net: in other words, the circulation of written messages and images doesn't always require an authentication by a producer. Facebook is in fact based on a communication model that dilutes the function of the addresser – or producer – to the advantage of the function concerning the addressee. It is as if, on Facebook, all the addressers of message were on an equal position with respect to a generalized competence and with respect to the right to speak and receive messages; reception doesn't require, in its turn, an origin guaranteeing the authenticity of the message. Not only, on Facebook, are the relations between public and private domains reset but, more specifically, are also reconsidered the usual communication functions. This is possible, I suppose, because spatial and temporal barriers – usually associated with *in vivo* communication – are dissolved on Facebook, a platform where users have greater freedom and can say things that, in face-to-face interaction, wouldn't be accepted. The notion itself of identity, as consequence, becomes fluid: the more decontextualized the communication, the greater the orientation towards a fluid identity or, in principle, less rigid roles. Along the same lines, I enjoy myself inventing, from time to time, some alter-ego who speaks in my place. Today, for example, I posted a photo of mine in which I portrayed myself, from below, with long, dangling hair. I am the subject in the photo, but I maintain that it is Attanasio, an alter ego of mine. I wrote that Attanasio had long hair last year because he was already on vacation, he

went to the beach and relaxed, but now that he is at work, he is very tired and his hair suffers.

There is something true about what I wrote on Facebook, but this is not the point; the fact is that, by using an alter ego, I can also joke around, perhaps freely exaggerating, at the same time interacting with my friends and maintaining a contact with them (the so-called Jakobson's phatic function). Of course, users' reactions are different in some cases: those who know that Attanasio is my alter ego joke about it and make fun of me, pleasantly interacting with me; those who don't know about it put up memes of astonishment and distance themselves from the post. This is a game I often play on Facebook – a game that I enjoy a lot. In some respects, this game has to do with the question of authorship and identity that I previously took into account. What's the use of inventing some alter egos? What's the need? My various alter egos allow me to have a more playful life and, at the same time, to contemplate other forms of identity or, however, to soften some rigid features of my own personality. As a matter of fact, becoming someone else is not only a way to have fun. It is also a communication strategy demanding adequate reception. If I joke around on Facebook, the addressee of the message has to adapt himself interacting along the same lines: I joke and I expect the addressee – when it is his turn – to start joking too. It is a mode of address that demands significant precision. It is not a coincidence that I am overtly referring to play: playing and joking are ways, for children, to learn flexibility (Bateson, 1972). If, for a child, play is essential in order to learn to be flexible, it is equally important, for an adult, to keep on playing in order to maintain flexibility, as well as to have the opportunity to play other roles, or to abandon routine for a moment.

More generally, social media give this possibility to play with flexibility because they blur distinctions and force us to rethink – often implicitly – notions such as identity, subject, seriousness or play. On closer inspection, even in the real and true world different roles intersect (for example, I am a teacher, a father, a researcher, and so on); in digital platforms, however, this effect is amplified. If used correctly, then, Facebook helps to ask the old philosophical question relating to identity – who are we really? – in new and even wittier ways. Obviously, having this possibility doesn't mean that everyone, without distinction, always makes use of it or would like to make use of it. But, beyond differences and given different situations, what counts here is that some important notions – such as authorship, subjectivity, identity and interaction – are usually brought forward by Facebook. To talk about it, in this essay, I followed, for strategic reason, the course of my own day. During my day, another element – apparently meaningless – has to be

remarked: I took some notes and I posted them on Facebook. This is something that I often do. What does it mean more particularly? The fact is that I also use Facebook as if it were a paper notebook: I post on Facebook ideas – in the form of short notes – that come to my mind and which I want to use, sooner or later, in some longer essays; sometimes, alternatively, I post a few lines – as a reminder – to write down a fragment of the day that I want to recall in the future and on which I want to work. Basically, instead of using a real notebook I directly use Facebook. Why? Is there some greater meaning beyond convenience? Firstly, it is playful to write down some ideas and to unintentionally recall them, from time to time, by scrolling down Facebook. Secondly, by publicly posting some notes on Facebook I can interact with other users and better reflect on what I intended to write. This is an advantage, compared to a paper notebook, because I can modify what I think and rewrite it on the basis of the feedback that I receive from others reading my posts. Basically, on Facebook, interactions with friends are fun; furthermore, interactions are a means, for me, to be critical about my own ideas and writings. Having continuous feedback, using a real notebook, wouldn't be possible. Facebook, instead, always allows different interactions with users, who can comment and, in turn, receive answers, in a sort of enriching and fertile dialogue.

At this point, I think time has come to conclude. To end, I would like to emphasize the fact that, to write this essay, I followed the course of my day. I used this strategy to connect the everyday and Facebook. I also did this to give some examples concerning significant notions permeating Facebook, a social platform become, for me, an object of auto-ethnographic study. My whole essay has, in any case, an auto-ethnographic orientation, with respect to the way I deal with languages and metalanguages, with the polysemy of some concepts such as simulation and technology, with media realities and reflexive research, with the everyday and its connection with Facebook itself. Rather than making a difficult summary, here, as a conclusion, of the questions addressed – somewhat distorting the linear ethnographic orientation that I adopted – I prefer, instead, ending with a quote by an anthropologist who precisely refers to the ethnographic methodology and its relationship with the human. I share his viewpoint: "the issue becomes whether ethnographic methodology can perpetually recuperate the human among those marginalized and expanding groups of quasi-humans (the virtual, digital, criminal, insane, and insurgent), or should it relinquish its role in policing those borders to reconceptualize the existing results and future strategies of the discipline? The answers must be 'yes' […] But we are not there yet" (Whitehead, 2012, p. 227).

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3. Scientific Discourse and Social Media. The Reliability of Information Sources and the Figure of the Expert in the Post-Truth Society

Marianna Boero[1]

Abstract

Social networks represent a more immediate way for researchers to communicate with the audience, dismantling the old epistemic hierarchies. In this sense, the ongoing social media revolution reconciles science and society. Alongside this advantage, however, the concrete use of social networks in scientific debates poses some critical issues, such as the increasing feeling of distrust for the expert knowledge, stimulated by the perceived wisdom of influencers on the Internet and social media. As various authors have argued, the gap between scientists and users' opinions on technical subjects, such as the climate change, the safety of vaccines, the safety of foods etc., is increasing. The possibility of debating of science on social networks highlights even more the difficulty of separating facts and opinions, reliable and false information, with the risk of spreading false news, intentionally or unintentionally. This process causes, moreover, a crisis of the figure of the expert, that is increasingly questioned by virtue of the spread of misinformation and disinformation, often amplified by social networks. The modern campaign against Covid-19 vaccines is a clear example. The aim of this contribution is to cross and deepen the described issues, as part of a broader reflection on the theme of fake news and post-truth. After an introductory section dedicated to the connection between social networks and scientific discourse, the paper will focus on the crisis of the figure of the expert at the time of social media, also analyzing the role and reliability of scientific sources in public debates and the contribute of the semiotic gaze in the description of the phenomenon.

Keywords: Semiotics, Post-truth, Fake news, Expert, Social networks

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1. Introduction

The advent of social media and new communication and information technologies has had a significant influence on scientific discourse in various fields. The research planning and development process is largely affected by the impact of the new dynamics of communication and interaction on social networks. The latter are used by scientists for professional reasons, to communicate with the public, to promote their research, or to create fruitful connections with physically distant people. Platforms such as *Academia*, *ResearchGate*, but also *LinkedIn*, seem to be essential to disseminate research products and initiatives; moreover, the use of social networks such as *Facebook*, *Twitter*, *Instagram* can have a key role in the spread and valorization of researchers' image and interests: then, the construction, sharing and promotion of the research products are modified by the participatory value of culture 2.0. The possibility of commenting on articles, posts, videos, initiatives is an example of such a process, unthinkable before the advent of social networks. Social networks also represent a more immediate way for researchers to communicate with the public, but also a space for discussion, a place for debate and dialogue between experts and citizens. In this way, science appears more accessible and closer to the audience.

Alongside these advantages, however, the concrete use of social networks in the scientific debate poses some critical issues. Indeed, the audience participation implies the possibility for social network users to comment and intervene even on technical and difficult topics, to question skills and data, favoring opinions, experiences, and personal feelings. Science on social networks highlights even more the difficulty of separating facts and opinions, reliable scientific information and false information, with the risk of spreading false news, intentionally or unintentionally. This process causes, moreover, a crisis of the figure of the expert, that is increasingly questioned precisely by virtue of the spread of misinformation and disinformation, often amplified by social networks. The case of vaccines in the period of the Covid-19 pandemic, but also the debates on climate change and other scientific topics, are clear examples of this process.

The relationship between social networks and scientific research is therefore controversial. How can a citizen check the veracity of data and statements, distinguishing between reliable sources and fake news? Likewise, how can a researcher exploit the advantages of communication on social media without penalizing the solidity of scientific studies and claims? Starting from these questions, the aim of this contribution is to cross and deepen the

described issues, as part of a broader reflection on the theme of fake news and post-truth. After an introductory section dedicated to the connection between social networks and scientific discourse, the paper will focus on the crisis of the figure of the expert at the time of social media, also analyzing the role and reliability of scientific sources in the public debate.

2. Scientific discourse and social media: a controversial relationship

According to historical evidence, the birth of the Internet is linked to purely scientific needs: at first, as a technological tool capable of connecting the scientific communities spread across the US and subsequently as a means of hypertextual sharing of digital texts at CERN in Geneva. The extraordinary impact of the Internet on science discourse reveals a profound change in the relationship between science and society, since the Internet allows unprecedented forms of collaboration and cultural co-production not only among scientists but, above all, between scientists and the general public (Cavallo & Spadoni, 2010). The most recent developments, such as blogs, tagging and social networking, collectively known as Web 2.0, have further expanded the number of available tools, so that today it is possible not only to consult the information already present on the net, but also to publish new information, to create (and manipulate) contents, making it necessary for journalism, marketing, politics and even science to adopt new ways of thinking and acting (Avveduto, 2015).

More and more researchers have begun to work using these tools, with positive repercussions both on contents update and in terms of widespread diffusion of the science itself. There are also advantages in terms of creativity and participation, with a positive impact on productivity. Scholars have always built their knowledge of the world starting from the work of other researchers, perfecting their own concepts and those of others through open debate. However, the potential offered by the web has made it possible to create collaboration networks between scientists and research communities, going beyond space-time frontiers. Through the Internet, every researcher does not address only to peers but to a potentially global audience, breaking down the barrier between "communication within the scientific community" and "communication with the outside". Thus, a different idea of doing science emerges, more participatory and interactive, less hierarchical. Waldrop (2008) uses the expression "Science 2.0" to describe it, indicating that this web-based science 2.0 is not only more collaborative than traditional science, but also much more productive.

The world of science and Web 2.0 adopt very similar philosophies, with common traits that become more and more evident. It is not a coincidence that in this climate of interaction a new figure is born: the "prosumer" (Ritzer, Dean & Jurgenson, 2017). The name comes from the fusion of the terms "producer" and "consumer" and refers precisely to the way of participating in the scientific community. The purely vertical information structure disappears, having the possibility to interact with anyone within the network and to share contents without limits. Each researcher becomes at the same time producer and consumer of information, accelerating the development of knowledge through the exchange of experiences and opinions. The revolution through the world of the web has therefore led to the sharing of information, that is increasingly free to circulate and generate knowledge. This process has favored the birth of real communities of scientists in various research fields. Exchanges and meetings are the contact points between the various communities, and the web platforms are increasingly configured as a social space. All this has made it possible to further expand the boundaries of knowledge. Researchers can meet and network even if geographically located in different departments or nations, exploiting the many possibilities that Web 2.0 offers them (Fedeli, 2017).

However, alongside the described advantages, the relationship between scientific discourse and social media appears controversial. A first critical aspect concerns the possibility for the non-specialized public to access scientific information available on the web, with the risk of distortion, misunderstanding and hyper-simplification of the message. Through social networks, even the non-expert public can freely intervene on any topic of a scientific nature, even if such topics do not belong to their own field of expertise. In such a scenario, conspiracy theories spread, with the consequent distrust towards the experts' opinions and the political decisions regarding public health, environment, science, and it is difficult for the public to check the reliability of a source. Contents, experiences and opinions shared on social networks by influencers and virtual contacts can be considered reliable as well as scientific reports. The number of likes and the type of reactions associated with a post or comment contribute to the authority and effectiveness of the communication. Consequently, users do not necessarily carry out further checks on the veracity of an information and believe that the information they have obtained through social networks is actual and appropriate. Social networks are in fact very often used as reliable sources, as documentation tools, and news spread primarily through this type of channel rather than through traditional media. Furthermore, information that do not correspond to the truth can become viral, appealing to emotions such as fear,

love, nostalgia, anger, etc. Personal opinions and objectives facts are confused in the new communication context, distorted and manipulated contents spread through the web, creating a fertile ground for fake news diffusion.

Another critical aspect concerns the way in which researchers use social networks for professional and private purposes. Indeed, there are social networks that allow researchers to promote and disseminate the results of their research, to reach a potentially global audience, to create research networks, in a virtuous circle. *Academia* and *Research Gate* are examples of a professional use of social networks. Scholars can share their research interests and establish a synergistic collaboration with other scholars all over the world, with positive repercussions in terms of research opportunities. If through social networks like *Academia* or *Research Gate* the scholar turns to the peer network, through social networks like *Facebook* and *Instagram* the tone of communication changes since researchers interact with the wider public of non-scientific people. These social networks are virtual *arena* of public debate and offer a gaze on the private life of the user, through photographs, video and other shared contents. In this way, they can have an impact on the scholar's personal image. On one hand, public issues become private; on the other hand, moments and aspects of private life become public. There are numerous examples of this phenomenon. Among them, the use that virologists have recently made of social networks, on the one hand communicating scientifical data on Covid-19 pandemic, on the other hand sharing their personal opinions on the most disparate social and cultural facts, not necessarily related to the health field. The insertion of private issues in researchers' public profile on social networks can have repercussions on their professional identity, thus requiring keeping under control the different images of themselves that are inscribed on the various social platforms.

Social media have therefore introduced new promotion and dissemination possibilities for scientific discourse, but at the same time they represent a place for questioning the same. The area of action of scientific discourse is thus eroded by other social discourses, such as journalism, but also advertising, television, tourism, politics, creating unprecedented spaces for interaction between the subjects involved (Boero, 2018). In the next paragraphs we will deepen these aspects, talking about the problem of the reliability of information sources and the "crisis of the expert".

3. Post-truth and fake news: the reliability of information sources

In the current communication context, social media are among the preferred information channels for users. Contents disseminated through social networks are considered simple, clear, reliable by users. However, the growing diffusion and importance of online and social media raises serious concerns over the quality, accuracy and credibility of circulated information and knowledge: countless contents published online are shared on social media without any control from a scientific point of view, and in a very short time can reach a high number of views. While certainly contributing to a greater pluralization of our information ecosystem, social networks stimulate the creation of "echo chambers" that amplify and reinforce existing views rather than support confrontation with dissenting perspectives (Lorusso, 2018), thus contributing to a faster and deeper polarization of opinions. This has been particular evident in the last two years. In the period of the Covid-19 pandemic, fake news and misinformation about diseases and medical treatments spread quickly and pervasively through the web. Controversial tweets, posts, comments contribute to strengthen the lack of trust in science and in the skills of experts. The phenomenon is not new. Conspiracy theories, "hoaxes" and fake news have always existed and circulated. Nowadays, what changes is the context of communication, in which relational and symbolic exchanges are increasingly outlined on social networks (Ferraris, 2009). On social media, the sphere of public opinion is fragmented into an archipelago of homogeneous communities, whose point of view, in the absence of a real exchange with those who think differently, tends to polarize. The individual is frequently exposed to incorrect information, without having the opportunity to access different contents that would represent a necessary counterpart for the formation of critical thinking.

While distrusting in journalism, readers are strongly influenced by the news that is shared on social media by virtual friends and close contacts, who often have the same point of view. Furthermore, the public internalize both the content and the emotions of those who propose it. The consequence is a general vindication of the opinion of the individual and of their autonomy from any rational and scientific consideration. Lorusso (2018) describes this phenomenon by analyzing the meaning of the word "post-truth", highlighting how it is linked to an evolution of thought strongly conditioned by the change that television has experienced since the 1980s. The gap between entertainment and information has increasingly narrowed in favor of information that was also entertainment (infotainment) and gradually towards a TV increasingly interested in representing reality, but a reality that is

necessarily manipulated and constructed. Reality shows and talents have already weakened the idea of reality and, consequently, of truth. However, in the current communicative context, reality and fiction are intertwined and often confused in an even greater way, in a cultural logic that rewards emotions and identifications rather than skills. Daily life is exasperated, and intimacy becomes a parameter of truthfulness. In a horizon of this type, if private experience and emotions are placed before judgment, it becomes increasingly difficult to establish the truthfulness of a news (Ferraris, 2012). Truth as a criterion of absolute judgment has weakened more and more in favor of a plurality of truths that find infinite multiplications on the web.

This context creates the favorable ground for the spread of fake news. Fake news has been a relevant topic of public debate since at least 2016, together with the cultural and epistemological context in which it flourishes: post-truth (Riva, 2018). Fake news and post-truth are topics clearly related to communication: it is worthwhile to discuss them from the point of view of semiotics, to understand whether semiotics can study these topics and what tools it can offer. It is not possible here to give a complete account of the debate on fake news classification, but it is useful to outline the most recurrent categories. A first distinction is made between disinformation ("inaccurate or manipulated information/content that is spread intentionally") and misinformation ("inadvertent or unintentional spread of inaccurate information without malicious intent"). The second step is to realize that fake news is only a part of a more general phenomenon, a new way of conceiving truth that has been indicated with the expression "post-truth" (Polidoro, 2018, p. 190).

According to the *Oxford Dictionaries* (2016), "post-truth" is an adjective "relating or denoting circumstances in which objectives facts are less influential in shaping public opinion than appeals to emotions and personal belief". This explanation clarifies that the prefix in post-truth has a meaning more like belonging to a time in which the specified concept has become unimportant or irrelevant.

There are two main aspects in this definition of post-truth. The first is that post-truth is characterized by the fact that in public debate our emotions, or what we already believe, prevail over rational argumentation. The second is that the consequence is a general disregard towards truth (Vattimo, 2009): truth is not considered central in the fixation of belief; it is more important that our initial point of view prevails. Fake news and post-truth weaken the role of rational or reasonable argumentation in public debates, substituting them with emotional and/or surreptitious arguments. They allow public argumentation to be based on false premises.

Fake news can be seen as a special species of disinformation. Fake news reports exhibit a lack of truth, but they need not be literally false. They may just be misleading in that they state something there is literally true but conveys something false. Not all false or misleading news report are in turn fake news: in advert journalistic errors should clearly qualify not as fake news. What turns false or misleading statements into fake news is a lack of truthfulness: fake news goes along with the intention to deceive or bespeak a disregard for the truth, in which case they fall into the category of "bullshit" (non-sense, trash) (Polidoro, 2018, p. 191). Fake news is news that does mischief with the truth in that it exhibits both a lack of truth and a lack of truthfulness (Marrone, 2017). It exhibits a lack of truth in the sense that it is either false or misleading and exhibits a lack of truthfulness in the sense that it is propagated with the intention to deceive or in the manner of bullshit.

Traini (2018) describes some fake news discourse strategies: documentality, storytelling, visual exaggeration, no call for interpretation. Documentality deals with referencing, with the "exhibition of proof". A photo, a witness, a document can be used as a guarantee of the veracity of what is being stated. The effects related to this strategy are indignation towards the status quo and call to action, for example the request to share a post on one's own timeline[2]. Storytelling deals with the narration of a story with omission of parts or with a manipulated chronology. Visual exaggeration deals with techniques such as the use of capital letters, of close-up photographs. The aim is to appeal to the emotions of the public and obtain indignation. The fourth strategy, no call for interpretation, deals with post or articles that do not require efforts of interpretation by the reader nor critical abilities. All ambiguity is cancelled out and the tendency is to guide the story through predictable and unproblematic scenario. All these strategies contribute to the effectiveness and trustworthiness of fake news discourse.

The spread of fake news in the context of post-truth society has led experts to deal more with the world of social media than in the past. Not only with social networks dedicated to research, like *Academia* or *Research Gate*, but also with commonly used social networks like *Facebook*, *Instagram Twitter*, to control the disseminated contents and give themselves the opportunity to reply. The attempt has not always proved effective, given the difficulty of the experts to get in tune with the social media audience and the way of communicating that characterizes this medium. The risk is the polarization of different positions, with the consequent difficulty of communication and

[2] See Mangiapane (2018) for a comparative analysis of fake news strategies in the Italian context of communication.

comparison: a polarization that, as we will see in the next paragraph, is at the basis of the lack of trust in the figure of the expert.

4. The crisis of the expert

In a recent work, Marrone and Migliore (2021) describe and specify the role of semiotics in investigating the "expert competence". The field in which the theory of signification has most worked on the theme of competence is that of narrativity. The starting point is the Chomskian notion of competence, understood as the ability of native speakers to produce an infinite number of syntactically well-formed sentences. According to Greimas and Courtés (1979), competence is not a thing in itself but a particular case of a broader phenomenon, which, under the generic denomination of competence, is part of the problematic of human action and establishes the subject as an actant, whatever the field in which he practices. Thus, any action, in order to be carried out, must presuppose its potential, a know-how; in technical terms, if the act is "making being", competence is what makes being. The linguistic theory thus merges with the narratology of Proppian origin and in particular with the ethnosemiotic concept of qualifying proof, an action necessary for the hero to acquire the necessary means for the accomplishment of the decisive fight against the antagonist. It is retranslated in a semiotic sense in terms of a theory of modalities: competence, conceived in this way, is a modal competence, which can be described as a hierarchical organization of modalities (it will be founded, for example, on a wanting to do or having to do, that support a being able to do and a knowing how to do). The task of semiotics will therefore be to build models of modal competence, which, based on the analysis of narrative discourses, are applicable to non-linguistic semiotics of the natural world and serve as premises for a semiotics of action (Bertrand, 2021).

From a narrative point of view, competence should not be understood so much as a property of the "subject of doing", but as a process within which it is acquired (or lost). As argued by Marrone (2021), the definition of the expert from the semiotic point of view is complex: considering the canonical narrative scheme, the expert is both the receiver and the subject, the initial receiver (the contractor) and the final receiver (who evaluates the execution of the contract and pronounces a verdict); he is gifted with competence and at the same time performs the performance. Faced with this syncretism, we understand the reason why these qualities of him make him desirable on the media scene perpetually seeking a stabilization, even momentary, of the rich

and elusive sense that regularly appears on his screens. However, these same qualities make the expert special, given that in the contemporary episteme "competence" tends to be considered a value. The expert designates a thematic role; its basic and almost exclusive modalization is knowledge. Almost exclusive modalization, given that it seems to exclude power, when the latter, to exercise itself, relies on that previous knowledge, giving it legitimacy. The ambiguity of this modal relationship is one of the first reasons for suspicion. Knowledge is actually the core of the particular authority recognized to the expert. This cognitive competence is valued according to the supposed complexity of the world to which it refers. The knowable, as the progress of the sciences goes on, is divided into progressively finer sections, in space and time and implies new strategies for observation, conceptualization and argumentation, whatever its domain of action (economics, biology, computer science, ecology). The credit recognized to the expert is based on the mastery that he exercises over one of these domains.

Nowadays, however, the figure of the expert is at the center of numerous debates and is characterized by an inedited crisis. The loss of representativeness by various public and private subjects; the direct access through the Internet to information and products of all kinds; the possibility of communicating immediately on a global level: these are some recent phenomena that seem to have undermined the functions of orientation, criticism, validation, and mediation that characterize the work of professional figures. The crisis of expertise coincides today with the role that political and scientific decisions have assumed in addressing and solving community problems of massive extent, from environmental pollution to immigration, from vaccines to pandemics. On one hand, there is a need for specialist skills, to cross and translate different kinds of knowledge. On the other hand, these knowledge and skills are questioned and opposed (Marrone, 2021).

The expert is a subject who, having developed knowledge, skills, and experience, is able to validate information, to provide the public with reliable data, to propose interpretations, paths and solutions. However, the trust in the experts is weakening. There are many areas in which this is happening: culture, medicine, psychology, journalism, environment, etc. The users can get any kind of news, information, service, product, directly and instantly from the Net and from technologies. For this reason, they no longer need intermediaries, mediators, and experts. Technical skills and knowledge are not considered more reliable and influential than an opinion or an information available on the web. There are various causes attributable to this crisis. Social dynamics, transformations in the field of communication, but also the traditional distance between intellectuals and the mass public. Another reason

for the crisis of the expert is the speed with which knowledge travels today in all fields of information, producing continuous relativism, overcoming consolidated paths with a continuous and rapid evolution.

Another cause can be found in the actual tendency to simplify / trivialize aspects, problems and discourses belonging to the most varied fields, without neither deepening the topics nor identifying the multiple connections among them. This approach favors simplification over complexity, reductionism to intertwining, unconditional adherence to critical thinking, elements functional to a fast, immediate, repetitive consumerism. Another phenomenon has contributed to creating the situation described above, a "rhetoric of participation", emphasized as symbol of inclusion and access. Such a rhetoric spread in several areas, while participatory practices are often limited to proclamations, instrumental practices of sharing, that are far from real participatory processes. These actions have generated ambiguity and confusion, making it difficult to distinguish and differentiate roles and responsibilities.

Redefining relationships is a central point for the inversion of this process. Already Edgar Morin and Norberto Bobbio conceived the role of the expert not only as someone who possesses certainties, knowledge, solid, stable and permanent skills, rather as someone who identifies needs, asks questions and doubts. Someone who recognizes how immense and limitless knowledge is, and who admits the limits of his own knowledge. The phenomena in progress require a redefinition of the role of the expert in this sense, rethinking tools, methodologies, relationships. On the contrary, today's risk is the tendency towards a hyper-specialization, which leads to the increasingly specific fragmentation of knowledge. From urban planning to anthropology, from medicine to culture, from biology to psychology, from economics to information, the ways to try to respond to these problems lie in the need to link separate, compartmentalized, dispersed knowledge. Indeed, only the connection of knowledge can consider the complexity of the problems and only the awareness of their interrelation can indicate effective solutions.

5. Conclusions: new trajectories of scientific discourse

The path undertaken allows us to reflect on the relationship between scientific language and social media from a social semiotic point of view. The debate on the reliability of the sources and on the competence of the experts can be inserted, in fact, within the changes that concern, more generally, the scientific discourse in contemporary society. Discourses "act" and "cause

action". As stated by Landowski (1989, p. 9), discourses create social acts that transform intersubjective relationships: it is necessary to understand, consequently, the interactions that occur, thanks to discourses, between individual and collective subjects. In this way the discourse becomes a space for interaction and social semiotics should study the social effectiveness of their trajectories. Indeed, in the system of social discourse – using Lotman's (1985) words, a "semiosphere" – the objects of meaning (the texts) travel trajectories that modify the system itself. According to Semprini (2003) in this continuous repositioning and in this continuous redefinition of discursive boundaries, it is important to pay attention to the conditions of manifestation of social discourses, as well as to their ability to create conflicts of powers and positions, beliefs and values: the social semiotic gaze thus becomes a real critical analysis of current society in all its discursive manifestations.

In the case of scientific discourse, the encounter-clash with other languages shows the attempt to redefine its areas of relevance to each discourse. Other discourses, such as journalism, politics, ethics, enter into relationship with scientific discourse and try to broaden their areas of action. This attempt, as we have seen, carries with it consequences, some of which are probably yet to manifest. Sensationalism, the mixture of facts and opinions, the lack of trust in skills are just some of the elements that emerged. At the same time, it is necessary to consider that scientific discourse also erodes, in a more or less intentional way, areas of relevance of other languages, such as advertising. An example is the video with which the Italian virologists decided to promote the vaccination campaign, with questionable results, as well as their entry into the world of mass media, primarily the television one. The elements of contamination among different discourses are therefore numerous and reflect the complexity of the social context in which we are immersed (Dominici, 2022). A context that can be described and understood only through a fluid gaze, oriented towards a continuous and synergic interdisciplinary dialogue.

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SECTION II

Humanities and Technology

4. New technologies and historical research of migrations. An example in the Sóller valley (Mallorca)

Antoni Quetglas Cifre[1]

Abstract

In the past decades, historical research has been helped by the arrival of new technologies to the archives repositories around the world. Thanks to digitalization projects, a large number of data is nowadays available to researchers, especially sensible records, often difficult to see for preservation causes.

In this chapter, we would like to expose how the technology improved the research of migratory movements, taking as example the case of the valley of Sóller, located in the island of Mallorca, and a place with an important migratory flow towards America and France.

Keywords: Mallorca, migration, digitalization, local history, Sóller

1. Introduction

Local history research, especially since the 70's of the past century, has experienced a large increase, thanks to the interdisciplinary focus that has arrived to the historical sciences and the use of other sciences, such as sociology, anthropology, economy or geography. In that sense, a small place like a town, a hamlet or a city, which is a historical result from a past place and time, can be studied from a micro point of view, using a detailed research that must be multidisciplinary. Furthermore, local history allow us to study the past of small locations, offering a vision of the single and collective motivations, which have caused the historical evolution of such a place and can be really interesting for the general public (Casanova, 1999). There are different approaches to study local history, being two of them the most important ones: the Italian microhistory (with authors like Carlo Gizburg, Giovanni Levi and Carlo Cipolla) and the English model known as *History Workshops.*

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In this context, local history has become key to develop historical research in the territories that formed the ancient Crown of Aragón (Valencia, Aragon, Catalonia and the Balearic Islands). In this area, as in a large part of the Western Mediterranean, there was an important migratory movement towards America from the end of the 18th century until the end of the Second World War (1945). The colonial expansion, the industrialization and the world wars, as well as internal factors, specific to each area, defined the evolution of the migratory currents. The colonization favored the displacement of Europeans, in search of better economic conditions and facilities in obtaining land. As example, in Algeria there was a great availability of land, since natives have been deprived of the right to property, and European colons controlled bureaucracy. Industrial development was another key factor regarding migrations, in that case usually between European countries. The status of foreigner has a legal meaning that related to differences between workers' rights, thus explaining worst working and social conditions for those who were foreigners.

Since the end of the 19th century, some authors and historical schools have formulated theories in order to stablish laws or common trends explaining human displacements. Amongst such theories, maybe transnationalism or the study of societal networks can include analytical frameworks that allow reaching wider explanations. Even so, it should not be forgotten that there are multiple factors related to migration and all of them must be taken into account when studying such a complex process. Other key concepts such as *migratory chain, migratory network* and *societal network* give prominence to the migrants, showing them as people able to create survival strategies and to connect with other people living around them, thus allowing the creation of large societal networks, allowing them to maintain their societal and cultural trends while receiving the influence of local characteristics. Moreover, the concept of *migratory chain* is linked to the capacity to cope with the migratory process and the relationship network between families. It must be taken into account the idea of "societal area", which is larger than the origin area of someone but reaches, during the 19th century, a surface of around 10-20 kilometers away from the emitters centers.

Regarding individual decisions, it is difficult to know a main cause that could explain a migration. The societal context, as well as economic reasons and cultural and political ones as well, can influence a decision. To complicate the research, it is sometimes not something related to one person but has deep collective thoughts from a whole community. The existence of a societal network of relatives in the receiving country can help to decide. In

that sense, the so-called migration chains could become true networks attracting people, increasing then the number of departures towards new territories. Such networks became a key factor for selecting a place to move abroad. They even can determine the migratory process from origin to destination (García Abad, 2001). All of those relationships form one of the so-called complex social sphere (Jofre, 1997). Thus, these social spheres respond to a set of reactions and activities, which is what is called a cultural area, according to F. Boas. This is, in the words of Jordi Casassas, “"the historical, geographical and social space defined by lifestyles, value systems, behaviors, political convictions and common religious beliefs” (Casassas, 2006). From such idea, the study of a migratory process must be undertaken from both a microanalytical and macroanalytical point of view, that is to say, to present the problem at a local level but within a general and international level.

It was the Annals, a French school of historiography, the first to assume the practical importance of a quantitative and serial history, supported by computer-generated calculations. Besides the possibilities of performing all kinds of serial and quantitative calculations, new technologies have changed the ways to communicate between people, within the fields of academia and research, as well as the location of information, documentation or bibliographic references amongst other changes. In that sense, we have witnessed the expansion of these resources through the Internet in recent decades. It has gone from data that could be found on static webpages to multiple and varied possibilities for interaction, collaboration and research: social networks, virtual encyclopedias-like Wikipedia-, websites of official agencies or institutions–archives, libraries, etc.- and private blogs.

Historical research using online sources is currently a valuable option to study events from the past, even if potential and limitations of the available data should be accounted for (Angulo Morales, 2006). Population variability is studied from online official databases that allow comparison between far away countries for birthrate research (Grande and García González, 2019) or worldwide cancer related mortality (Ferlay *et al*., 2019). Moreover, research about migrations using traditional resources are complemented by new technology, such as online archives (Tjaden, 2021), allowing wider scale studies with large spatial scopes, like Europe for example (Zapata-Barrero and Yalaz, 2018).

2. Migration movements in Sóller

This chapter would like to present, within the framework of the local History trend, the available sources that can be find to study migratory processes. Such analysis will be developed in Sóller, a specific area of Mallorca, the largest island of the Balearics, where the migration process was a key factor to define the political, societal and economic evolution of the area between the 19th and 20th centuries.

Within the area, two municipalities can be identified, Sóller and Fornalutx. Both share a common geographical space, defined by its isolation from the rest of the island. The valley is located in the middle of the Tramuntana mountain range, where the highest mountains of the island are found surrounding both municipalities. On the coast side, a small bay allows a seaside exit from the zone. Until the 19th century, Sóller and Fornalutx were a single entity, but Fornalutx was granted independence in 1837 thus forming a new town. Historically, the valley had a land distribution based on the small property and an economy related to trading- with fabric and agricultural products as oranges and olive oil as the main trades- thanks to a small fabric industry. In that sense, there was not, as common in Spain, a nobility dominance. Instead, the economic and social power resided on traders, industrialists and landowners.

Migration from Sóller as a historical phenomenon started during the decade of 1830, when Joan Marquès Marquès *–Alic-* moved to Puerto Rico. He is likely the first migrant from the valley. This move stablished the basis to a migration process towards America, which lasted until the first half of the 20th century. Two main phases of the process can be identified, both related to different causes. On the one hand, a first phase is related to individual causes, as the number of migrants is small. A second phase started in 1860, when the relevant reasons caused a development of the migration flow. From the first years of the 20th century, the process became a phenomenon deeply imbibed in the local society, being an important element of the social and economic system of the valley. Factors related to migrants' emission and attraction (*push-pull model*) must be considered as well. International factors can work to attract migrants while internal causes can cause the expulsion of people on certain times[6]

By mid-19th century, the local economy was highly dependent of the orange trade and the cotton production, thus creating a vulnerable system when facing changes on the market economy. During the 1860s, an important crisis affected the economy, a fact that is related to the increase of the migratory flux. In that sense, the migration movement is linked with a

breakdown of the local economy axis but we shall not forget sociological aspects.

