PUBLIC SMOG OFFSETS
TOMORROW TODAY

STS in Italy - Financial Crisis & Climate Change
Scientists & Society - Technoscientific Imaging
Digital Culture Infrastructures - HeLa

copertina / cover

Public Smog *(2004-ongoing), by Amy Balkin et al.*

Public Smog is a "clean-air" park in the atmosphere that fluctuates in location and scale. The park is constructed through financial, legal, or political activities that open it for public use. Activities to open Public Smog have included the purchase and retiring emissions offsets (NOX and CO2) in regulated emissions schemes in the US and European Union, making them inaccessible to polluting industries.

This activity resulted in the opening of parks above Southern California (June 2004), the European Union (2006-7), and the United States (2010). When Public Smog is built through this process, it exists in the unfixed public airspace above the region where offsets are purchased and withheld from use. The park's size varies, reflecting the amount of emissions allowances purchased and the length of the contract. Other activities to create Public Smog impact the size, location, and duration of the park.

The work is currently focused on building a larger, permanent atmospheric preserve through an effort to inscribe Earth's Atmosphere on the UNESCO World Heritage List, begun in 2006, but developed more fully in collaboration with Documenta (13) since 2010. This undertaking has involved an invitation first presented to Germany, then to all UNESCO States Parties, to act as lead State Party in initiating an extraordinary nomination process for inscription of Earth's atmosphere. With the exception of the Kingdom of Tonga, no reply of interest was received, so a petition was launched from within the exhibition, requesting the audience to further petition their respective governments via signed postcard. Over 100,000 audience-participants supported this call while the exhibition was open. However, the outcome of this activity is uncertain.

Other activities to articulate Public Smog have included a climate-futuring breakfast (2006), and a series of thirty billboards presented across Douala, Cameroon in 2009, prefiguring the benefits, complications, and implications of enacting Public Smog over Africa. The cover image, by curator Benoît Mangin, documents this iteration of the work.

In addition to activities that open Public Smog, the work attempts to examine and enact a response to the increasing impacts on the climate system from anthropogenic activities. It is also concerned with the politics of participation, particularly around claims of markets and states to act on behalf of local and global publics to mitigate the impacts of climate change. To this end, the project has involved a growing group of interdisciplinary participants and advisors, including climate scientist Dr. Alexandra Thompson. A full credit list is online at publicsmog.org.

Amy Balkin

(photograph by Benoît Mangin)

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STS, ITALIA

Attila Bruni

Abstract What is the state of art of Science and Technology Studies in Italy? What happened in the last five years? In this paper, the departing President of STS Italia traces the main lines of research of STS scholars in Italy, highlighting the ways in which a scientific field (previously under-represented in the Italian scenario) has gained visibility and substance. In particular, the narration concentrates on the capacity of researchers to build research networks (at both national and inter-national level) actively contributing to the inter/national debate, as well as to question and innovate ways of thinking about technology and the social itself.

Keywords Science and Technology Studies; Italy; scientific community; academy; research.

Introduction

> Our policy, and one point: we want to examine the pulsar for the way it is *in hand* at all times in the enquiry. We want to see the way it is 'per-formatively' objective. We did *not* examine and we want *not* to examine the end-point object for its correspondence to an original plan. We want to disregard, we want *not* to take seriously, how closely or how badly the object corresponds to some original design – particularly to some cogni-tive expectancy or some theoretical model – that is independent of their embodied work's *particular occasions* as of which the object's production – the *object* – consists, only and entirely.
>
> (Garfinkel *et al.* 1981, p. 137)

During the joint EASST/4S conference of this year (Copenhagen, 17-21 Octo-ber 2012), two particularly flattering things happened to me. First, I was invited (in my capacity as President of STS Italia) by the Netherlands Graduate Research School for Science, Technology & Modern Culture (WTMC) to speak briefly on

the occasion of the 'lunch meeting' organized to celebrate the twenty-fifth anniversary of its foundation and the second edition (again after twenty-five years) of *The Social Construction of Technological Systems* (Bijker *et al.* 1987, 2012). The editors were present at the lunch, as well as some of the contributors to the book and other leading scholars and personalities in the international STS panorama. Considering that I had just started high school in 1987, and that STS Italia did not even exist until 2005, perhaps the reader will understand the pride and satisfaction which I felt on receiving the invitation.

In less institutional and more strictly personal terms, perhaps even more satisfying for me was the fact that one of the first people that I met at the conference (Cornelius Schubert) told me that two people sitting behind him on the plane had spent large part of the flight reminiscing enthusiastically about the EASST conference held in Trento in 2010. Then another person (Miquel Doménech) told me that he had heard the same in his group of Spanish colleagues. To tell the truth, in both cases the comments concerned the quality of the food and the espresso coffee, but given that I had been one of the main organizers of the conference, and that it had absorbed my time for a year, the reader will again understand my pleasure at what I heard. And I hope that science and technology scholars in Italy will be pleased as well, because both episodes were the result of a collective enterprise whereby STS studies in Italy have changed substantially over the past few years, gaining visibility both nationally and internationally. How this has happened I shall seek to explain in the sections that follow.

1. Signals

> Disney: We've got a bleeding *pulse* here
> (2.0)
> Cocke: He::y!
> (4.5)
> Wo:::w!
> (1.2)
> You don't suppose that's really it, do you?
> (2.0)
> Ca::n't be:.
> (Garfinkel *et al.* 1981, Appendix 3, p. 149)

Every story has its founding myth. That of STS in Italy narrates that in 2004, in Paris, during a coffee break at the 4S/Easst Conference, four researchers (or maybe five… founding myths always contain ambiguities), noticing they were the only Italian scholars attending the conference, decided to set up an association and create the Italian Society for Social Studies of Science and Technology (STS Italia). The association was founded with the aim of bringing to Italy a debate as much established and acknowledged at the international level as it was neglected and dis-

regarded in Italy. Explanation of this situation would take us too far afield, but it is useful to bear in mind that Italian academe (and careers within it) is dominated by 'disciplinary scientific sectors' (*settori scientifico-disciplinari* - SSD). Yet STS (unlike in other countries) have never been one such sector, and their status within other disciplines (sociology, philosophy, history, anthropology, political science) has always been somewhat marginal, when not being regarded with suspicion. This is not to say that STS was neglected in Italy until the mid-2000s (Bucchi 1996, 1997, 1998, 2002, 2003, 2004; Bucchi and Mazzolini 2003; Neresini 1993, 2000; Bucchi and Neresini 2003, 2004; Gherardi and Lippi 2000; Nacci 2000; Bennato 2002; Volontè 2003a, 2003b; Guzzetti 2002a, 2002b; Mongili 1998; Pellegrino 2003, 2005a, 2005b, 2005c, 2005d; Bruni 2004, 2005a, 2005b; Bruni and Gherardi 2001; Gherardi and Strati 2004; Grasseni 2003, 2004), but rather to say that their circulation had been restricted to individual scholars and research niches.

In this context, STS Italia has been an original form of aggregation able to attract researchers who not only share the same areas of research interest but are also willing to meet the challenge of changing current knowledge production and sharing processes in scientific settings. The work carried out to date (through the organisation of national and international workshops and conferences, and establishing dialogue with not exclusively or strictly academic institutions) has made it clear that the breeding ground for Italian STS is the development of opportunities to foster new perspectives and new generations of scholars, especially at a time when the social sciences (not just in Italy) seem to be plunged in a crisis with no apparent way out.

The advent of occasions and arenas for discussion (as well as for identitarian self-representation) has indubitably given major impetus to the formation of a community of scholars and to the evident growth in Italy of a research sector hitherto almost invisible. Nevertheless, because impulses should pulsate, it is necessary to look more closely at what has happened over the past five years in the panorama of Italian STS studies and publications.

2. Pulses

> Disney: …(I won't believe it) 'till we get (a)
> second one.
> (0.4)
> Cocke: …I won't believe it until we get the
> second one and until th–
> the thing has shifted somewhere else.
> (Garfinkel *et al.* 1981, Appendix 5, p. 154)

Personally (and at the risk of neglecting the work of a number of colleagues), I consider *Il senso degli oggetti tecnici* ("The sense of technical objects" - Mattozzi 2006) to be the main impetus behind the 'visibilization', if not the outright institu-

tionalization, which STS were about to undergo in Italy in following years.[1] This book proposed the translations of a number of articles (by, among others, Latour, Akrich, Mol, Woolgar) that have somehow made the history of contemporary STS. It opened with a long Introduction in which the author (a semiotician who had just received his doctorate) for the first time presented to the Italian public, in copious detail, the concepts and keywords by then circulating in STS for around ten years. To be noted is that this happened in a context in which the only Italian translations of ''contemporary STS classics' were *Science in Action* (Latour 1987) and *Of Bicycles, Bakelite and Bulbs* (Bijker 1995), both published in Italian in 1998.

Whenever something begins to pulsate, the pulsation repeats itself. Shortly afterwards, therefore, two further publications, in handbook format (Mongili 2007; Parini 2007), provided Italian readers with a systematic overview of two debates difficult to summarize (the relationship between technology and society from an 'ecological' standpoint; the construction of scientific knowledge).

The handbook nature of these publications was symptomatic of another ongoing process: the greater presence of STS-oriented courses on degree, master, and doctorate programmes; and, therefore, also the greater inclination of Italian publishers to invest in such publications. This is further evidenced by the publication (in the immediately following years) of several books testifying to the contribution made by Italian research to topics such as technoscientific innovation (Pellegrini 2008) and technology as a social practice (Gherardi 2008).

Further evidence is provided by a special issue, edited by Federico Neresini (2008), of the *Rassegna Italiana di Sociologia* devoted to STS "inside and outside the laboratory" and, above all, by the growing number of articles testifying to the capacity of Italian STS to participate in the international debate, especially as regards media and the communication of science (Bucchi and Trench 2008; Bucchi 2009; Neresini and Pellegrini 2008; Neresini *et al.* 2009; Castelfranchi *et al.* 2009; Bucchi and Lorenzet 2009; Balbi 2009a; Balbi and Prario, 2010); scientific knowledge production (Volontè 2008); the intersection between organizing, work practices and new technologies in medicine (Bruni 2005; Bruni and Parolin 2009; Perrotta 2008); ubiquitous interaction (Pellegrino 2007, 2008a, 2009a); information systems (De Paoli and D'Andrea 2008a; 2008b; Teli *et al.* 2007; Teli *et al.* 2009); design (Mattozzi and Mangano 2009); and risk and responsibility in environmental choices (Pellizzoni 2010).

These diverse pulsations have given unprecedented impetus to the Italian STS debate and to its visibility. They signal that, independently from STS Italia, social studies on science and technology command the attention, in Italy as well, of a

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[1] For the sake of brevity, in this and the following sections I refer only to publications by Italian authors resident in Italy. This excludes the large number of Italian researchers working in foreign countries who have contributed to the growth of the Italian STS community. I apologize to them, hoping that they will understand the criterion that I have adopted. Nor will I refer to articles published in previous issues of *Tecnoscienza*, because I presume that readers of the journal are already well acquainted with them.

growing number of scholars. Moreover, as well known in physics, directly connected to pulsations is the frequency of motion.

3. Frequency of motion

Disney: I– *It's growing*!
Cocke: HH Hehh hehh hehh!
(0.8)
Disney: (kh) Yeah, *that's it*!
Cocke: Hihh hihh!
Disney: *By God*! *We got it*!
Cocke: Naow, naow!
(Garfinkel *et al.* 1981, Appendix 4, p. 151)

When, in 2010, I was elected president of STS Italia, together with the two newly elected Vice-president (Alvise Mattozzi) and Treasurer (Assunta Viteritti) of the association, we decided to try to map the various areas of interest within Italian STS, asking the people (around 80) whose names were stored in the STS Italia database to indicate their research interests in three keywords. Classification and grouping of these keywords yielded the following scenario:
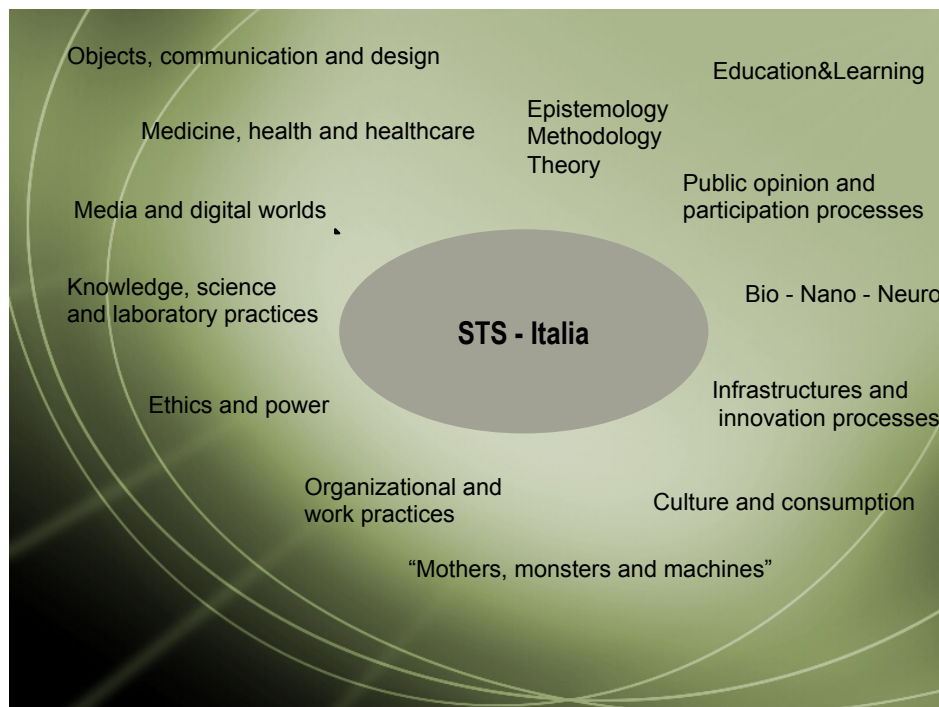
2010 - Principal topics of interest of STS Italia members

I remember my surprise at finding both such a wide variety of themes and the overall coherence of the research scenario that emerged. I also remember thinking how difficult it would be to translate this scenario into something more concrete than a graphic representation.

Almost three years later, I perhaps have some clues. Firstly, this scenario has been translated into a quantity of studies and publications that would be difficult to summarize here without merely constructing a summary list of citations. I shall therefore do no more than demonstrate the continuity in publication of both handbooks/anthologies (Bucchi 2010; Parini and Pellegrino 2010; Bennato 2011) and research volumes, particularly on the following topics: the media (Balbi 2011a; Neresini and Magaudda 2011); the 'politics of proximity' (Pellegrino 2011); digital cultures and consumption (Magaudda 2012a); innovation processes and the relative controversies (Arnaldi and Lorenzet 2010; Lorenzet 2013, Minervini 2009; Pellegrini 2011; Magaudda 2012b; Neresini 2011; Nicolosi 2011); laboratory practices (Viteritti 2012); the interweaving among technologies, organizational processes and medical practice (Bruni 2010; Parolin 2011; Turrini 2011); a national survey on the relationship among science, technology and public opinion (Bucchi and Neresini 2010; Bucchi and Pellegrini 2011; Neresini and Pellegrini 2012); and critical readings of the relation between neoliberal policies and technoscientific research (Pellizzoni and Ylonen 2012).

Also dating to 2011 is the publication of a special issue of *Etnografia e Ricerca Qualitativa* (edited by Alessandro Mongili and Luca Guzzetti) on "biomedical laboratories, technoscience and ethnography", which further testifies to how STS have gained recognition and autonomy within the Italian social sciences and, at the same time, established relations and dialogue with other scientific communities.

Then founded in 2010 was the journal that you are reading at this moment, whose existence is one of the most tangible results of the vivacity of the debate in progress and the concreteness assumed by the scenario at that time. Again in 2011 the organization of the first STS Italia Summer School (Alghero, 27-30 June) assembled thirty PhDs and post-docs (equally divided on national and international bases) around the topic "Cities, Technologies and Infrastructures".

This year, on the occasion of the fourth STS Italia conference on "Emerging Technologies, Social Worlds" (Rovigo, 21-23 June 2012), 180 scholars (around half of them non-Italian) attended 20 parallel sessions ranging from "Politics of technoculture", through "Working in technologically dense environments", "Design Articulations and practices" and "Internet and new productive paradigms", to "Bodies, technologies, practices and knowledge in biomedicine". I stress the 'mixed' dimension (from the point of view of nationalities and tracks) because I consider it a distinctive feature of the construction process of the Italian STS community. Giving oneself an identity as a scientific community at national level, however, does not mean estrangement from the broader international panorama, nor does it mean closing oneself off within an orthodox research perspective. Rather, it is to become a link able to connect networks and debates that otherwise would never have occasion to meet.

At this point, amid so much scientific production and such wide-ranging debate, we may turn to the current interests of Italian science and technology scholars.

4. Tangential velocity

> Cocke: I hope to God, this isn't some sort of
> artefact of the (uh) instrumentation.
> (2.0)
> Disney: My God
> [
> McCallister: never saw it befo:re.
> (Garfinkel *et al.* 1981, Appendix 4, p. 153)

Several topics have been addressed in recent years in the Italian debate. One of them – perhaps most consolidated at academic level – has to do with the public communication of science and, in general, with the relationship among innovations, media, and public opinion (Bucchi and Neresini 2011b; Bucchi and Pellegrini 2011; Neresini and Pellegrini 2012). This is a classic topic in STS, but it is of interest that in Italy it has been treated especially in terms of the relationship between science and citizens in technoscientific controversies (Bucchi 2010b; Bucchi and Neresini 2011a; Lorenzet 2013), for instance addressing (particularly in recent years) the issues of bio and nanotechnologies (Arnaldi 2009, 2010a, 2010b; Arnaldi *et al.* 2009; Arnaldi and Lorenzet 2010; Bucchi and Neresini 2006; Neresini 2011; Beltrame 2012), climate change (Bucchi *et al.* 2010) and organ donations (Lorenzet and Turrini 2012).