Figure 1 - *Family of migrants in Puerto Rico. Source: Sóller Municipal Archive.*

In this respect, the migration process was a part of a family plan as the migrants completed the family income, thus avoiding the deterioration of living standards. Such fact is clear during the first waves of migrants, when the familiar bonds dominated the migratory networks. Once the agricultural and manufacturing crisis are overcome, migration became a key part of the economic system of the valley as industry was funded by capital arriving from abroad. At the end of the 19th century, the main migratory trend changed towards Europe, mostly to France and francophone areas of Germany, Switzerland and Belgium. This trend existed until the 1930-1940 decade and they were cut off by the Spanish Civil War first and the Second World War afterwards.

3. New research options: Internet available resources

Regarding the migratory phenomenon affecting the valley of Sóller, the first research study appeared during the 19th century. It was the work of a local historian, priest Josep Rullan i Mir, who wrote *Historia de Sóller en sus relaciones con la general de Mallorca* (1875), which was considered as the most important one of the epoch, because it gave data about the town history and showed how the status of research in Mallorca was during the 19th century. Other works referring to migration appeared on the same

epoch, written by foreign travelers and researchers like Archduke Lluís Salvador d'Àustria (in his book *Die Balearen*).

After a long period without research, at the end of the 1960s local investigation revived due to the arrival of university scholars, who combined with local historians following the historiographical trends of the period. Nonetheless, it will be during the 1990s when a research focused on the migratory process will start. Different local historians like Dr. Plàcid Pérez Pastor (*Publicitat i emigració a un mitjà de comunicació local mallorquí: el setmanari "Sóller": 1925-1935*, Palma, Jornades d'Estudis Històrics Locals, XII, IEB, 1993), Dr. Antoni Vicens Castanyer (*Sollerics a França (1870-1940). Passions i Quimeres*, Palma, El Tall, 1993; *Jeroni Frontera, matemàtic. Un mallorquí a Paris durant el Segon Imperi*, Palma, El Tall, 1995), Catalina Mª Bernat Joy (*L'anhel de tornar a Sóller. Emigrants: canvi social i progrés econòmic, Sóller*, El Gall Editor, 1999) or Joan Miquel Castanyer Sastre (*Emigración y capital: circuitos de financiación de la industria de Sóller y su coyuntura en el periodo 1939-1945*, Palma, Trabajos de Geografía 38, Universitat de les Illes Balears, 1984) published papers or books about migration. Some other research was done in places were migrants arrived, with prominent works from Dra. Astrid Cubano Iguina (*Un puente entre Mallorca y Puerto Rico: la emigración de Sóller (1830-1930)*, Colombres (Asturias), Colección "cruzar el charco", Fundación Archivos Indianos, 1993) or Anita Gómez Arbona (*L'émigration majorquine vers la France de 1880-1940. Un cas: Soller*, Université Paris X Nanterre. U.F.R. d'études ibériques et latino-americaines, 1990).

In 2013, the author of this chapter defended his PhD thesis at the University of the Balearic Islands. Titled *Societat, cultura i política a l'època dels moviments migratoris cap Amèrica i Europa. El cas de la Vall de Sóller (1830-1936)*, its main objective was establishing the causes of the migratory process from Sóller and Fornalutx, the spatial distribution, the number of departures and, especially, the effects that such process caused in the remaining population, as it was a key factor of social and economic transformation.

Traditionally, to study a migration process, the sources were diverse: archives, historical press, oral sources and publications. Due to the arrival of informatics systems, historians have developed wider and accurate studies and analyses, encompassing different fields such as Economy, Demography, social structures and so on. Another key fact from the past decade has been the arrival of thousands of documents on the net, from public and private institutions. The improvement and underselling of scanning systems,

coupled with the modernization of internet related infrastructures (optical fiber, servers) has had as a result that institutions invest on digitalize their sources, increasing every year the number of public archives that are online, allowing access to all the documents or to data directories. In that sense, a researcher has access to information around the world with only a click with his mouse.

Regarding the research area and its migration process, there is a large amount of data available online. The starting point are the archives from public institutions where databases guide the historian towards available sources to study a particular issue. Some international examples are the *Repositories of Primary Sources* or the French *Arxives Nationales* and the project *Mémoire des Hommes*.

Within Spain, there is the portal *Movimentos Migratorios Iberoamericanos*, created by the *Subdirección General de los Archivos Estatales del Ministerio de Educación, Cultura y Deporte* of the Spanish government. Its main objective is to foster and facilitate access to documentary sources regarding Spanish migration to Latin America in the contemporary epoch. The portal offers an open and free access to digitized images and documents. It is a database created from the systematic discharge of data from different archives, such as the Archivo General de la Administración and Archivo General de Indias from Spain, the Archivo General de la Nación de México. It also includes data from the Archivo General de la Nación de Uruguay, the Archivo General de la Nación de la República Dominicana and the *Fundación Complejo Cultural Parque de España de Argentina*.

To study the migratory process from Sóller, a research must be done using the "place of birth" field. In that case, 15 results are available, everyone with an identifying file that includes data like age, sex, date of birth and occupation. Such data allows the researcher to create tables, graphs and other quantifying and comparative work.

Another Spanish portal is called *Portal de Archivos Españoles* (PARES) (Figure 2). A platform gathers all the data from statewide archives that are operated by the Ministry of Culture and Sports. It includes sources like Arxiu de la Corona d'Aragó, Archivo General de Simancas, Archivo General de Índias, etc. PARES allows an access to the inventory of resources but also to descriptive files and digitalized images from parts of the documentary data conserved on the different archives, data that is increasing yearly.

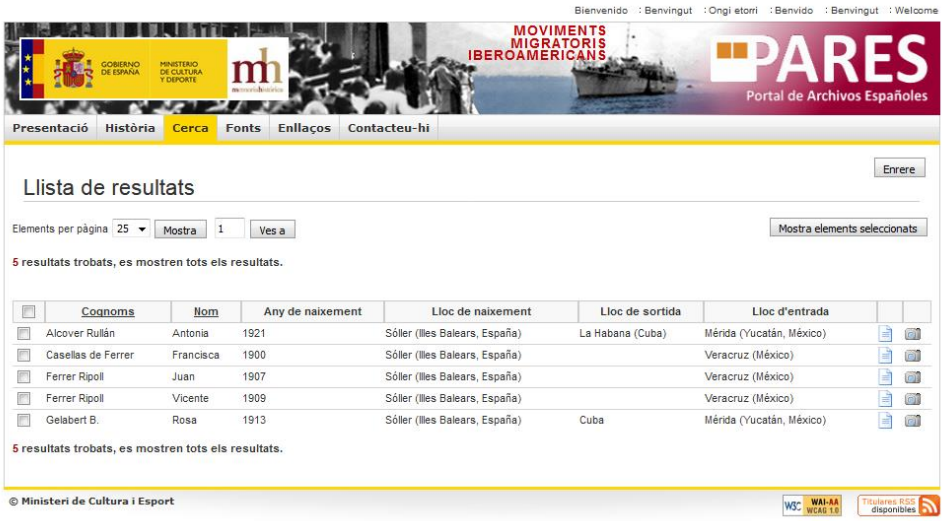


Figure 2 - *Screenshot of the PARES portal.*

Another online source from Spain, with statistical data at different levels, from national to local, is the *Instituto Nacional de Estadística* (INE), where the census of population for each Spanish municipality from 1852 to our days are available (Figure 3). A similar source regarding the Balearic Islands is the web of the *Institut Balear d'Estadística*, where data from the past decades is freely available.

A private project to be praised is the one from the *FamilySearch* organization, related to the *Genealogical Society of Utah*, which depends of the Mormon Church. The platform allows the access to worldwide genealogical data, the result of a great work of digitalization of archives from municipalities, provinces, counties and so on. As example, the migration files from the National Archive of Brazil are available.

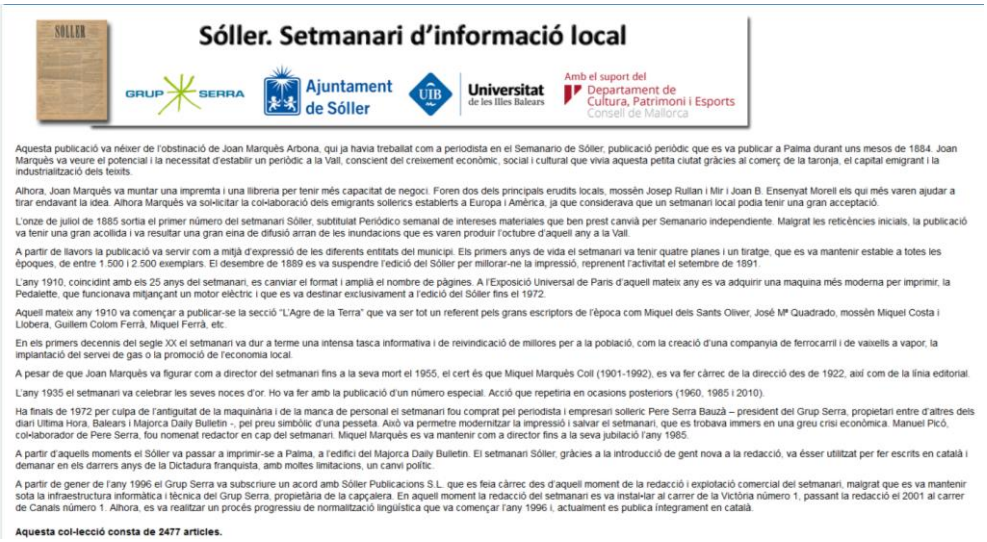
Figure 3 - *Screenshot of the INE web page with available data.*

At a regional level, the University of the Balearic Islands (UIB), who created the *Plataforma d'Arxius Històrics de les Illes Balears*, where all the databases of the municipal archives of the islands would soon be included.

Another source to study migrations from Sóller is the historical press. At the end of the 19th century, local publications appeared on weekly basis. The main one was the Semanario Sóller, still published today. Other newspapers were *En Xerrim*, *El Pueblo* and *La Voz de Sóller*.

Two online platforms give access to the press coverage. One is national, the *Biblioteca Virtual de la Prensa Histórica*, funded by the Subdirección General de Coordinación Bibliotecaria from the Ministry of Culture and Sport. It is an online library with a large repository of newspapers and journals from all Spain. By numbers and quality, it is the main source of digitized press from Spain. In that sense, it has become an important tool for historical, sociological and cultural researchers. Amongst the repository, local newspapers like *Sóller*, *El Pueblo* i *En Xerrim* can be found.

A regional platform is the one created by the University of the Balearic Islands, known as *Biblioteca Digital de les Illes Balears*. It includes all kind of publications, from scientific journals to PhD thesis, archives documents and a large library of local newspapers, with a complete collection of the Semanario Sóller weekly from 1885 and 1939 (Figure 4).



Sóller. Setmanari d'informació local

GRUP SERRA · Ajuntament de Sóller · UIB Universitat de les Illes Balears · Amb el suport del Departament de Cultura, Patrimoni i Esports Consell de Mallorca

Aquesta publicació va néixer de l'obstinació de Joan Marquès Arbona, qui ja havia treballat com a periodista en el Semanario de Sóller, publicació periòdic que es va publicar a Palma durant uns mesos de 1884. Joan Marquès va veure el potencial i la necessitat d'establir un periòdic a la Vall, conscient del creixement econòmic, social i cultural que vivia aquesta petita ciutat gràcies al comerç de la taronja, el capital emigrant i la industrialització dels teixits.

Alhora, Joan Marquès va muntar una impremta i una llibreria per tenir més capacitat de negoci. Foren dos dels principals erudits locals, mossèn Josep Rullan i Mir i Joan B. Ensenyat Morell els qui més varen ajudar a tirar endavant la idea. Alhora Marquès va sol·licitar la col·laboració dels emigrants sollerics establerts a Europa i América, ja que considerava que un setmanari local podia tenir una gran acceptació.

L'onze de juliol de 1885 sortia el primer número del setmanari Sóller, subtitulat Periódico semanal de intereses materiales que ben prest canvià per Semanario independiente. Malgrat les reticències inicials, la publicació va tenir una gran acollida i va resultar una gran eina de difusió arran de les inundacions que es varen produir l'octubre d'aquell any a la Vall.

A partir de llavors la publicació va servir com a mitjà d'expressió de les diferents entitats del municipi. Els primers anys de vida el setmanari va tenir quatre planes i un tiratge, que es va mantenir estable a totes les èpoques, de entre 1.500 i 2.500 exemplars. El desembre de 1889 es va suspendre l'edició del Sóller per millorar-ne la impressió, reprenent l'activitat el setembre de 1891.

L'any 1910, coincidint amb els 25 anys del setmanari, es canviar el format i amplià el nombre de pàgines. A l'Exposició Universal de Paris d'aquell mateix any es va adquirir una maquina més moderna per imprimir, la Pedalette, que funcionava mitjançant un motor elèctric i que es va destinar exclusivament a l'edició del Sóller fins el 1972.

Aquell mateix any 1910 va començar a publicar-se la secció "L'Agre de la Terra" que va ser tot un referent pels grans escriptors de l'època com Miquel dels Sants Oliver, José Mª Quadrado, mossèn Miquel Costa i Llobera, Guillem Colom Ferrà, Miquel Ferrà, etc.

En els primers decennis del segle XX el setmanari va dur a terme una intensa tasca informativa i de reivindicació de millores per a la població, com la creació d'una companyia de ferrocarril i de vaixells a vapor, la implantació del servei de gas o la promoció de l'economia local.

A pesar de que Joan Marquès va figurar com a director del setmanari fins a la seva mort el 1955, el cert és que Miquel Marquès Coll (1901-1992), es va fer càrrec de la direcció des de 1922, així com de la línia editorial.

L'any 1935 el setmanari va celebrar les seves noces d'or. Ho va fer amb la publicació d'un número especial. Acció que repetiria en ocasions posteriors (1960, 1985 i 2010).

Ha finals de 1972 per culpa de l'antiguitat de la maquinària i de la manca de personal el setmanari fou comprat pel periodista i empresari solleric Pere Serra Bauzà – president del Grup Serra, propietari entre d'altres dels diari Ultima Hora, Balears i Majorca Daily Bulletin -, pel preu simbòlic d'una pesseta. Això va permetre modernitzar la impressió i salvar el setmanari, que es trobava immers en una greu crisi econòmica. Manuel Picó, col·laborador de Pere Serra, fou nomenat redactor en cap del setmanari. Miquel Marquès es va mantenir com a director fins a la seva jubilació l'any 1985.

A partir d'aquells moments el Sóller va passar a imprimir-se a Palma, a l'edifici del Majorca Daily Bulletin. El setmanari Sóller, gràcies a la introducció de gent nova a la redacció, va ésser utilitzat per fer escrits en català i demanar en els darrers anys de la Dictadura franquista, amb moltes limitacions, un canvi polític.

A partir de gener de l'any 1996 el Grup Serra va subscriure un acord amb Sóller Publicacions S.L. que es feia càrrec des d'aquell moment de la redacció i explotació comercial del setmanari, malgrat que es va mantenir sota la infraestructura informàtica i tècnica del Grup Serra, propietària de la capçalera. En aquell moment la redacció del setmanari es va instal·lar al carrer de la Victòria número 1, passant la redacció el 2001 al carrer de Canals número 1. Alhora, es va realitzar un procés progressiu de normalització lingüística que va començar l'any 1996 i, actualment es publica íntegrament en català.

Aquesta col·lecció consta de 2477 articles.

Figure 4 - *Screenshot of the Sóller weekly newspaper.*

Another source to investigate migration processes are the bibliographical sources, published in the past or currently. Monographies, papers or unpublished research can be located online. As written before, there is a large corpus of local research about this subject, which can be completed with regional, national or international sources, thus allowing the comparison of processes, its causes and its effects. There is a large number of search engines and databases, such as *Dialnet*, from the La Rioja University, which includes hundreds of scientific papers. Another example is the *Biblioteca Digital Hispánica* of the Spanish National Library, where more than 2371 titles of references are included and allows searches using key words from various fields, like place of edition or date of edition.

Finally, oral sources are the weak link for historical research. There is much work to be done as the data is disperse and there is a lack of resources to gather it and to make it accessible to researchers.

4. Conclusions

To conclude, new technologies and digitalization processes as well as IT have helped historical research to reach a higher level of detail, allowing the completion of missing data, which could not be reached before due to a lack of connectivity and knowledge about available information. As an example, the study of a local migration process, from Sóller to Brazil between the

final years of the decade of the 40s and mid 50s has been presented. Initially, according to Local Registers between 1949 and 1970, only one man was living in Brazil, Joan Enseñat Julià, who worked as trader, and was the lone migrant living in that country.

Other archives from Mallorca, such as the Kingdom of Mallorca Archive, did not have documental data related to passports or travel abroad during the 40s and 50s. Thanks to the possibility of consulting, a database above mentioned allowed to identify as much as 71 Sóller inhabitants residing in the South American country. Even if this figure has a small importance on national terms, it is important on local terms, as it shows the movement of population related to the existence of a migration network based on neighboring knowledge.

It is clear that historians have at their disposal a large amount of sources that did not exist before or were only available on local basis or after a compulsory travel researching information. Even so, the discovery of new sources implies the need to analyze carefully the data to verify and contrast it. Moreover, some disadvantages exist. Firstly, the digitalization process can damage original documents and books. Another problem can be related to the obsolescence of digital archives, as there are no guarantees that a scanned document would be online forever. An important issue is the oral sources, as there is a large gap of availability of that kind of data. Finally, there is the need to form professionals to develop such activities, with an important economic cost that not always can be supported by developing countries were migrants were living.

To sum up, the Anthropocene-related improvement of technological applications has greatly helped the research from the historian's point of view. The wide variety of resources nowadays available allow undertaking researches that were not possible less than 50 years ago. Even so, there are issues related with those possibilities, issues to be studied and enhanced, in order to further pursue research venues and obtain better results in the future.

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5. ICT and the classroom, a difficult relationship?

Iris Morey[1], *Marina Palou*[2], *Joan Rosselló*[3].

Abstract

The COVID-19 pandemic increased the use of ICT (Information and Communication Technologies) tools inside the classrooms worldwide. Nevertheless, this fact allowed revealing the existing differences between students, teachers and the community, which are in part the result of economical and societal inequalities. Furthermore, such inequalities affect classrooms at all levels, from school to university.

Even though the use of technologies has improved education as new communication and learning systems have been implemented, the existing differences can enlarge the gap within the educational structure, something that should be avoided at all costs.

In this chapter, an analysis of the ICT resources used in three classrooms of the Spanish Educational System is presented. The ones used before the pandemic, the ones used during the COVID lockdown and the ones being used nowadays are explained, with a focus on their advantages and disadvantages.

Keywords: ICT, secondary school, online courses, Mallorca

1. Introduction

The technological revolution, which started at the end of the 20th century, provoked large societal changes (Torres Albero, 2002). A result of this revolution has been the arrival of an ICT-based society.

According to Castells (1997-1998), ICT are all those technologies developed in different fields, such as electronics or computing, and its

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evolution in terms of applications, elements and technological advances in robotics or virtual reality.

Technology has improved and facilitated the daily life of people, being the education field one of those most affected by this change.

The arrival of ICT in the educational field implied learning and communication changes between the parts of that system, students and professors.

Authors like Duart and Sangrà (2000) or Roschelle *et al.* (2001) defend that technology entails a large number of advantages for the educational process, especially at the communication level, enhancing the students' participation and creating a more direct and customised learning system.

Nevertheless, this revolution on education also implies some drawbacks. On the one hand, there is an absence of technological capability within the teaching staff, and some of them do not want to use technological tools as they do not know how to (Watty et al., 2016). On the other hand, there is a wide debate about how to properly use those tools. The large scope of available information can provoke misunderstandings and misinformation among the students and they have to learn skills and criterions to search and assess correctly the information at their disposal (Aliaga & Bartolomé, 2006).

Another highlighted problem is the fact that technological innovation does not mean a pedagogic improvement and Fowler (2015) proposed to create virtual spaces from current pedagogical resources.

Finally, it must be taken into account that each student has individual differences, regarding the disposal of advanced devices or the use of them. It is common to observe that the use of technology is not positive even though the devices are appropriate.

In this chapter, the evolution of ICT in a Spanish high school is presented, from the point of view of three subjects: Geography and History, Physics and Chemistry and English. There is an analysis of the use of ICT before the 2020 pandemic, followed by a description of the use of technological tools during the lockdown and, finally, a focus on the current situation, pointing out the advantages and disadvantages of their use, both for students and for professors.

2. Study area

The research is developed at the Institut d'Educació Secundària (IES) Son Rullan, which is located in the city of Palma.

Palma is the capital of Mallorca, the largest island of the Balearic archipelago, located off the Eastern coast of Spain. Palma is the biggest city, with a population of 422 587 inhabitants in 2020 (IBESTAT, 2022). The city is located in the southern part of Mallorca (Figure 1) and it is divided in neighbourhoods as well as by census districts for administrative purposes.

The IES Son Rullan is in the northeastern area of Palma and it serves the population of four neighbourhoods: Es Vivero, Rafal Nou, Son Cladera and Son Rullan (Figure 2).

It is an area largely populated by immigrants, mainly of Spanish origin even though lately there has been a large number of people arriving from South America and Africa.

At present, the IES has 829 students, who can study ESO, compulsory education until they are 16 years old, Bachillerato, two years, which lead to the examination to access university studies and Formación Professional, a formative course related to physical activities and leisure. A total of 87 professors make up the faculty.

The faculty is divided into departments, which are created according to the different knowledge areas. We can find a Mathematics department, a Catalan department, a Spanish department and a Foreign Languages department among others. Each one has a variable number of members, depending on the IES necessities.

The classrooms are equipped with a PC and a projector as well as an interactive board. There is internet connection for the students and the professors. The centre has a computer's room, with 20 PCs but it must be taken into account that, to use it, it is necessary to book the room in advance and there is usually a waiting list. To complete the available resources, there are laptops to be used by the students but there is also a waiting list to use them.

It should be noted that a large number of students come from low-income families, as the surrounding neighbourhoods comprise working-class people, mostly with low-skilled jobs. Such a fact implies that there is a great amount of difficulties, in terms of economic capacity of the families, level of interest in their sons' education and the existence of unstructured families. The faculty has to deal with those problems while trying to properly teach their students.

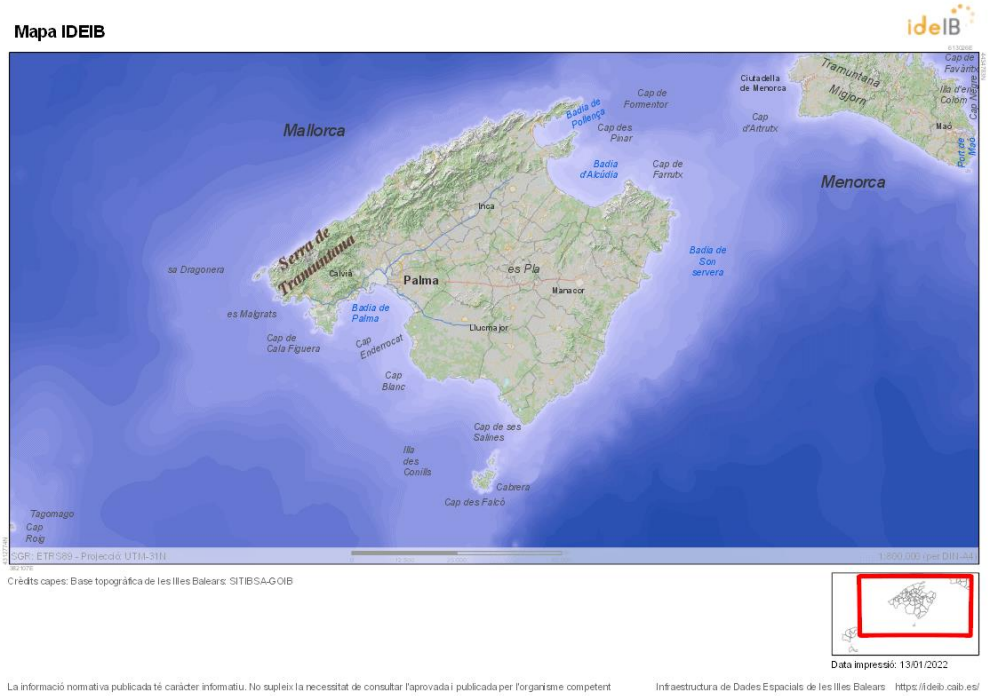


Figure 1 - *Location of Palma within Mallorca. Source: IDEIB, 2022.*

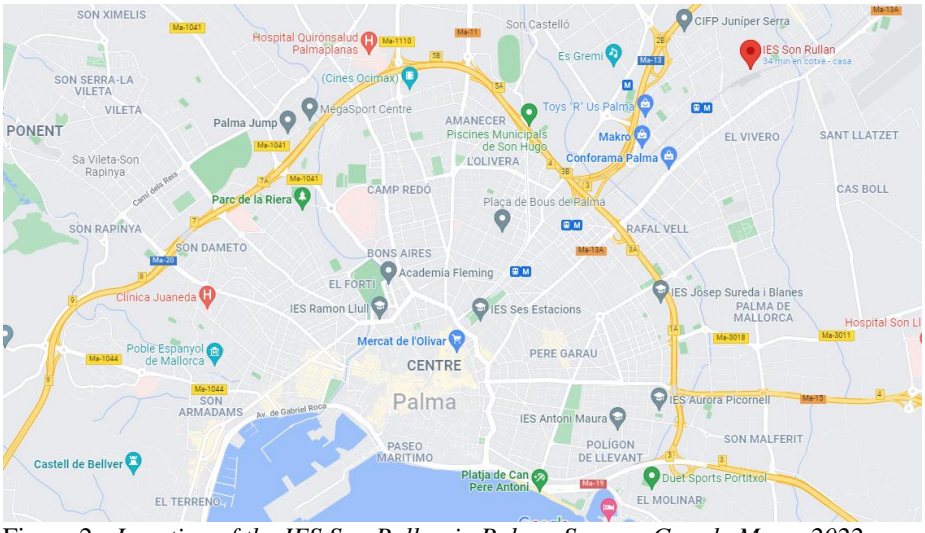


Figure 2 - *Location of the IES Son Rullan in Palma. Source: Google Maps. 2022.*

3. ICT applications before the pandemic

3.1 Management platforms and communication tools

Before the arrival of the pandemic, the most common tool used by the staff was the GestIB application, developed by the Education Ministry of the Balearic Islands (Figure 3).

Despite being the only official application, it was sparingly used by the teaching staff. Its main uses were checking students' assistance, grading them at the end of the evaluation term and, finally, registering the arrival and departure of the professors on each working day. Another available option of GESTIB consisted of texting families and using it as a communication network, but few families had full access to the application and a phone call was easier to establish contact when needed.

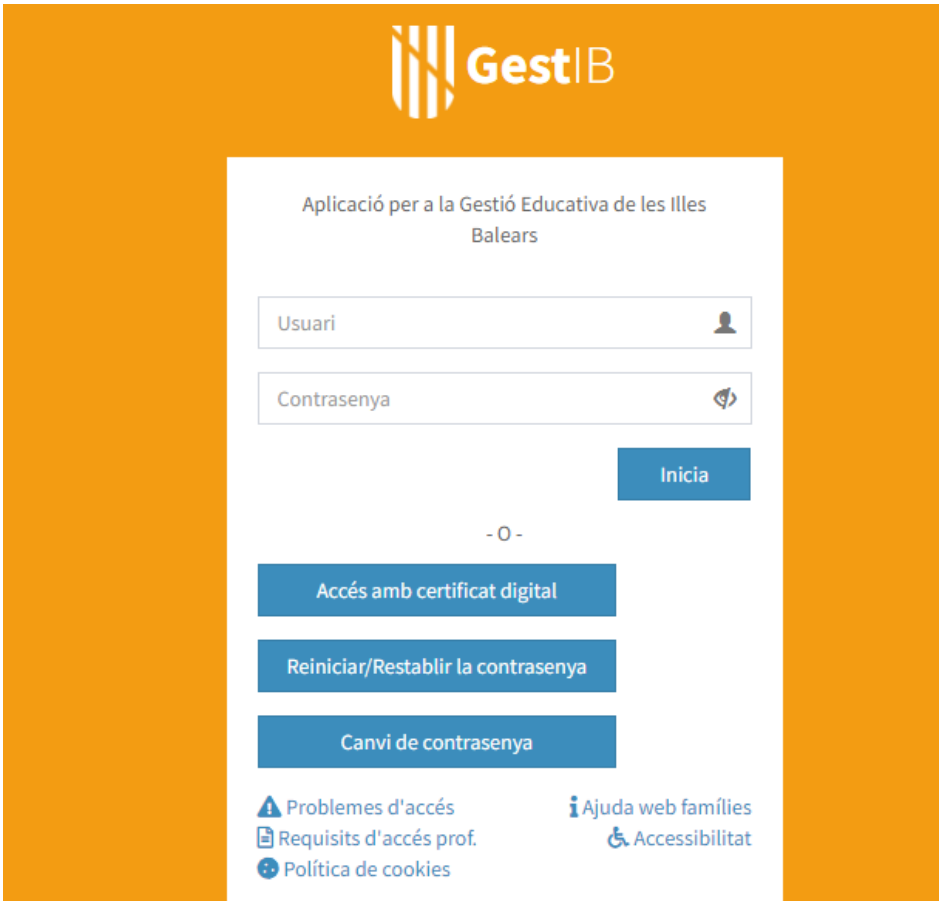


Figure 3 - *Screenshot of the GestIB application.*

Regarding the communication with students before the COVID outbreak, few professors used Google applications, such as Gmail or Meet. The main reason is that their use was not compulsory and face-to-face meetings in class or afterwards were commonly used. Another aspect to take into consideration is that the Moodle platform was being used in some centres and by some professors, thus creating some confusion about which platform was the best option to be on hand.

When the lockdown arrived, there was the necessity of establishing a quick communication tool and the IES decided to use Google Classroom for that purpose. It was clear from the start that there were problems related to the lack of technological formation from the part of professors but also of students, while the situation was exacerbated by the lack of technological means in many families. The IES Son Rullan created an ICT commission, formed by five professors, to help with the implementation of all of those applications. One of the most important actions was to teach how to use a video call system to allow direct and live contact between students and professors.

3.2 Geography and History

Geography and History are both subjects within the educational system and, at the same time; this is a part within the societal system. However, while society has evolved, the teaching of Geography and History has not, as it still has a large theoretical corpus, which is related to the difficulties that exist to develop practices in the real space, away from the classroom (Graves, 1985).

The arrival of the new technologies allowed us to move some reality, in terms of space, to the classroom. The use of educational videos from Youtube and other websites and applications like Google Maps allows a closer contact between theory and reality.

Even so, the broad knowledge of the subjects, which ranges from worldwide to regional and even local topics, makes it difficult for the teaching staff to adjust contents and class time. Another hurdle is the capability of professors in terms of ICT use, as a large number of them are over 50 years old and are not able to use new technologies as younger professors do, as they usually have had some kind of ICT experience during their graduate studies.

Taking all of the above into consideration, the ICT use before the pandemic was low amongst Geography and History classes. Practical research was devoted to field trips of small duration (from three to six hours), where the professor taught about the geographical or historical relevance of

the visited area and students usually had to complete worksheets or answer questions in-situ. There were also cooperative works within the classroom but again the use of computers and presentations using applications like PowerPoint or Prezi were the only ICT-related activities developed.

In some cases, professors used web platforms like Moodle where students could consult notes and presentations as well as they sometimes had to complete tests. In addition, gamification was on hand, with applications like Kahoot or Quizlet, to lure the students into specific parts of the course syllabus.

3.3 Physics and Chemistry

In the early 1970s, science teaching considered the students as a "tabula rasa" (Pinker, 2000, quoted by Solbes, 2009). It was believed that learning should be based simply on attending classes and doing repetitive tasks. However, as soon as other kinds of questions, different from those worked in class, were introduced, a serious misunderstanding of some of the most fundamental scientific concepts was revealed, even those, which had been insistently practised. In addition, it was found that these "conceptual mistakes" (so-called at first) were not unusual errors, but were shown as ingrained ideas, similar in students from different countries, inconsistent and resistant to being replaced by the scientific knowledge of the usual education (Pinto, Aliberas & Gómez, 1996). This problem of conceptual learning led to the so-called "constructivist view of learning", where the previous knowledge of students is considered as the starting point for a meaningful learning (Ausubel, 1983, quoted by Rayas, 2004).

a) Experimental work

The proposal of experimental activities is one of the most obvious techniques to ensure a constructivist view of science learning. "Experimental work" is understood as any activity that involves the manipulation of materials, objects or organisms in order to observe and analyze phenomena (Sanmartí, 2002). Therefore, from this point of view, practical work can be done in the laboratory, in the classroom or in the field.

Before the COVID-19 pandemic started, in IES Son Rullan, almost all the experiments were conducted inside the high school's own laboratory. Thus, ICT applications were just taken into account in the final phase of the research: spreadsheets to analyse or present the experimental data, text documents to make lab reports or presentations to exhibit the research results.

b) Cooperative work

Apart from experimental work, cooperative or collaborative work applied to science teaching is an ideal situation to reinforce the three fundamental levels of learning: knowledge (acquisition of concepts), skills (social, mental and working skills) and attitudes (entrepreneurship, innovation, organization of time...). As with practical work, cooperative work would be considered one of the most effective learning methodologies within the constructivist vision, as it is an excellent opportunity for students to practice what they are trying to learn and to bring out their previous ideas (Gorchs, 2009).

Before the pandemic, the use of this kind of active methodology was relatively easy. In general, it was not strictly necessary to consider the use of any ICT applications to carry out an activity based on cooperative work. Sometimes, Google environment tools, such as its word processor or its presentation creator, could be proposed to facilitate the development of products shared by several students at once. Besides, getting heterogeneous groups of students who could interact and cooperate with each other was as simple as rearranging classroom furniture.

3.4 English

English as a Foreign Language (EFL) is a compulsory subject included in the Spanish educational curriculum, both for the obligatory levels (primary and secondary education) as well as for the upper non-obligatory stages (baccalaureate and some vocational studies).