However, perhaps most characteristic of current Italian STS is a certain type of interest in, and attraction to, debates that arise at the borders with other disciplines (and which probably represent the future of STS).

The debate which in recent years has seen STS in Italy merge with organization studies and the sociology of medicine, for example, has given rise to various studies on telemedicine (Gherardi and Strati 2004; Bruni *et al.* 2007; Piras and Zanutto 2010, 2011a, 2011b; Bruni and Parolin 2009; Parolin 2011) and the flirting between humans and machines in hospital settings (Bruni 2004, 2005b, 2008, 2011; Lusardi 2009; Lusardi and Perrotta 2009; Lusardi 2012). The result has been the diffusion (in Italy and abroad) of a curious expression – "technologically dense environments" (Bruni 2005a, 2005b) – which refers to the fact that, in contemporary organizational and work settings, complex sociomaterial practices mobilize the joint action of heterogeneous elements (both human and non-human), blurring the distinction between technological and organizational processes. Still lacking, however, is a thorough analytical definition (when and how is it possible to affirm the "technological density" of an environment?). Nevertheless, the expression has begun to spread (a track on TDEs was present on the 2010 EASST conference pro-

gramme, as well as the one of this year, and also those of the 2011 Colloquiuum of the European Group on Organization Studies and the STS Italia conferences), to the point that other researchers have begun to appropriate and rephrase the expression (Rennstam 2012).

Another boundary debate ongoing in the most recent STS, and which has attracted the attention of Italian scholars as well, concerns bio-objects (Vermeulen *et al.* 2012) and the forms of re/production of scientific knowledge. The feature shared by studies in this field is their focus on the practices of writing and visualization (and therefore on textual and visual artifacts) that accompany the re/production of research and scientific knowledge (Grasseni 2007; Bellotti *et al.* 2008; Volontè 2008; Turrini 2011a, 2012; Maestrutti 2008, 2011; Viteritti 2012 – see also the Scenario in this issue). They use an approach to knowledge as a situated practice involving the body, the material world and, hence, the aesthetic dimension (Landri 2010; Turrini 2011b; Viteritti 2011). Perhaps also because of the recent Italian law which restricts medically assisted reproduction practices, equally close attention has been paid to the role of the institutional and organizational dimension that serves as the background to bio-objects (Perrotta 2011; Gherardi and Perrotta 2011). Not coincidentally, this will be the theme of the 2013 special issue of *Tecnoscienza* (*Re-conceiving Life in the Labs: The Emerging Meanings of Cells in the Italian Reproductive Biomedicine and Beyond*, edited by Manuela Perrotta).

A further debate of close interest to Italian scholars has developed at the intersection among STS, cultural studies, and design studies (Shove et al., 2007). Here the concern is with: a) practices of consumption and appropriation of technologies and their translation into social practices (Magaudda 2006, 2008, 2010, 2011a, 2012a, 2012c; Piccioni 2010; Pellegrino 2008b, 2009b); b) reconstruction of the 'biographies' of objects (Burtscher *et al.* 2009; Balbi, 2009b, 2010, 2011b) and methodologies for the analysis of design-in-use (Mattozzi 2010, 2011; Marian and Mattozzi 2012; Volontè, 2010). In both cases, the attention centres on the object as a part, result, and generator of a broader network of practices and relations in which consumers/users perform a central role and reconfigure themselves as 'prosumers'.

Moreover, the attention to users and practices of re-appropriating and hacking technological devices and innovations is particularly widespread in the research sector that mixes information systems, participatory design, and discussion of property rights on software (De Paoli and D'Andrea 2008a; 2008b; De Paoli *et al.* 2008; De Paoli *et al.* 2012; Teli 2012; Hakken and Teli 2012) and scientific innovations (Delfanti 2010, 2011, 2012, 2013; Delfanti and Söderberg, 2012). Whilst attention, therefore, centres on software or genome sequences (and the property rights connected with them), the shared feature in this case is an emphasis on the political dimension inherent in scientific knowledge, in technologies and, above all, in the dynamics that regulate the circulation and use of ideas and artifacts. Moreover, given the specificity of the methodological problems that the study of digital worlds and interactions raises for the social sciences, this sector of inquiry is at present characterized also by explicit attention to current survey techniques and

methodologies, especially in cyber-ethnography (De Paoli and Teli 2011; Teli *et al.* 2007) or, more generally, in digital worlds (Arvidsson and Delfanti, 2013).

As it has also happened at international level (Guggenheim and Söderström 2010) a lively and innovative line of inquiry has arisen at the boundaries among STS, sociology of the territory, and urban geography. Two research lines have proceeded in parallel: one centred on the interrelations among institutions, territory, technology and citizens (Pellizzoni 2010; Minervini 2009); the other on a view of the city and space as networks of relations among heterogeneous elements (Sonda *et al.* 2010; Coletta and Gabbi 2013; Brighenti 2009). Whilst the former redefines the concept of sustainability (see the Symposium of issue no. 2/2012 of *Sociologica* edited and introduced by Luigi Pellizzoni on "Reassessing Sustainability"), the latter revises the category of 'city' through a rhizomatic reading of space.

Last but not least, also the debate that looks at gender and technology as intertwined practices (Haraway 1996), attracts in the interests of Italian scholars (Cozza 2009a, 2009b, 2011a, 2011b; Perrotta 2009, 2010)

If there is a common denominator in all these boundary conversations, it is a methodological inclination of ethnographic, participatory, historico-documentary kind, or at any rate intended to furnish a detailed description of the logics, processes and practices that weave technology and society together.

The tangential velocity assumed by STS in Italy prompts the following final remarks.

Final remarks: tomorrow now

> Disney: Now the fun *begins*, we've got to
> get this::,
> (0.6)
> We've got to write out some sort of a
> program to
> (0.3)
> to *reduce* this tape, (and have the whole
> lot go in), so, (   )
> [
> Cocke: (I don't think we need) to reduce
> the damn tape.
> (Garfinkel *et al.* 1981, Appendix 5, p. 157)

When I began writing this article some days ago, I thought that it would not take me too much time. I had chosen the type of narration that I wanted to adopt, and I believed that I had a sufficiently clear idea of the geography of Italian STS and its developments over the past five years.

Contrary to my expectations, assembling a systematic account of STS in Italy proved to be a rather complex task, both because of the sector's high 'scientific

productivity' of recent years, and because of the heterogeneity of its topics and approaches, which would have required much more detailed illustration than that provided here in an attempt to describe a debate still developing. In this regard, I should specify that my reconstruction is inevitably partial and has probably favoured the authors and lines of inquiry that I personally find most congenial.

I should also emphasise that, notwithstanding the enthusiastic and celebratory tones that I have used (which derive from the enthusiasm of someone who has the impression of participating in an ongoing process), the status of STS in Italy is still far from being 'stabilized'. Suffice it to cite the fact that the list of 'class A' scientific journals compiled by the National Agency for University and Research Assessment (National Agency for the Evaluation of University and Research, AN-VUR) includes (for the social sciences) none of the main international journals of Science and Technology Studies (whereas numerous Italian journals not even included in the international databases receive an 'A' rating from the ANVUR). Moreover, the scenario emerging from the current process of assessing universities and research in Italy seems to be one of adherence to the *status quo* and of the further sectorialization of knowledge, with the consequent risk of disqualifying, if not stunting at birth, what is emergent and interdisciplinary. And STS in Italy still share both these features. This scenario is of ill omen for our scientific community, which by acting crosswise with respect to the rules and rituals of Italian academy (but, as I have tried to show, in substantially and incisively manner at the level of research and scientific productivity), has in recent years increasingly acquired visibility in Italy and abroad. It is indeed so for any scientific community that seeks to conduct research in an open, innovative and vibrant manner.

The future of STS in Italy (and, maybe, not only in Italy) will thus continue to depend on the capacity of researchers to build research networks (at both national and international level) actively contributing to the inter/national debate, as well as to question and innovate ways of thinking about technology and the social itself.

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Pandora's Box: Opening Up Finance to STS Investigations

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Abstract. Only two decades ago, finance was mainly the province of economics, a territory into which only few outsiders wandered. Nowadays, finance has become a central topic and various social science and humanities disciplines, have made inroads into this territory. Should the social sciences (and STS in particular) just analyse finance, or should they mainly criticize it, or maybe even provide what some have called an alternative narrative to capitalist finance?
Stemming from an ironic and innovative overview of social studies of finance (SSF), the paper presents the core characteristics of such a perspective, taking into account also the main critique that SSF attracted. The contribution concentrates then on the three issues where STS investigations of finance promise good yields: (1) agency and robots; (2) epistemic cultures; (3) expertise.

Keywords social studies of finance; financial crisis; epistemic cultures; expertise; agency and robots.

Only two decades ago, finance was mainly the province of economics, a territory into which only few outsiders wandered (but see Adler and Adler 1984; Baker 1984; Abolafia 1996). STS scholars didn't mingle much with the finance crowd. Nowadays the situation is significantly different. Various social science and humanities disciplines, not least among them science and technology studies, have made inroads into this territory.

Research projects have been completed, and PhD dissertations have been brought to fruition. Books and scholarly articles have been published, and some have won prizes. It is perhaps time to take a step back and assess the situation, perhaps even more so since the expectations about how STS should approach finance have been somewhat complex.

This article is an edited version of the lecture given at the concluding session of the 4th STS Italia Conference "Emerging Technologies, Social Worlds" (Rovigo, 2012, June 21-23).

Should the social sciences (and STS in particular) just analyse finance, or should they mainly criticize it, or maybe even provide what some have called an alternative narrative to capitalist finance? And if yes, how could this narrative look like? It seems that finance as an object of investigation has morphed into a veritable Pandora's Box, creating more discord than unity.

Sometimes concerns have been voiced at conferences, in book reviews and in more or less polemical articles, that STS is too technical and not critical enough with respect to finance. Sometimes, and especially in these times of crisis, it has been argued that social studies of finance (SSF) – the offspring of STS – do not offer an alternative critical project, that they do not provide a much needed broader narrative of financial capitalism, focused as they are on small technical details. Some have also voiced the concerns that SSF strayed away from the parent discipline, STS. Akin to a teenager acting against the will of the parents, SSF have eloped to Vegas together with finance, whereas they should have remained within the solid walls of the parental home.

All these debates and criticism makes it perhaps even more necessary to take a look back at the journey undertaken by SSF scholars and scholarship over the past fifteen years or so and review the projects lying ahead. In any enterprise of this sort, one which wants to be both retrospective and prospective, a good metaphor helps. The one I used above – elopement - does not work so well, unfortunately: the road taken by SSF is no journey to Vegas. I might need here to look for a different metaphor encompassing the notion of journey as well as that of adventure, a metaphor which contains the prospect of future, hopefully productive instalments.

As far as I can see or remember, SSF didn't start as a thoroughly organized and programmatic project, but rather with a more or less ragtag group of PhD students who, together with their then supervisors, were embarking on uncertain enterprises. While some tongue in cheek attempts at formulating a program have been made at some point (e.g., Preda 2000), these have remained individual statements rather than being embraced at community level.
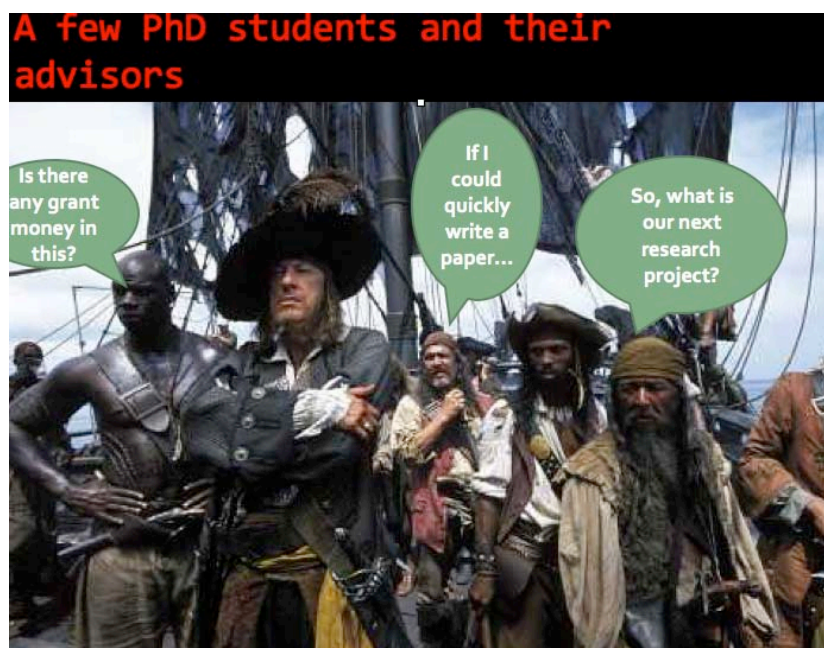
Many of those who embarked on this enterprise were trained as STS practitioners, coming either from a tradition of historical studies or from an ethnographic one - and indeed, many of the first studies were ethnographic or historical (including here contemporary history), as they continue to be today. SSF scholars had to spruce up their knowledge of finance by a combination of individual study and ethnographic work - witness here the many internships providing the institutional format for participant observations.

What were then and still are now the stakes in this enterprise? Why leave the safe STS home for an adventure into the unexplored finance? The latter has proven to be a turbulent domain; during its relatively short existence, SSF has witnessed several major crises, and in all probability this will not be the end of it.

If we were to apply here the old STS dictum about opening black boxes, what is at stake in attempting to open the black box of finance? And, to recycle the metaphor a little, what if this black box is Pandora's Box? Since SSF have attracted enough criticism for not being critical and combative enough, this jump across metaphors may be less far fetched than some may think.

As we are seeing more and more claims that the black box of finance has finally been opened, the curiosity is legitimate. What is inside? A code? A formula? What else? And if we know what is inside, will we be able to concoct an antidote?

True, in good academic fashion there have been debates as well (mostly at academic conferences). Some have said that the true black box hasn't been discovered. Some others have said that it is all about storytelling, about culture, or about ethics, or about politics… might it be that everybody is looking for a different black box? Nevertheless, we need to ask, what does SSF think that is hidden in the black box of finance, and what do they think is the key to opening the box?

We have then to do with two distinct questions, but which are linked to each other. What SSF think that it is in the box is not independent of what SSF think is the key to the box.

What is the key to the box? Until now, the key has been mainly seen as social histories of communication technologies and of mathematical models of prices. Why mathematical models? Because the starting point has been provided by the empire of financial economics itself, namely by the quest to forecast prices of financial securities (e.g., Mehrling 2005; Bernstein 1998). In practice, these forecasts are nothing else but trading in financial derivatives—the prices of derivative instruments are public forecasts of the underlying instruments. (Public in the sense

of the market public). Forecasts are made with the help of forecasting models, which in their turn are formulae for calculating the prices of derivative instruments.

What SSF did in this respect was to take over the key provided by financial economics and tweak it. While financial economics sees such pricing models as a benchmark mirroring the rational behavior of market participants, SSF did mostly historical studies of pricing models, seeing them as social instruments by means of which participants reach some form of consensus (e.g., MacKenzie and Millo 2003; MacKenzie 2006). If everybody thinks this is the key to the box, then they will also think they have opened it. This works well provided that nobody takes a closer look and then it's too late. Consensus, however, does not mean mere superficial agreement or "pretending to agree". Consensus is reached in a long and complex process involving procedural and communicational hurdles, a process which is not devoid of struggles and controversies, as we know only too well from the history of science.

Of course, the notion of consensus makes more sense if one associates it with the notion of dissent. That is, there will always be some market participants who do not buy into the mainstream models of financial economics, who either ignore them or develop their own approaches. This is best illustrated by some hedge funds making a killing in the present crisis by betting against the consensus.
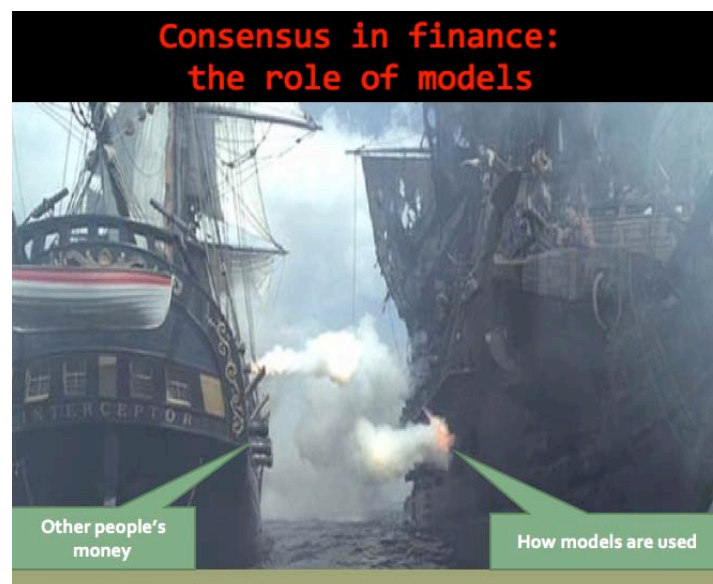
SSF, with its main emphasis on how social consensus around pricing models developed historically, has not looked at dissent with the same intensity—and maybe the time has arrived to do it. But of course, we can recognize in the emphasis on how consensus is achieved a classic theme from the Kuhnian sociology of

science which has been translated first into STS and then applied to financial markets. At the same time, STS has a rich history of investigating scientific controversies (e.g., Latour 1988; Collins 2004), a history which can be productively used in investigating outliers, non-conformists, or contrarians in finance. We should not forget that in finance, for every party there is a counterparty as well.