Nowadays, the development of the linguistic competence in a foreign language appears crucial to adapt our students to an increasingly globalised society, characterised by global exchange, the mobility of citizens and the development of the technologies of information and communication. Considering this, the teaching-learning methodologies in the subject of English have evolved during the last years towards a more *competencial* area, thus reinforcing the role of the communicative skill and including progressively the use of technological resources.

Before the pandemic, ICT tools were already on the rise at the educational level and this fact was naturally influencing many aspects of the teaching language process. The use of new technologies in the English classroom was showing several benefits in the increase of the students' language awareness and motivation and in the wider variety of resources for teachers to apply in their lessons. "*The implementation of ICT will lead to variety in English content, contexts and pedagogical methods in the teaching environment. ICT makes English language environment interactive, flexible and innovative*."

(Qin and Shuo, 2011; quoted by Çakici, 2016). The versatile character of the subject favoured the introduction of new resources and methodologies, mainly on the part of innovative teachers with a desire of changing the approach to teaching a foreign language. Nonetheless, even though the introduction of innovations was gaining ground, it was still far from being adapted to our daily basis in the classroom.

Overall, the technological equipment implemented before the pandemic consisted of:

- The teacher's computer connected to the digital screen and to the speakers to develop explanations, project PowerPoint presentations, show videos, recordings…
- A digital interactive whiteboard and an overhead projector.
- The individual students' cell phones, used as a resource in some occasions to look up information on the internet or words in the online dictionary.

Even though it is true that several teachers were already implementing new tools and methodologies into the EFL classroom, many teachers remained sceptical about changing their teaching focus. It was also favoured by the difficulties for introducing new technologies at the school, which counted with few technological resources, a deficient system of internet connection and students with economic difficulties to access the internet from home. As a result, those teachers who tried to introduce innovative resources into the foreign language classroom had to put a great deal of effort to overcome all these obstacles.

4. Applications during and after the pandemic lockdown

4.1 Geography and History

Once the pandemic caused a lockdown, first thought to be for 15 days, it was decided by the Education Ministry that professors should provide online classes and activities. In our case, as stated before, the IES decided to use the Google Classroom app to maintain the communication. Before the start of school year, 2019-20, as a department it was agreed to use Classroom as a communication tool with students, where syllabus and activities would be uploaded, even if it were not compulsory to be used by all students.

Once the lockdown became a reality, the need to use the app for all school related activities showed the failure of the system. During the first weeks, meetings were scheduled using the Meet application but turnaround was

small, as a large number of students did not have full internet access from home and/or did not have computers to be utilized. It was clear that doing online classes was not a possibility, as the students left behind were more than the ones being attended.

The solution was to use the Google Classroom as a tool to upload contents and activities and to solve doubts once the students had finished their assignments. When it was time to mark students at the end of the year, the questionnaires of Classroom appeared to be the best option.

When the next school year, 2020-21 started, it was on a *semipresencial* basis; students attended class one day at the IES and remained at home the next. As it happened during the lockdown, the differences between students with access to resources and those without were evident from the start and, again, it was decided to use the Classroom app to assign activities and assess results (Figure 4). Students staying at home had to work to be able to follow the courses when they were attending the IES. As it happened during the lockdown, the intent of developing online classes was a failure, as a large number of students could not connect from home, usually for the lack of proper tools such as computers or laptops. In fact, there was an important number of pupils using cell phones to connect with the classroom and do their assigned activities.

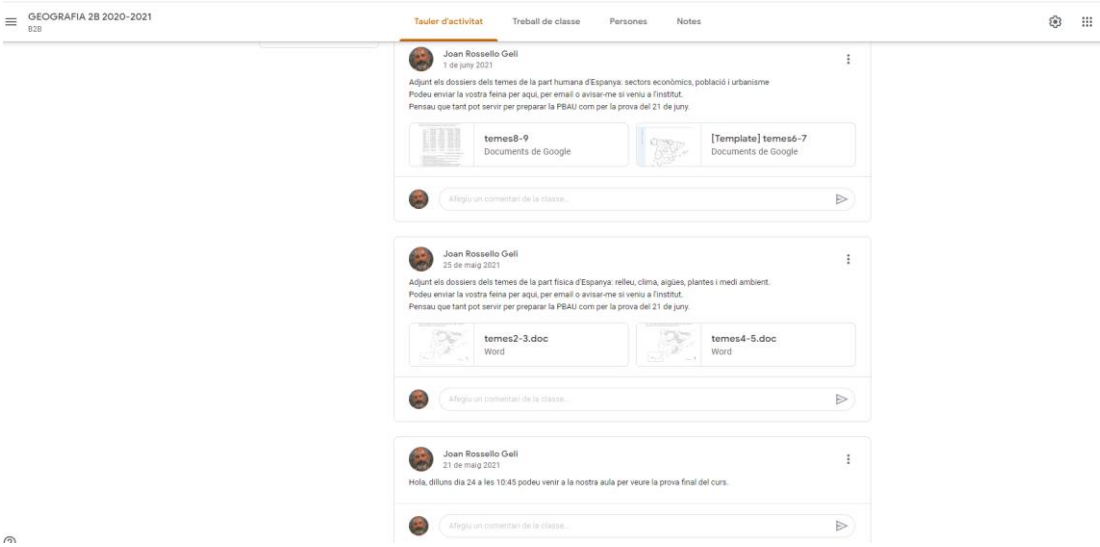


Figure 4 - *Screenshot of the Geography Classroom 2020-2021.*

Regarding practical activities, it was impossible to have the students together due to the necessity to maintain social distance, so the use of cell

phones was a solution. The students worked in groups but from their seats or worked remotely from home, when they were to stay there. Clearly, it was not the best solution but it allowed working on practical exercises and developing cooperative teamwork.

As going out of the classroom for field trips was not allowed, the use of live video feeds and applications such as Google Maps allowed students to see “almost “real explanations of the syllabus contents while sitting in class or at home.

Once the 2021-2022 school year started and students returned to classes on a daily basis still keeping regulations such as masking or social distancing, the department decided to continue using the same teaching approach, with the Google applications as a tool to teach and communicate with students, and the GestIB to communicate with families. Day by day activities are defined by the current situation, as in some cases, a large number of students are missing classes as they are confined at home so online lessons and tasking is the most common option nowadays.

A wider use of applications like Kahoot and Quizlet is also common, to introduce gaming into lectures and increase the student interest. Now that the use of mobile phones is allowed within the classroom, it is easier to develop tasks that allow students to play and learn at the same time. To introduce topics, tools such as Creately or LucidChart are being used in the classroom, facilitating the interaction between students and professors.

4.2 Physics and Chemistry

a) Experimental work

During the March - June 2020 lockdown, as well as during the following school year (2020-21), it became impossible to perform, physically, any experimental work, due to the new regulations about security distance between students. In addition, in many cases, the Physics and Chemistry laboratories had to be temporarily transferred to other didactic departments, since more classrooms and spaces were required to allow the blended-learning system.

Fortunately, many digital resources and ICT applications can be found on the Internet to make this up, such as virtual labs. According to De Jong *et al* (2013), a virtual laboratory is understood to be a computer simulation in which the activity to be carried out by the user is similar to that which should be carried out in a real laboratory, but which does not necessarily reflect the

reality of a real lab. Virtual experiments can be adapted to see, for example, phenomena that would not be observed in a physical laboratory.

Virtual labs have a number of advantages over physical labs. First, virtual laboratories are ideal for very abstract phenomena or for those that cannot be seen with a naked eye (structure of atoms, chemical bonds…). The availability of space, materials and equipment is obviously unlimited. In terms of safety, there are no risks and their cost is usually more profitable than traditional practical work. However, they have some disadvantages: on the one hand, they are not so favourable for the development of practical skills, since in a physical laboratory students have to pay attention to the assembly of equipment and materials and, on the other hand, they do not place so much emphasis on hygiene and safety measures.

Currently, the range of available virtual labs is quite wide. Take as an example the comparative table (Table 1) prepared by Padilla (2021), where you can see the main differences between some of these platforms:

- Go-Lab: https://www.golabz.eu/labs
- Educaplus: https://www.educaplus.org/
- PhET: https://phet.colorado.edu/
- OLabs: http://www.olabs.edu.in/
- Labster: https://www.labster.com/
- Chemcollective: http://www.chemcollective.org/
- Labovirtual: https://labovirtual.blogspot.com/p/fisica.html

Table 1 - Comparison of different virtual laboratories' platforms.

Lab name	*Go-Lab*	*Educaplus*	*PhET*	*OLabs*	*Labster*	*ChemCollective*	*Labovirtual*
General info							
Language	E, Sp, C	Sp	E, Sp, C	E	E, Sp	E, Sp, C	Sp
Research field	Ph, Q, +	Ph, Q, +	Ph, Q, +	Ph, Q, +	Ph, Q, +	Q	Ph, Q
Grade	P, S, B	P, S, B	P, S, B	S, B	S, B, U	S, B	S, B
Free	Yes	Yes	Yes	Yes	No	Yes	Yes
Technical aspects							
Digital devices	PC	PC, T, M	PC, T, M	PC	PC	PC	PC, T, M
Online access	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Design	2D	2D	2D	2D	3D	2D	2D
Username	No	No	No	No	Yes	No	No
Experiments	Both	Both	Both	Real	Both	Real	Both
Assessment	Yes	No	No	Yes	Yes	Yes/No	No

Note. The language row shows the language in which the simulation can be found: E. English; Sp. Spanish; C. Catalan. In the research field, there are the subjects treated by the virtual laboratories: Ph.D. Physics; Q. Chemistry; +. Other fields of research other than physics and chemistry. The following row reflects the grades to which the laboratories are directed: B. Baccalaureate; P. Primary education; S. Secondary education; U. University studies. The digital devices row shows the electronic devices that can be used: M. Smart mobile; PC. Computer; T. Touch tablet. The username row indicates whether you need to register to access the virtual labs. The experiment row specifies whether the simulations show practices that can be performed in a (real) lab or whether they include variables that could only be performed in a virtual lab (impossible), or both. The last row (assessment) indicates whether the virtual lab allows you to evaluate tasks automatically.

The most used platforms at IES Son Rullan during lockdown (March - June 2020) and during the 2020-21 school year were mainly: Labster (Figure 5), PhET and Educaplus.

Figure 5 - *Labster (2022). Virtual practical [Image]. (https://www.labster.com/).*

b) Cooperative work and development of other active methodologies.

As well as with experimental work, collaborative activities had to be transformed after the COVID-19 pandemic. As it has been stated before, IES Son Rullan adopted a blended learning system, so new interaction formulas

between students had to be designed in order to guarantee an equal and synchronous access to school tasks.

In Physics and Chemistry, “Miro app” was the platform which best fitted to this situation. “Miro” is a visual collaborative whiteboard that can be used online (Figure 6). It allows inviting other users to the same session-class and carrying out a videoconference with them. Besides, a large group of people can be split into several smaller groups, so each of them can perform a particular task autonomously, and then reconnect again with the entire group-class. The resulting whiteboard is shared and everyone can write on it, encouraging brainstorming, taking notes, keeping track of what is being written, and so on.

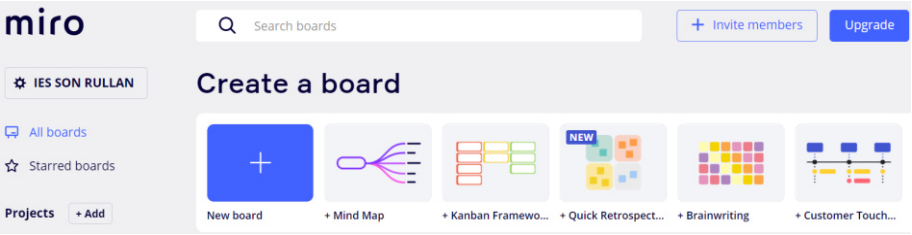


Figure 6 - *A personal dashboard in Miro app (https://miro.com/app/dashboard/).*

Despite the use of these advanced ICT tools, very soon after the pandemic started, the students’ decreasing interest in the subject became evident. The advantages derived from face-to-face teaching (better attention to diversity, quick communication, closer relationship…) are difficult to beat up by a blended learning system. For this reason, other active methodologies, such as gamification and game based learning (GBL), were brought into the Physics and Chemistry class. Gamification consists of applying mechanics and dynamics, which are common in board games or videogames in a non-play environment (as a classroom). For example, giving “experience points” to the students when they do their homework correctly is possible so they can use these points to buy "rewards” that give them benefits during an oral or a written test. On the other hand, in game-based learning, concepts and procedures are acquired directly through board games or digital games. For example, the popular game "Battleship" can be versioned by using a periodic table as a board, marking the coordinates of the missiles by using the name of chemical elements. Thus, all these games can be used online as well.

One of the examples of GBL which worked best, during and after the pandemic, were the digital escape-rooms or educational breakouts. In an escape-room, students must solve a series of challenges or missions related to

the subject in order to achieve a final goal (opening a lock, uncovering a closed box, getting an object…). Different puzzles are usually related to each other through an immersive story and many of them have to be solved as a team. An example of a digital escape-room created for the purpose of Physics and Chemistry is shown on Figure 7.

Figure 7 - *Part of a breakout created to study Hydrostatics [Screenshot]. Source: Morey, 2021 (https://fisquiris.wixsite.com/elinstitutodepapel/c3-1-2).*

Both types of methodologies allowed students to become more motivated and more willing to work on the subject. Given the good results, during the current academic year (2021-22), the teacher decided to continue using these active methodologies.

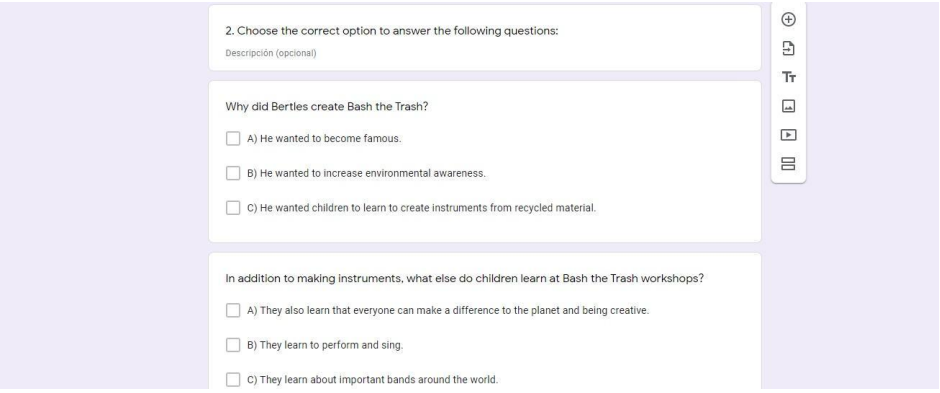
4.3 English

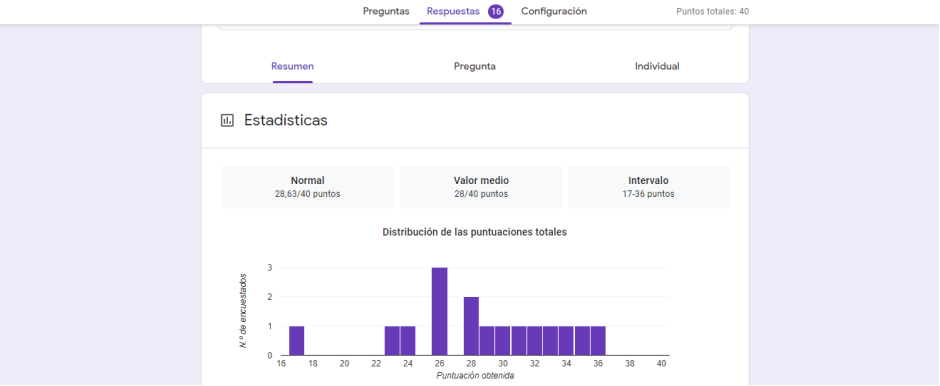
As it has been stated above, with the arrival of the pandemic and the consequent lockdown, the educational system had to assure the access to education of all students in a new scenario. Both teachers and students had to tackle an improvised online education, many without being technologically prepared and without having the necessary tools to face virtual lessons. This portrayed the deficiencies of education in terms of ICT resources and technological training.

As regards the English subject, the department decided to use Google Classroom as a platform of communication between students and teachers. It became truly useful for both: for teachers because it allowed them to post

tasks with the possibility to attach documents, and for students as they received an immediate alarm on their mail notifying a new task had been uploaded. Once completed the task, students had to send it through the same platform and receive a correction from the teacher. Communication between teacher and students was mainly carried out through Google Classroom, but other tools were also applied, including Gmail and GestIB (a program of educational management from the Balearic Islands' Ministry of Education and University), the latter used to a large extent to contact with the families.

Another aspect teachers had to solve during the lockdown was how to evaluate whether students had acquired the contents of a unit. Through Google Classroom, it was possible to create Questionnaires, scheduled and with a variety of questions which ranged from multiple choice to questions requiring short or long answers. Once the time to do the questionnaire had expired, the teacher received a summary with all the students' answers and a graph with the results, as well as the punctuation each of the students had received. The disadvantage of using this platform was, on the one hand the difficulty of some students to have internet access at a specific time of the day to do the exam, and on the other hand, the failures on the internet connection some students had to deal with while completing the questionnaire.





Figures 8 and 9 - *Screenshot of a Questionnaire from the English Google Classroom 2019-2020.*

Furthermore, if we take into account the communicative character of the language it became crucial to assess the students' oral skill. In this respect, the resource Meet was highly used to do video calls with students and, therefore, develop oral activities. They were allowed to prepare oral activities either individually or in pairs, in both cases using different online resources like Google Drive for presentations or Canva to create posters, which had to be presented afterwards in front of the teacher, with a previously prepared speech and developing their foreign language abilities. In addition, other activities included recording videos about a certain topic or creating an animated video using the application Powtoon, which offered the possibility to insert their own voice to an animated character. ICT tools like these demonstrated an increase in students' motivation towards language learning, as they were allowed to create their own virtual material, inserting images, audio, animation and video clips.

In the two school years that have followed the pandemic lockdown (2020-2021 and 2021-2022) the ICT tools aforementioned have been implemented into the English classroom. Students have already been accustomed to using platforms like Google Classroom to receive and post tasks and Gmail to communicate with the professor. These platforms have been helpful for those students who have been confined at home for a few days, since they have been able to follow the lessons from home and participate in the learning process. However, it must be noted that the problems of connectivity and lack of technological devices like a computer with internet access or a mobile phone on the part of some students continue to be present today.

The benefits of applying ICT tools in the English classroom seem to be directing education towards a new scenario. Information and Communication

Technology has enhanced the development of students' autonomy and digital competence and has boosted their involvement in the learning process: "*A dynamic class environment makes teaching more flexible and adaptable and creates classes featuring activities and tasks such as project work, cooperative learning and peer tutoring that allow students to develop and control their learning, thus leading to a less teacher-dominated learning environment and encouraging personal initiatives and more individualised learning.*" (Kassim et al., 2007, quoted by Azmi, 2017). Despite all its advantages, the challenges and barriers teachers face seem to hinder this process of change towards a more innovative, student-centered learning environment.

5. Results and conclusions

The ICT implementation in secondary schools shows a wide variety of results, mostly related to the societal and economic situation of the students and their families.

In that sense, the IES Son Rullan is a perfect example of a centre located in a low-income neighbourhood, with a large number of students that are not properly equipped with home internet or computers. Even though the Education Board and the IES provided laptops to students in need, the ICT gap is really large and increasing even today. Obviously, the presented situation is not representative of all the schools located in Palma or Mallorca. The social and economic trends affecting each centre, as well as the implication of parents' associations and the professors' formation, largely influences the implementation of ICT resources.

Amongst the positive aspects of ICT implementation, the personalization of the education stands out as a main thing. The possibility to fulfil activities online and the immediateness of the e-mail communication are some of the advantages of such application. On the other hand, as stated before, the digital gap is becoming a reality that should be addressed as soon as possible by educational authorities.

The use of video calls to teach has become common and nowadays, once a student must remain at home due to health problems, he can attend online classes, something almost impossible two years ago. Also common is the use of an application, in that case Google Classroom, to upload syllabus and tasks, as well as a tool to assess students and contact them if necessary.

Technology makes learning easier and more interesting and allows the acquisition of objectives but there still exists a lack of competence and training on the part of both professors and students.

In that sense, one of the negative aspects of ICT is related to the lack of technological capabilities of the teaching staff, widely recognized across Spain (Fernández-Cruz and Fernández-Díaz, 2016). The option of voluntary workshops is not a solution and there is a need for an increase of financial support, both for schools and staff.

Future can be bright even if it is a result of the Covid pandemic. Nevertheless, there is clearly a necessity of greater and better cooperation between all those involved within the education system: administrators, professors, parents and students.

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SECTION III

Practical Application of Technology

6. FLOODUP, a citizen science project to increase flood risk awareness and collective knowledge

Montserrat Llasat-Botija[1], Maria Carmen Llasat[2]

Abstract

In recent years, there has been a growing demand to strengthen the connection between science and citizens, either through knowledge transfer or through co-participatory and co-creative processes. The goal is to ensure that the benefits of any knowledge gained reflect back on society and, in turn, that citizens become more involved in knowledge generation and more empowered. In this context, this article analyses the importance that this two-way exchange can have when dealing with flooding. To do so, the article focuses on floods in Catalonia (northeast Spain) and on the development of a methodology to encourage this exchange through the FLOODUP application, used mainly as a citizen science tool. This paper presents the adaptive learning-while-doing approach of the FLOODUP project in each of its three phases. The floods in the Maresme county in Catalonia during October 2016 are presented as a case study. In this case, citizen participation through platforms such as XOM, Meteoclimatic and FLOODUP allowed a better diagnosis of the event.

Keywords: Floods, citizen science, resilience, Catalonia, FLOODUP

1. Introduction

According to the EM-DAT database, 951 natural disasters occurred in Europe between 2001 and 2020 related to the weather. 41% of these were floods, which caused 2,142 fatalities, followed by storms (27%) and extreme temperatures (23%). Floods are the type of natural disaster that affect the highest number of people: more than 6.6 million people were affected in

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Europe over this 20-year period (CRED, 2021). The floods recorded in July 2021 in Germany and Belgium caused 200 fatalities and $20 billion worth of damages. In Spain, between 1971 and 2020, the "Insurance Compensation Consortium" (*Consorcio de Compensación de Seguros*, CCS) paid more than €7 billion (updated for 2020) in damages by floods, a figure that represents more than 60% of total insurance claims (CCS, 2021). These numbers show the significance of floods in Europe and their consequences.

The impact of these disasters is related not only to their frequency and to magnitude, which depends on hazard conditions, but also on the vulnerability and exposure (Merz *et al*., 2021; Kreibich *et al*., 2017). Consequently, knowledge of these components is very important to improve resilience and preparedness. In recent years, advances have been made in the investigation of these events from different approaches (Barredo, 2010; Petrucci *et al*., 2019; Blöschl *et al*., 2019; Di Baldassarre *et al*., 2013). In particular, the response of the population and their capacity to deal with natural hazards is important to reduce the impact of disasters (Moser, 2014). For this reason, it is so important to improve awareness among the population and engage them in prevention actions. For example, understanding meteorological warnings determines the response of the population; this understanding is not complete if the phenomenon is not well known. On the other hand, it has also been observed that citizen participation improves the response to emergencies, as well as their prevention and recovery, since citizens feel empowered and capable of making proactive decisions. For this reason, greater importance is being given to the participation of the population in coping with natural hazards (Fekete *et al*., 2021; Starkey *et al*., 2017).

The content of the paper is structured as follows: Section 2 presents the area of study (Catalonia, northeast Spain) the floods database INUNGAMA in this region, and the spatial distribution of flood events for the 1981-2020 period. Section 3 addresses the application of citizen science to increase flood risk awareness and collective knowledge; Section 4 continues with the presentation of a case study; and lastly, Section 5 presents the conclusions.

2. The importance of floods in Catalonia

2.1. Area of study

Catalonia is in the northeast of the Iberian Peninsula and covers an area of 31,895 km^2 (6.3% of Spain). The French border is located at its northern edge, this is, the Pyrenees Mountain Range, while to the south is the Iberian

Mountain System. This already complex orography is rounded off with the Pre-Coastal Mountain Range and the Coastal Mountain Range, which both lie parallel to the coast. As the population's reliance on agriculture and livestock have reduced, the population inland has decreased, and people have moved to coastal municipalities. Consequently, out of a population of 7,522,596 (IDESCAT, 2016), 3,239,337 inhabitants live in the Metropolitan Area of Barcelona (*Àrea Metropolitana de Barcelona*, or AMB), which covers 636 km^2 and frequently experiences heavy rains. The majority of this population is concentrated in the municipality of Barcelona (1,608,746 people), located between the Besòs river and the Llobregat river, the Coastal Mountain Range and the Mediterranean Sea.

Catalonia is divided into two main large hydrological regions (Fig.1). The first region (16,423 km^2) is within the Autonomous Community of Catalonia (the Catalan government manages it) and includes all the Internal Basins of Catalonia. The second is part of the Ebro Basin (85,534 km^2, and less than 25% is in Catalonia), and is managed by a consortium of regions in different Autonomous Communities under the umbrella of the Spanish government. Although this division between different administrations does not affect the INUNCAT flood prevention and management plan (DGPC, 2017), which depends on Civil Protection, it does hinder the exchange of basin data (flow, precipitation and so on) and communication to the population.

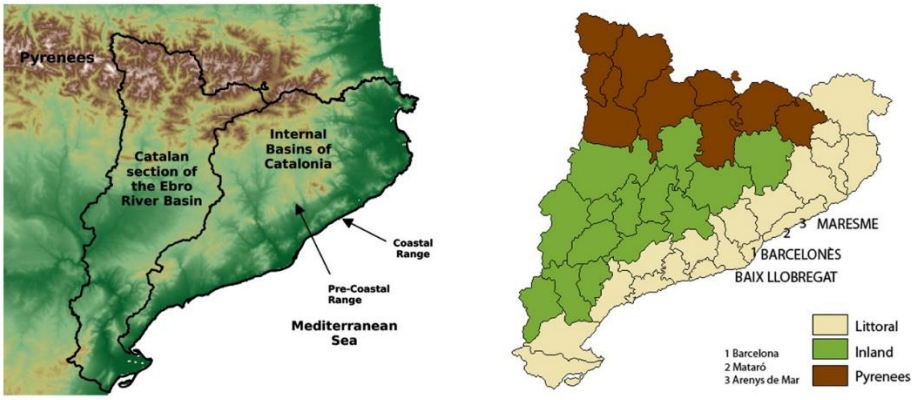

Figure 1 - *Map of Catalonia showing the toponyms and locations cited in the text (Source: Llasat et al., 2014).*

2.2. Floods in Catalonia

The proximity to the Mediterranean Sea, coupled with these orographic characteristics, results in torrential rains developing that result in frequent flash floods and urban floods, mainly in summer and autumn (Llasat et al., 2016). In general, these floods affect the coast, where most of the population lives. The number of residences in flood prone areas and the lack of knowledge of flood risks by a large number of the population are the main reason for economic and human losses. The Spanish public reinsurer, the Insurance Compensation Consortium, paid more than €700 million (values updated to 2020) (CCS, 2021) in compensation for flooding during the 1996–2020 period. Approximately one-third of the flood episodes affected the counties of Maresme, Barcelonès and Baix Llobregat, which belong to the Metropolitan Area of Barcelona (Fig. 1).

Floods in Catalonia are usually surface water floods, which means rainfall-related floods (Bernet et al., 2017), including pluvial floods but also flooding from sewer systems, small open channels, diverted watercourses or groundwater springs (Falconer et al., 2009). The presence of the coastal mountain range encourages heavy rainfall to develop which in turn results in flash floods and urban floods. They take place in ungauged catchments or in urban environments where there are no measurement stations. Therefore, there is usually no hydrological information on these floods. This lack of information and the need for this information in order to reconstruct historical events is one of the main reasons to call on citizen contribution.

Despite the fact that flash floods are usually local and do not cause significant damage, in some cases they can be catastrophic. The most severe flooding episode in Catalonia took place on 25 September, 1962, in the Besòs river basin, in Vallès Occidental county, to the west of Barcelona. There were 815 casualties and more than €600 million (adjusted to 2020) in direct losses, which were the result of heavy rains (212 mm in less than 3 hours) that led to river floods to levels not seen in 200 years (Martín-Vide & Llasat, 2018), and were also caused by high levels of exposure and vulnerability. It was also the result of an over occupation of flood zones by migrants that arrived in Catalonia in large numbers from other Spanish regions to work at the booming textile industry, the absence of flood prevention and management plans, and the poor weather forecasting tools at the time. Compared with the flood event of 10 June, 2000, under similar hazard conditions, there was a considerable improvement both in exposure (less population density due to the textile factories closing down), and vulnerability (improved protection and flood prevention plans and early warning system, together with the

creation of Civil Protection) (Kreibich *et al*., 2017). However, a field visit to residents who currently live near the rivers that flooded in 1962 shows that they no longer feel at risk due to floods, and vulnerability has again increased (the “levee paradigm" that creates a false feeling of security, Di Baldassare et al., 2018). On the other hand, a post-event analysis carried out recently (Martín-Vide & Llasat, 2018) that includes more observations, has shown that initially estimated discharges were 2 to 4 times greater than the approximate rainfall-based water discharges. This fact justifies the benefits of collecting more information from pictures, witnesses, and so on. This flood event is an example of the dual benefits of the application of citizen science to floods: greater risk awareness, better events reconstruction.

An analysis of historical floods since the 14th century shows a growing trend in so-called extraordinary floods in Catalonia (Llasat *et al*., 2005, 2014; Barrera-Escoda & Llasat, 2015). This trend, which began in the mid-19th century, has mainly been attributed to greater occupation of potential flooding areas and to the alteration in land use. Future scenarios show an increase in flood damage (Cortès *et al*., 2019), which is partially justified by the increase in short but heavy rainfall events (Llasat *et al*., 2021). The last catastrophic floods recorded in Catalonia, known as storm “Gloria”, were a good lesson for the population on how climate change could produce more severe compound events than in the past (Canals & Miranda, 2020). The problem, however, is that we are in a so-called liquid society (Bauman, 2000), in which news and events are easily forgotten. One of the objectives of FLOODUP is to awaken historical memory on what floods meant for the region historically and what measures have been developed and can be applicable to mitigate their impact.

2.3. INUNGAMA database

In addition to post-event analysis through surveys (Ruin *et al*., 2014), press and internet plays a major role to collect risk data. Press is also very useful for the reconstruction of episodes and for the completion of serial episodes (Bayés Bruñol *et al*., 2003; Llasat *et al*., 2009b; Petrucci, 2012). Press reports and other sources such as insurance companies or official reviews allow us to fill in data when there is not enough instrumental information. They are also useful to compare with available information, and to have a detail of flood impacts through photographs and videos. The media is the best source when there is interest in creating a systematic database with all the floods recorded over a long period in a broad region, including floods that occurred in

ungauged catchments, as it contains daily and continuous information over long periods. For episodes prior to the presence of newspapers, it is possible to resort to historical archives.

In 2000, a historical flood database began to be created by the GAMA team in the context of the European SPHERE project (Benito *et al*., 2004) using criteria to classify floods based on damage descriptions (Llasat *et al*., 2005). This criterion is applied in the present paper. The compiled information comes from historical archives (for the oldest events), press news, technical reports, and scientific articles with a view to collecting sufficient rigorous information to characterise flood events and their impacts, as well as to analyse trends in the context of risk change. The result was INUNGAMA, a flood database in ACCESS connected to a GIS (Geographical Information System), which in 2007 contained 217 flood episodes for the 1901-2000 period (Barnolas & Llasat, 2007). A posterior analysis of the systematic period 1981–2010 (Llasat *et al*., 2014) showed that, from 219 floods recorded across the region on this period, 11% of them were catastrophic, 53% were extraordinary, and the rest only produced minor damages. The reader can find more information about the classification criteria and methodology in Llasat *et al.* (2013, 2016). INUNGAMA is part of the Mediterranean database on catastrophic floods, FLOODHYMEX (free access in https://mistrals.sedoo.fr/?editDatsId=1150&datsId=1150&project_name=MISTRALS). This database is updated continuously. Figure 2 shows the number of catastrophic flood events recorded on a municipal scale over the last 40 years. The maximum frequency corresponds to the coastal region where the three components of risk, hazard, vulnerability, and exposure are at their highest (Llasat *et al*., 2016).

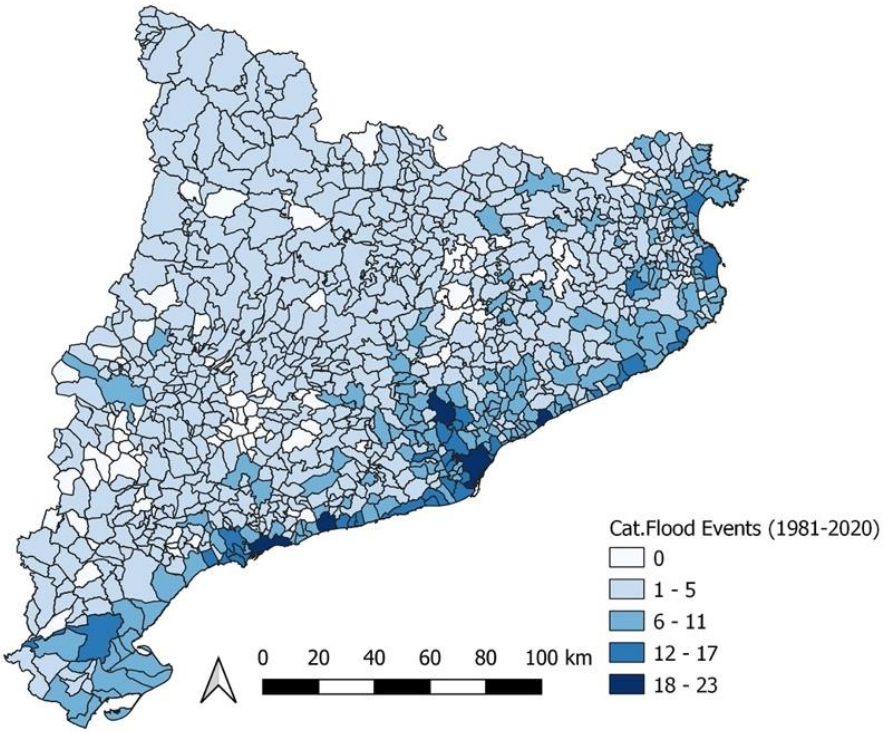

Figure 2 - *Map of the number of catastrophic flood events that have affected each municipality of Catalonia from 1981 to 2020.*

It should be said, however, that despite the systematic search for information, there are still notable uncertainties about the date, location, and damage of the floods, which can be reduced with the collaboration of the population.

3. The application of citizen science to increase flood risk awareness and collective knowledge

3.1. Citizen science

Over the last few years, new technologies have developed that allow the emergence of collaborative and participatory projects in which citizens contribute to scientific research, for example through their data and observations, in what is known as "citizen science" (Paul *et al*., 2020; Vohland *et al*., 2021). The concept of citizen science is very broad and there

are different definitions for it. The "Green paper of citizen science" (EC & SC, 2013) defines it as follows: "*Citizen Science refers to the general public engagement in scientific research activities when citizens actively contribute to science either with their intellectual effort or surrounding knowledge or with their tools and resources*". The European Commission (2016) defines it as a "*scientific work undertaken by members of the general public, often in collaboration with or under the direction of professional scientists and scientific institutions*" (European Commission, 2016). Muller et al. (2015) synthetises the work of different researchers and concludes that "*Citizen science is a form of collaborative research involving members of the public: volunteers, amateurs and enthusiasts. It can be thought of as a form of animate crowdsourcing – or 'participatory sensing' – when it actively involves citizens collecting or generating data. Hardware sensors can be used by citizens to collect data, but citizens themselves can also be classified as 'virtual sensors' by interpreting sensory data".*

With these definitions in mind, citizen science comprises a broad series of activities and practices with the common thread of non-specialist citizens taking part, in an active and meaningful way, in tasks in a scientific project. In Spain, there are an increasing number of projects of this nature, as shown by the Observatory of Citizen Science (Ibercivis, 2021) and the Citizen Science Office of Barcelona (Ajuntament de Barcelona, 2021). Along these lines, the review paper by Buytaert et al. (2014) shows how citizen science can be applied in hydrology and water resources and, contains some mentions of how it can be applied in relation to flash floods.

Citizen science presents an opportunity to increase the information available, improve awareness, prevent flood risk, and mitigate its impact.

3.2. FLOODUP

FLOODUP is a citizen science project developed by the authors with the aim of improving the awareness among the population about natural hazards (mainly floods) and climate change, while increasing the information available to researchers (Llasat-Botija *et al*., 2019).

The aim is to create, in a collaborative way, a map of the main impacts of natural hazards and climate change, as well as areas for improvement and ways communities are adapting. To achieve these objectives the main tools developed have been a Mobile Application (Floodup) and an online platform. Through this App, users can provide information on observed phenomena and the damages caused; observations of bad practices or places that could be

particularly affected in the case of floods or other natural hazards; observations related to adaptation, such as traditional local prevention measures, protection infrastructure, or new proposals such as Nature Base Solutions. (Llasat *et al*., 2020).

The citizen science projects are dynamic and must adapt and evolve attending the social and scientific challenges. Considering that this book deals with new scientific methods for the Anthropocene related with Information technologies and social media, the following paragraphs show the three phases of FLOODUP, with the challenges and lessons learned. The FLOODUP project started in 2014 with the support of the Spanish Science and Technology Foundation (FECYT, FCT-14-8681). At first, it focused on flooding, but now it has been expanded to a wide range of hydrometeorological phenomena (droughts, storms, landslides, etc.), and includes a category of "other" to accommodate several other phenomena that participants wish to send for research purposes.

3.2.1. Start of the project (2015-2017)

The project was founded with the aim of being a scientific dissemination project with a component of citizen science. During this phase, the first mobile application was developed and launched, alongside a website, a flood educative dossier, and numerous educational activities and pop-up campaigns.

The first version of the app (2015-2017 period) was downloaded by more than 1,100 people but only 27% (330 people) registered on the app. Profiles of registered users were analysed. 70% of them were men, while 23% were women, and the remaining 7% were institutions and entities. As for their origin, 74% of users came from Spain. 5% of all registered users were citizens of other European Union countries (Germany, Italy, France, Hungary, Slovakia, Bulgaria and Austria), while 8% were from countries outside the EU (mainly countries from South America like Colombia, Argentina, Perú, Uruguay or México, but also people from Nigeria, Burkina Faso, India, Indonesia, Malaysia, Saudi Arabia, Kazakhstan and Canada). The origin of the remaining users is unknown (Fig. 3). As for users from Spain, Catalonia had the greatest share of users out of all the Autonomous Communities, with 46% of the total number of users.

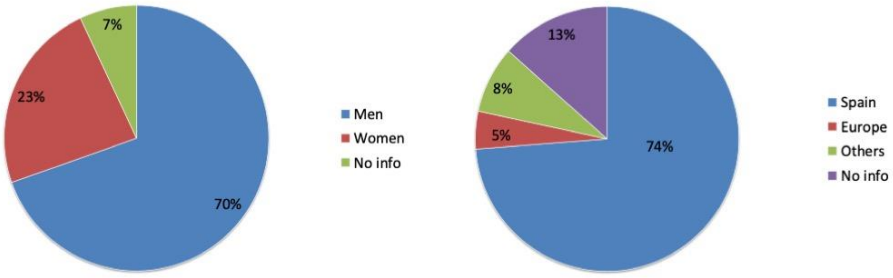

Figure 3 - *Profile of users registered in the FLOODUP app according to gender (left) and origin (right).*

Over 700 contributions were collected through the different channels in its first phase. Through the app, 263 observations were uploaded and validated, out of which the most important share (59%) were connected to flood observations, followed by the category of "other phenomena" (23%), in which a significant proportion were storms and hail. The rest covered other observations (8%), vulnerable areas (5%) and historical flood memory (5%). 47 episodes of flooding (3 located outside Spain) and 35 episodes of other phenomena were identified too. Most observations were images of events (heavy rain, floods, etc.) that were going on at the time, although events from previous years were also uploaded. This information was useful in completing some episodes of the INUNGAMA database. Another result of this first phase was the information collected on the October 2016 flood event (see Case Study).

In summary, the main objective of the project in this phase was educational, with a citizen science component, and it was more heavily focused on floods. At the time, there was a great growth in science education apps. Two lessons were learned in particular: the need to register is an obstacle to app use, and the importance of developing educational activities to increase the project's impact.

3.2.2 Intermediate phase (2017-2019)

During this phase, the project evolved, with citizen science taking centre stage. The app did not operate during this phase, but alternative channels were tested to encourage participation. With the goal of detecting potential improvements to create a new version of the app, a participatory campaign

was launched. Relevant methodology to carry out the project in secondary schools was designed during this phase. The main objective was to gather information about floods in local neighbourhoods and raise awareness about natural hazards and climate change. A physical flood model that could be taken to schools and workshops such as Science Fairs was developed (Fig. 4). In collaboration with the flood management entity in Barcelona, BCASA, some materials were developed to explain the risk of flooding and flood management in the city.

Figure 4 - *Physical flood model.*

Another key activity in the second phase were workshops with elderly people. These workshops, held in the city of Barcelona, worked on a map of the environment, and gathered information on specific areas that were the most frequently flooded, with proposals from citizens on green areas and other measures that could reduce the flood risk. Around 40 observations were collected, of which more than 50% were about flood events. Most people remembered the events were the most recent or the most catastrophic, such as the 1962 event. The rest of the observations corresponded to “aspects to improve” (20%) such as problems related with the drainage system or the design of public squares, and “good practices” (25%) such as green spaces or rain gardens.

The pop-up campaigns continued, and the project participated in the FORCES project of the Barcelona Education Consortium. The project became a member of the Barcelona Office of Citizen Science (https://www.barcelona.cat/barcelonaciencia/es/ciencia-ciudadana). This gave a remarkable boost to the project. In summary, this phase was characterised by links with other citizen science projects through the Office of Citizen Science. The citizen science component became more important

and begun to be linked with research projects carried out by the group. The educational component was not lost, and was reinforced using citizen science as an educational strategy. The most important point learnt from this phase was the importance of collaborating with other projects, not only to learn but also to establish synergies between projects. It could be seen that workshops are a good strategy to collect information, but that they require physical supports such as models or maps.

3.2.3 Third phase (2019-present)

A new app has been developed in the context of the PIRAGUA project (EFA210/16 Interreg V Spain-France-Andorre Programme POCTEFA 2014-2020, EU) and a Twitter project profile has been launched (Fig. 5). In this phase FLOODUP has been included in the Observatory of Citizen Science in Spain (https://ciencia-ciudadana.es/proyecto-cc/floodup/) and in the European portal EU-CITIZEN.SCIENCE (https://eu-citizen science/project/173).

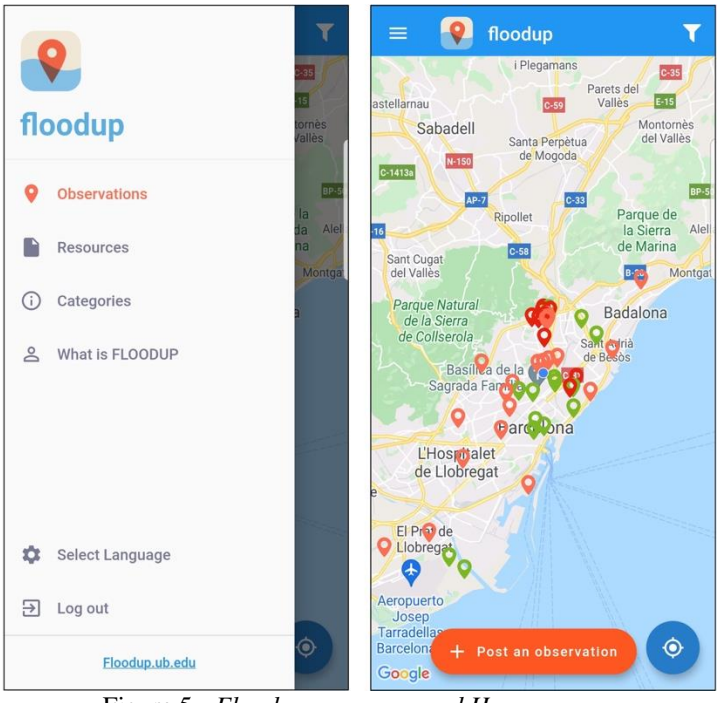

Figure 5 - *Floodup app menu and Home screen.*

In the new version, the phenomena that can be collected through the app has been expanded beyond floods. Some of these, such as extreme temperatures, are phenomena that have significant media coverage and a high social interest as we have seen in previous studies (Llasat *et al*., 2009a). Currently, the app has almost 300 registered users. As for the twitter profile (@floodup_UB), which was launched in September 2019, it has already accumulated more than 190 followers and has published more than 390 tweets (between tweets and re-tweets).

Two relevant actions can be highlighted in this phase: some projects carried out with high school students, and post-event flood campaigns. The last campaign was devoted to providing information about a flood event that took place in October 2019, sharing information with citizens and develop a co-participative project. In terms of the school projects, the curriculum dossier for the schools has been expanded, and seven projects have been carried out in schools. Students have contributed to this project by uploading observations made if a rainfall event was recorded near the school during the project, good practices and problematic areas in the neighbourhood; they also measured the rain collected and gathered information from local residents through questionnaires. The results have scarcely been homogeneous and, in some cases are not at all representative. This led us to debug projects to make them easier to implement as well as more systematic. However, these activities helped students to feel part of the project of characterizing a neighbourhood in terms of flooding and valuing the importance of their observations.

In summary, during this phase a new version of the mobile application was launched and continues to evolve as a school project. The project is no longer limited solely to floods and has expanded to climate change. In relation to the context, it is necessary to highlight the national and international tendency to give more importance to citizen science with new lines of public funding. During this stage, large events have followed in quick succession (storm Gloria, the Covid pandemic, etc.) with a strong impact on society. Finally, concepts such as the climate emergency are emerging, and the SDGs have become popular. An important learning point from this phase has been that post-event campaigns should be conducted as close as possible in time to the event, in order to take advantage of mobilisation and citizen's recent memory.

4. Citizen participation in a case study: the Maresme flood event in October 2016

The first study in Spain of an adverse meteorological phenomenon considering information from social networks, was that of the snowfall of March 2010 (Llasat *et al*, 2010). In this case, social networks were used as a source of information to learn about the different types of population response to an extreme weather event. Along the same lines, the article by Oliver *et al*. (2021) focused on tweets collected during three campaigns to assess the population's perception of coastal risks and climate change. In both cases, the citizens were not aware of participating in the process, rather they were the object of study. In the episode analysed below, the citizens consciously sent the information, which made it possible to improve the diagnosis of the episode. Most of them provided rainfall data through the network of volunteer weather observers (XOM) of the Meteorological Service of Catalonia (SMC), and the METEOCLIMATIC network that compiles a large number of the meteorological observations sent by professional and amateurs observers, while a few provided images and descriptions through FLOODUP.

Between 12 and 14 October 2016, there was intense rainfall that had a particularly significant impact on the Maresme region (Fig. 6), where most of the streams overflowed. On 12 October, the rain began to fall on the southern part of the region and soon spread along the littoral counties. During the afternoon and evening, the heaviest rains affected the centre and northeast of the Catalan coast, leaving the rest of the territory with more representative rainfall. The next day, 13 October, the rain became more widespread everywhere, without exception. Finally, on 14 October, the rain disappeared gradually from west to east. Figure 6 shows how cumulated precipitation in 72 hours was over 100 mm in all the coastal counties between the Barcelonés county and France, with a very localised maximum above 200 mm in the southern part of the Maresme county. Most of this precipitation was recorded in a very short time, giving rise to flash floods that caused damages estimated at some €7.4 million euros, and one death.

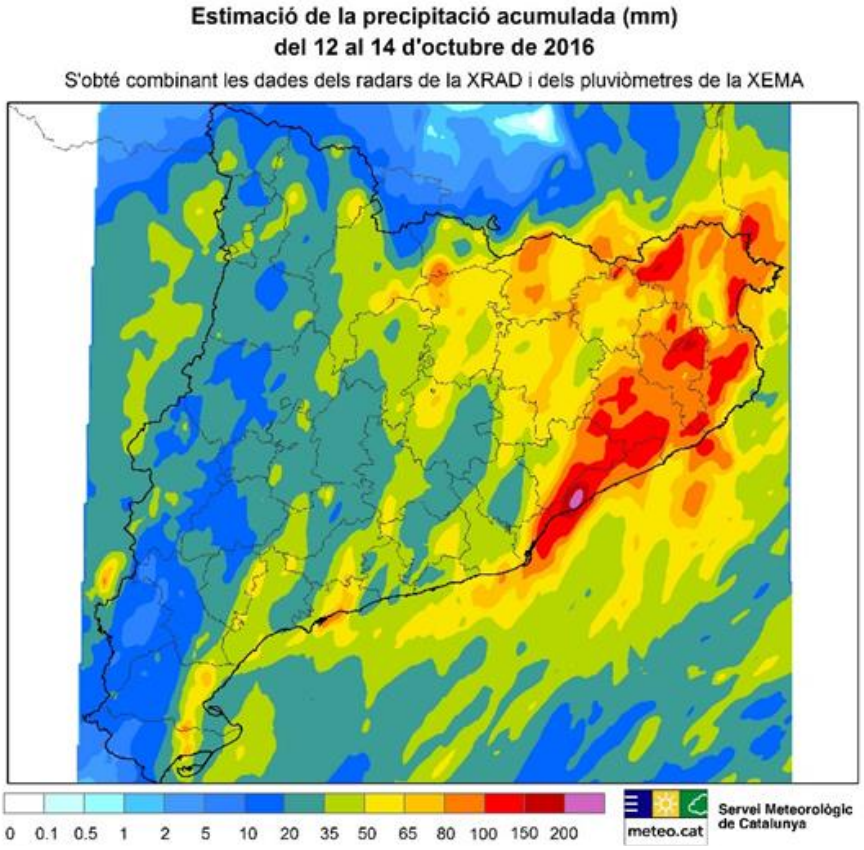

Figure 6 - *Cumulated rainfall in Catalonia between 12 and 14 October 2016 (Source: SMC).*

The XOM collaboration and fieldwork through the app allowed us to collect over 200 observations on the effects of the episode, most of them in the Maresme region (Fig. 7, 8). Throughout the episode, XOM members made some 50 warnings about rain intensity, rough sea conditions and windstorms, amongst others. More than 480 tweets, 71 posts on Facebook and 8 posts on Instagram were posted in connection with this episode. With the help of FLOODUP, visual information concerning this episode was also obtained. The Maresme region is crossed by numerous streams in the Coastal Range. They are characterized by their steep slope, they only carry water when heavy rains occur, and they can cause serious damage since they all run through urban areas (Fig. 7). Since these are ungauged catchments, rainfall data and observations of water level and impacts are very useful to reconstruct the event. In this event, the images showed how the water height and speed

was important and affected communication infrastructure, (highway, roads, streets, etc.) as well as partially destroying the sewer network (Fig. 8).

Figure 7 - *Photo of the flooded area in Vilassar de Mar (Source: Twitter FLOODUP).*

Figure 8 - *Damages to the pavement caused by floods in Vilassar de Dalt (Source: FLOODUP).*

According to the official rainfall network of SMC (XEMA), 256.5 mm were recorded in Cabrils over the three-day period (234.1 mm in 24h, Fig. 9) but the big difference in comparison with other nearby stations cast doubts about accuracy. Citizen collaboration through the XOM corroborated this value, as they recorded 290.5 mm (257 mm in 24 hours) and 200.3 mm (176.2 mm in 24 hours) in Vilassar de Mar and Teià, respectively (Fig. 9). METEOCLIMATIC also corroborated this information, with maximum cumulated precipitation of 296.2 mm and 223.6 mm in Vilassar de Mar and Premià de Mar, respectively. The maximum intensity was recorded in Cabrils by a XEMA station with 84.4 mm in 30 minutes, showing the extraordinary magnitude of this rainfall event.

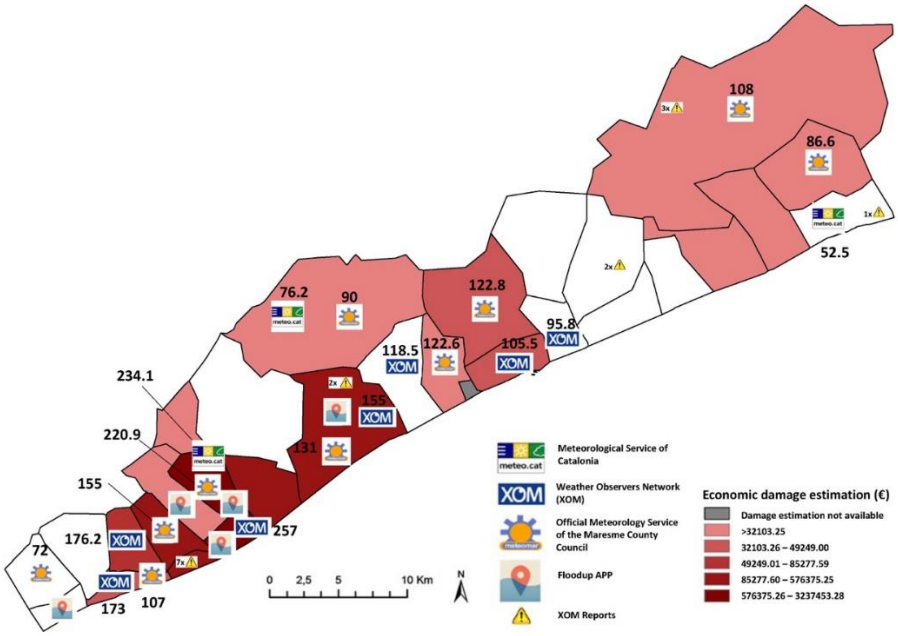

Figure 9 - *Map of the Maresme episode with the available information. The municipalities are coloured according to the economic losses as estimated by each Town Hall concerned. Precipitation (mm) refers to 24 h. (Source: Llasat-Botija et al., 2019).*

FLOODUP allowed 342 impacts to be identified. The study by Cortès *et al.* (2018) showed that, in Catalonia, it is possible to obtain a relationship between accumulated precipitations over 24 hours and the likelihood of serious damage estimated by the Insurance Compensation Consortium (CCS). In the case of October 2016, the correlation between CCS compensations for flood damages in each municipality and the maximum daily precipitation registered is 0.7. Taking into account that other factors also influence the amounts paid (Cortès *et al*., 2018), we can consider this correlation relevant. Figure 10 shows the relationship between the compensation paid by the CCS to each municipality, the estimate made by the city council and the total rainfall of the event. It is observed that the city council estimates a higher amount than the CCS. This is not unusual, because there are some urban assets that are not covered by CCS. The relationship between rainfall and damages is adjusted to an exponential law, in which from a certain value of the cumulative total precipitation (between 150 and 200 mm) economic damage quickly increases. Teià (3) stands out for having a high precipitation, but their damages were below the curve (lower population density, more resilient buildings due to high GDP). Pictures collected through FLOODUP highlighted the largest accumulation of water in Premià de Dalt (4) and

Premià de Mar (5), located downstream, despite the apparently low rainfall recorded in situ. Although the high water level could be the result of rainfall in the upper part of the basin, data provided by four METEOCLIMATIC stations located in Premià de Mar show accumulated values above 200 mm, that also justify the floods in situ. The picture from Vilassar de Mar (1) (Fig. 7), downstream of Cabrils (2), allows us to see the stream overflow and helps us to understand the tremendous scope of the damage. The gap from the curve shown in the cases of Vilassar de Mar and Premià de Mar is justified by the high vulnerability of both villages because they are crossed by the national road, the railway track, and are at the mouth of the streams that overflowed.

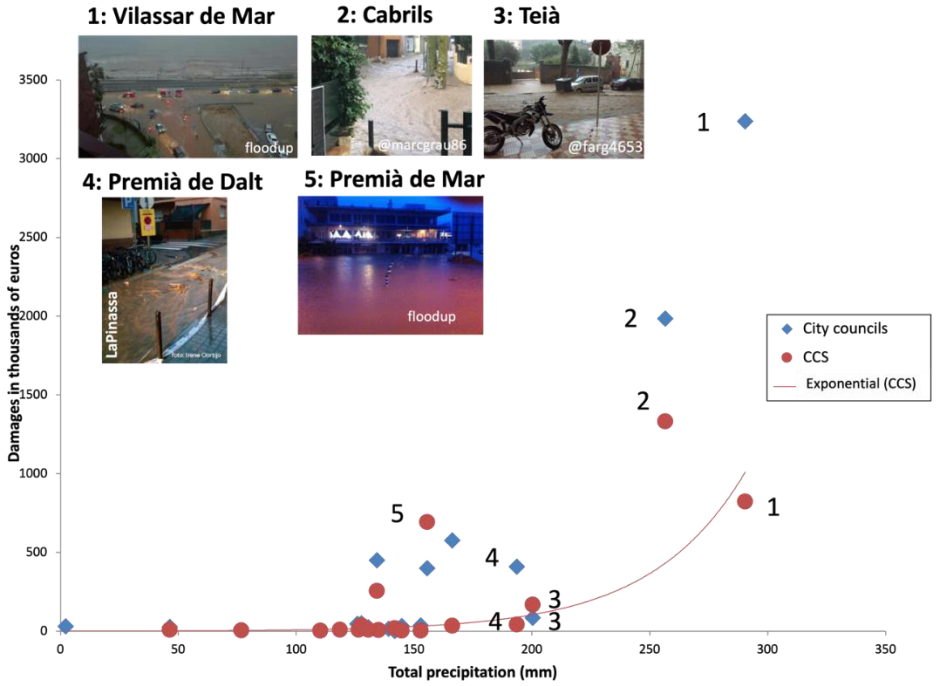

Figure 10 - *Relationship between the economic assessment of damages made by the Municipalities and the amounts paid by the CCS (€) with the total precipitation in the municipality (mm). (Source: Llasat-Botija et al., 2018).*

5. Conclusion

Throughout this paper, the FLOODUP project has been presented as a tool to improve flood risk awareness and available information for research. It has been observed that hands-on and participatory activities promote greater engagement among the population in helping to protect and prepare for

natural hazards. It is also an opportunity for citizens to participate closely with researchers and provide help. A close follow-up and respectful relationship can allow us to build a lively and enriching community for all.

The use of technology such as the app or Twitter allows for fluid and almost real-time communication. It also makes it possible to share information among the population. However, there are some issues to be taken into account. The low percentage of registered users once the app gets downloaded shows that registration and privacy management are sensitive aspects in this type of project. Other obstacles to participation have been identified. The first is related to the time and location of the event in relation to the collaborator's coordinates. The second issue is associated with technological difficulties and barriers (for example, not having enough free space on mobile phones to save images). A third issue to be taken into account is recognition of citizen participation. In this case the project has difficulties due to competition with the media, especially regional TV broadcasters, which also collect images. The expectation that citizen contributions will appear on the weather news on TV, makes it the main channel where photographs are sent by citizens. Finally, a fourth question to take into account is the complexity of developing and maintaining tools like the mobile application.

Citizen science is an important source of information to increase available data—especially from remote or under-reported locations—, to identify differences in the distribution of impacts through more detail, and to validate meteorological observations. In relation to weather and hydrological information, the case study presented (October 2016) shows the usefulness and importance of having "weather stations and observation points" distributed across the territory, especially when it comes to episodes with concentrated precipitation both in terms of time and space, as large variations can occur from one point to another nearby. This type of network of volunteer observers is highly appreciated and is an important asset to the existing network of official stations. Pictures and videos can also contribute in a useful way to hydrological modelling or to understanding damages thanks to the visual and detailed information provided by citizen observations.

Finally, a project such as FLOODUP should be coherent and rigorous in its objectives and applications, while being flexible enough to adapt to social and technological changes over time and taking into account the comments and suggestions of the participants.

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7. HYDRIC BATH — recent learnings and a new research methodology for the assessment of long-term flood risk using documentary evidence

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Abstract

The HYDRIC BATH Project was a multidisciplinary project which aimed to investigate and assess the utility of documentary evidence of past flood events (1823-1960) for contemporary flood risk assessments. By bridging the fields of engineering, history and statistics and drawing from the combination of the use of historical documentary evidence and modern technological modelling techniques, it allowed an improved assessment of long-term flood risk of the City of Bath, United Kingdom.

Bath is a historical UNESCO world-heritage site and as it has always been located close to the river, communities in Bath have experienced the effects of flooding since early settlements in Roman times. The novelty of this research was the different methodology adopted for information and data gathering compared to current scientific practice. A 1D hydraulic model representing the River Avon through the city of Bath was constructed using data collected from a variety of sources and in various formats, including historical photographs, local knowledge, engineering drawings, technical reports, water level charts, and physical markings of historical water levels in the city. Identification and translation of this material into a unified and useful format was a major and challenging undertaking, at times relying purely on serendipity.

This project showed that the inclusion of historical flood data can have a dramatic effect on the outcome of a flood frequency analysis for contemporary flood risk assessments showing a 20-30% increase in the 100-year flood. The use of documentary sources is relevant to many disciplines, thus, central repositories of this information need to be created to facilitate this. This research was an important paving stone towards the integration of

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social science and digital / IT to aid scientific investigations in the field of engineering.

Keywords: flooding; historical flood; flood marks; documentary sources; hydrological reconstruction

1. Introduction

The city of Bath is located in the county of Somerset in the South West of England with an estimated population of 101,106 (The Geographist, 2019). In 1987 the city was recognised as a cultural UNESCO world-heritage site, a place of "outstanding universal value to the whole of humanity" (Bath World Heritage, 2022). The first known settlement in Bath (named Aquae Sulis), was founded around 44AD by the Romans and the city of Bath is a remarkable case study in how the history, architecture and development of a city can be closely connected to the city's relationship to its river; the River Avon. Thus, the city has a particularly rich record of historical evidence, primarily physical flood marks on buildings and bridges, but also a well-documented history of flooding through sources such as photographs, technical reports, and previous research. UNESCO recognised the city for its "Roman Remains, 18th Century Architecture, 18th Century Town Planning, Social Setting, Hot Springs and Landscape Setting" (Bath World Heritage, 2022).

The HYDRIC BATH Project was a 2-year multidisciplinary project at the University of Bath generously funded by the Leverhulme Trust. The objective of the project was to investigate and assess the utility of documentary evidence of past flood events (1823-1960) for contemporary flood risk assessments in the City of Bath. Research into historical flooding requires a multidisciplinary approach and thus, by bridging the fields of engineering, history and statistics and drawing from the combination of the use of historical documentary evidence and modern technological modelling techniques, it aimed to provide an improved assessment of long-term flood risk of the city. The project had a long and, at times, difficult journey whilst investigating flooding through the ages. From identifying the flood marks throughout the city; to looking for historical information in the Record Office of the City of Bath, and the archive rooms of the Centre of Ecology and Hydrology as well as the Environment Agency; participating in public engagement activities; creating awareness through a blog and website; starting a wide-Twitter search for additional historical information; and

finally developing a 1D hydraulic model representing the River Avon through the city of Bath and using the model to assess the peak flow of historical flood events in the city.

Over the years citizen science has been used in closed collaboration to research. The HYDRIC BATH Project believes that there is a strong need to engage local communities and involve them in scientific research especially in multi-disciplinary projects such as this. Local knowledge in historical flooding is key and as such data-driven citizen science is a fundamental step towards changing the way communities deal with flooding and towards raising awareness and community resilience. The successful completion of the project was accompanied by extensive public engagement activities (Minerva Public Lecture, Walking with the Scientists, Swindon Science Festival etc.), the publication of a book dedicated to the historical flooding of the city of the Bath "Flooding through the ages: Reconstructing historical floods in the city of Bath" and a journal paper in the Journal of Flood Risk Management (Stamataki and Kjeldsen, 2021) entitled "Reconstructing the peak flow of historical flood events using a hydraulic model: The city of Bath, United Kingdom".

2. Background

The Aquae Sulis settlement was founded around 44AD, and by 50AD a temple and public baths had been constructed around the hot springs to exploit their healing properties. From the 17th century many schemes were suggested to improve the navigation of the River Avon (Buchanan, 1998) but were not realised. The River Avon was finally made navigable by Architect John Wood the Elder (1704- 1754) who introduced weirs and locks to control the river and allow boats to travel upstream from Bristol to Bath. This brought economic prosperity to the area allowing Bath to become an inland port supporting agriculture and the burgeoning industrialisation economy (Buchanan, 1998). During the Georgian period, in the 18th century, the city developed into a spa city (i.e. a city designed for public bathing) which led to an increase in population growth and to the city's development with neoclassical Palladian buildings.

The River Avon (also known as the Bristol Avon) flows through the city centre of Bath creating a very strong connection of the city with the water. The river rises in South Gloustershire and ultimately flows into the Bristol Channel at Avonmouth (see Fig. 1 below). As the city was built around the river, the residents in Bath experienced the effects of flooding from Roman

times and documented the history and their efforts of combating the curse of flooding in countless accounts; which has been extensively discussed by Buchanan (1998) and Greenhalgh (1974).

Figure 1 - *Map of the river Avon which rises in South Gloustershire and flows into the Bristol Channel (NRFA, 2020)*

What is most interesting in the City of Bath, however, is the physical evidence of the historical floods which provides a strong historical record through the town itself. Although this has only been identified for events from the 19th century onwards, historical evidence of past flood events is left on buildings throughout the city in the form of water level marks. There are three locations (see Fig. 2 below) where dated historical water levels have been identified within the city. From east to west: Grove Street, Halfpenny/Widcombe Bridge and Norfolk buildings. The earliest flood mark dates back to 1823 in Grove Street but subsequently, the majority of extreme floods have been recorded underneath Halfpenny (Ha'penny) Bridge (fourteen marks from 1875 to 1960). These historical flood marks predate

data from the available river gauges of the River Avon at Bathford (1969 - present) and St James Bridge (1939- 1968). The flood marks therefore provided a unique opportunity to extend the flow record length in time and to include significant events not captured by the contemporary flow gauging efforts.

The HYDRIC BATH Project focused its research on the centre of Bath, modelling an 8 km stretch of the River Avon from Bathford (~3 km upstream of Bath City) down to Twerton Sluices (on the western side of Bath) where the river flows down to the city of Bristol and ultimately to the at Avonmouth.

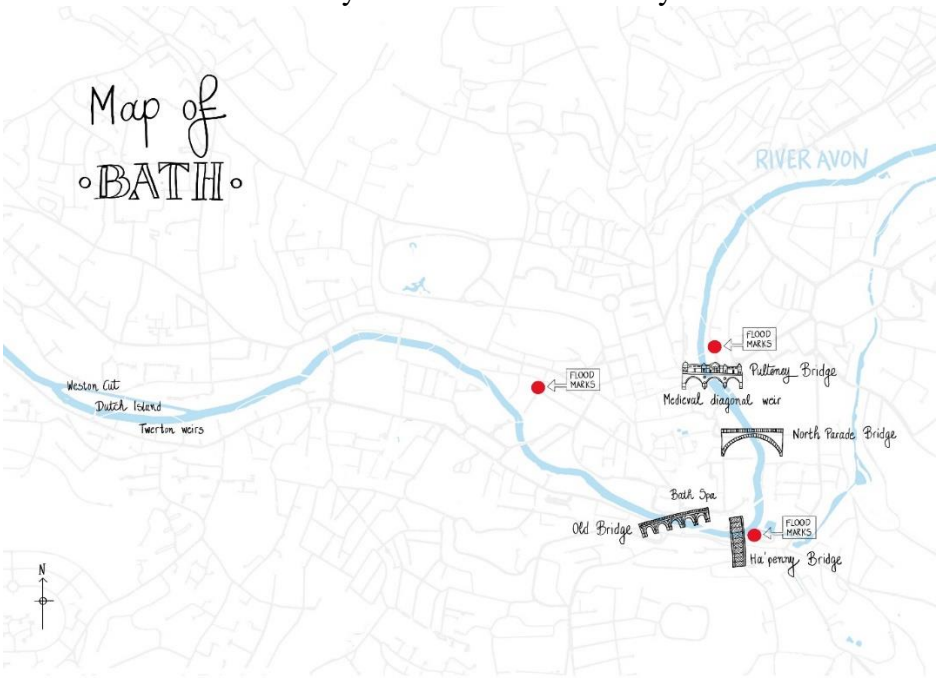

Figure 2 - *Map of flood marks and important hydraulic structures in the City of Bath (Stamataki et. al, 2020).*

Even though the city was combating extreme flood events for centuries, it was the severe flooding of the city in 1960 that led to the implementation of a more effective flood management approach to protecting the city from future events. This ultimately resulted in the development of the Bath Flood Protection Scheme in the mid 1960s which was completed in the early 1970s. The scheme included radical changes to the geometry of the river channels, the removal of a 5-arch bridge and the construction of new sluice gates. As a result, the modern-day hydraulic structure of the river is changed from the earlier conditions prevailing at the time of the floods leaving the flood marks.

Thus, a credible reconstruction of the historical flood events required consideration of the hydraulic conditions prior to the changes imposed by the Bath Flood Protection Scheme.