Oftentimes social studies of finance have been fascinated by the "big guys"—be they big investment banks, big stock exchanges, big firms—in short, big money. Big money has been seen as where the action is, echoing one more time the standard view of financial economics. The advantage of this approach is that it potentially opens a portal onto the technologically multi-layered world of electronic finance where, perhaps more than in other domains, the dictum "time is money" becomes true. The drawbacks consist in difficulty of access to the field, of penetrating the field in depth, but also sometimes in ignoring the technological complexity, diversity and dynamism of the field we call finance.

It will boost SSF to move from historical studies of mathematical model development—extremely valuable, but not enough—to ethnographic studies of their production and use (e.g., Yonay and Breslau 2006; Lepinay 2011; Lepinay and Callon 2011). If you want, social studies of finance should follow here the historical lead of laboratory studies from thirty years ago and go into the laboratories where models are produced.

True, we have a number of ethnographic studies of trading rooms. Yet, many of them, including ones recently published, have been actually conducted ten or twelve years ago, more often than not as PhD work, which then—understandably—had to wait a while to be processed in book form.

Having said that, I shall move into the second domain of investigation, namely studies of communication technologies. This branch of SSF has taken a different

direction from the historical studies of financial price models, in a double sense, both theoretical and methodological. Theoretically, studies of communication technologies in finance—be they trading screens, telephones, or tickers—have not sought to replicate themes from financial economics, but have been concerned with observation as a fundamental cognitive process, and with how observation is socially produced (e.g., Muniesa 2008; Knorr Cetina and Bruegger 2002; Wansleben 2011; Zaloom 2006). If you want, this is another way of questioning rationality assumptions in financial markets (Knorr Cetina and Preda 2007), which take observation as an individualized and atomized, unproblematic activity.

Questioning price observation as a basic cognitive activity in finance has also opened the door onto investigations of the specific formats of social behavior in markets. In STS, observation has been long associated with laboratory- or big engine-specific cooperations (e.g., Collins 2004). In finance, we have to do not only with cooperation, but with combinations of cooperation and competition, and with forms of strategic behavior where presentation is dissociated from intention. At the very least, SSF can investigate deeper in this direction and pay more attention to the complexity of cognitive processes related to strategic behavior, which can include, but is not reduced to cooperation.

It is not very difficult to recognize the anthropological and phenomenological roots of this approach, going back to the work of Alfred Schutz (Schutz and Luckmann 1972) and Erving Goffman (1970) among others. Methodologically speaking, investigations of communication technologies in finance have been more balanced between historical and ethnographic approaches, and we know a deal more about the uses of contemporary technologies than we do about the uses of models.

Yet, even this branch of SSF could have paid more attention to the complexity, dynamism and diversity of contemporary finance, where changes take place now a greater speed than that of writing academic articles.

Going back to the introductory metaphor, we can see that various groups involved in this enterprise have actually taken different approaches about how to open the box and about what is inside.

Have they opened it? Do we know what makes finance so agitated? Can SSF offer solutions for calming it?

More recently, SSF research has suggested that the origins of the financial crisis are to be found in models, which are used not for their accuracy, but in order to establish valuation consensus among market actors, leading to the creation and trading of deficient financial instruments, with disastrous consequences (MacKenzie 2011).

Critics of SSF have countered that ethical issues are ignored here, that the key to understanding the crisis lies not in pricing models but in deviant subcultures which foster greed and risk taking, and which should be curtailed by tougher regulations. All we need here is more patrol boats, and the hurricanes will recede. What these critics curiously do not see is the argument formulated by the other branch of SSF, namely that communication devices bring about global observation and coordination mechanisms which are very difficult, if not impossible to regulate

at local or national level. What critics have also failed to grasp is the extent to which dedicated communication technologies continue to spread and evolve globally, establishing new centers of finance partly in response to local regulatory measures. Finance is indeed about to become a mechanism of global coordination, with significant consequences—among others, that apparently minor events in one part of the system can trigger system-wide snowballing reactions. This was not the case ten to fifteen years ago, when the various Asian, Mexican, Argentinian, or Russian crises were more or less contained at a regional level.

It is precisely the fact that global finance is grafted upon global, dedicated technological systems (which are still very little understood), together with the widespread use of analytical technologies of varying complexity which should make us push the investigation more and more into these systems rather than resort to calls for more patrol boats.

Coming back one more time to our main topic: what else should we expect from Pandora's Box? Well, the really interesting things are still to come…

Here are just three issues where STS investigations of finance promise good yields: (1) agency and robots; (2) epistemic cultures; (3) expertise. I shall touch very briefly upon each of them.
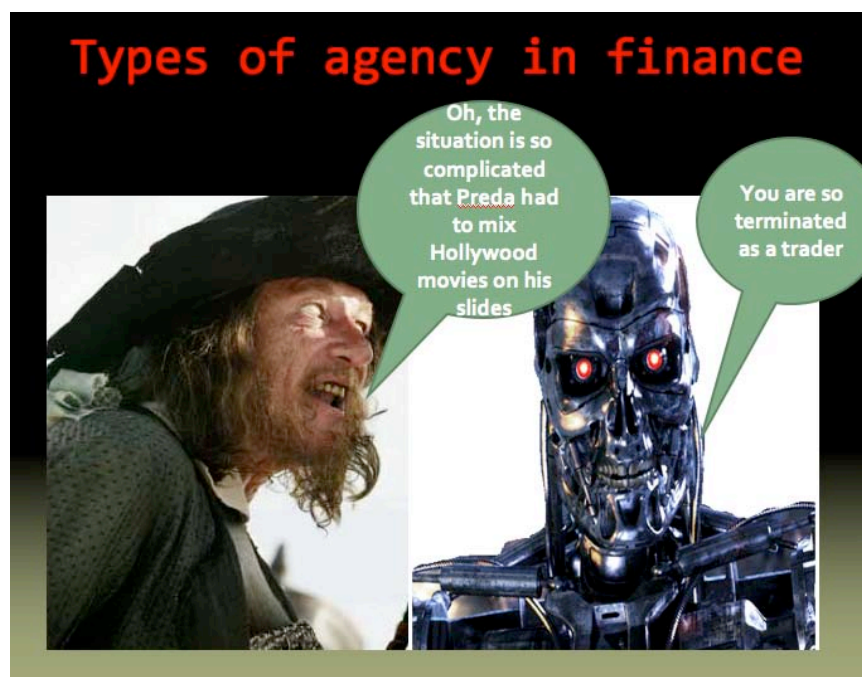
Agency has figured prominently on the STS agenda during the past twenty five years, and a great deal of papers have dealt with how technologies force human agents to take unforeseen paths of action, or with postsocial sociality (e.g., Knorr Cetina 1997). What we have witnessed in finance during the past five years or so has been the rise of algorithms, robots replacing humans in trading. In some mar-

kets, more than half of the overall trading is now done by algorithms, and this proportion is bound to increase. What is more, regulators have begun using robots for market surveillance. The flash crash of May 2010 has been linked to algorithm trading, and it is worth remembering here that previous crashes (October 1987) have been linked to program trading as well. The trend towards increased market automation goes hand in hand with an increased technologization, as illustrated not only by the increased speed of transaction, by deepening technological linkages among exchanges, but also by the increased presence of science professionals in finance. We should keep in mind here that finance firms recruit heavily among science and engineering graduates.

Are we looking now at a world where trading will be done exclusively by robots? And what place do humans have in this world? First, there is the issue of human-robot interaction on trading screens. In electronic markets, human traders and robots can be indeed pitched against each other. We have to do with a world where human agency is confronted on the trading screen with active non-human agencies, agencies which are different from the more or less passive resistance of the scallops from twenty five years ago (e.g., Callon 1986). This raises a whole series of interesting issues for STS research: how do I recognize non-human agency in action? Can human agency be recognized as such by non-humans, and to what consequences? What are the consequences for the notion of strategic action?

Imagine here football teams combining human and non-human players, and confronting each other. But they do not know from the start who is human and who is non-human on the other team, and they can find this out only during the game. The challenge for STS research is to investigate how various types of agencies are configured as accountable and recognizable as such in action. Another challenge is to investigate how robotic agencies are produced and put to use collaboratively by various groups in finance.

Thirteen years ago, the notion of epistemic cultures was introduced to denote the variety of ways in which scientific disciplines produce knowledge (e.g., Knorr Cetina 1999). Recently, SSF studies have begun turning away from the concept of performativity (e.g., Callon 1998; MacKenzie *et al.* 2006) to that of epistemic culture, in an effort to capture the diversity of the ways in which knowledge is produced and put to use. And by knowledge, I do not mean here any kind of financial knowledge, but most and foremost theoretically grounded knowledge claiming predictive power with respect to the prices of financial instruments. It appears that in this respect finance is way more diverse and rich than the initial criticism of a dominant model of rationality would have us believe. It also appears that at least for some types of transactions such a model was never dominant, and that a rich variety of academically sanctioned theories, and well as non-sanctioned ones, co-exist side by side, and very often encounter each other in action.