3. Methodology & Data Collection

This research, using the modelling software Flood Modeller (Jacobs, 2019), built a 1D hydraulic model of the River Avon by combining river geometrical data and available hydrological data. As discussed above, the model represents the river channel and surrounding environment at the time the flood marks were left on the building, i.e. prior to the construction of the Bath Flood Protection Scheme.

3.1 Data Needed

Hydraulic models are a numerical representation of a river and are used as an investigation tool to understand a system's hydraulic behaviour. They can be useful for flood prediction, planning, catchment management, mitigation strategies, future infrastructure works and in this case for the reconstruction of historical flood events. To reconstruct the historical flood events of the city of Bath using a numerical model required therefore for the HYDRIC BATH Project to reconstruct the hydraulic conditions of the river at the time of the floods.

Building a historical model and finding the correct input conditions is not an easy task and requires different aspects to be carefully considered as well as the use of historical and modern data sources. The first step is to separate in the numerical model the river channel into cross sections that represent the geometry of the river at specific locations. The cross sections can either be simple river cross sections, bridges or weirs. Then the next step is to specify the longitudinal distance between the cross sections. But to create a realistic flood model, we don't only need geometrical information but also flood data and information. Flood hydrographs are the most important input in numerical models. They are graphs that show how a catchment responds to a rainfall event by plotting the flow rate over time for the duration of the flood. Hydrographs are introduced at the upstream boundary of a model and dictate how the water propagates through the river model. The schematic below (Fig. 3) shows a simplified setup with an input hydrograph (the flow rate in the

river over time) at the upstream end of the river, an initial river cross section, a bridge and another river cross section.

Figure 3 - *Example of simple hydraulic model consisting of an inflow hydrograph, two river cross sections and a bridge section (Stamataki et. al, 2020).*

3.2. Data Sources

This section details how the required information was extracted for the modelling of the historical floods of the city of Bath. It will discuss the data sources for: (i) the longitudinal distance between these sections, (ii) cross sections of the river channel, (iii) the geometry of the hydraulic structures, and (iv) the inflow hydrograph (boundary condition).

3.2.1 River cross sections and hydraulic structures

The individual cross sections were found in the Environment Agency's Digital Archives in their office in Bridgwater among another 1,112 scanned drawings relevant to the BFDS. The Environment Agency established in 1996 (Environment Agency, 2022) is a non-departmental public body in the UK whose main responsibilities entail flood management. A total of 233 locations were recorded on the longitudinal section found in the archives, showing measurements of the right and left bank levels, the bed elevation and their longitudinal distance from Avonmouth in feet. In 54 of these recorded locations full cross sections were drawn. All sections were taken in 1934 and were replotted after 1954 to Newlyn Datums; the ordonance datum used in the British Isles.

However, all files were given names in date formats from their scanned date, for example, “2011–12–013” and there was no accompanying index, thus each individual cross section needed to be separated individually. Following the separation, each river cross section drawing was manually digitised, and all dimensions converted from inches to metres before being added to the numerical model.

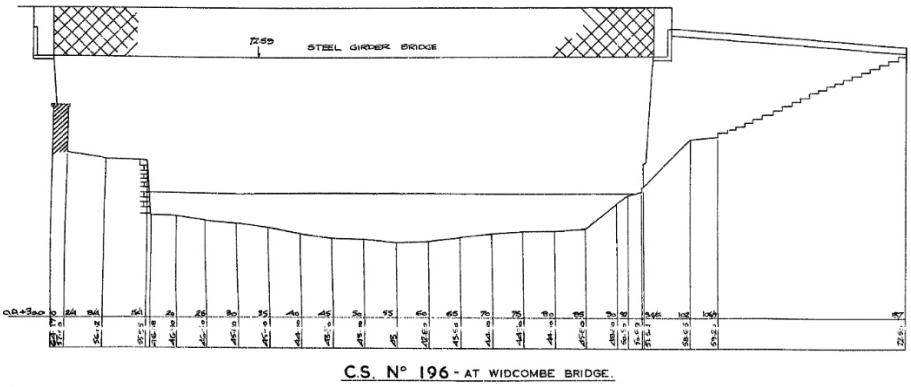

Figure 4 - *Cross section of the river at Halfpenny/Widcombe Bridge taken in 1934 and replotted to revised Newlyn Datums.*

3.2.2 Distance between cross sections

The river cross section drawings were accompanied by an engineering drawing of a longitudinal section between Netham (Bristol) and Bathampton (upstream of Bath) dated 1954 where the distance between cross sections was specified and thus could be implemented in the hydraulic model.

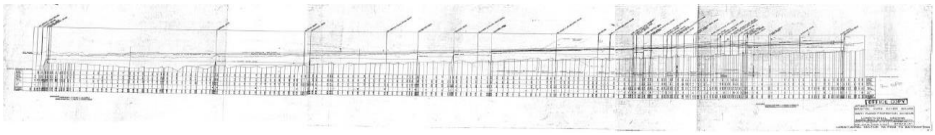

Figure 5 - *Longitudinal engineering cross section from Netham (Bristol) to Bathampton (upstream of Bath) dated 1954.*

3.2.3 Hydraulic structures

The two main types of hydraulic structures in the numerical model are bridges and weirs. The location of the different structures was identified using historical maps as well as reading the history of the city. As the City of Bath was built around the banks of the River Avon and the natural springs, these inevitably brought economic prosperity which in its turn depended upon the construction of important transport routes. Thus, permanent crossing points and bridges played an important role from Roman times. In the 8 km stretch

of the River Avon which was studied by the HYDRIC BATH Project, there were nine bridges.

Weirs also played an important role in the history of the city, and there are three important weirs incorporated in the numerical model: one in Bath's city Centre and the two Twerton weirs located downstream of Bath's City Centre. The name "Twerton" is derived from an Anglo-Saxon word meaning "Two Weirs" and the first mention of a weir at the Twerton location appears as early as 945 AD (Von Behr, 1996) whilst the first sighting of a weir in Bath's city centre was found in "The Savile Map of Bath", dated 1603. The purpose of the weir at the time was to establish a water level difference to power mills. There were two mills at Bath's city centre and the medieval diagonal weir connected these two mills. At the beginning of the Industrial Revolution, whilst the West of England was known for its wool textile manufacturing, there were five mills located around the two weirs in Twerton. In the middle of the sixteenth century however, the Bath cloth industry collapsed, and by the seventeenth century the Twerton mills were reverted to grist milling (Von Behr, 1996). All three weirs played an important role in the economic prosperity of the city as well as the control of the River Avon's hydraulics and remained in place until the Bath Flood Protection Scheme. The weir in Bath's city centre was replaced by the current-day Pulteney Weir and the two weirs at Twerton were replaced by a twin automatic sluice barrage.

Technical drawings of the bridges and weirs were included in the cross sections found in the Environment Agency's office and were digitised and formatted as input into the hydraulic model.

3.2.4 Inflow hydrograph

At the upstream boundary of the hydraulic model, in St James' Bridge, there was a gauging station operational between 1939 and 1968, thus capturing two major events: the 1947 and 1960 floods. For the 1960 flood (the most significant and most recent pre-BFDS flood in Bath) a microfilm version of the recorded water levels documented during the flood was found in the physical archives of the National River Flow Archive (NRFA), in Wallingford (Fig. 6). The microfilm was digitised to create the 1960 inflow hydrograph using an existing rating curve for St James Bridge. However, it is interesting to notice two different parts of the scanned hydrograph: the top and the bottom. At the top it reads "Flood reached the top of the tube. Peak not recorded." and at the bottom "Bottom of chart removed to allow peak level to be shown.". From a reconstruction perspective this can become an

issue, as important information needs to be correlated with secondary sources and shows very clearly the possible uncertainty associated with documentary data.

For the remaining of the historical flood events, due to the lack of a recorded inflow hydrographs, the hydrographs were modelled by scaling the 1 in 100-year design hydrograph for the River Avon developed by Reed (1988) using either peak flow data recorded (e.g. 1947) or reconstructed using the numerical model.

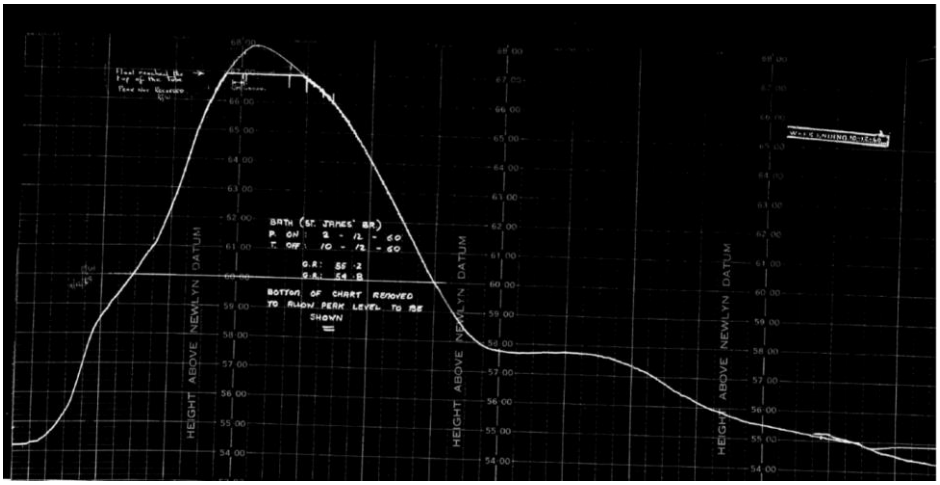

Figure 6 - *Hydrograph of the December 1960 flood event. Microfilm capture of the water levels at St James (Bath City Centre)*

3.2.5 Floodplain extents

Having separated the river channel into cross sections it became obvious that during all the historical flood events the floodplains around the river were inundated (which was also evident from historical pictures), an effect that had to be incorporated in the numerical model. To further understand the hydraulic balance between the river and the floodplains of the catchment area, historical pictures from the floods in Bath were examined, mainly from the 1960, 1882 and 1894 floods. First, using the photographic online archive "Bath in Time" (Bath in Time, 2019), numerous photos of Bath during flood events were identified and geo-referenced. This initiated the creation of our own database and interactive historical flood map containing historical photos from Bath in Time; overlaid with the Environment Agency's historic flood map GIS layer (Environment Agency, 2020) showing the maximum extent of individual Recorded Flood Outlines based on records from 1946. Initially, the

objective of this interactive map was to understand the size of the different floodplains of the city. This allowed us to extend our cross sections to incorporate the effect of the floodplains into the hydraulic model. Figure 7 below for example shows one of the river cross sections in the model. The continuous black line shows the river cross section (River Avon) obtained from an archived engineering drawing and the dashed black line shows the extended floodplains (Dolomeads) which was calculated using the interactive map.

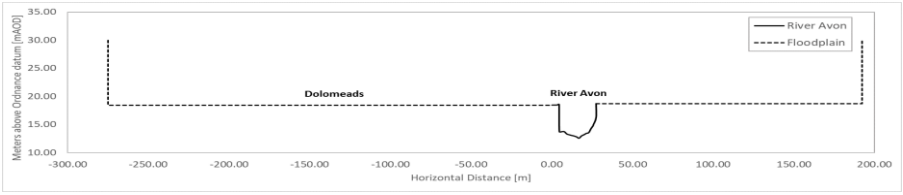

Figure 7 - *Example of a river cross section of the River Avon (continuous black line) and its extended floodplains towards the Dolomeads (dashed black line)*

3.2.6 Additional useful information

Further to the aforementioned data sources, different methods were attempted for obtaining additional historical information. Firstly, a project website (https://hydricbath.weebly.com/) and blog were initiated which were used both for interaction with the general public through comments but also for dissemination purposes of the different updates of our project. The Tweet announcing the website launch reached 982 impressions and 31 engagements.

Our blog posts created peaks of 30-50 views at a time of our website and each blog post gained considerable engagement on Twitter: 4,204 impressions and 110 direct engagements on our first blog post; 1626 impressions and 474 direct engagements on our second blog post; 2037 impressions and 93 direct engagements on our third blog post; 3369 impressions and 212 direct engagements on our fourth blog post; 2006 impressions and 115 direct engagements on our fifth blog post; 2689 impressions and 104 direct engagements on our sixth blog post; 4315 impressions and 308 direct engagements on our seventh blog post and 2945 impressions and 102 direct engagements on our eighth blog post.

In terms of obtaining additional historical information, time was spent looking for hitherto unknown flood marks in the city. A Twitter-wide search was launched by asking Bathonians and Bath residents whether we missed any known flood marks. The tweet obtained 6,967 impressions and had 198

direct engagements and 18 retweets. Overall, the tweet thread obtained a total of 10,184 impressions and 249 direct engagements. To reach an even wider audience, we then extended this with a form on our website allowing everyone to submit a message directly on the flood marks.

4. Application/Reconstruction

4.1 Reconstruction of historical peak flows

The aim of the project was to use existing flood marks in the city of Bath to create a hydraulic model for the reconstruction of these historical events. In the centre of Bath, under Halfpenny/Widcombe Bridge flood marks existed for the floods of: January 1866, March 1867, July 1875, November 1875, October 1882, November 1888, March 1889, 13th November 1894, 15th November 1894, February 1897, December 1900, February 1900, June 1903, January 1925, March 1947 and December 1960. The purpose of the reconstruction was to ultimately obtain a more accurate estimate of the peak flow of these events, which could potentially prove useful in understanding the contemporary flood risk facing the city of Bath.

After the river geometry, cross sections and hydraulic structures were reconstructed numerically, the parameters of the model were calibrated to represent the river geometry pre-Bath Flood Protection Scheme (pre-1960). Calibrating a numerical model is a very important step in numerical modelling and involves adjusting unknown model parameters within some acceptable uncertainty margins in order for the simulated water levels to match some known measured values (e.g. a water level of a flood mark).

In this case, the model was calibrated using inflow input from two more recent flood events where observed data were available (1947 and 1960floods). The calibration was achieved by adjusting unknown parameters in the model (primarily the value of the Manning's roughness coefficient n) until the modelled water levels were in agreement with the historical water levels. As two different flood events were used to calibrate the model, this resulted in a range of credible values of Manning's n which resulted in an upper and a lower threshold envelope of the results.

Once the model was calibrated the remaining historical flood events (for which historical water level marks were identified) were reconstructed and validated from documentary sources where possible. The outcome of the analysis was the upper and lower set of historical peak flow data and all historical peak flow values were incorporated in a composite annual

maximum series of peak flow consisting of data from 1866 to present day (Figure 8). The figure combines the peak flow data from: (i) 1969-today measured in Bathford gauging station upstream of Bath's city centre (blue dots); (ii) 1939-1968 (Reed, 1988) measured in St James gauging station at Bath's city centre (red dots); and (iii) the modelled historical floods 1866-1960 (Stamataki and Kjeldsen, 2021) with an upper and lower envelope threshold (black lines). By providing the results of the analysis with an upper and lower threshold envelope, the uncertainty in calibration values is taken into account.

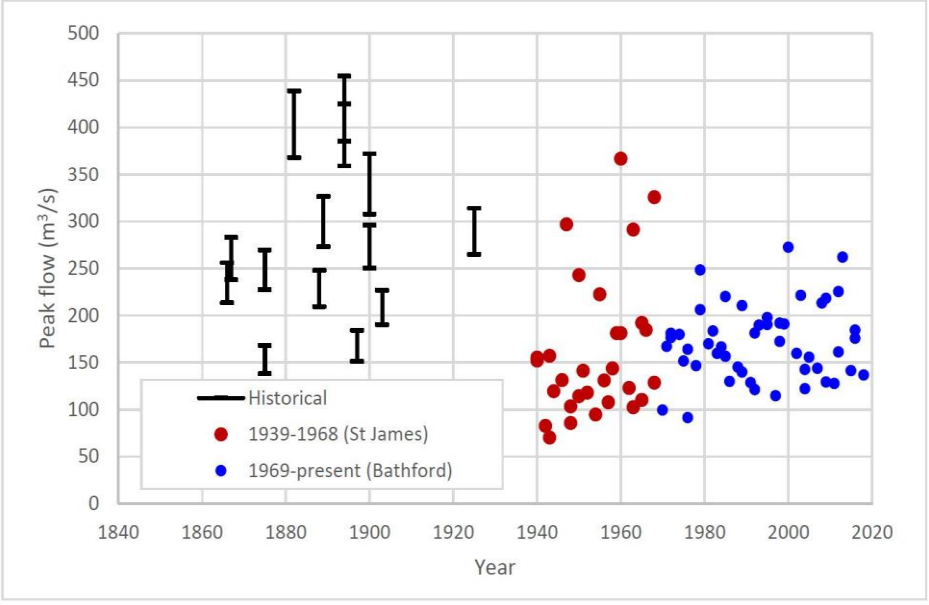

Figure 8 - *Measured maximum flow from 1969-today (blue dots); 1939-1968 (red dots) (Reed, 1988) and modelled historical floods 1866-1960 with upper and lower envelope threshold (black lines).*

4.2. Dissemination

Dissemination of the HYDRIC BATH Project's results was very important for maximising the impact of the project and raising awareness for the magnitude of historical flood events and their importance in contemporary flood risk. In the first 6 months of the project, the University of Bath posted on their twitter account an interview I did explaining how historical flood data can predict the risk of flooding in the future which reached 1,927 views. Following this, at the end of the project, we summarised all our research and published a journal paper in the Journal of Flood Risk Management

(Stamataki and Kjeldsen, 2021) entitled "Reconstructing the peak flow of historical flood events using a hydraulic model: The city of Bath, United Kingdom" to disseminate our research to the research community. We also presented our research at the University of Bath's Minerva Lecture Series which was attended by over 250 people with more than 30% being local residents. The lecture was recorded, and the video has 76 views (as of 04/05/2022). Finally, we published a book "Flooding through the ages: Reconstructing historical floods in the city of Bath" which was printed in 200 copies and given freely as well as being freely distributed online (downloaded 462 times as of 04/05/2022).

4.3. Challenges

The development of the HYDRIC BATH Project's numerical model included several stages. Firstly, identifying the flood marks throughout the city was a fundamental step before taking engineering measurements so that they could be incorporated into the numerical model. The project also required searching for historical information in the Record Office of the City of Bath and the archive rooms of the Centre of Ecology and Hydrology and the Environment Agency. Subsequently, participation in public engagement activities and generating awareness through a blog and website were crucial for dissemination purposes but also for the continuous search for additional historical information. Finally, combining all the above, the 1D hydraulic model representing the River Avon through the city of Bath was developed and used to assess the peak flow of historical flood events in the city.

There is a large variety of documentary sources that can be used in an endeavour like this, including: historical photographs, local knowledge, engineering drawings, book chapters, technical reports, water level charts, physical markings of historical water levels and many others. Due to the diversity of all these types of data, the challenges come first in the stage of identification which is then followed by the stage of translation of this material into a unified and useful format.

Knowing where all this information is stored is very important but equally difficult to identify. Central repositories of this information need to be created and specifically trained people to be employed as the type of information required may be considered of little or no importance to current management, and therefore not deemed a priority for preservation efforts.

Following this, the digitisation stage can also be very challenging from different used units, to low-quality scanned, or even missing, documents,

smudged information or just contracting information. Thus the following steps are recommended to easy the work required for reconstruction of historical flood events at this and other locations:

1. Identification of available information amongst the different agencies
2. Creation of repository with clearly organised folders
3. Re-naming of existing files or creating a list of all available files and information
4. Digitisation of some of the available files/information

Furthermore, open access to the data and information is key to ensure that the valuable historical data are brought into contemporary evaluations of flood risk.

5. Implications

The novelty of the research undertaken in this project and summarised in this chapter is without doubt novel lies in its newly adopted methodology for information and data gathering compared to current scientific practice, including the identification and translation of all documentary evidence into useful formats was a major and challenging undertaking, at times relying purely on serendipity.

Climate change is widely expected to increase flood risk in the future and this research showed that the River Avon appears capable of producing events not seen in modern times. From a scientific perspective thus, the implications for the inclusion of historical flood data for contemporary flood risk assessments showed that it can have a dramatic effect on the outcome of a flood frequency analysis. For example, detailed statistical modelling of the observed extreme events suggested that the inclusion of the historical events resulted in a 20-30% increase in the 100-year flood, compared to using only contemporary data.

This project allowed an assessment of long-term trends or shifts in flood risk of the city of Bath and paved new avenues towards the inclusion of historical peak flows in future quantitative flood risk assessments. However, this methodology and the inclusion of information from documentary sources is relevant to many other disciplines and such data can be applied from economical, to architectural, urban planning, statistical and geographical approaches. Recognising the importance of such datasets and the necessary methodologies for their inclusion is an important paving stone towards an integration of social science and digital / IT to aid scientific investigations.

Acknowledgements: the HYDRIC BATH Project was kindly funded by the Leverhulme Trust (RPG-2017-118), who's generosity is acknowledged with gratitude. The authors would also like to thank Jacobs for providing a Flood Modeller licence allowing us to undertake this research and the Environment Agency staff in Bridgwater and the Centre of Ecology and Hydrology for their help and the dedication of access to different sources of data.

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SECTION IV

Multidisciplinary Research

8. Artificial Intelligence and Anthropocene

Francesco Mele[1], *Antonio Sorgente*[2], *Paolo Vanacore*[3]

Abstract

"Being acrobats of time" – imagining how the world we live in, the natural environment, art, culture or our scientific knowledge will change, by the actions we are currently carrying out - is a very complex process to describe. In this work we choose a subset of possible actions and we will try to analyze the impact of Artificial Intelligence (AI) on this transformation process. AI is a discipline that perhaps more than any other provides a simultaneous and abundant contribution on two axes: the functional one, due to the number of innovative and original systems it produces at the service of society, and the theoretical and methodological one that has an impact on many disciplinary areas. In other words, we believe that AI is tangibly transforming our daily life, and society in general, but at the same time it is changing the face of many scientific and humanistic disciplines in their theories.

In the chapter we will talk about how AI has improved the methodological apparatus of the human, social and natural sciences, such as linguistics, cultural heritage, medicine and jurisprudence. We will also provide some examples of systems developed with AI methodologies on some application domains. We will cover some specific themes that highlight the critical issues of AI in the anthropocene era. In particular, we examine the problem of technological unpredictability and that of the unexpected results of AI systems. For the latter, we also discuss the problem of regulation, opacity and prediction of the future, which is based on data from the past.

At the end of the chapter we report some regulatory proposals concerning the commercialization of AI systems and, some methodological aspects for the impact analysis of these systems.

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Keywords: Artificial Intelligence, Anthropocene, Artificial Intelligence Criticalities, Artificial Intelligence Opacity, Artificial Intelligence Regulation.

1. Introduction

In the chapter we will mainly discuss the contribution of AI to the various disciplinary areas concerning the natural and humanities sciences. We will also discuss some critical points of AI in the era of the anthropocene[4] – we wonder if AI defends us from the anthropocene that increases it with its *technological presence*.

AI is a discipline that is receiving a lot of attention at the present time. Eric Sadin in (Sadin, 2019) tries to evaluate the *temperature* related to the interest that AI is receiving in the world. Without hiding his irony, he labels this discipline the "golden calf of our centur" and in a peremptory way he reports that:

> … since 2010, Artificial Intelligence represents the most decisive economic challenge in which to invest with determination and without hesitation. In addition to companies, it is the nations themselves that employ all the means in their power to position themselves at the forefront; this objective has become a major national priority for each of them. First of all the United States, which draws up far-reaching strategic plans, supported in particular by Darpa, the NSA, the Department of Defense, and a myriad of universities and research institutes that benefit from federal grants…
>
> But many nations are no longer willing to come second and manifest a willingness to engage body and soul in this fierce planetary competition. This is the case of China, which aspires to get "on the podium" by 2030, thanks to programs planned in detail, which would lead it to become the undisputed world leader in the following five years.
>
> Canada claims to stand as a "global AI hub" and supports companies and laboratories with the help of generous public

[4] In this chapter we will use the term "anthropocene" often in the sense of a negative path of our humanity that leads to a state of degradation, not only of the physical environment where we live, but of the set of our cultural and social values.

funds.

> Russia, for decades almost non-existent in the panorama of the electronics industry, plans to become one of the protagonists of this sector, …, Vladimir Putin has in fact declared that "the leading nation in this field will dominate the world" and that therefore "we should avoid leaving the monopoly in the hands of a single nation". The list of countries wishing to try their hand at this promising epic is very long, Israel, Japan, South Korea, … The United Arab Emirates has even gone so far as to set up a ministry for Artificial Intelligence: "Artificial intelligence will be the next big revolution. And we want to be ready"

AI more than any other discipline is characterized:

1. for having provided an interesting increase in innovative artifacts that have been produced using AI technologies (functional contribution of AI)
2. for having inserted new methodological aspects in disciplines that also have robust foundations such as mathematics, engineering and medicine (methodological contribution of AI)

With regard to the first point, AI in recent years has contributed to proposing artifacts with original functionality and a certain usefulness for mankind. If the past millennium was characterized by the arms race by nations, to have prestige and capacity for political control, this millennium was born and grows with the prerogative of possessing the best technology. In particular, at this current moment there is a widespread belief that those who are in possession of technologies such as those of AI will be a country that will have an economic and political competitive advantage over others. Every country right now is drawing up a strategic program for AI, or already has it.

With regard to the second point, namely that of the methodological contribution (which will be discussed in detail in the section 2), AI has contributed to formalizing and conceptualizing knowledge and methods of reasoning of different existing disciplines. In this direction, AI debuted more than 40 years ago with expert decision support systems (especially in medicine) and automatic diagnosis systems. In the last decade, AI has entered with authority in disciplines such as jurisprudence and those related to financial markets. In other disciplines, the methodological contribution of AI has been so decisive as to replace almost entirely the methodological

apparatus such as in the domain of Cultural Heritage and in the study of natural languages.

It should be noted that in some disciplinary areas, even without providing a strictly methodological contribution, the inclusion of AI tools has created, and continues to create, a change in procedures and practice in these disciplines. For example, such as the inclusion in some courts of tools to support the decision of the judgment of punishment or acquittal. We believe that this AI contribution should also be considered a methodological contribution. The European community is deeply concerned about the development of AI methodologies. In the section 4 we report the regulatory proposals of the European community for the regulation of the production of products developed using AI technologies.

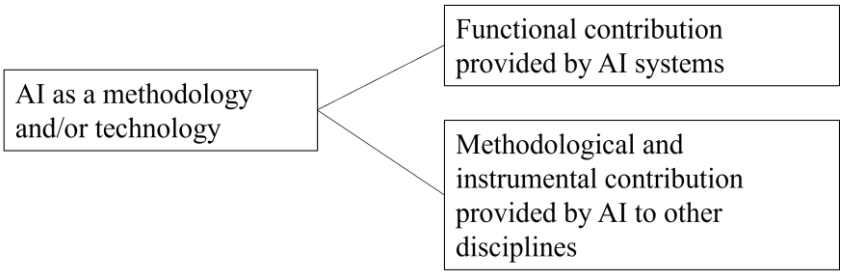

Figure 1 - *Functional and methodological contributions of AI.*

2. Methodological and instrumental contribution of AI to the natural and human sciences

For what follows in this section we will try to maintain, where possible, the distinction between the contribution of AI on the methodological and instrumental level. To better clarify, here are two examples. The introduction of reference schemes or taxonomies in Cultural Heritage (we are talking about the ontologies that we will better specify later) as a classification method is a methodological contribution that AI has provided to the sector. With the advent of the ontologies of AI in Cultural Heritage (see Figure 2), the superintendencies for Cultural Heritage have had to change their way of classifying an object of art. While for example the adoption of AI systems in Law (built with Machine Learning methods) has provided an instrumental contribution in the sector, because it has led to a change in evaluation practice. Although in the same field of Jurisprudence there is to be questioned how much the axiomatic apparatuses of the deontic logics, of an AI nature, have

"inspired" the most rigorous formulation of some new law, and therefore have provided a more specifically methodological contribution to the discipline.

In the analysis of the methodological contribution of AI to disciplinary areas we will discuss only some of the main methodological areas of AI: Knowledge Representation, Logic Programming, Natural Language Processing, Machine Learning, Computer Vision and Robotics-AI.

2.1. Knowledge Representation

We open the analysis of the contribution of AI to other disciplines with the Knowledge Representation. This area was the first set of AI methodologies. Since this internal term was coined in the 60s to now, the expression "Knowledge Representation" has gone into disuse for the simple reason that almost all AI methodologies address this problem. The term, however, historically characterized, in a positive sense, the first applications of AI.

The first AI applications that used Knowledge Representation methodologies was called Expert Systems. In those years before the advent of AI many areas of knowledge required initial conceptualizations. The initial goal of this area was precisely to make explicit what was implicit.

Although there was physics that successfully provided models for natural phenomena, there was no methodology capable of making explicit the great knowledge that exists in practice and that leads to problem solving. For example, in the field of medicine there were the skills of doctors to discover the causes of diseases, which required to be codified through systems of rules of thumb. The methodological approach of systems expert in medicine has also migrated to other application areas such as fault diagnosis. Over time, systems that are experts in AI technology have suffered a rapid decline, due to the fact that the knowledge represented in them required great resources to be updated.

Certainly, the significant turning point in the field of knowledge representation took place a long time later, with the advent of a methodology of fascinating perspectives, including theoretical ones: ontologies. Methodology that has established itself in many application areas. Ontologies have played a fundamental role in knowledge management. We can say without exaggeration that there are no social and technological areas where ontologies have not been used.

In order to give a qualitative and non-formal idea of an ontology, we report a simple example in the figure 2, where it can be observed that in this structure there are classes belonging to a taxonomy. Where for each class there is a

description that is represented through attributes. In such a structure the individual elements of a domain, represented as instances of the classes, are thus classified. In an ontology there is always a mechanism of prototypical inheritance between a class and its subclasses. This mechanism allows each class to propagate its attributes to each of its subclasses, giving these taxonomies an efficient method of classification.

One of the main tasks to which a nation's superintendency must perform concerns the classification of art objects. The ontologies in the field of Cultural Heritage have provided both an instrumental contribution, but also and mainly methodological. A complex domain that of cultural heritage that involves spatial, temporal and causal knowledge. Each object of art has its own spatial location, its own history made up of events that are connected by causal relationships. AI methodologies could not remain outside the ontologies sector (Bordoni *et al*., 2013; Bordoni *et al*., 2016). The methodological contribution of AI has *wiped out* the small and weak classification methodologies existing in this area. The institution of many nations responsible for the classification of Cultural Heritage, first "clinging" to the most famous methodology of the Dublin Core (Kunze & Baker, 2007), then ended up adopting different approaches and formalisms for the ontologies that obviously needed to be integrated[5].

[5] For the problem of the mediation and integration of ontologies, a project SM@RTINFRA-SSHCH (Smart Integrated Infrastructures for Data Social Sciences, Humanities and Cultural Heritage Ecosystem — Italian Ministry of Education, University and Research decree nu. 973 of 25 November 2013) has been activated in Italy. This project was sponsored by the CNR (National Research Council of Italy). This project had an extensive scope of application that did not concern only the field of Cultural Heritage.

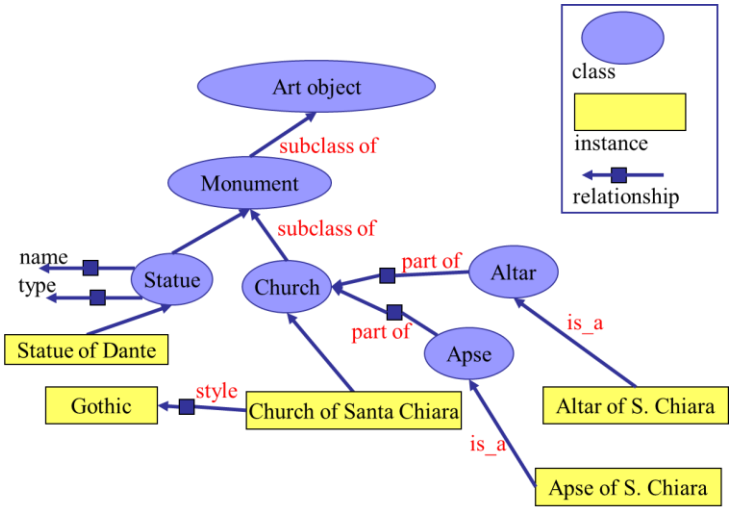

Figure 2 - *Cultural Heritage - a sketch ontology.*

Cultural heritage has taken a large part of the methodological heritage of AI by elevating this sector as a scientifically well-founded discipline. This change has taken place thanks to some new generation operators of the superintendents who have fought against the poverty of method and the arrogance of the generation of operators who preceded it.

Around the 2000s on the axis of AI methodologies of knowledge representation a visionary idea and great perspectives the Semantic Web was proposed (the term is presented in detail in (Tim Berners-Lee & Lassila, 2001)). With this term we mean in essence to provide a semantics to each entity present in the Web, associating a category of belonging, for each of them. This allows web data and knowledge to be easily found and interpreted.

In fact, the application of the Semantic Web (Web, 2021) as a methodology for developing the network (even if not all the web has been brought to this level of operability) has made it possible to facilitate users' access to knowledge and to integrate (semantically) the knowledge of the systems present on the web. The Semantic Interoperability (Interoperability, 2021) and the integration of knowledge sources present on the web has been a significant contribution of AI, where the role of ontologies has been decisive above all in the flexibility and rigor in representing knowledge.

2.2. Logic Programming

Although Logic Programming is on the axis of knowledge representation, its methods make it a unique tool within AI and therefore worthy of being presented separately.

Born around the 60s as the computational form of the concepts of Mathematical Logic. The major proposal in those years was the Prolog (Cohen, 1988) language, from which the Fifth Generation research project was defined, which involved the construction of specialized hardware that reproposed the structures of the computational logical paradigm.

The importance of Logical Programming lies in the fact that it has shown that rigorous axiomatics, concentrated in a few lines of program, are sufficient to model important human activities such as reasoning on actions and events (Kowalski & Sergot, 1986a). In fact, these axiomatics have been used as basic modeling representations of robots moving in ordinary and hostile environments. A separate topic constitutes the representation of spatial relations and related inferences (Stock, 1997). In general, logical programming has been used to model and then simulate almost all human activities that carry out common sense reasoning (Muller, 2015).

But what methodological benefits can a discipline that simulates human behavior give? Certainly, making reasoning explicit and finding out whether or not human rational agents are in possession of specific rules of reasoning, or if some of them apply reasoning containing fallacies and contradictions. Cognitive Sciences have inherited many useful methods from logical programming, especially in the simulation of mental processes.

From the instrumental point of view, Logical Programming has been included in numerous programs also used daily, such as spell checkers, specific expert systems and recommendation systems. And in other application sectors such as relational database management system, expert system, natural language processing, symbolic equation solving, planning and prototyping[6].