We need to map therefore the variety of knowledge forms encountered in finance, in relationship to each other, together with the variety of groups producing and reproducing them. We need to map their boundaries, as well as their clashes. In the initial setting where the concept of epistemic cultures was introduced, they were kept apart by disciplinary boundaries, namely by the fact that these cultures

had developed and evolved within distinct scientific disciplines. In finance, things are more complicated. While in part epistemic cultures have evolved within different markets—and we could talk here about a foreign exchange culture as different from a derivatives culture, they can also overlap organizationally, or develop more tense relationships.
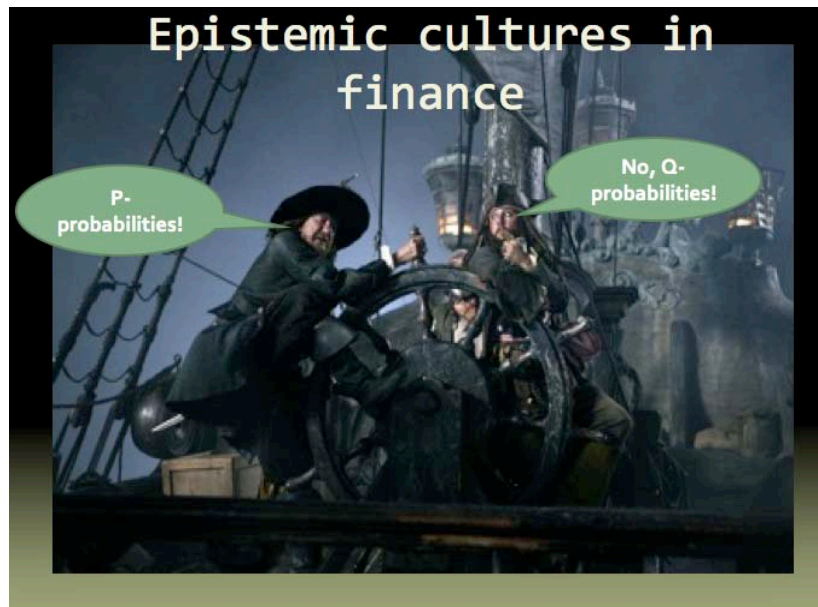
Epistemic cultures can stretch over a wide variety of settings, from the academic settings of mathematical finance down to practitioners' elaboration of mundane theories, tools and models of finance. Not all of them have pricing models of the core. Some center on tools with the help of which price movements can be monitored and explained. This would also explain why we do not encounter the same intensity of use of the same pricing models everywhere. The notion of performativity, launched about fifteen years ago, implied (without stating it as such) that some model becomes dominant if not the standard. (And performativity can be seen as an extension of the notion of standardization). Meanwhile, the picture has become more complicated. We know that competing models can be developed, or that models can be ignored by practitioners.

It would be mistaken to reduce the epistemic cultures of finance to large organizations, based solely on the grounds that they have the most money and therefore the most influence. In order to get a better picture—one which should help understand why finance is so dominant in contemporary life—we need to pay attention to cultures of finance at various levels of professionalization and expertise, and see how they correlate with each other. We need to include here institutional formats addressing the public, such as brokerage houses, but also regulatory agencies and central banking.

Expertise has been another major STS topic over the past ten years or so (Collins and Evans 2002). In relationship to finance, expertise can be understood at least as being about how a specific domain of knowledge is locked in by specific groups which set up mechanisms for controlling access but also instituting a specific form of knowledge about finance as the legitimate one, while other formats retain a marginal position. This would also mean examining the social mechanisms through which this form of expertise is reproduced in institutional settings, and disseminated at various levels. It would also mean looking at how variations are produced within this form itself—that is, how different groups produce alternative and competing theories, models, and explanations, all within the dominant format of expertise. I am thinking here for instance of how different quant groups produce competing theories and explanations, publish in journals, meet at conferences etc., while remaining all within the same domain of expertise.

Lock ins of this kind usually go hand in hand with reproducing a domain of expertise like finance at different levels and across various institutions, so that we now have for instance TV experts on finance, but also government experts, academic experts, bank analysts, and so on. The ongoing crisis has brought afore a great deal of experts and expertise, and there goes not a single day without various experts and analysts commenting the ongoing events in the media. This raises at least a few questions in need of closer examination: first, is the public understanding of finance enhanced by this permanent display of expertise in the media? Second, and this is perhaps the question to begin with, what is the public understanding of finance? To what extent and how do publics understand financial theories and finance? Third, what is the link between this permanent display of exper-

tise and the legitimacy of finance? Do we encounter here contestations or alternative forms of expertise?

Where is the expertise on finance situated by rapport with the social sciences, but also with the natural sciences? We have to keep in mind here that for quite a while finance was not seen as part of economics and the topic was not dealt with very much within economics departments (e.g., Jovanovic 2012). Even today, the situation is not very clear. While financial economics is now a firmly entrenched feature of business schools, institutionally it is often associated with accounting rather than with economics. Its disciplinary status is not necessarily very clear, especially if we think of the complexity of the discipline itself. We also need to keep in mind that disciplinary status can shift according to the background of practitioners, and more and more of the latter have a background in the natural sciences. Is finance then a form of social science expertise, or of natural science expertise, or are we looking here at a hybrid form, which is not very easy to classify?

At this point, after having tried to identify a few ways in which finance can be made into the object of STS investigations, some may object that all this still does not take into account morality, and that it is all about profit making. To which the answer should be: haven't we learned from so many STS studies, and from the classics of sociology as well (and I am thinking Durkheim and Weber here), that morality cannot be separated from how forms of social knowledge are produced and from the specific interaction formats corresponding to this production? And doesn't profit making require the ability to extract rent from specific forms of expertise? Investigating the morality of markets cannot be logically seen as a project alternative to that of investigating financial knowledge and technology, but as something intrinsically related to it.

Some might say that this approach does not answer the general question, "what is finance?" Since this very finance seems to bring about crisis after crisis, since it seems to be of such importance for the welfare of entire societies, this question may seem legitimate, in the hope that an ultimate answer to it will help us find a cure for all the economic and social malaise of our times. So, it might be here that some will call for SSF to reach deeper into Pandora's Box, in the hope that somewhere, at the very bottom, we'll find the ultimate answer and with it the ultimate cure.

Shall then SSF try and answer such metaphysical questions? Do answers to metaphysical questions provide cures? This is doubtful. This is not to say that SSF investigations cannot contribute to shaping policy toward finance—they certainly can. SSF investigations definitely can contribute to public debates, and to raising public awareness as well. But they cannot offer any cure to the general social malaise caused by a state of crisis which seems to become semi-permanent. It is tempting to try and see SSF as a form of cultural therapy, but in the end this would hollow out the very enterprise, which has built its name upon rigorous investigations.

Coming back to the above question, what lies then at the very bottom of Pandora's Box, underneath all the questions about agency, expertise, and epistemic cultures? This reminds me of the question in the title of Niklas Luhmann's farewell

lecture at the University of Bielefeld twenty years ago, "What Is the Case? What Lies Behind?" (Luhmann and Fuchs 1994). As a curious and newly arrived PhD student, I went to the packed auditorium to hear this lecture. Luhmann's answer was, "nothing at all!".

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Essay

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Behind Closed Doors

Scientists' and Science Communicators' Discourses on Science in Society. A Study Across European Research Institutions[1]

Silvia Casini and Federico Neresini

Abstract Public Engagement (PE) is a marginalized field within a science institute's 'core business' of doing research. Using interview data from a range of science professionals working in European research institutions, this study addresses fundamental questions about science communication: What role do scientists think they should have in SiS activities? What audience do scientists think they should address? Despite an openness to experiment with PE initiatives, the deficit model remains dominant among research practitioners. The importance of the institutional factor emerges, namely research institutions failure to recognize SiS activities as an integral part of the research profession.

Keywords scientists; communication; public; engagement; space; evaluation.

Introduction

In responding to the call made by Lévy-Leblond back in the 1990s (1992), recent literature has started paying attention to scientific experts' understanding of the general public (Besley and Nisbett 2011; Davies 2008; Young and Matthews 2007; Burchell 2007), emphasising a need to engage with these often-neglected questions: how do scientists perceive the public? What do scientists understand by public communication and engagement? But, according to Davies, "little recent work has specifically examined scientists' ideas and assumptions about public communication and engagement, despite the fact that these will certainly affect the ways in which they engage in such activities" (Davies 2008, p. 415).

How scientists engage with the public(s) is related to their broader understanding of so-called "Science in Society" (SiS), a field comprising activities in both Public Communication of Science and Technology (PCST) and Public En-

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gagement (PE), and to the different publics that scientists and communication experts address in their everyday working lives.