2.3. Natural Language Processing Technologies

Natural Language Processing (NLP) is an area of Artificial Intelligence that deals with computational methods and techniques for analyzing and

[6] https://www.easyexamnotes.com/p/applications-of-logic-programming.html

representing texts at one or more levels of linguistic analysis in order to obtain human-like processing for various natural language tasks.

Most of the technologies of NLP have made a contribution (methodological and instrumental) to the study of natural language and the communication.

NLP results have also had a great approval in other sectors, especially in the last decade. There are NLP techniques that have become support tools and/or an integral part of the methods of different disciplines/domains.

The basic techniques of NLP allow the analysis of texts at various levels (Morphological, Lexical, Syntactic, Semantic and Pragmatic) which are the basis of other more complex processes and techniques that describe a class of problems. The main ones are: Text Classification, Term Recognition, Text Summarization, Topic Modeling, keyword extraction, Information Retrieval, Conversational Agents and others. NLP approaches are of great interest to all disciplines that need to analyze texts for the identification of correlations or answers.

Many applications have made it possible to define new research and intervention protocols, or at least alternative protocols for medicine. Just think of the chatbots designed for the triage and initial diagnosis phase, such as Sensely[7], or even the health care chatbots like Amanda Care[8] that monitor patients in order to improve adherence to treatment. In addition, there are systems such as Babylon Health[9] that support the doctor in remote consultations by providing suggestions analyzing the patient's responses, or that suggest ways of life to prevent disease or not worsen the state of a disease like AIDA[10]. These tools are part of Sustainable Development Goal (SDG) 3 – Health and Wellness.

Another area that has benefited of NLP tools is Education. In fact, these techniques are adopted, and support teachers, to improve students' reading and writing skills. In addition to the classic systems for automatic correction or in-depth suggestion for the content different tools have been defined. One example is Cognii[11] , a virtual assistant that engages students in personalized tutoring conversations, providing instant scoring and feedback on written answers to open-ended questions. In the Netherlands, the De-Enigma (Riva & Riva, 2020) project has created a robot with multimodal interaction (facial, body, vocal and verbal signals) for the recognition of emotions and expression

[7] https://www.sensely.com/
[8] https://amanda-care.com/
[9] https://www.babylonhealth.com/
[10] https://www.aidachatbot.it/
[11] https://www.cognii.com/

to teach autistic children of school age. Also interesting is the StorySign[12] project created by Huawey, an application that aims to help deaf children improve their reading skills by translating the text of selected books into sign language. These are some projects of how NLP supports SDG 4 – Quality Education.

On the other hand, from a social point of view, part of the research is currently focused on the predictive analysis of text-based signals, such as those coming from social networks like Twitter or Facebook. Today, textual data is a very rich source of information, and it is growing day by day. Today, most individuals use these platforms to make decisions about purchasing goods, travel, or expressing opinions on social, political and other topics. These predictive techniques are used in many areas from the prediction of the elections of a political candidate to the study of opinions on major issues such as homophobia, racism, bullying, etc., used for the objectives of SDG 16 - Peace, justice and strong institutions.

2.4. Technologies Machine Learning

In 1959 Arthur Lee Samuel, a pioneer of the Machine Learning (ML), reports some studies that "*have been concerned with the programming of a digital computer to behave in a way which, if done by human beings or animals, would be described as involving the process of learning*" (Samuel, 1959).

Learning techniques can be classified into three main categories: *supervised learning*; *unsupervised learning*; *reinforcement learning*.

The *supervised learning* algorithms build a predictive model starting from a set of tagged data (said *samples*). The labels, associated with each example, represent the expected results that the system must "learn" to provide. The labels can have discrete or continuous values; the ML algorithms are called *Classification* algorithms in the first case and *Regression* algorithms in the second one. In this type of learning the training process ("ability to learn") is reported in Figure 3. The sample dataset, called *Dataset*, is splitted into three subsets: the *Training set*, the *Validation set* and the *Test set*. The samples consist of the data for which the system must provide a prediction, and the expected results. The model is trained on data from the Training set and the performance is evaluated using the Validation set. If the achieved performances do not meet expectations, the model parameters are changed (process known as *parameters tuning*), and the training process is repeated.

[12] https://consumer.huawei.com/uk/campaign/storysign/

At a satisfactory level of performance reached, the model is tested on a set of data that did not take part at the training process, named the Test set. As result of the described training, validation and test process a *model* which provides a prediction, in probabilistic terms, from input data (*observations*), is obtained.

In the *unsupervised* learning, the data has no labels. These algorithms try to extract information from the data without an expected result being known a priori. Some examples are the *Clustering*, in which you try to select and group data into "clusters", based on a measure of "similarity"/"homogeneity" between the data; the *Association*, which attempts to identify relationships between data; the *Dimensionality Reduction*, in which the system tries to reduce the data dimensionality, identifying potentials correlations between them.

In the *reinforcement learning* the system does not learn from a Dataset but, acting to achieve a goal, modifies its own behavior (future actions) in function of the feedbacks (*rewards* or *punishments*) provided by the environment with which it interacts.

The instrumental contributions of ML are many and transversal to various sectors including e.g. the Financial Markets and the Jurisprudence.

In the financial sector, and more specifically in the stock markets and the stock market indexes, ML applications are used to predict price trends. In "*Machine Learning for Quantitative Finance Applications: A Survey*" (Rundo et al., 2019) a description and comparison of different ML systems, for quantitative finance with application implications in trading systems and for financial portfolio managements, are reported. The analyzed models are based on both *technical and fundamental analysis* approaches and have the goal of predicting time series by maximizing the accuracy. Technical analysis is based on the assumption that market movements are cyclical (that is, they have patterns repeated over time) and are trained on Datasets containing historical market data. On the other hand, the fundamental analysis seeks to identify the factors that determine market trends, in order to exploit any correlations to predict future market movements. If on the one hand the technical analysis underestimates the variability of the markets, on the other hand, the fundamental analysis can be computationally complex, and this affects the decision rate of the system.

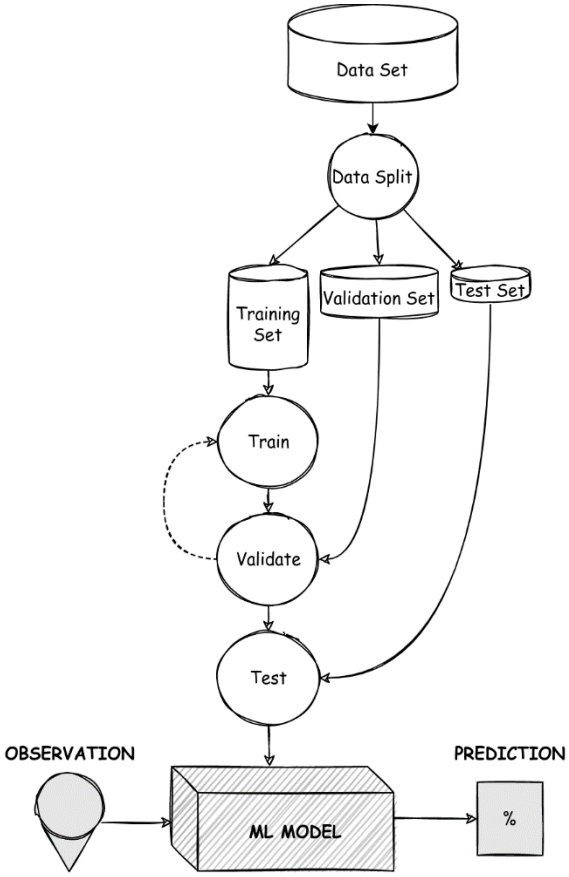

Figure 3 - *Supervised training process.*

Also, in the area of jurisprudence ML-based applications have been developed in support of judges and in judicial proceedings. In 2019, for example, in China, an application called System 206[13] was used in a courtroom to allow a judge and lawyers of the parties to request and quickly obtain documents, expert opinions and videos. In addition to useful in the trial stages assistance systems, such as System 206, decision-making systems have been developed. An article published by the "South China Morning Post", on December 26, 2021[14], a system based on ML capable of making accusations is reported. Shi Yong and his team of researchers trained a model on a dataset of over 17.000 court cases from 2015-2020. The implemented system, which uses natural language descriptions of a case, is able to identify a hypothesis

[13] https://www.chinadaily.com.cn/a/201901/24/WS5c4959f9a3106c65c34e64ea.html
[14] https://www.scmp.com/news/china/science/article/3160997/chinese-scientists-develop-ai-prosecutor-can-press-its-own

and formulate an accusation. The dataset and the system predictions cover the most frequent crimes affecting the city of Shanghai, such as credit card fraud, theft, gambling, dangerous driving, injury, and so on. The research team claimed an over 97% system accuracy.

As is evident in the case of jurisprudence, the instrumental contribution of ML influences, in the practice of use, the methodological approach.

2.5. Computer Vision

Computer Vision is a field of artificial intelligence that deals with methods and techniques for analyzing images and videos in order to allow computers to reproduce human visual functions and processes. Machines can accurately identify and classify entities and then react to what they *see*. In many areas, Computer Vision competes and surpasses human vision. Some Computer Vision techniques involve image segmentation, object detection, facial recognition, image classification, background detection and others.

This AI discipline has also entered various sectors, for example Medicine, redefining some procedures. Many medical diagnoses are based on the study of images and many tools have been developed in the Computer Vision field to help doctors identify pathologies and/or anomalies. An example is X RAIS[15], a platform for medical image analysis developed by Laife Reply that uses 106 different diagnostic methods to support the doctor by automatically suggesting suspicious areas and performing the related classifications. The goal is to reduce the number of misdiagnosis and improve the efficiency of the entire diagnostic process. Midis Ayni Lab[16], is a Peruvian medical project that allows low-cost diagnosis to detect anemia by analyzing images of the eye.

Another contribution of Computer Vision, of great international significance, was made to support investigations to search for missing children. The non-profit organization "International Center for Missing and Exploited Children" (IC-MEC) has announced the launch of GMCNgine[17], a system that helps find missing or abducted children by comparing their photos with those of children online.

There are also human science disciplines that have had great benefits of using Vision Computer technology such as archaeology. With these techniques, systems have been built to support archaeologists in their

[15] https://www.reply.com/en/industries/public-sector-and-healthcare/x-rais
[16] https://fairlac.iadb.org/en/midis
[17] https://gmcngine.globalmissingkids.org/

evaluation and classification of the finds found, thus introducing a faster process in the classification phase (Resler *et al*., 2021).

2.6. Robotics-AI

In recent years, AI has provided contributions regarding systems and processes in automation and robotics, obtaining important results such as, for example, in the Medicine sector and in the Automotive Industry.

Medical Robotics includes applications to support various activities, from diagnosis and prevention, to surgical operations, physiotherapy and rehabilitation practices. Recent technological development has made possible to create micro-robots capable of exploring the human body, with ever greater precision, in order to diagnose and prevent diseases. Even in operating theaters, through robotic arms and camera systems controlled by surgeons, sometimes even remotely, robotics makes an important contribution to the implementation of precision interventions. In rehabilitation and physiotherapy practices, in cases of permanent or temporary disabilities as a result of trauma or disabling pathologies, exoskeletons and, more generally, wearable devices have been created to allow correct mobility and/or the recovery of compromised functionality of limbs and hands.

Among the various objectives of AI applied to the Automotive Industry are the optimization of the use of transport infrastructures, the improvement of mobility, the support for people with disabilities, the minimization of risks through active safety systems, the transport times and, consequently, the energy consumptions. The first attempts to build driverless vehicles can be traced back to 1925, when the US Army electrical engineer Francis P. Houdina modified a Chandler automobile by equipping it with a radio antenna and electric motors for remote control its movements via radio control. Over the years, several prototypes have followed one another, with increasing levels of automation, with the aim of achieving fully automated driving control without the need for any human intervention. Among the first examples of vehicles capable of automatically processing signals from the environment, through cameras and sensors, is the German prototype "VaMoRs", built by the engineer Ernst Dickmanns of the University of Munich in 1985. In 1994, the "VaMP" and the "Vita-2", also made by Ernst Dickmanns in collaboration with Mercedes Benz, were self-driving cars based on computer vision techniques and were tested for over 1000 km, with an average human intervention required estimated at one every 9 km. In 1998 the ARGO project, led by Prof. Alberto Broggi of the Department of Information Engineering of the University of Parma, was developed as part

of the Transport Project 2 of the Italian National Research Council[18]. The project saw the modification of a Lancia Thema, which was equipped with two video cameras for processing data from the external environment. The vehicle traveled about 2000 km in six days, and an autonomous driving time was estimated to be 94%. Subsequently, numerous prototypes were made up to commercial vehicles, both automobiles, such as the popular products of Tesla Motors, as well as "heavy" vehicles, for the construction and public transport.

3. Criticalities of AI in the Anthropocene Era

In the previous paragraphs we have discussed the transformations due to the methodological and instrumental contribution of AI in other disciplines. This benefit of increasing method and theoretical improvement is certainly positive in the path of growth of knowledge of humanity. It is clear that an extension of method can lead to the development of new technologies and the development of new systems. But, it is on the latter and their functionalities that careful control must be carried out, not on the development of disciplines. They raise concerns, therefore, about the impact that determine the functionality of new AI systems in the anthropocene era, where one wonders what individual and social actions such systems can cause. Are there any obscure changes that our society undergoes (or could undergo), with (or without) awareness, for the injection of new features labeled "intelligent" or that independently perform some tasks that previously only man performed? We have grouped in some themes (not exhaustive), the answer to this question.

3.1. The application unpredictability of AI systems

In this paragraph we will discuss the unpredictability of the application directions that AI technologies can take. The latter problem is different from the problem of "unexpected results" of AI system that we will discuss in the next paragraph 3.2.

In (Tamburrini, 2020) the author seems to agree with Ellul's thought that the direction of technology is really unpredictable. The work gives the example of IBM's Watson system, which is very relevant to the ongoing discussion. Watson was originally designed to participate in Jeopardy!, a

[18] Consiglio Nazionale delle Ricerche (CNR)

general-purpose television quiz show, where he scored a victory over human competitors. The system was built with AI learning technology using natural language technologies. A domain, that of the game, that did not suggest dangers of use. However, it happened, using the same methodological apparatus and AI approach, was developed on a new application on another domain considered ethically sensitive – such as that of purchasing advice.

We agree that unpredictability is a characterizing factor for every technology and especially for AI, but we also believe that worry should be directed to the type of use of a methodology, without limiting the discovery of new applications that can be generated by the methodology itself and without also placing constraints on the extensions of it. We believe that a methodology in the design phase can also allow a glimpse of some application field that requires a subsequent precautionary analysis of use. But it is on this use that a certain filter and control must be made, not on the development of the methodology.

We report the case of Hacronym (Stock et al., 2002) a research project funded for the study of computational humor. This project had among its potential applications in the educational field, since humor presents itself as a very effective form of communication for teaching. Hacronym presented, however, as many possibilities of being used in the commercial field of advertising and purchasing advice. What to do then? Not undertake a fascinating research challenge that studied man in one of his most creative activities such as humor? The research on computational humor was developed and coordinated by the Bruno Keller Foundation and completed around 2001. This research reported flattering theoretical results in humor modeling (Stock *et al*., 2002) that enriched many different disciplinary areas such as linguistics, logic, cognitive sciences, and of course AI itself. To our knowledge, research related to Hacronym did not lead to the development of e-commerce systems.

We believe that with a good methodology of impact analysis and control such as the one we will present below (section 4.1) can greatly reduce the problem of “unpredictability of AI systems”. Indeed, we believe that this aspect, if properly managed, can become a positive feature for the search for original application opportunities. We fully agree with sentence reported in (Cucchiara, 2021): “the way is to regulate not research on AI, but its applications and final products”.

3.2. Unexpected executions of AI systems

Unexpected executions of AI systems[19] does not concern the application unpredictability problem, the latter described in previous paragraph. The latter is inherent in the direction that a research can take and therefore not foreseeing in which sector such a methodology will be applied. An unexpected result, however, concerns the fact that a system that has been defined to operate a certain way, against the intentions of its builders, behaves differently. A popular chatbot, built with AI technology called Tay, was designed to follow language patterns in order to be friendly and reasonable. In some of his executions, however, he displayed racist and sexist behavior[20]. The problem of unexpected results is not an easily solved problem, especially due to the fact that AI systems have achieved a high quality of performance of the tasks they are required to fulfill (especially those concerning aspects of perception, reasoning and learning - typical of AI) and, what happens is the higher the quality of the tasks, the more difficult it is to discover unexpected behaviors of AI systems.

In this context we believe that in the verification of the functioning it could be of some benefit to design and develop systems that have explanatory modules (see forward the paragraph 3.4). The explanations make it possible to analyze the inferential paths of a certain system and therefore allow the correction any unwanted or even erroneous behaviors.

For the problem dealt with in this paragraph we believe that it is also useful to carry out adequate design methodologies[21].

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[19] The famous American statesman Henry Kissinger written an article "How the Enlightenment Ends. Philosophically, intellectually — in every way — human society is unprepared for the rise of artificial intelligence" (Kissinger, 2018). The article contains three main points of discussion:

> First, that AI may achieve unintended results. Second, that in achieving intended goals, AI may change human thought processes and human values. Third, that AI may reach intended goals, but be unable to explain the rationale for its conclusions.

The first point is the argument of discussion of this paragraph, while the third point will be discussed in paragraph 3.4.

[20] https://dailywireless.org/internet/what-happened-to-microsoft-tay-ai-chatbot/

[21] For example, the *i** (Yu, 1997) framework was developed for modeling and reasoning about organizational environments and their information systems and can be adopted in the early-requirements modeling step.

3.3. Difficulty for regulating AI systems

There are fields of application of AI methodologies, which are crucial for addressing a regulatory discussion of the use of such systems. There are areas that require urgency and particular attention and are those related to the protection of life and human health in general - specifically, we believe that priority should be given to the arms, medicine and transport sectors, where various technologies have been used robotics-AI (see section 0).

With regard to the regulation of AI systems, the points reported in (Cucchiara, 2021) are expressed very clearly and are fully shared by us, even if we believe they must be addressed with varying degrees of urgency. The points are: (1) No AI weapons, (2) Identifying accountability, (3) Understanding the nature of Intelligence, (4) Privacy, and (5) Human control over generalization.

The first point that the author labels as a priority is expressed with the slogan: "No AI weapons". We agree, in no uncertain terms: "to ban the weapons based on Artificial Intelligence and to intervene on global level (worldwide)". For this, we believe that a research ban on associated methodologies in this topic would also be necessary. However, we believe it is useless to debate on the topic of "armaments ethics" trying to discriminate between autonomous functions and those of human competence. "Ethics" and "weapons" cannot exist in the same context of discussion since they are terms that are mutually exclusive, whatever meaning one may choose for the term "ethics".

The second point contained in (Cucchiara, 2021) is "Identifying the liability for damages from the use of AI systems". It is a very difficult point to solve, because it involves not only a discussion on what AI is and the functionality of its systems but also aspects of a social nature because it is necessary to address the problem of responsibility. For the first discussion we believe that the proposed analyzes on the levels of autonomy both in medicine (Yang *et al*., 2017) and for vehicle control (SAE, 2018) are valid, in order to better understand from this decomposition which are the functions that the machine must perform and which are those of man. This analysis also helps to understand which anomalies are labeled as "machine malfunction errors" or even "design errors". With these analyzes as input, it is possible to switch more clearly to the assignment of responsibilities.

This last question of a behavioral-social order constitutes the heart of the problem. Various responsibilities and actors gather on it. The manufacturing companies together with their programmers, although the need to sell a product, tend not to take any responsibility, while users of AI robotics systems

require guarantees of correct operation and do not wish to have responsibility for any adverse situations. Independent groups do not seem to have the right reasons to start initiatives to draft liability regulations. Consider the case of Google's proposal to set up an independent ethics committee, ATEAC, aimed at discussing cutting-edge AI initiatives that quickly failed[22]. The proposal was withdrawn in a few days due to protests relating to the existence of conflicts of interest of some members of the committee.

We believe that interesting initiatives can only arise at the government level, where there would be the right reasons for drafting regulations for the responsibility of the use of AI robotics. It is the government's responsibility to promote a reduction in road accidents, or to include more effective surgical tools in hospitals.

The applicability of the rules of responsibility presents a last not negligible problem, which in this pandemic period has emerged in all its facets, that is, the fatigue attitude and sometimes of rejection of people to social regulations. To this last problem some elements of resolutions have been the object of the attention of the European community which has issued a documentation in which it invites all potential users of AI systems to have confidence in this technology, a confidence that for the European community can only be acquired with a better understanding of AI technologies.

We believe that point (3) concerning the "Understanding the nature of intelligence" also falls into this last discussion. We will not address point (4) in this paragraph because we believe it is a general problem and it is not a discussion topic of this work in which we are discussing, in particular, AI systems.

Regarding point (5) Human control over generalization, we believe that the generation of systems that always try to generalize and organize everything into classes, can lead to classification problems, generating problems, in some cases, even of racial and ethnic ones. This can arise because in trying to improve these systems more and more features are considered and they can bring into the model some biases present in the training data (as also reported in the explanation section) and that, even if correct, may not be always valid in a society that is constantly evolving. An example is *predictive policing*, a system that predicted the likelihood of crime in certain areas and thus focus police attention. After a first phase it was abandoned as a system because it was discriminatory, the areas identified were mostly areas where Latinos or African Americans reside. According to (Cucchiara, 2021) generalizations, Aristotle taught, make sense if there are

[22] https://www.bbc.com/news/technology-47825833.

general postulates ("*All men are mortal*"), but, since these are few, we must avoid relying on systems that could to say that all men with pointed mustaches are artists or that beautiful women are stupid. Or much worse. You can have systems that can classify artists, stupid people or dangerous areas but they must provide explanations and that take into account characteristics and properties that are not discriminatory for the person.

3.4. The problem of explaining AI systems

One of the open questions related to AI, in particular with the intensive use of systems based on Deep Learning, but also ML, is the problem of *explanation*. We now have systems with high predictive or classification capabilities, but *opacity* has also grown (Gunning *et al*., 2019). This is because most of the models are of the black-box type, so they that do not allow you to inspect the process and therefore the choices/decisions made by the system are not understandable. This is especially important in areas such as medicine, defense, finance and law, where understanding decisions and building trust in algorithms are critical [*ibid*]. As reported by authors in (Guidotti *et al*., 2018), it is not only a transparency problem, in fact the ML and DL models learn from examples and if these examples provided hide prejudices and defects (bias) then the algorithms will suggest unfair choices, for example discriminatory and racist like Compas-Correctional Offender Management Profiling for Alternative Sanctions (Skeem & Eno Louden, 2007). Compas is a system that has been used to predict the risk of criminal recidivism by some US courts to support judges for release claims. A study carried out by some journalists[23] showed that the system had a strong racist bias. In fact, black people were assigned twice the risk of whites even if they were in the same conditions. This implies that the model has inherited a bias from the data, meaning that the data used for training are *biased* towards black people. This system, even if properly trained, considered unethical characteristics of people and was unable to provide an explanation of the assessment made. Having systems that *explain* their evaluations are able to give clues about the choices made by helping experts, stakeholders to make better decisions.

The problem of explanations does not only impact the quality of the functioning of a certain system but in some cases it is decisive for the adoption of the system itself. A sentence of the Lazio Regional Administrative Court

[23] https://www.propublica.org/article/machine-bias-risk-assessments-in-criminal-sentencing.

of 2019 (summarized in (Numerico, 2021)) rejects the use to adopt an algorithm for the choice of a decision to transfer some teachers from Puglia to Lombardy. The Lazio Regional Administrative Court accepts the rejection of the transfer provision, also raising questions of principle on automatic evaluation systems in general. The main argument for the acceptance of the appeal reside in the fact that the ruling issued by the program is based on rules that are not made public and cannot be subjected to evaluation, neither on the method, nor in the result obtained. In other words, it does not give the res judicata the possibility to oppose the sentence, nor the judge to issue a judgment on the validity of application of the law itself.

3.5. Epistemological opacity of AI systems

In the various disciplines the formulation of the theoretical apparatus passes through a mechanism of abstraction of concepts. This mechanism often concerns a labelling activity using abstract terms that tend to associate categories, ie references, to relationships and processes existing in a domain.

At the beginning of its path, AI started from the representation of knowledge with the aim of making every type of knowledge explicit. For a long time, AI has played the role of a good archaeologist who unearthed hidden relationships, complementing theories with elements of abstractions that were lacking in certain disciplinary systems. With Expert Systems, AI has made the hard-wired knowledge of doctors explicit. From there began a process of formalization and theorizing of abduction which took its most rigorous form in its logical formal representation.

The elegant and rigid formalizations of classical physics do not take into account concepts belonging to the common sense of everyday life. The modeling of natural phenomena must not only be based on formal notions of position, acceleration and force, but also needs to represent behaviors, which require qualitative notions, often contained in expressions in natural language. In physics, for example, notions such as trajectory, speed, acceleration and force have been theorized, but there are no formalizations of the concept of action or event - these are present instead in explicit axiomatic logic programming - such as the Event Calculus (Kowalski & Sergot, 1986b; Miller & Shanahan, 2002) - which have paved the way for innovative applications in Robotics.

And again, in physics the concept of causation is present only implicitly in the natural systems that it describes, but it has never addressed the notion of mental causation, which is the basis of all cognitive activities of human rational agents.

On the linguistic side, AI has overlapped with Chomshy's transformational theories (Chomsky, 1975), where starting from the aspects of representation of the grammar of a language, he founded a new discipline that of computational linguistics (Hausser & Hausser, 2001; Mitkov, 2004), a discipline that has been highlighted not only for the extensive results reported in the applications, but above all for having created a new theoretical and reference approach to natural languages.

Ultimately an AI that accustomed us to surprise us with speed and rigor entering many different disciplines. Along a path that has been proposed as a sort of new epistemology of science that for every even small AI application, has provided methods (even if partial) to represent theories that are also very different from each other.

In this path of AI has suffered, in our opinion, a stop, at least one of the branches in which AI has continued - that of Big Data and Machine Learning, a sector where while proposing applications with interesting features, it has not continued on the path of integration and extensions of existing disciplines. With the new approaches of AI, systems have been developed *imprisoning* the knowledge in a sort of *black box*, where it is difficult to build a process of explanation of the functioning of a system and, it is not possible to identify rules, abstractions and concepts that are the basic constituents of theories.

At this point we would like to say that the AI approach based on Machine Learning or Big Data produce epistemologically opaque systems.

We will not construct a formal definition of epistemological opacity of the theories generated by AI systems – it is beyond the scope of this work. However, we will show how the notion of opacity given by Humphereys (Humphreys, 2009) can be used for processes, to suggest some criteria for evaluating the epistemological opacity of a theory.

We can assume that a set of programs that use AI methodologies evokes (opaquely or not) a theory. We make no assumption of how this mechanism happens. However, we can reasonably assume that every AI program is in effect a process, just as every process is made up of parts, so is a program.

At this point we will use the notion proposed by Humphereys formulated for the opacity of processes:

> A process is epistemically opaque relative to a cognitive agent *X* at time *t* just in case *X* does not know at *t* all of the epistemically relevant elements of the process. A process is essentially epistemically opaque to *X* if and only if it is impossible, given the nature of *X*, for *X* to know all of the epistemically relevant elements of the process.

We can think that this definition can be applied to AI programs, making a substitution of "AI program" instead of "process". It is true (as assumed for processes) that an AI program is made up of parts. And that there are parts of a program that are epistemically relevant and others that are not. We report two different parts P_1 and P_2 belonging to two different systems (programs) S_1 and S_2, of which P_1 and P_2 evoke the same theory, but where P_1 is not opaque while on the contrary P_2 is. The part of theory evoked is that relating to the rule of transitivity, that is:

RT: For all events E_1, E_2, E_3 where E_1 precedes E_2 and E_1 precedes E_3 then E_1 precedes E_3

In S_1, this rule is represented by the program part P_1 as follows:

$$\forall E_1, E_2, E_3 : event(E_1) \wedge event(E_2) \wedge event(E_3) \wedge prec(E_1, E_2) \wedge prec(E_1, E_3) \Longrightarrow prec(E_1, E_3)$$

For the rule 1 part of S_1 theory exists (it probably exists, and later we will explain why), a recognition that is epistemically not opaque. While, for the P_2 part of the theory in S_2, it is epistemically opaque – it is a hypothetical inductive P_2 program that starting from a corpus C_n of n statement of events *brings out* the *RT* rule. Namely:

$$C_n \; P \Rightarrow Tex$$

The example given helps us to understand what are the terms to be taken into account to evaluate if some programs and therefore theories are opaque. An explicit and declarative formulation of the parts of a program, where the use of entities such as universally quantized variables (for every X,Y : $F(X, Y)$) as present in rule 1, plays an essential role for the recognizability of the non-opacity of a part of a theory.

The multitudes of instances and *obscure* processes in ML systems, oppose the process of recognizability of the detection of non-opacity. Such systems therefore do not provide theoretical increases and interrupt a path of increasing the theories to which AI had accustomed us.

The aspect of fear, and of anthropocene due to AI, arises precisely from the coming to power of these immense and "obscure" masses of data that

constitute only instances (not knowledge) of real-world relationships and processes - instances in search of a clarifying conceptualization.

In other words, with such systems, AI returns to the point where it started, when it proposed to replace databases with knowledge bases, when we listened to seminars in which the difference between information and knowledge was emphasized.

A reset and then build other epistemological pathways? Or a definitive renunciation that surrenders to the slogan: large databases (the Big Data) work well, no matter if I give up increasing my theories and knowledge about the world?

3.6. AI systems, the risk to confirm the past when they making predictions

Prediction of the future is an operation that is performed in many types of applications in which AI systems operate. We believe there are some of them that present a troubling social action: making predictions that confirm people's past behavior. In general, we ask ourselves how we can move away from the anthropocene direction in which we are going, if people, and everything around us, at this moment confirm the erroneous choices of yesterday? Our poor health now is determined by the choice of our eating yesterday; today's polluted air is determined by yesterday's choice of fuel; our bad rulers today, from the votes made to the last elections; the bad movies or fiction that we watch now, from the fictional products we saw in the past television season. Many application areas of AI, such as recommendation systems, base their operation on recording the behavior of people, physical and social phenomena that occurred in the past. They provide purchase suggestions based on future forecasts of people's liking. However, recommending products can guide our judgment, focusing our choices on a limited set of elements, excluding for us useful or preferred products. It is therefore important to understand the operating mechanisms of these AI systems.

Let's examine the latter in detail, then looking for potential corrective actions. Let's take for example a real system RS where we can associate transformations $M_1 \rightarrow M_{11}, M_2 \rightarrow M_{22}, \dots, M_i \rightarrow M_{ii}$, between the states $M_1, M_{11}, M_2, M_{22}, \dots, M_i, M_{ii}$ where RS can be found. Let's leave out the discussion of what the representation of states and transformations should be: if we have all the tools to do it, if we are good at doing it, if there are limits to such a process. In this discussion it doesn't matter.

We emphasize the fact that $M_x \rightarrow M_{xx}$ are all possible transformations, that is, those registered and classified, those that have occurred and not registered, and those that we (or any person) do not know.

We then have a corpus of data where a subset of transformations (which we indicate with SM_j) actually occurred in *RS* have been classified in past time. Let us also imagine that there is a forecasting system *P* which from a state M_x at time *t* provides a forecast M_{xx} at time $t + 1$.

If we think to realize a prediction system *P* only on the cases actually occurred SM_j (subset of all those potentials) then, in the reality, some transformations can occur that are not predictable by the system *P*.

An example of predictions on all is present in e-commerce systems where user behaviors are classified at a time t_1 and some purchases are suggested at a future time t_2. The choice does not take into consideration whether the product may be useful or the user may like it at time t_2, but on a classification made on the behavior of the same user, or of a user similar to the latter, at a time t_1.

Basically, systems that predict future events that are based only on facts or behaviors that occurred in a previous time, are to be avoided, because they cannot make predictions about events that did not happen, that is, they do not allow a choice to be made on all the possible predictions.

Theoretically, what has just been stated consists of the gap between scientists and politicians approach in the context of the current pandemic. Scientists, although often do not provide a strictly causal explanation of the pandemic event, declare that it could have been avoided if precautions were taken in the interactions between humans and the animal world, while politicians speak of Covid as a completely unpredictable tsunami. For them, nothing that could be observed at that moment gave a glimpse of what would happen. The former base their beliefs using causal laws, the latter perform a sort of induction based only on confirming what has already happened.

3.7. Anthropocene transformation loop of AI technologies

The question of proposing objectives that lead to functionalities that are "useful" or so-called "advantageous" for humans, society or the environment and, at the same time, constraints on the functionalities or methods of use of AI systems, highlights a very topical problem: whenever an *Sx* system defined with certain functions, methods of use and construction specifications is used to obtain advantages for a specific task, it is necessary to highlight the physical, social and environmental context in which the *Sx* system operates, in order to anticipate and reduce any risks or collateral damage that *Sx* could

cause. In other words, for these types of problems it is necessary to identify which subsystem of a given physical or social system *Tx* which benefits from the so-called advantage in using *Sx* and which other entities of the same *Tx* system which on the contrary are disadvantaged.

The problem for some systems, such as AI ones, could become complicated if other control systems (perhaps still defined with AI techniques itself) are needed to reduce any risks.

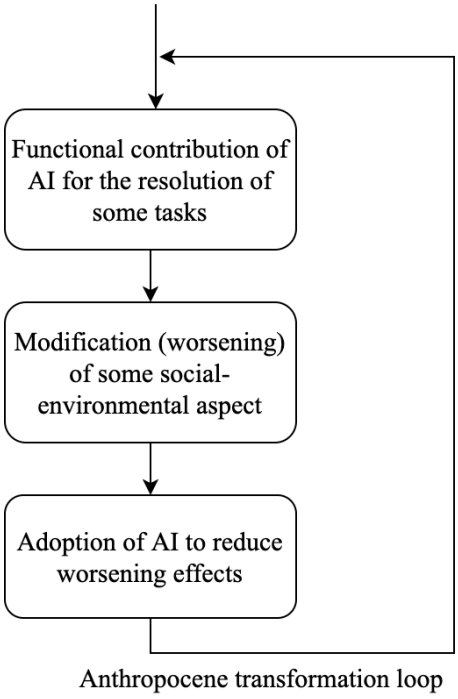

Figure 4 - *Anthropocene transformation loop.*

In an elegant way, in one of his articles, Peyron (Peyron, 2021) questions himself the subject in the following way:

> Artificial Intelligence transforms the society, economic and political relations: if our action is aimed at reducing, limiting, mitigating or reversing the misuse of the human presence in the ecosystem, the so-called anthropocene, the question that arises is

whether to increase the anthropocene is the correct way to reduce the anthropocene[24].