"Science in Society" is a locution that has been recently proposed to replace the previous one "Science and Society". The reason for the change lies in the belief that speaking of "Science in Society" would better address the need to overcome a "diffusionist" conception of public communication of science. This last conception was centred on the belief that science was too complicated for the public and, consequently, there was the need for a mediation capable to make science understandable to non-scientists. These are some of the ideas underpinning the diffusionist conception, and in particular: "the notion of the media as a channel designed to convey scientific notions, but often unable to perform this task satisfactorily due to lack of competences and/or predominance of other priorities (e.g. commercial interests); the public as passive, whose default ignorance and hostility to science can be counteracted by appropriate injection of science communication; science communication as a linear, one-way process in cui the source context (specialist elaboration) and the target context (popular discourse) can not only be sharply separated, but only the former can influence the latter; communication as a broader process concerned with the transfer of knowledge from one subject or group of subjects to another; knowledge as being transferable without significant alterations from one context to another, so that it is possible to take an idea or result from the scientific community and bring it to the general public"(Bucchi 2008, p. 58). Often the diffusionist concept is referred to as "deficit model", although the latter more aptly refers to the second term of the previous list (Bucchi 2008), giving PCST the task of filling the gap of scientific culture that characterizes contemporary society. The weaknesses of the diffusionist conception and the necessity of overcoming it have been widely reaffirmed by the numerous criticisms of the deficit model. Those criticisms call for a relationship between science and society based on dialogue and engagement with citizens seen as active interlocutors and worthy of consideration (Funtowicz and Ravetz 1993; Gibbons *et al.* 1994; Lewenstein 1995; Michael 2002; Nowotny *et al.* 2001; Wynne 1995). That is why the locution "science in society" sounds more appropriate than "science and society". Science and society should not be interpreted as two separate entities to be related assuming that the first one should transfer something to the second, rather one as part of the other in an equal relationship. This is also the reason why to understand how scientists see their potential interlocutors and how they envisage the interaction with them is particularly relevant for research in the field of Science and Technology Studies.

In considering those issues, one should keep in mind that scientists are not isolated when they carry out research activities or when they interact with the public(s). In both cases, their attitudes and the actions they take are highly influenced, for better or worse, by the motivations and resources coming from the research institution to which they belong. The organizational culture of scientific institutions, therefore, cannot be overlooked when seeking to understand the approach scientists have toward SiS activities as a whole. Similarly, one should not forget that scientists, in so far as they belong to a certain institution, may find

themselves working side by side with other professionals such as those who are engaged in communication and/or public relations (PR).

At the same time, one should be able to analyze what public(s) is (are) addressed by researchers and science communication experts, given that "in the area of science communication, as in any area, it is firstly important to ask who the public is. The public of course includes the informed, educated, interested and engaged populations as well as naive, uninterested and poorly educated groups" (Turney 2006, p. 38). Nevertheless the most common tendency still seems to be that scientists consider "the 'public' as a passive entity with 'attitudes' or 'understandings', but not as a bumptious technoscientific actor" (Haraway 1997, p. 94), even though the willingness and capacity of the public to become actively involved in technoscientific practices have been largely recognised (Funtowicz and Ravetz 1993; Epstein 1996; Irwin and Wynne 1996; Callon *et al.* 2001; Jasanoff 2004; Bucchi and Neresini 2007). The general public is neither completely uninterested in science - especially when it senses its relevance for everyday life - nor unable to actively contribute to science development, either by means of taking part in the process of doing scientific research, or by getting involved in the initiatives of PCST (Felt and Wynne 2007).

There remains much to be done in order to understand how scientists conceive that part of their professional commitment that has gained increasing relevance under the pressure of the public, the media and politics. Furthermore, the increasing demand of public communication and engagement seems to conflict with the traditional requirements put forth by the scientific community in terms of laboratory work, exchange with colleagues, writing up of peer-reviewed papers.

1. From deficit to engagement: which public and which role for the scientists?

According to available literature, the prevailing conception of the public among scientists is the so-called "deficit model". In this respect, the scarce scientific culture and the strong disinterest that characterizes lay people constitute the basis of unfavourable attitudes toward science (Brossard and Lewenstein 2010). Those attitudes might foster irrational behaviour - such as the rejection of GMOs or the belief in horoscopes; additionally, they might render the study of science and prospective careers less attractive to young people. The latter attitude deprives research institutions of necessary resources (Sturgis and Allum 2004).

This dominant perspective emerges in a straightforward manner from the detailed review recently presented by Besley and Nisbett, in which studies show that "scientists believe the public is inadequately informed about science topics" and that, at the same time, "is uninterested in becoming more knowledgeable" (2011, p. 4). They agree with Davies (2008) that "these findings reflect, a traditional 'deficit model' of science communication" (Besley and Nisbett 2011, p. 4).

This is further confirmed by a measured tendency among scientists to attribute responsibility to others for a lack of scientific culture in the lay public; less than one third of scientists think that the problem stems mainly from scientists themselves (MORI-Wellcome Trust 2001). Science communication scholars also think that scientists "hold a deficit model perspective" thinking that the public have not meaningful opinions, even if "the members of the science community remain mixed in their views of the public" (Besley and Tanner 2011, p. 256). The prevalence of the deficit model among scientists, and the resulting tendency to interpret their interaction with the public as a one-way form of communication, however, is not inconsistent with more flexible positions. These may include subjects or situations about which lay people express interest in interacting with the scientists, such as topics or applications of science perceived as relevant to the public (Davies 2008, p. 417). On the other hand, findings from research by the Pew Trust in 2009 confirm that scientists may broadly view the lay population as ignorant, but remain in disagreement about whether or not this is a problem.

Therefore, research concludes that most scientists frame SiS activities in terms of the deficit model, a fact that has consequences related to the way scientists perceive the public(s), and interact with it. This is a typical situation of self-fulfilling prophecy: "false conceptions of the public operate in science policy making and misguided efforts at communication of scientific institutions which alienated the public still further" (Bauer *et al.* 2007, p. 85). The naïve view scientists have of society and its interactions should not be surprising, as they are - like everyone else – obliged to assume some model of social reality in order to be able to interact with it (Wynne 1989). Moreover, scientists are encouraged to take as good models those that are ready at hand, namely those of common sense, such as: communication exchange described using the metaphor of the transmission of knowledge; the lack of knowledge explains the prejudices against science; the 'others' tend to form a homogeneous whole uninterested - or even hostile - towards us even when we are – on the contrary – really engaged in what we do. There is no reason to believe that scientists are immune from the cognitive processes that typically come into play when ordinary people need to get an idea of how social interactions work (Besley and Nisbett 2011, p. 13). The deficit model is the combination of these elements of common sense; this explains, among other things, its persistence, even among scientists. And for these reasons it is crucial to understand what scientists think of PE and PCST, now grouped in SiS. This goal can be declined in a number of issues that address very general questions. First, it should be understood who is (are) the public(s) that scientists address. It is already known that the predominant tendency is to characterize it as scientifically illiterate and with very little interest in filling a knowledge gap. Simultaneously, there is the belief that public perception is pervaded by scepticism, if not outright hostility, towards science. On these premises, it is logical to expect that the public is imagined as a homogeneous rather than as a differentiated entity. The data available confirm that we are heading in this direction. Therefore, Davies (2008) asserts, when scientists think of their interaction with the public they seem to have in mind three main objectives, in descending order of importance:

to form scientifically literate people; to recruit potential future scientists and to arouse interest in scientific research.

The role scientists think they play or might play in SiS activities appears to be much less clear. In this regard some indications come from how scientists view their relationship with media. The conception scientists have of media, in fact, comes into play in building their idea of the public and, therefore, in their understanding of the complex nature of SiS activities. The most recent and comprehensive research on the relationship between scientists and the media is the one conducted by Peters and colleagues between 2005 and 2006. The opinions expressed by scientists interviewed about their relationship with the media are in many ways ambivalent: on one side " 'possible critical reactions from peers' were considered important concerns for 42% of the respondents (while) a similar proportion (39%) found 'enhanced personal reputation among peers' to be an important outcome of media contacts"; at the same time, "when assessing the quality of media coverage of scientific topics in general on four aspects (accuracy, use of credible sources, presence of a hostile tone, and comprehensiveness), scientists on average were neither clearly positive nor negative" (Peters *et al.* 2008, p. 203). However, what is more relevant is the fact that "increasing the public's appreciation of science was the most important benefits mentioned by scientists as an incentive to interact with the media" (Peters *et al.* 2008, p. 204).

When scientists talk about PCST they simultaneously build both themselves and their audience (Davies 2008, p. 427): if others possess little knowledge, they have a lot of it; if they are disinterested and passive, as scientists – as an interested party – they have the task of taking the initiative; if scientists have a lot to say, then the public should just be ready to listen. If the public should be educated to look at science with goodwill, despite the difficulties involved in dealing with the media, then scientists tend to define the public as a subordinate interlocutor, but to look at it with favour. The monodirectionality associated with communication via the media, especially the more traditional ones such as print and television, reinforces the idea of a passive audience, receiving knowledge and information from scientists.