An example of the lats statement is reported in *Energy and Policy Considerations for Deep Learning in NLP* (Strubell *et al.*, 2019) where regarding the adoption of NLP systems, in particular with Deep Learning techniques, the impact in terms of CO_2e emissions is analyzed[25]. The **Errore. L'origine riferimento non è stata trovata.** shows the estimated cost of the training process, for some commonly NLP models, in terms of emissions CO_2e and cost, in euros, by adopting cloud computing platforms.

Table 1 - *Estimated cost of training a NLP model in terms of CO2e emissions and in-cloud compute cost (EUR).*

Model	Power (W)	Hours	$kWh \cdot PUE$	CO_2e (lbs)	In-cloud compute cost (€)
$Transformer_{base}$	1.416	12	27	26	36 - 124
$Transformer_{big}$	1.515	84	201	192	256 - 867
$ELMo$	518	336	275	262	382 - 1.302
$BERT_{base}$	12.042	79	1.507	1.438	3.317 - 11.116
NAS	1.515	274	656	626	833.866 - 2.831.171

The table shows us how the massive use of some AI techniques, which we use daily today, have a negative impact on the environment. So, for the proposed technologies, in particular for AI, it is necessary to leave the anthropocene transformation loop highlighted in the Figure 4). In (Sadin, 2019) the authors provide a suggestion that could lead to the resolution of the problem posed: the cultural profile. The latter consists in choosing a more meaningful use of technology in such a way that the latter pushes the behavior of individuals in a more ecological direction.

In particular, we believe that a solution is the adoption of methodologies for impact analysis, which must become an integral part of AI projects. Regarding this point, we postpone the discussion to the section 4.3.

[24] As one can see, Peyron uses the term anthropocene in the sense similar to that given by us in the footnote of the introduction.

[25] Wikipedia: "*Global warming potential (GWP) is the heat absorbed by any greenhouse gas in the atmosphere, as a multiple of the heat that would be absorbed by the same mass of carbon dioxide (CO2). GWP is 1 for CO2 (. . .) Carbon dioxide equivalent (CO2e or CO2eq or CO2-e) is calculated from GWP. For any gas, it is the mass of CO2 that would warm the earth as much as the mass of that gas".*

4. Remedies and attempts to control AI technologies

With regard to the AI functionalities, the game is played on two tables: that of directives that lead to the creation of systems that exhibit functions (understood as the capacity of artifacts/systems) that provide an advantage for humans and the environment in which it lives, and to provide restrictions on the generated functions.

The Italian AI scientific community took care of the first objective, elaborating an interesting document submitted to the current Italian Prime Minister which also reports the existing AI plans of other countries in the world (document that we present in the paragraph 4.1).

Instead, about the second one, relating to restrictions, the contribution came from the European community with a regulatory document based on the risk analysis for the marketing of AI systems (document that we present in the paragraph 4.2).

In the final paragraph (4.3) of this section we report some basic concepts to build methodologies for the impact analysis of AI systems, during the design, development and verification phases.

4.1 An AI strategy proposal for Italy

The Italian AI scientific community in a document (Semeraro *et al*., 2021) submitted to the Italian political community (Council Presidency) entitled "Artificial Intelligence for Sustainable Development" took entirely as a reference the objectives of the 2030 Agenda for Sustainable Development[26] proposed in September 2015 by more than 150 international leaders in a meeting at the United Nations to contribute to the global development of the planet.

In the Italian document on the massive adoption of AI for sustainable development, an analysis of the impact of AI was carried out on all 17 objectives proposed by the 2030 Agenda. Objectives that we explicitly list: *No Poverty; Zero Hunger; Good Health and Well-being; Quality Education; Gender Equality; Clean Water and Sanitation; Affordable and Clean Energy; Decent Work and Economic Growth; Industry, Innovation and Infrastructure; Reduced Inequality; Sustainable Cities and Communities; Responsible Consumption and Production; Climate Action; Life Below*

[26] https://sdgs.un.org/goals

Water; Life On Land; Peace, Justice, and Strong Institutions; Partnerships for the Goals.

Each goal is enriched by the contents of two key attributes: "what AI can do to achieve the goal" and "what are the dangers and risks to avoid" .

4.2. Guide Lines for commercial AI products

The European community has provided guidance based on risk analysis, proposing to group commercial AI products into 4 risk levels (Commission, 2021):

- a first level consists of AI systems that use subliminal techniques to distort a person's behavior, causing physical or psychological harm to that person or to others;
- a second level labeled as high risk is defined by the functioning of certain AI systems that can have negative repercussions on people's safety or their fundamental rights;
- a third level known as limited risk includes those systems that must be subject to minimum and precise transparency constraints, such as chatbots and voice assistants. These systems must ensure operation such that those who interact must be able to be aware that they are interacting with a machine, in order to be able to decide with full knowledge of the facts whether or not to continue using them;
- a fourth level in which the risk is considered minimal, for the safety, rights and freedoms of citizens. This last category would include maintenance systems, spam filters, and video games developed with AI techniques.

In this regard, always in the Ethical Guidelines on AI (Group, 2019) of the European Commission, it manifests the vision in which, to be ethically correct, the AI must be reliable, compliant with the laws and must comply with the following 7 conditions:

1. human supervision of AI systems, to ensure respect for fundamental rights and the well-being of the user;
2. robustness and safety, such as the safety and reliability of the algorithms and the degree of effectiveness and efficiency of the control systems in the event of hypothetical illegal operations;
3. privacy, control and data management;

4. transparency to guarantee the traceability of the systems and to demonstrate the operations carried out by the algorithm;

5. diversity, fairness, absence of discrimination: artificial intelligence systems should take into account the different and distinct human skills and abilities, at the same time guaranteeing free access to these tools to everyone;

6. social and environmental well-being, that is, always paying attention to the impact on the environment and the social order, promoting the use of AI only where its use can guarantee sustainable development;

7. responsibility, i.e. continuous systems verification, both internally and externally.

4.3. Methodologies for impact analysis of AI systems

The loop presented in 3.7, the directional unpredictability of AI technologies and, the problem of unexpected behavior of systems can be a cause for concern if you think that there are no remedies to make reductions in "quantities of anthropocene" that can be inserted at some point in the development of AI systems.

In addition, a loop reported in 3.7 gives rise to the suspicion that there may be many other loops of a non-technological nature whose existence we do not know. Sadin in (Sadin, 2019) warns us that industrial production is no longer sensitive to the need to carry out multiple and meticulous quality tests. Indeed, it declares that at the moment the trend is that there is:

> almost no discrepancy between design and marketing. Competitive pressure and the primacy of immediate return on investment prevent the slightest latency period, as well as any concerted assessment of the value and relevance of products. Research and development units must prove without delay and relentlessly that they are levers of profit.

However, this does not always happen. AI systems enter our daily lives not only through a strong bet determined by market reasons of unscrupulous companies. But also, through national and territorial research programs funded by government projects. It is these types of programs that we take as a model for controlling the divergence of any technological loops. In recent years, various AI technology projects have been funded, where impact analyses have been associated as a mandatory requirement of the project. A

real activity that takes place in parallel with the development of the project itself that goes through the various phases of design, development and analysis of the final result. An example of this type of project is the one that was launched in Italy in the year 2020-2021 by the San Paolo Foundation call, the "Artificial Intelligence, Art and Culture", where the candidate projects were formed by mixed academic, research, business and industry groups. And where, as a design requirement, there was that of in the activities an impact analysis methodology to be applied in all phases of the project. We believe that these latter methodologies are perhaps the only way to make rigorous assumptions of social change.

We will not report what the specific impact methodologies are, but we believe that this chapter is the right context to provide a brief presentation of the basic components. We will exemplify this presentation taking as a reference the AI projects that are composed of mixed research and business groups, which have as their purpose the development of AI products with not only profit-making purposes, but which must by choice or by project constraint perform a social impact assessment.

They play an important role in the construction of an impact chain the set of stakeholders, i.e. all types of natural persons or social entities involved in the development or use of an AI system that is intended to be designed and developed.

The choice of the sets of stakeholders referring to the development project is decisive for identifying the indicators through which the impact assessment will be built and formulated, which we repeat must have a quantitative evaluation characteristic.

In order to formulate an impact value chain, it is first necessary to define the concepts of input, activity, output, outcome and impact (Etica & Consulting, 2016), on which the selection phase of the indicators will also depend. For the interest to AI system projects, we believe that two phases require specific attention:

1. outcome (results) - are all the changes, positive and negative, both short-term and long-term, that occur on the lives of the recipients of the realized AI system. The outcomes are therefore the benefits obtained and also the negative effects verified as a result of the adoption of the system. The outcomes can be short or long term depending on the social needs to be met and the functionality or service provided by the system. They can be direct (reasonably direct consequence of the system or service on the life of users) or indirect (indirect effect on the life of the beneficiary or other natural persons or body of the company). In addition, outcomes can be expected or unexpected, i.e. results not expected after the adoption of a certain system.

2. impact - is the part of the outcome related to change. The impact is therefore a measure of outcome net of the essential changes, which would have occurred equally even without the use of the AI system realized. The impact measurement therefore represents the actual ability of the use of a certain AI system to cause expected changes.

In these impact assessments the key elements to be considered are: the living condition of people and the surrounding environment (natural, sociocultural, economic, institutional); the power structures that can influence the adoption of the systems produced by the project; the number of organisations and partners involved in the project and their role in pursuing results.

We have presented some essential notions of social impact assessment that can be used to evaluate AI projects, defined by mixed research-business groups, which need an impact analysis in sectors (let's make a hypothetical list), such as cultural heritage, smart cities, smart buildings, elderly care systems and educational systems.

5. Conclusions

In this chapter we distinguished two types of AI contributions: the functional one, due to the number of innovative systems it produces at the service of society, and the theoretical and methodological one that has an impact on many disciplinary areas. We examined the contribution of AI to the humanities, social and natural sciences. In particular to disciplines such as Linguistics, Cultural Heritage, Medicine and Education. We reported some critical issues of AI systems, we examined the problem of technological unpredictability, the unexpected results of AI systems, also discussing problems of regulation, opacity and prediction of the future of such systems. At the end of the chapter we reported some regulatory proposals of the AI systems commercialization and, we provided some elements for the impact analysis of these systems.

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9. The making of space, music, and soundscapes through digital art tools

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Abstract

Starting from a grounded case, the purpose of this chapter is to examine how research on/with artists who frequently use the internet and ICT might shed new light on traditional geographical concerns such as space/time and place/identity. Internet and ICT enable the formation of groups of people influenced by new characteristics, creating a highly intriguing geographical discourse. Contemporary artists tend to use digital tools in combination with traditional ones. They also make extensive use of social media to communicate, share experiences, and promote their art. Digital technology provides inescapable support to any artistic creativity and determines different forms of aggregation. The knowledge generated by musical sounds is more abstract, intuitive, and unconscious than the disembodied knowledge produced by words and images. The Internet would produce a new *digital generation*, more complete and aware than predecessors, happy to unite in collaborative networks of independent peers. Individual consciousness would transcend the human body's limits and would finally be free to explore spaces of creative and spiritual sharing. The chapter reports the research experience on the 2019 paint exhibition *Raging Babies*, dubbed by two digital musicians. The outcomes of in-depth discussions (as *focused conversations*) with three artists regarding the formation of collaborative networks utilizing ICT and the Internet are reported. The effects on geographical research performed by the author are also explained and commented.

Keywords: real and virtual places, art performance, painting, music, soundscapes.

1. Introduction: Geography and Grounded Art Experience

The chapter reports an art experience conducted in 2018-2019 with three visual and musical artists. They are Lorenzo Tonda, painter, Abo Carcassi

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and Pietro Michi, electronic musicians. They all use both traditional and digital tools. Starting from a grounded case, the chapter examines how research on/with artists who frequently use the internet and ICT might shed new light on traditional geographical concerns such as space/time and place/identity. Space and place are central topics for geographers, densely intertwined with the definition of community. Internet and ICT enable the formation of groups of people influenced by new characteristics, creating a highly intriguing geographical discourse. After at least thirty years of public ICT, all aspects of human life are facing a profound transformation, if not a revolution. All issues of politics, economics, the perception of the self, and the sense of community belonging, the sense of personal and public are involved. The internet appears to enroll a new digital generation capable of practicing collaborative networks of independent counterparts, imitating the web. The human body would no more be a limit to social relations and the spatial dimension of places, as human senses and abilities can transcend physical borders and share activities in so-called virtual spaces (Heim, 1995).

In this line, the electronic age presents a double opportunity for artists. It allows both to engage the audience and refine art techniques. Individual artists or any art collective can access a great wealth of audiovisual information and engage audiences with direct use of social media. An artist can implement personal abilities by combining digital devices and software with traditional tools. Digital tools help artists paint, take photos and videos, compose music, design, produce, reproduce, and even deliver their works of art. You might even say those new instruments are in the toolbox of any artist today. So, devices and technologies are effective in building an art community and fostering a creative atmosphere in a broader space. In addition, artists can design and organize art exhibitions or events using the web. At issue are the quality and quantity of acquired knowledge, reducing costs and saving time. There is also the possibility to manage new creative languages and the mix of physical and virtual art places (Arvola, 2014; Jeacle & Carter, 2014).

The chapter will detail the experience made by the author in designing and organizing the exhibition entitled *Raging Babies*, held in Florence from January 19 to the end of February 2019. The people involved in the event were the author as curator, the painter, the electronic musician, and the producer of hi-fi recordings of soundscapes. To delve into the experience and give critical interpretation the text is organized as follows.

The next section deals with the background theory used in the study. Section 3 discusses information selection issues in the representation of both real and virtual places. Section 4 describes the design and implementation of *Raging Babies* as a multidimensional art performance. The paragraph sets forth the results of the analysis. It is divided into two parts, the first devoted

to the geography of the pictorial representation, and the second to its relationship with the sonic environment designed around it. The last paragraph is devoted to comments and conclusions, also in view of future similar initiatives.

2. Background Theory

Any art uses aesthetic means to express and communicate with an audience. Whether art is expression and communication or much more, is a complex multidisciplinary issue, of a philosophical nature (Casey, E.S., 1971) yet even political, as Theodor Adórno (1973) put it in dealing with music in his 1949 *Philosophie der neuen Musik*. The issue of the philosopher was the sociopolitical conflict between content and language/grammar. He opposed the dodecaphony of Arnold Schönberg to the neoclassicism of Igor Stravinsky, the latter mistakenly considered a reactionary composer compared to the revolutionary inventor of the twelve-tone method (DeNora, 2017).

Throughout history, artists have always been enlisted to serve some form of culture, religious beliefs, political power, knowledge, and achievements of science. Geographical knowledge has been fostered by transferring the visual power of the eye into cartographic representation, especially during the period of the world's great explorations (Cosgrove, 1999). Although many cartographic representations of the Earth are works of art, the political power used them as a weapon to make war (Lacoste, 1976). The hyphenated spelling of Geo-*graphy* (writing the Earth) emphasizes the Geo-human interactions and the aesthetic sensitivity for relationships between emotions, feelings, and places in the real world (Malpas, 2011). Representation can be the construction of meaning. Yet, attention to place as a container of feelings and emotions is both a properly geographic and a challenging theory-making. The cultural geographers' recent interest in art has expanded beyond the usual focus on visual and iconographic readings of paintings, drawings, maps, photographs, landscapes, architecture, monuments, and sculptures. Geography includes increasing attention to the spatialities of sound, music and noise, video, film, performance, and dance. Attention to performing arts has also an epistemological meaning for the discipline (Thrift, 2008). Movement and performances of people produce *aesthetic* geographies, as they trace the Earth with a bodily topography, writing (*graphein*) cultural meaning on physical space with movements.

"If texts can create images, then spaces can change bodies and vice versa. If images can change cultures, then the body can create text; it *is* and *has* the text that controls cultural spaces, and at the same time is controlled by cultural images." (Hallensleben, 2010, pp. 18-19, original emphasis).

A corollary is that arts and artistic performances can also be seen as a means to change human behavior, which always has a place, and a public and environmental impact. According to Dewey (1934), a work of art is more a practical rather than a theoretical act. A work of art is not simply an object, because it creates a relationship with the viewer, thus becoming a social experience. It is an in-progress experience of doing and enjoying. And, as with any human experience (bodily or mental) it always has a place (Casey, 2013). So, you can add, aesthetic experience has a place.

Reconsidering the philosophical positions of Theodor Adórno on content versus language/grammar of music, the analysis of sociologist Tia DeNora (2017) helps us extend the considerations on music to any form of art and relationships with place. Following her ideas, Stravinsky wanted to restore an authenticity of its own to art. He had an aversion to the established system and subjective expression, preferring to create second-rate art, namely an art that refers to itself. Adórno interpreted this as renouncing the artist's self in favor of social consciousness. But Stravinsky, to renounce subjective expression, did not need to create a new idiom, atonal or serial, but used many different musical styles. Tonality was not a fetish but a compulsion to bring order and preserve artistic integrity. He just needed a way to connect many dissociated elements placed on different layers, for example, using simultaneously two different tones, offering the listener a real collage. In this creative patchwork, the listeners can find and choose their own meanings. So, the two subjectivities of the author and the listener remained autonomous. But the integrity of the artist is intact. Eminent Italian musicologists and musical critics put at the same creative climax composer Igor Stravinsky and painter Pablo Picasso, the two most influential artists of the XX century (Mila, 2012; Vlad, 1958). They both changed over time their styles while maintaining artistic integrity and authorial identity.

Stravinsky, unlike Schoenberg, anticipated the postwar avant-garde, though he did not take the decisive step of renouncing the grammar of a language, tonal, atonal, or serial syntax. Musicians such as John Cage and Edgar Varese, inheriting from both Schoenberg and Stravinsky, brought an end to syntax. If the music has a seven-note order, the twelve-notes would be an ordered grammar too. Thus, Varese redefined music as organized sound, introducing noises as new sounds (Cassidy & Einbond, 2013), produced electronically or naturally, by the environment, or by the audience in the location, as in Cage's composition 4'33". The written score of 4'33" destroys

the authorial aura but derives from a traditional artistic approach. There are the musical theater, a stage, a player with an instrument (or an ensemble), and a musical score written by the composer. Moreover, Cage demonstrated that music execution and listening must have a *situated* feature. The music-makers are the composer, the listener, and the environment, with its unavoidable randomness. Geographers might be happy about this finding. They can appreciate also that the geographical topic of *sense of place* (Relph, 1976) is similar to the concept of *aesthetic ecology* (DeNora, 2017), within which music plays a non-marginal role.

Following these suggestions, you can consider people capable of building up located social clusters using sensory relationships with others, materials, and environments, as well as situated languages, symbols, values, and ways of doing things, even with a bit of randomness. In conclusion, communities take action by using precognitive and nonverbal assets such as emotion, impulse, and symbolic manifestations. Material and immaterial "things" influence actions, collectively preferred and executed in real life. Practices of agents make situated identities and capacities manifest. There are many references to *tacit knowledge* and *embeddedness*, investigated by two Hungarian scholars, the economist Michael Polány (Polány & Sen, 2009), and his brother, historian and anthropologist Karl Polány (1944/2001). Human practices determine the borders and qualities of a place, substantiating the relationships between society and economy and vice versa. Today, place can be both real and virtual (Relph, 2007) just like social networks are real and virtual (Wellman, 2001).

3. Representing places: imagining a selection of details

When describing a place, whether real or imagined, in a novel, on canvas, or digitally, it is necessary to choose from the infinite details of reality. It is impossible to describe every detail, and any author must select a few elements by using a language (Tuan, 1991). The void between them is filled by the artist's representation capacity and entrusted to the audience's imagination. Representation *and* imagination compose the complete image of the place. In the same way as the design of virtual environments/places, the pictorial representation involves a subjective act of selection. Performing music adds a sensory possibility (Leyshon, Matless & Revill, 1998; Ouzounian, 2015), but the subjectivity of the sound designer remains. Virtual reality is three-dimensional, giving more sensory information than a movie or novel. So, you might assume that users can use less imagination yet have more interactive spatial perception possibilities (Relph, 2007).

Digital places are usually interactive and can be explored from different directions and modified by visitors (Dodge & Kitchin, 2003). The more vivid the imagination of visitors, the more intense the exploration and modification of virtual places will be. Arguably, attending a virtual space requires a different kind of creativity than reading novels. Virtual realities are not read but practiced (Adams, 1998).

The designer of virtual places should understand in advance the type of participation. They might provide some triggers to behaviors even though the results of participant involvement are never entirely predictable. In this sense, virtual places are works of art whose form is constantly changing due to the simultaneous actions of authors and participants.

The sense of a virtual place might not be different from that of a real place (Relph, 2007; 2009). Human senses will be engaged electronically, and emotions will vary between individuals, but the sense/meaning of place might also have a common expression. The organization of sounds, music, and noises can add a sensory possibility. In the future, virtual reality will engage the sense of smell also (Flavián *et al.*, 2021). Shared common sense/meaning would come from the accurate description of connections between users and virtual worlds: for example, online games, museums, and virtual art galleries. The place to share emotions will be somewhere on the webspace. Eventually, as in real life, the linkage between humans and places can become obsessive and dysfunctional, as in the topophilia/topophobia sentiment enlightened by Tuan (1990; 2013).

A virtual sense might be an added variant to real places as now variably distributed in the geographic diversity of the world. The "real" will furnish ways to create virtual places with compelling identities.

4. The exhibition Raging Babies as a multidimensional art performance

In preparation for the *Raging Babies* (Pic. 1) exhibition at *Studio Rosai* in Florence, the working group met a dozen times in the painter's studio in 2018. The meetings were with two, three, or all four members together. The meetings had the character of Focused Conversations (FC) (Heritage, 2008). Following Stanfield (2000), the FC method gives face-to-face relationships an orderly and structured focus to meetings. The group is made of peer agents intentionally moving from shared topics. All have clear information and pay attention to common issues. Thus, individual experiences are shared among participants to identify meanings, options, possibilities, and solutions to the questions raised. Meetings at *Studio Rosai* aimed at achieving a twofold goal.

On the one hand, participants aimed at organizing both the exhibition and the opening event. On the other hand, the conversations had a research purpose, aiming at acquiring qualitative data (Paulus *et al*., 2008) along with data retrieved during and after the exhibition. The group analyzed the retrieved data, discussed and approved findings after the end of the exhibition and again during a last meeting on January 3, 2022, in view of this text. The following parts of this section report the results of the group's conversations.

Pic. 1 - *Lorenzo Tonda, Raging Babies, 2019. Oil on canvas, 250x250.*

4.1. Desiring sustainability through painting

Why Raging Babies? There is nothing more terrible than innocent children. Their rage can be devastating, subject to the power of objects, shapes, and the charm of feeling virging. Human beings are attracted by

excess, capable of bringing into play exorbitant energies, fantasies, needs, and desires that are infinite and often candid. Today we feel trapped. Yet in the trap we feel good, fulfilled, in the company of friends and family, happy, we even laugh, we open vintage wines to celebrate. The economy that governs us is based on the claim of the universality of the principle of spending, the sun that illuminates society with the powerful rays of utility that, instead of making us happy, originates the accumulation of savings, capital, and power. So that children become furious at the perennial lack of things, and willingly throw themselves into a physical struggle, into a perennial brawl, to obtain something that is at hand. And why should it not be so? But there is an inconceivable contradiction between wanting things—the more useless they are the more they give joy—and saving capital. It's as if someone who throws candies in the air were to become the most powerful man on earth just by making a gesture of throwing shiny objects at the sky. Immediately the children will enter into a furious struggle for the conquest of a fistful of candies. There is no trace of ambiguity in this, and the fight deserves center stage and full attention. The painter puts angry children at the center of the square, within which both the distinction and the tangle of forms, some soft, some hard, are displayed. The soft ones are the flesh ones, they are alive and have a sex. The hard ones are geometrical forms and impose themselves sharply in the scene. To recognize the candies thrown into the air by an invisible hand requires an expert eye, the naive one of children, while the hard shapes of geometry can be seen very well, they are evident to each of us with their edges. They are perfect in the complete abstraction of form: almost as if they have self-awareness.

We must move in the grammar and syntax of discourse about things and never among them as they are in the world. Neither faith nor ideology are helpful. Art manifests itself through the steady hand of the artist who, appropriately enough, wastes time in the aristocratic consumption of his artisan talent. It is the waste, the excess of energy, and the true artistic nature of children, who never exhaust the naive search for physical confrontation. Only the one who wastes can give a complete artistic discourse, the only one within which colors and shapes take their true meaning.

4.2. Electronic music and soundscapes to give a space to the painting

The painting represents space in two dimensions. The final *Raging Babies* picture reproduced on canvas with traditional brushes and colors is first prepared digitally. The painter meticulously takes care of the details, perspective, and spatial distribution of the 3D-drawn shapes. Digital images

can create environments that are accessible to VR-viewers and smartphones. The composer designed an electronic music score specific for the opening event, inspired by the whole figure and the spatial details of the painting[2]. He placed speakers to produce a quadrophonic soundscape in the gallery enveloping the sonic space for the visitors (Pic. 2).

Pic. 2 - *Musician Daniele Carcassi preparing the hall for the music listening*
Source: Photo by Fabio Norcini.

The piece of situated music produces a space of triple nature. One is internal to the music score as designed by the composer as a cartographer; a second one is internal to the exhibition hall, a designed architectural space; a third one is external to the exhibition hall because the sound goes beyond the walls into the adjacent space. People coming to the gallery could hear sounds even from the street before entering the hall. The painting *Raging Babies* is then immersed in a soundscape and an aesthetic ecology. During *Raging*

[2] *Raging Babies* by Daniele Carcassi, retrievable at https://danielecarcassi.bandcamp.com/album/raging-babies

Babies, 13 soundscapes recorded by *Biodiversità Records* were streamed in the hall for visitors[3].

The world is made of landscapes. Our eyes allow us to see one of them at a time. Technology helps us widen our sight and senses; perception might become even bigger than imagination. The web (the internet) allows sharing the real listening of the soundscapes that are scattered in the world. In fact, the internet is an instrument capable of producing community through the web. You might risk feeling omnipotent, passing through the door of too big a perception, of immense sharing, of appropriation of other people's landscapes. And so, we need prudence and sensitivity in listening. We need an ecology of soundscapes. The 13 soundscapes of *Biodiversità Records* surround the audience with *noises* coming from the home garden, from the cultivated countryside, from the city full of people and noises, from the thick of the forest, from the bottom of the sea, from the skies furrowed by airplanes and birds, from the world divided into personal and collective landscapes.

Soundscapes are stories of knowledge, experiences, and feelings: is it true that mind, sound, and landscape don't exist if not in a reciprocal relationship? Fatigue and joy in looking for as many sonic details as possible are the basis for building up a soundscape. The artist who puts together soundscapes retrieved from the whole world is looking for his landscape. It becomes ours, unifying memory and the Earth, between memories and sound materials to be combined. Putting soundscapes as the sonic environment to *Raging Babies* is a simple operation: a fight scene, some background noises. But the world has many noises, many sounds: confusion is possible. The clarifying technique is available. The web belongs to everyone and it is possible to make a community out of it. The artistic game is the appropriation of the soundscapes of other artists from all over the world who have made them available to create a collage that is greater than the individual parts. Ecology of the Earth, sustainability of life, is the understanding that only artistic waste will save us all from the waste of material resources.

5. Discussion and conclusions

The chapter presents a case study on a situated art exhibition. Participants in the working group aimed to make a ground experience of testing different skills using digital and traditional tools. The occasion was the painting of a picture displaying fighting babies as the depiction of present-day

[3] *13 sounscapes*, by Pietro Michi, retrievable at https://biodiversitarecords.bandcamp.com/album/13-soundscapes

environmental anguish and fear of the young for future unsustainable life. The painter's intention to engage an electronic musician and a producer of soundscape recordings at the exhibition opening suggested framing the present work geographically. The aim to treat the topic *place* as a performing object was intriguing yet fruitful. The exhibition's curator proposed to have meetings organized as conversations oriented to identify organizational practices and analyze different points of view on the relationship between art, digital tools, and the making of space. The group had several meetings to establish confidence and organize the job as FC (focused conversations) to gather data useful for epistemological purposes (Heritage, 2008). The easy collaboration and complete concordance of the newly acquired knowledge proved the method as effective, at least for the group's goals. All participants declared the digital art tools as fundamental for their individual and collective activities. They usually manage social media such as Facebook, Instagram, and Twitter. They also declared the unavoidable role of the internet and social media in promoting this initiative as any other performance. Artists can increase their capabilities by using digital tools, intended as the numerical control of the rendering of their work through professional software. On the one hand, the use of ICT expands the technical possibilities of making art by building virtual networks, engaging different disciplines, such as geography, sociology, and media studies (Adams, 1998; Dodge & Kitchin, 2003; Jeacle, & Carter, 2014). On the other hand, the internet expands the communication global web-space for art activity. This option allows intense cultural exchanges that contribute to making communities (Wellman, 2001).

Both the organizing process and final exhibition confirmed many findings of scientific literature considered in preparing this paper. *Raging Babies* represents on a flat canvas the space performed by children fighting over futile objects. Human bodies and geometric solids produce the shape of the space of conflict. The artist has reproduced the third spatial dimension using painted perspective and adding the show of computerized virtual reality. The audience was able to experience the third dimension of the work using special devices as well. The addition of musical sounds and recordings of natural noises enhanced the audience's spatial perception. The entire performance provided attendants the opportunity to perceive a triple space. One is internal to the painting as perspective cartography. The second is the exhibition space, an architectural venue already designed. The third is the space that the sound reached outside the gallery, beyond the walls of the building. Participants were immersed in an actual aesthetic ecology as defined by Tia DeNora (2017).

In perceiving space, the eye and ear usually work together. But they can act separately to assess its size and quality, a kind of situated sentiment, the

spirit of the place. Perception of space, the sense of balance, and the information about movements and vibrations around us depend also on our ears and the interpretation of sounds (Leyshon, Matless & Revill, 1998). The geographical significance of the spaces and places of music does not simply concern the place where the music is performed or the physical point of direct or mediated emission of the sounds, but also concerns the different spatialities that musical emission and resonance can form and delimit (Ouzounian, 2015). You can feel the musical space even with closed eyes. Opening your eyes, you can combine the sound spatiality perceived through hearing with the vision of the surrounding space and landscape. Conversations among components of the working group confirmed the above literature findings.

The main lesson learned from the ground research on *Raging Babies* is that the visual experience of looking at a painting is enhanced by the diffusion of music because it induces the audience to feel different spatial dimensions. The environmental message inherent in the exhibition was supported by the multi-sensory perception of images, music, and recorded soundscapes. It is possible to assume that any other type of artistic message would have induced the same geographical considerations on spatial perception. In this sense, the controversy over Adorno's contrast between the content and language of music seems to remain intact. But the figurative painting language merged with the abstractness of electronic music and the combinatorial randomness of sounds from distinct and distant landscapes produces a collage of artistic styles. This finding is consistent with DeNora's criticism of Adorno's rigid position. ICT and the internet add great potential to artistic collage making, and it is consistent with the geographical topic of the making of space. The involved artists did agree on this point, which is valid for theory and research-making in many disciplines.

A final consideration about limitations of the present work. Doing field surveys is an inherent quality of geography. However, the present work appears to be in some way original. According to the author's current level of knowledge, the number of comparable grounded works is limited. This issue depends mainly on the sporadic attention paid so far by Italian geographers to music and noises, if not to art in general. The uniqueness of the work defines both its originality and limitations. Therefore, it should be considered exploratory, although the results were of particular interest to the working group and future research design. The team will be engaged in supporting the painter in a large mural project located in a public garden in the city of Florence. Comparisons with similar research initiatives are necessary to confirm the results and lessons learned during the work.

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10. Technologies for communication and new models of thought. Culture, philosophy and social identities

Alfonso Di Prospero[1]

Abstract

The Covid 19 pandemic has forced us to a much larger use of digital communication technologies. The article proposes to investigate the structure underlying a cultural model capable of supporting the widespreading of the new forms of communication along more desirable lines. The article also examines the opposition between those who hold favorable views and those who hold negative views about the employment of the new technologies. I maintain that the most important factor is not in the technical nature of the devices, but in the structure of the meaning constituting the content of communication. I also consider it of pivotal importance to analyze how cultural models can offer semantic tools and aids in order to give a more fruitful configuration to the contents of communication.

Keywords: Pandemic, ICT, Agamben, Self-organization, Objective pull

1. Pandemic and new models of culture

The shock of the Covid 19 has brought about the effect of the necessity of a fast advancement in the process of wide spreading of the new technologies for communication. Of course this circumstance has provoked an intense debate. In the Italian context we can recall the positions of Maurizio Ferraris (2021a, 2021b), who defends a positive interpretation of the meaning of technology in general and of the new technologies for communication in particular, while Massimo Cacciari (2020) can be mentioned in particular among the critics who make some serious accusations against the use of digital devices in education and teaching. Giorgio Agamben (2020) has also become well known to a larger public of non specialists for his position against lockdowns and the use of the

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greenpass in Italian politics, as a means of contrasting the pandemic. Massimo Adinolfi (2021), Donatella Di Cesare (2021), Giacomo Marramao (D'Alessandro, 2021) entered the debate so as to contrast Agamben's and Cacciari's positions. Zuolo (2021) dwells on the suggestion that Agamben's tenets about the Covid 19 are a direct consequence of his previous and well known philosophical elaboration.

One aspect of the thesis that I wish to defend is that these episodes – even if relevant in the ordinary sense in the public discourse about decisions of collective interest – only affects one level of the issue to be dealt with today. The dimension of the question that I wish to consider does not concern the specific and explicit contents of texts and discourses that philosophers and intellectuals are proposing on this subject, but rather the sociological meaning of their productions. Actually my analysis will not concern the authors that I have mentioned, but some aspects of the general structure of the communication processes in the cultural dynamics – within which the discoursive practices of these philosophers are also contained. All the same, the kind of trouble that the philosophical reflections have gotten into while facing the particular problem of the pandemic is a pertinent example of the difficulties discussed in this paper.

The Covid-19 pandemic itself is a correlated of the present process of globalization and it is a cue and a symptom of the limits that affect it. Every pandemic presupposes a net of relationships that has reached a too high degree of developement: a sort of promiscuity that can show itself in different ways. Animals living in too close proximity to human beings, people living in too dangerously crowded conditions, too many individuals moving from one country to another. Then – this is my issue – what is the *model of culture* that could be adopted to manage these processes? In other words, in a nutshell: what is the model of culture that can be suitable to the Anthropocene era? (Mercatanti, Montes 2021; Delanty, 2021; Ricciardi, Vella, 2021; Aime, Favole, Remotti, 2021; Indirli, Di Maio, Martinelli, 2021).

The reference here is to the *structure* of communication in cultural activities, not to its contents. Which patterns of communication should be adopted in a world where the standard of sociality is designed on a global scale? The increasing amount of messages and relations today render different from the past the underlying logics that control the dynamics of communication and explain the strategies adopted by the speakers. Our reflections about the meaning and the functions of the cultural productions must also take these aspects into consideration. An example of the problems to investigate can be found in the political ideas of Dario Fo, a great writer

and Nobel Prize winner. In the Seventies Fo expressed his appraisal for the figure of Mao Tse Tung, but the question arises of what ground there could be – in principle – for a reliable evaluation of the above mentioned case, when an observer claims to understand something concerning the politics of a faraway country, in such an exacting issue (of course the circumstance that Fo visited China does not alter the nature of this problem). Clearly Fo's case is only one example of a widespread way of being engaged in political and cultural activites (Tesini, Zambernardi, 2018): similar difficulties are well known in the history of philosophy (we can also recall the different case of Martin Heidegger's endorsment to the Nazi Party, in his own country). In these years, and since a long time, this attitude is less common, yet the issues that it entails remain urgent. In my perspective the question is utterly general. What is the epistemology of these connections that the social actors attempt to find on a global scale?

What happens in a city like Wuhan – mostly unkown in the West, up to the pandemic outbreak – can change our life. We can also remember that, while in Western societies the causes of the Covid 19 pandemic are attributed to the poor sanitary conditions of the markets in Wuhan, China widely maintains a different interpretation, according to which the virus has been brought from the U.S.A. (ADNKronos, 2020). In perspective, what are the entailments of such a divide within the global public opinion?

The flows of communication are not always reliable. Often, they are rather wholly conditioned. Even if pieces of information about these far countries (slaughters, persecutions, lack of freedom of speech) are available, in some cases it is difficult to evaluate if they are trustworthy. (In an obvious sense, it is to be considered that in the history of the political movements, the phenomenon of echo chambers has always existed.) The kind of difficulties that were present in the years of the first representations of *Mistero buffo* are still extremely dangerous – furthermore they have increased as the net of global intersections has become denser and more intricate. Refusing to give relevance to the facts that concern people from other countries cannot be a viable option. Rather, we should develop models of communication to contrast these mechanisms.

2. Culture and self-organization

Edgar Morin (1973) applies the concepts of self-organization to the study of human nature and its capacity of producing culture. He believes that the presence of "noise" in the flows of information is not necessarily an obstacle

for the tasks of the system, but rather a condition that can facilitate a shift towards more advanced levels of organization. Scott Ashby's principle of "order from noise" is also largely used by Niklas Luhmann (1984) in his *Social Systems* theory. Among many others, Maurizio Ferraris' hope (even if his analysis follows different lines from mine) is that the pandemic can be the ground to obtain:

> "il cambiamento di prospettiva necessario per trasformare lo *choc* in esperienza […] e per trarre da questa crisi […] un insegnamento che non ha precedente nella storia e che costituisca un possesso perpetuo dell'umanità" (Ferraris, 2021a, 66)[2].

Can we detect any conditions that are suitable to catalyze such a kind of process? When put in these terms, the task is too exacting. But I wish to make the attempt to offer some remarks.

One focus will be on the field of teaching, but in a perspective that is not that of the concrete application of pedagogic tools in the classroom. In schools, a moment of *mediation* can be found between the contents of the cultural universe and the learners, therefore the definition and the conceptual analysis of those contents can also be involved in the issues of teaching, if finalized to understand the *impact* of cultural productions on the learners' lives. But my interest does not lie in detecting the best way to transmit knowledge, competencies and abilities. Of course this is also an interesting point, but it presupposes that *we* (the adults) *know* with a certain precision how to identify the best contents, competencies and abilities that young people need to learn. In the current historical moment, when cultural frameworks are rapidly changing, the task of this detection is neither simple nor is an obviously attainable outcome.

The debate about the employment of digital technology in the field of teaching is truly interesting (Riva, 2014; Ranieri, Pieri, 2014; OECD, 2012; Maragliano 2013; Midoro, 2015; Roncaglia, 2018; Reale, 2013). It is well known that there are strong differences in the evaluation of the impact of technology on learning and on cognitive processes. Manfred Spitzer (2012), Nicholas Carr (2010), Jean Twenge (2018), Byung-chul Han (2013), Sherry Turkle (2011, 2015), Susan Greenfield (2014), Maggie Jackson (2008), Adam Gazzaley and Larry Rosen (2016), have maintained in various ways

[2] «[A] change of perspective necessary to transform the *choc* into experience […] and to draw from the current crisis unprecedented lessons bound to become a perpetual heritage of Mankind» (author's translation).

that the effect of digital technology on the human mind is negative. As the effects of digital technology increase, the patterns of thought are damaged, the structure of the attention becomes less effective, and the quality of interpersonal relationships deteriorates: the image of the "swarm" is used by Han to describe a new kind of sociality; the empathic contact between individuals is threatened by new models of relation where distance is overwhelming. Finally, individual thought becomes less capable of keeping its focus for a long time.

On the opposite front, there has been an important contribution by Pierre Lévy (1994) concerning collective intelligence (see also, among many others, boyd, 2014; Johnson, 2006). Marc Prensky discusses the entailments for pedagogy: «if Digital Immigrants educators really want to reach Digital Natives – i.e. all their students – they will have to change. It's high time for them to stop grousing, and as the Nike motto of the Digital Native generation says, 'Just do it!'» (2001, 6).

In all likelihood the main limit of this debate is represented by the existence of a strong polarization between optimistics and pessimistics. Those who embrace one party tend to overvalue all the aspects that converge with their opinion. If someone defends the use of technology, he or she also defends a model of language and communication that seems to have an affinity with it. So Prensky's wish is that educators adopt the "languages" and the aesthetics of the new media. On the contrary, if someone criticizes the diffusion of the new technology for communication, they seek in the past models of communication and in the traditional conception of culture the right exempla to be followed, both in the contents and in the aesthetics precepts. It can be argued that something in this frame is not convincing, by considering the potential of a fundamental tool of pedagogy in the field of new technologies: the hypertext. In the hypertext, a more structured form of thought can be exercised, perfectly in line with the demands of a traditional request of autonomy in thinking: it allows us to analyze, decompose and recompose the contents of learning. Since the choice to activate a link depends on the individual will, it is also adapted to grasp the individual level of capacity and knowledge, corresponding to the need of satisfying the individualization of learning. But the complementarity and the reciprocal recall of the two sides of this evolution – the traditional one and the future one – are much more important than the only example that the hypertext can show: they concern the very framework of the cultural activities. When we talk about culture, we are also talking about an extremely differentiated world. The symbolic dimension of the communication processes within the cultural productions allows and

increases the possibility of this differentiation, so as to make the contents of culture, arts and science appear meaningful and profound, for their capacity of grasping ever more subtle aspects of reality. The improvement of knowledge is acquired by means of setting new constrains on the structure of meaning. Niklas Luhmann's picture of social evolution makes use of a parallelism with Darwinian biology. Within a species the biological organisms evolve and reach fitness to the environment by imposing new constrains to their own structure. As a result, the organism's freedom is larger if it develops the proper constraints on its own structure. Also in the cultural and social dynamics, systems can evolve and become more complex if they impose to themselves the proper constraints. "*Legum servi sumus ut liberi esse possimus*" (see also Elias, 1983: on the connection with this author, see *infra*).

Along these lines, the aesthetics of the new media, based on fragmentation, speed and lack of structure, can be critcized (against Prensky), while the underlying and incresasingly progressing level of complexity of the universe of meaning can be seen as a part of a global process in the evolution of culture: in my perspective, this aspect of the cultural production is still more *amplified* by the new technologies for communication, i.e. some structural properties of the traditional dynamics in the production of culture are *kept* and empowered by the new technological tools. If we look at the writing itself, we easily find that *virtuality*, *abstraction*, *differentiation* in the formulation of meaning and *distance* are four fundamental aspects of the kind of meaning that is conveyed by the *book*, namely by one of the most representative devices and symbols of the traditional paradigm of culture. In an early stage of the process of civilization, the fact of using books instead of oral communication could appear as a damage and a vulnus to the basic insight of the culture of that time (Plato). The fact of reading books (e.g. novels) could be the ground for the charge of having the regrettable attitude towards escaping from reality, with a sort of parallelism with what is known today as "phubbing" (in Plato's Academia Aristotle was ironically named "the reader", since his habit of reading was much greater than other Plato's disciples'). But these remarks connot be only seen as a reason for a sarcastic criticism of the conservative attitude shown by many philosphers and intellectuals: "when writing was the most innovative technology, philosophers like Plato were enemies of writing; now the greatest innovations are in digital communication, and many philosophers' position is to defend writing and criticize the new devices". Actually, caution in front of new inventions is wise: they can bear new systems of equilibrium between the parts that

constitute our social universe, and this can produce dangerous recoils. The net of connections between the parts constituting the social system is large and intricate. We do not know where and when the effects of our actions will be felt. We need to observe what happens for a sufficingly long while of time in order to understand what is the better thing to do. Obviously, dealing with the goal of delineating a general picture of such an issue would be too exacting a task for this paper. All the same, some interestng points can be highlighted.

3. Teaching, reflexivity and collective mind

A first consequence of these observations is the necessity to admit that the relationship between teachers and learners – and also the still more important relation between the traditional models of culture and the new forms of thought and expression – is not linear (*from* teachers *to* learners), but circular. Paulo Freire (even if in a different field of pedagogical interests) emphasizes that each act of teaching is also a form of learning (Freire, 1996). In my perspective, this point should be radicalized, meaning that the single teachers cannot be left to work with their obviously limited strenght. Rather it is necessary to discuss models that can be able to obtain the endorsment of large social groups, and it is necessary to define the contents that constitute the cultural universe and their epistemological status. The effort of the single teacher can be useful to mediate between the most idealized and abstract goals of teaching and the limits of the concrete context where the learners live. But the task of delineating the scientific meaning of the cultural contents is something that the teachers must take from external sources: books, debates, specialists and experts, and also from the feedback of their classrooms and from the social environments where the students live, since the boundaries of meaning are a collective and collaborative artefact, and therefore the students' feedback can also help to establish in some cases the exact line to trace in order to say whether an utterance is correct or not. For example, this last aspect is fundamental in order to establish *the point from which* we can speak of "fake" news in the public communication concerning the results of scientific research: some ambiguities are necessary in every kind of communication, so also the results of the scientific inquiries need to be presented with approximation.

In this historical moment the task of shaping the universe of culture, its form and its boundaries, is radically constructive. The meaning and the effects of intellectual habits that we (the adults) believe to be clear, in the

future may turn out to be very different from our present diagnosis, simply because these years the structures of communication have been quickly changing and the resulting meaning of a message that only exteriorly remains the same, might become different. For instance, this problem might arise: the traditional contents of culture (for example the works of the great writers) have a more articulated and complex structure, so they provide an enhancement, but their complexity – in statistical terms – can become a reason why there will be fewer opportunities for the social condivision of their outcomes. Is this not ground to fear that their complexity (under some circumstances) can become an obstacle for the enrichment of personality? If the language that I am competent to use – for its complexity – is appropriate to only few kinds of social context, in the other ones I will be forced to employ a language that I am less able to use compared to others (of course the condition *ceteris paribus* is always to be maintained), and this can be a factor of hindrance for the full development of my capacities. The power and the value of the individual capacity of reflexivity is to be asserted, but we need to consider also the adjustments that are necessary to make it compatible with Bauman's "liquid modernity" (Margaret Archer's contribution is to be recalled here). I really do not wish to defend a direction of thought in which conformism is to be rewarded. Both the individual and the collectivity need to tap into the resources of the individual creativity. But this fundamental goal is to be concelead with the other one, for which the several lines of communication between persons are to be maintained undamaged.

These remarks drive us to the other side of the issue, namely the bad outcome that we have obtained in these years from the WEB mediated channels of communicaion (Zickmund, 1997). Ferraris' claim certainly is right when he says that the WEB communications have been indispensable in the course of the pandemic. But this evaluation can be done more confidently in relation to the activities that were relatively designed as routines. In the decisional and informative moments (in those cases, namely, where the dimension of novelty is central) the outcome has been more delusive.

In general, even before the pandemic exploded, the analyses of the processes of digital communication were controversial. The enthusiastic vision of Lévy has been shown to be unrealistic. The extremely dispersive character of the most widespread forms of digital communication leaves us with the suspicion that the level of rationality and cognitive complexity that a social group can reach by means of the "collective/connective intelligence" model is lower if compared at least to the best products of the

traditional model of culture. Under this aspect, it is the lower level of the internal differentiation of the meaning that makes online communication less rational and articulated in comparison with the medium of books. But the problem – I wish to sustain – is not in the tool – in the technological device – that we use. This claim could lead us to an excessive form of technological determinism. Rather it is the structure itself of information that is involved: even without the use of technological devices, human life in the present times is absorbed by patterns of behaviour for which the level of *abstraction* is highest. If some individuals appear on the scene of communication, the respective biographies, activities and beliefs are different and unknown to the others. The content of information that anyone possesses about their interlocutors can be seen as abstract in the literal sense where everyone must "abstract" some simple items that are present now in the shared scene from the actual identity of those persons. Each person's messages and behaviours should be designed in such a way to be coherent with the specific social scene, but also with the personal projects, wishes and goals – even if these do not appear in the present scene of communication – if they need to remain coherent with their own identity. If they could hope to attract other individuals in a collaborative relationship with them, in order to pursue common purposes, this would become a "concrete" context of communication, but the fragmentation of the social system and the precariousness of the various contexts where each of us is acting, make this strategy extremely difficult to adopt. Before a relationship has been established, each individual must assume patterns of behaviour that are coherent with the pieces of information that are shared (simply because other ones are not available). If someone aims to share some personal project with others, they need to convey their messages and behaviours in such a way that they could be coherent *also* with this proposal, but if the scissor between the contents of information pertinent with the *first* proposal (when the first meeting occurs) and those pertinent with the *second* one (in the sake of increasing the reciprocal knowledge) is too great, it will be impossible in principle to pursue the goal of building relationships endowed with a richer meaning.

In the debate about the new technologies for communication the attention has been brought to the "virtual communities" and to the capacity of the WEB to offer great resources to create new nets of relationships (Rheingold, 1993; Tubella, 2005; Ragnedda, Ruiu, 2017; van Dijk, 2004, 2006; Berg, 2012; Boase, Horrigan, Wellman, Rainie, 2006). This is an aspect of the issue that is fundamental in my perspective. Also in this case, however, the most relevant point is not the availability of more sophisticated devices for

communicating, but rather the epistemological structure of the pieces of information that are transmitted. The assumption here is that a virtual community will be productive and positive only if the epistemological format of the contents of information is defined so that the interlocutor could be convinced to take part in a shared effort of work and elaboration: this fundamental condition cannot be realized by the technological devices alone. In this sense it is urgent to conceive of a form of culture that can be an aid to set and control the flows of information in the proper ways.

4. The objective pull and the real as virtual

From my point of view we should dwell on the architectural logics of the processes of communication, refusing a bipolar opposition between holders and enemies of technics and new forms of communication. A good point of departure is David Lynch's work on *Internet of us* (2018). This author expresses opinions that are very balanced about the risks and the limits of the kind of knowledge that is mediated by the WEB, but also for the kind of knowledge that was offered by the traditional conception of tuth. His theoretical formula is "The Real as Virtual" (Lynch, 2018, 67):

The problem of distinguishing the real from the unreal, or the true from the untrue, is hardly the result of the digital age […] Take a coin out of your pocket and hold it in your hand before you. Now look at the coin: what shape does it look like? [… If requested] A child might draw a circle, but a more skilled artist wuld draw the ellipse. Why? Because that's what we are perceiving. But if so, then we have a puzzle. The coin is circular. What we pereive is not circular. Therefore, what we perceive is not the coin (ibidem)

The author offers important remarks on the meaning of this point for the issue of fake news: a reporter will never describe exactly what he/she sees, and this was also true before digital and WEB communication became dominant.

Willard Von Orman Quine speaks of "objective pull" (1960, 5) to describe a point that is the same as that which Lynch illustrates with the example of a coin.

The usual premium on objectivity is well illustrated by "square". Each of a party of observers glances at a tile from his own vantage point and calls it square; and each of them has, as his retinal projection of the tile, a scalene quadrilateral which is geometrically dissimilar to everyone else's […] the more objective usage is, by its very intersubjectivity, what we tend to be exposed to and encouraged in (Quine, 1960, 6).

Actually this is a general question affecting the processes of thought that we undertake. The fact that these examples are taken from simple acts of perception, is not a reason to minimize their relevance. Rather it is the opposite: in other conditions – when social or subjective interference are more distinguishable – the problem becomes still more important. Lynch's observations are useful to underline exactly this aspect.

Quine's words show that the root of the problem is in the relation between intersubjective knowledge and subjectvity (even if his own position is connected with a behaviouristic heritage that makes it difficult for him to ackonwledge the right weight of the subjective point of view). In sociological analysis, the severity of this kind of issues becomes overwhelming.

Within the framework of the psychology of development (especially with reference to Jean Piaget's genetic epistemology) and with a systematic analysis of the works of the Gestalt Psychologie, Ash Gobar deals with this subject in a very interesting research. Even if the details of his conclusions are not relevant here, he observes that

> "the degree of the intersubjectivity of knowledge varies directly with the degree of object constancy and inversely with the amount of critical interference: Thus objective knowledge (e.g. logic) builds its home on the bedrock of permanent constancy, and where critical interference prevails there also prevail conflicting viewpoints" (e.g. aesthetics) (Gobar, 1968, 281).

In some of my previous works I have tried to develop a gnoseological framework that relies on genetic epistemology, by connecting it with a specific perspective on the problem of induction (Di Prospero, 2020a, 2020b). I hold that in the debate about induction it has been under evaluated the importance of the fact that it is a non-monotonic form of inference, for which the correctness of inductive conclusions is to be maintained – in a procedural sense – only in relation with the initial knowledge from which the inference has been drawn. In this picture, my hypothesis that the cognitive development of the child – in the representation of it that is given by Piaget – can be resolved as due to continuous applications of inductive generalizations. The newborn is in a condition of "solipsism without subject" (since the newborn does not possess the notions of subject and object): the notions of space and time, object, subject are acquired step by step, thanks to inductive generalizations. Furthermore, the capacity of

rational reciprocity is developed thanks to inductive generalizations. In other words, the fact that the child finds that the human beings around her react and furnish pieces of information in a regular and essentially reliable way, becomes the ground of our sense of intersubjectvity. Therefore – in relation with the debate about the use of the WEB today – the entailments that should derive is that *new* and more evolved levels of intersubjectivity should be created, on the ground of the *trust* that has been realized and enhanced in the previous ones. This means that we should look at the evolution of media communication under the sign of continuity, even in the presence of phenomena of strong acceleration. In order to make the net of relationships that this kind of sociality can produce more reliable and humanely livable, new patterns of behaviour and thought should be elaborated, but the simple choice of being pro or contra the new technologies seems to be conceptually too poor to guide or to make it possible to understand this evolution. Probably a very meaningful term of comparison can be found in the "process of civilization" described by Norbert Elias, while the school of Toronto (McLuhan, Innis) gives essential insights on the technological dimension of the issue. The basic idea is that new models of "manners", namely some new "etiquette" must be developed, even to regulate the most evident distorsions in the WEB communications (e.g. hate speeches), but not (or not only) in the relatively superficial form of a system of rules ("netiquette") to control the contents of the chats on the social platforms: rather in the form of a deep reflection concerning the entailments of the new forms of (digital) *distance* between users. The desire to keep the same patterns to express, e.g., empathy, is probably not to defend. But which new patterns should be introduced in order to facilitate the processes of auto-organizations of the social relations?

5. Representations of culture

An important consequence of my assumptions is that intersubjectivity should be conceived not as a prius in the human condition, but (strictly speaking) as the object of *a posteriori* and empirical learning. If we scrutinize the most widespread representations of culture and scientific research, this request seems to not be satisfied. The mainstream epistemology seems to take the principle of the intersubjective and public character of scientific knowledge as obvious and undisputable. In philosophy, at least since the writings of Wilhelm von Humboldt about language, it seems that the idea of the priority of language over thought and

perception is commonly accepted. Of course it is not my intention to make an attempt to minimize the importance of the attitude towards social life for human beings, but maybe the great complexity of the flows of information and communication in these years can be a reason to utilize a more analytical approach. The thesis that the sense of sociality is the outcome of a learning process (at least if we conceive of it as a well stuctured form, evolved beyond the simple reactions, for example, smiling to adults, that appear early in the child development), can give a plausibile account of the fundamental relevance of the social relationships in human life, but it is also able to explain the different properties of the various contexts. In a *Gemeinschaft* all the individual reactions to the claims of truth arising from the social environment can be still understood within a pattern of behaviour that is analyzable in a way that is similar to Quine's objective pull. But such a kind of automatisms today cannot be seen as innocuous any longer. In general, we know from the history of the tragedies of the last century that in a *Gesellschaft* (a modern State-Nation is intrinsically a *Gesellschaft*, accordingly to Benedict Anderson and Ernest Gellner's investigations) the "social" instincts of human beings can become a trap (as it is shown by George Mosse). The point is that in modernity, in the presence of too long lines of communication, the distance between persons makes it impossible to exercise a sufficient form of control over the claims of truth coming by the interlocutors. Today these mechanisms are still more accentuated. The general lines of the sketch of theory that I propose lead to retain that today – with reference to the problems created by the WEB communication – we should accept a representation of the cultural universe where each individual counts as a centre, in the sense that each one has to go by itself through the process of construction of intersubjectvity, but the entailments of the constraints due to intersubjectvity must be dislocated according to a more complex map of the engagements that are involved. Elias' lesson is that before the beginning of modernity the most usual emotional reactions were totally different from the patterns that became dominant in the following time. Furthermore his analysis entails a conception that is symmetrical and specular with Foucault's and Agamben's biopolitics: is the net of the increasing interdependencies between the social parts in modernity a condition for a more fruitful process of civilization, or is it a device to better control and limit the freedom of the individuals? In any case today this evolution is still ongoing. Everyone is a centre of cognitive activity: in this sense the processes of cultural production need to fulfil the constraints that this circumstance brings about. It is at this depth that we need to deal with the analysis of the cultural productions in front of the global challenge

posed by the Covid 19. The hypothesis that I wish to support is that – in accordance with the theoretical framework that I have derived from genetic epistemology – the cultural productions must also be considered expressions of the complex movements involved in the shaping of intersubjectivity. In this sense, for example, the creations of philosophy, arts and culture should be offered to the learners not as some "direct" contents of "truth": this would imply the risk of justifying an attempt to construct the social sharing of meaning under the sign of an excessive claim of uniformity, almost as a "fusive" experience betwen the individual coscience and the global set of the contents of culture, following a model that I have illustrated by the notion of "objective pull". Instead, the symbols and creations that the cultural productions offer constitute a "semantics" in the sense of Luhmann: a repertory of concepts, issues and topics that become easy to treat for their large accessibility in the flows of communication. In this way, those are the tools for autonomous processes of self-organization that people should manage by starting from their personal experience: in my interpretation of Piaget's epistemology, the ground for stable and progressive improvements in the economy of the social and the psychic systems can be found mainly in the individual experience and the correspondent inductive generalizations.

It is meaningful that Agamben expresses one of the main aspects of his philosophical problems with the followig words:

> "Che significa che la vita privata ci accompagna come una clandestina? Innanzitutto, che essa è separata da noi come lo è un clandestino e, insieme da noi inseparabile, in quanto, come un clandestino, condivide nascostamente con noi l'esistenza. Questa scissione e questa inseparabilità definiscono tenacemente lo statuto della vita nella nostra cultura" (Agamben, 2014, 17)[3]

> "E, tuttavia, solo se il pensiero sarà capace di trovare l'elemento politico che si è nascosto nella clandestinità dell'esistenza singolare, solo se, al di là della scissione fra pubblico e privato, politica e biografia, *zoè* e *bios*, sarà possibile delineare i contorni di una forma-di-vita e di un uso comune dei corpi, la politica potrà uscire dal suo mutismo e la biografia

[3] "What do we mean when we say that our private life accompanies us clandestinely? First of all, that our private life is separated from us just like a clandestine traveler is, and – at the same time – it is inseparable from us. The reason is that, as a clandestine traveler, our private life secretly shares it existence wth us. This split and inseparability strongly define the statute of life in our culture" (author's translation).

individuale dalla sua idiozia" (Agamben, 2014, 18)[4].

In *Quel che resta di Auschwitz* (Agamben, 1998) he develops a subtle and interesting analysis of the figure of the "Muselmann", also using it to criticize Apel's theory about the foundational claim of communication in ethics. For Agamben the fact that the Muselmann in the Nazi lagers could *not* speak and testimony their tragedy – because they were those who lost all hope and will – is exactly the reason for which we must give the maximal weight to their experience. The attitude of Agamben in relation to this issue has been criticized for its intellectual complexity, in front of such a tragic event, but maybe this has been a mistake. It is exactly the intense desire to oppose historical experiences similar to Auschwitz that can drive us forward with articulate and subtle investigations. In any case, the combination of this point with the other one, previously cited, can constitute our leading thesis: my proposal is to reflect whether the main problem actually is in the definition of the background categories that are employed. In his book *The Knowledge Machine. How Irrationality Created Modern Science*, Michael Strevens (2020) underlines the contrast between subjectivity and intersubjectivity, claimimg that the orthodox conceptions of science dismiss the fundamental role of subjectivity. In his reflection Agamben poses a corresponding issue. In both cases, the assumptions that I have proposed entail that maybe it is necessary to reformulate the relationship between the individual and the social knowledge from its basis, avoiding a sharp contraposition and interpreting the social contents of knowledge as a progressive result of individual undertakings. According to this approach, Agamben's criticism of Apel is utterly correct: if we accept the idea that the principle of ethics lies in communication, then the most vulnerables subjects (the "Muselmann") will be abandoned; but the risk deriving from following Agamben's line lies in the fact that *my* subjective perspective is different from that of anybody else's, therefore also the concrete lines of communication between persons (also between *me* and *them*, or between *Agamben* and each other one) are to be taken into account. The dimension of intersubjectivity is not an *a priori* that can be presupposed as a given reality in absolute terms (contra Apel). It needs to be built, by means of individual

[4] "Nevertheless, our thought will only manage to find the political element hidden in the clandestinity of our singular existence if – beyond the split between the public and the private sphere – politics and biography, *zoè* and *bios* –, it will be possible to outline the contours of a form of life and the form of a common use of our bodies; only then politics will be freed after its muteness and individual biography from its idiocy" (author's translation).

efforts that can be uncertain, difficult and very exacting. For this second clause, Agamben's position can also be criticized, because (in the case of the Covid 19 pandemic) the claims of the collectivity (or of its representants: scientists and political decision makers) are to be considered by means of empirical reasons, treating the notion itself of the claims of an "intersubjective" knowledge concerning the right policies to adopt, as a kind of knowledge that is founded on a storage of empirical pieces of information. In this sense, the request of an "absolute" demonstration of the rightness of these policies would be in principle without meaning: surely scientists and decision makers engaged against the Covid 19 may have made mistakes, and there can have been tricks and cheats, but we must also consider that the possible opposite plans of action in any case would have been required to bear the burden of proof (as a condition for the process of constituting a more complete intersubjective sharing, in principle, of the decision-making) and no one among them was able to satisfy this requirement (both in the scientific dimension and in the ethical and political one).

Clearly, in dealing with the complex philosophical ideas that have been recalled in this paper, and in dealing with the emergent global issues that have appeared over the past few years, my suggestions can only aim at being of little interest, but I hope that their basic lines can be perspicuous enough to invite the public to undertake a more systematic reflection on them.

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Maria Carmen Llasat is full professor at Department of Applied Physics of University of Barcelona. She has a extensive experience on multidisciplinary analysis on hydrometeorological hazards and climate change, transference of knowledge to policymakers and divulgation. She has participated in about 115 research projects, usually as IP, having published about 180 articles in peer-reviewed journals, 80% of which are international and more than 70% of them are in Q1. She is member of the steering committee of the Mediterranean Experts on Environmental and Climate Change, and coordinator lead author in the First Mediterranean Assessment Report on Climate and Environmental Change (MedECC, 2021). She has been a member of the Advisory Council for Sustainable Development (CADS) of the Generalitat de Catalunya for more than 10 years.

Montse Llasat-Botija has a degree in Biology and she is currently doing her PhD. She is researcher in Meteorological Hazards Analysis Team (GAMA) in Department of Applied Physics of University of Barcelona since 2003. Her lines of research focus on the analysis of the social impact of natural hazards, especially floods, the improvement of risk awareness and citizen science. She has participated in more than 15 research projects (nationals and internationals) and in more than 25 publications (articles in

scientific journals, book chapters, ...). She coordinates outreach activities and educative projects and the citizen science project FLOODUP.

Francesco Mele teaches Artificial Intelligence at University Parthenope of Naples and is associated researcher at Institute of Applied Science and Intelligent Systems (ISASI) of National Research Council (CNR). For twenty years he has been an inspirer and coordinator of several research projects concerning: Human Computer Interaction, Natural Language Processing, Computational Cognitive Model, and Artificial Intelligence for Cultural Heritage. In the same period of time, he also taught disciplines in the field of Artificial Intelligence at University Federico II and University Parthenope of Naples. For more than a decade he was teacher of Semiology of Cinema at the University Institute Martucci of Salerno. He was directive member of Italian Association of Artificial Intelligence (AIxIA) and was member of Cybernetics Institute of CNR. He was coordinator of working group "Artificial Intelligence and Cultural Heritage (AIxCH)" of AIxIA. He was founder and leader of Semantic Multimedia Cognitive Multimodal Systems group of ISASI.

Stefano Montes teaches Anthropology of language, Anthropology of migrations and Anthropology of food at the University of Palermo, in Italy. He taught in Catania, Tartu, Tallinn e and at Ciph (Collège International de Philosophie) of Paris. His work explores the relationships established between languages and cultures as well as between literary and ethnographic forms. Recently, his research has come to focus on the everyday in a perspective linking together cognitive and agentive practices. He's editor of the book series Spaction for the publishing house Aracne.

Iris Morey Serra was graduated in Chemistry from the University of the Balearic Islands (UIB) and with a Master's degree in Food Science and Engineering from the Polytechnic University of Valencia (UPV). During the last 8 years, she has been working as a Physics and Chemistry teacher in different high schools, but she currently works at IES Son Rullan (in Palma), where she applies active methodologies in the classroom such as cooperative

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Antoni Quetglas hold a PhD in History from the University of the Balearic Islands and he is the archivist of Sóller, where he has organized the local catalogue. A member of the local research group GRES, he is the organizer of the yearly Local Studies Workshop, which started in 2006. He has written 10 books and more than 20 papers studying the local history of his hometown, mostly related to the 19th and 20th century societal aspects.

Joan Rosselló is an associate lecturer at the Open University of Catalonia. He holds a Physical Geography PhD, has published more than 20 papers in national and international journals and his research focuses are natural hazards, flash floods and precipitation, studying historical and contemporary events. He sits on the editorial board of the Geographies of Anthropocene book series, Physio-Géo Journal and the Journal of Flood Risk Management Journal.

Gaetano Sabato, PhD in Tourism Sciences, is currently Researcher of Geography at the Department of Psychological, Pedagogical, Exercise and Training Sciences of the University of Palermo (Italy), where he teaches "Geography for Primary Education" at the Sciences of Primary Education master degree. He has published several scientific articles and a monograph: "Crociere e crocieristi. Itinerari, immaginari e narrazioni", published by Giappichelli, Turin 2018. Moreover, he is guest editor, with Leonardo

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Ioanna Stamataki is a lecturer in Civil Engineering at the University of Greenwich, United Kingdom. Prior to joining the School of Engineering, she worked at the University of Bath as a lecturer and as a consultant modelling specialist at Edenvale Young Associates. She received her MEng Civil Engineering from the University of Bath in 2014 and she continued into completing successfully a PhD in 2020 at the University of Bath entitled "Experimental and numerical investigation of flash floods and their interaction with urban settlements". Following this, Ioanna worked a Research Associate in the HYDRIC BATH Project and investigated and assessed the utility of documentary evidence of past flood events with contemporary flood risk assessments in Bath. Her expertise lies in the analysis and modelling of extreme events such as floods through laboratory experiments and CFD modelling. Ioanna has led and contributed to various outreach activities and participated in several initiatives for disseminating research to the general public.

Paolo Vanacore is a Computer Science technician at the Institute of Applied Sciences and Intelligent Systems “Eduardo Caianiello” of the Italian National Research Council (CNR). His interests concern Software architecture and design, Multimodal Dialogue Systems, Knowledge Representation, Ontology Mediation, and Semantic Multimedia Mashups. He has been involved in several research projects for which he has provided contributions in the design and development of software in the field of human-machine interaction, natural language processing and semantic multimedia applications.

The development of technology during the Anthropocene has affected science and the ways of "doing science". Nowadays, new technologies help scientists of several disciplines by facilitating knowledge and how to manage it, but also allow for collaborative science, the so-called "Social Science", where everyone can be a scientist and be involved in providing data and knowledge by using a computer or a smartphone without being a specialist. But is it really that simple? Actually, the daily and integrated use of different digital technologies and sharing platforms, such as social media, requires important reflections. Such reflections can lead to a rethinking of epistemologies and scientific paradigms, both in human geography and social sciences. This volume titled "Information Technologies and Social Media: New Scientific Methods for the Anthropocene" includes 10 chapters exploring some changes related to the way to do science with a multidisciplinary approach. From classroom experiences to the use of Citizen Science, from Artificial Intelligence use to how Social Media can help researchers, the book reflects on the ICT influence during the last few decades, exploring different cases, complementary perspectives and point of views.

***Gaetano Sabato**, PhD in Tourism Sciences, is currently Researcher of Geography at the Department of Psychological, Pedagogical, Exercise and Training Sciences of the University of Palermo (Italy), where he teaches "Geography for Primary Education" at the Sciences of Primary Education master degree. He has published several scientific articles and a monograph: "Crociere e crocieristi. Itinerari, immaginari e narrazioni", published by Giappichelli, Turin 2018. Moreover, he is guest editor, with Leonardo Mercatanti, of two Special Issues of "AIMS Geosciences". His research focuses are on cultural geography and digital representations of the space, didactics, tourism, and perception of risk.*

***Joan Rosselló** is an associate lecturer at the Open University of Catalonia. He holds a Physical Geography PhD, has published more than 20 papers in national and international journals and his research focuses are natural hazards, flash floods and precipitation, studying historical and contemporary events. He sits on the editorial board of the Geographies of Anthropocene book series, Physio-Géo Journal and the Journal of Flood Risk Management.*

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