In any case, interaction between scientists and the lay public develops far beyond occasions created through traditional forms of media. There are indeed many ways of being in contact or, to use Beaulieu's concept, co-present. Bearing in mind that being physically located in the same space might not be the same as being ready to interact, as Beaulieu points out quoting Goffman; she defines co-presence as a type of interaction that can take different modalities, such as face-to-face or web-based interaction. The space, therefore, can be a physical location or a virtual one: "Co-presence decentralizes the notion of space without excluding it" (Beaulieu 2010, p. 2). The web space, namely, can foster horizontal ways of being in touch between the lay public and the researchers, thus emancipating the public from a monodirectional communication dynamic.

In this perspective, the contact with the research world that the public can gain through a website is of particular importance and the websites of scientific institutions become a strategic resource. However, direct experience of the la-

boratories, through visits, and of the research centres as a whole, through open days, are still a unique opportunity for interaction between scientists and the public. This is why an institution's organization of space in relation to the presence of visitors who are not scientists themselves can tell a lot about how scientists conceive their relationship with the public and their role within it.

Additional information can be derived from the meaning that scientists assigned to evaluation activities in the context of SiS. Indeed, we are led to consider evaluation as a set of tools – more or less articulated and more or less reliable – through which one can determine whether and to what extent a particular initiative has produced those results for which it was undertaken. However, the way in which evaluation is designed and built can tell a lot about how the promoters of a given initiative think of themselves in the context of its realization. In the case of SiS it is clear, for example, that if scientists ask evaluation to detect only the changes produced in the public – a request which is very difficult to satisfy – or also to detect the changes possibly generated on scientists, the role of scientists is completely separate. While in the second case scientists and the public are imagined as part of a process that sees both of them actively involved, carrying different points of view but both recognized as an equal partner, in the first case, scientists place themselves in a position of relative supremacy, in so far as they assume that only others have to change, hopefully in the direction desired by scientists themselves (Pellegrini and Neresini 2008).

Finally, as noted at the beginning, scientists do not work as isolated individuals, but rather within organizations that make research possible and at the same time affect their activities. Here, then, the way in which scientists thematize the relationship with the scientific institutions to which they belong becomes an additional perspective from which to derive useful information on their role. Scientists can interpret their contribution to initiatives of communication and public engagement as part of their institutional role as researchers, attributing to this task a role more or less consistent with the activity of research strictly speaking. This attribution, however, will depend significantly on how research institutions define SiS activities: are they a mere appendix to delegate the task of interacting with the public or, conversely, a major component of their organizational culture to which all are called to contribute?

Depending on the response, the role of scientists in SiS activities will obviously be defined very differently. Within the general issue concerning the meaning they attribute to communication with and involvement of the public we can therefore identify some more specific questions, which can be summarized as follows:

    1)   Which audience do scientists address or think they should address?
    2)   What role do scientists have or think they should have in SiS activities?

This second question can be divided into three more specific questions:
    a)   Which kinds of interaction do they prefer, direct or mediated? And how does the interaction influence the organization of space in research centres?

b)   What do they understand about evaluation of SiS activities?
c)   Which value do scientists believe research institutions assign to SiS activities?

In order to answer to these questions the present study uses data coming from extensive fieldwork undertaken as part of a broader research project in which a set of interviews with researchers and communicators working in leading research institutions in various European countries. Choosing institutions where SiS activities are not minimal, allowed us to compare the opinions of scientists engaged in research with those of their colleagues only or mainly engaged on the front of SiS.

2. Methodology

This article stems from a broader research project which consisted of two different phases. During the first phase (2006-2008), the largest European scientific research institutions were surveyed in order to map and analyze their SiS activities. The second phase (2009-2010) centered on the actors involved in such activities; they were asked to be interviewed about the meaning assigned to PCST and PE by their research institution. A sample of researchers and communication practitioners was selected for interview from among those working at the research institutions already surveyed in the first part of the project. Two main criteria guided the sample selection: a) the importance of SiS activities in the research institution; b) the size of the research centre, which was calculated by considering the number of staff employed rather than the budget of the institution, because this latter parameter varies considerably according to the research field.

Because there are differences in SiS activities, due to the research fields of the institutions, 6 of the 12 selected work in biomedical sciences and 6 in advanced physics. Finally, the institutions surveyed are distributed across several European countries: the United Kingdom, Germany, Portugal, Sweden, the Netherlands, Romania and Italy. The number of research institutions surveyed is not sufficiently large to constitute a representative sample with which to depict the current situation of biomedical and physics research organizations at European level. Nevertheless, we can identify a number of common trends that help us highlight the interviewees' perceptions of SiS without widening the gap between the scholarly understanding of SiS and its concrete understanding among scientists and communication experts.

Four different professional profiles were interviewed at each research institution: the head of communication/PR, the director (if not available, a manager with an executive role), a senior researcher, and an early-career researcher. Each interview was scheduled to last between 40 and 50 minutes. The common language among all participants was English and so this was utilized in the face to face interviews. The population sample therefore consists of 48 individuals belonging to different professional groups: 24 researchers (equally distributed be-

tween early-career and senior), 12 professionals in charge of communication and engagement activities, 12 with top-level managerial responsibilities (directors of research centers and/or deputy directors). One-third of the interviewees are women, with a large majority belonging to the category of communication professionals. But only one woman was interviewed among the 12 top-level managers, reflecting the well-known under-representation of women occupying senior positions in scientific organizations (Blickenstaff 2005; Probert 2005).

Comparative analysis is limited to scientists and those professionals involved in communication and PR activities. While working on the data from the interviews, in fact, we realized that the major differences were between those two broad categories. We also detected some differences between women and men, between biomedical and physics research institutions, between junior and senior scientists, but the differences noticed are not relevant for the purposes of our research questions.

The face-to-face interviews were conducted using a semi-structured grid prepared by the researchers on the basis of the questionnaire used in the first part of the research project. The interview grid is structured around the following main topics: range of concrete activities implemented by the research institution and regarded as S&S; the interviewee's perception of the role of media in science communication and his/her conception of the public(s); the interviewee's attitude to the relationship between science and society (science and territory, science and publics); the interviewee's opinion on the purposes of science communication; the use of evaluation and feedback tools. Clearly, these topics give an idea of some of the issues addressed, without representing all the themes encountered in the course of the face-to-face interview.

While designing the interview grid, we did not to use the expressions 'public engagement' or 'science in society' in our questions so that interviewees would not be conditioned by them. From this we determined that the vast majority of the scientists and communicators surveyed did not use the term "engagement" when describing the range and type of science communication and PE activities that they undertook. Almost none of the researchers and communicators used the expression "science in society", instead preferring the locution "science and society". For this reason, in what follows we prefer to use the term "S&S" instead of "SiS", an expression that might look more appropriate from a theoretical point of view – as we have seen in the introduction – but less adequate for describing the positions of the interviewees.

All the interviews were transcribed using a slightly modified version of the standard conventions of transcription (see the legend in the annexes for details). Their content has been analyzed in order to identify key themes and concepts (Silverman, 2001; Flick, 2002). We look at the themes and issues discussed in the conversation samples selected with the aim of bringing out what scientists think about their involvement in PCST and PE activities. Therefore, the interviews were transcribed and then analyzed identifying parts relating to the research questions.

3. Science and society: the scientists' point of view

The research centers considered by this study fall into two main categories:
1) institutions where S&S activities are managed by the communication-PR department/office;
2) institutions where the organizational unit responsible for S&S activities operated separately from the one dealing with PR and communication.

An institution of the first type tends to promote a conception of S&S closer to a deficit-oriented model, while one of the second type is more inclined toward a dialogue-participatory model. The former collapses S&S into the public communication of science in general, whereas the latter generally takes primary and secondary schools as the main targets of its S&S activities with an organizational unit – department or office – dealing specifically with education and outreach activities.

In both cases, however, there is a general lack of awareness of the existing different models for pursuing public engagement and science communication. This can be regarded as a gap present in the research centers at institutional level. S&S activities were enacted without being part of a broader strategy capable of profoundly influencing the structure of the research center itself. In fact, "it is particularly important to establish whether the commitment to public engagement takes the form of an extension of the range of activities undertaken by research institutions – adding extra tasks without altering their overall structure and underlying rationale – or whether a more profound process of organizational change is actually in progress" (Neresini and Bucchi 2011, p. 65). This is especially the case in research institutions where there is no department or office specifically devoted to S&S, but only a PR and communication office.

However, it would be wrong to conclude that most of the research centres surveyed are exclusively deficit model oriented and that S&S is mainly understood as being the communication of scientific content to the general public. In some cases, the deficit model has been superseded by individual initiatives that put dialogue, debate and engagement into action. These initiatives are often undertaken because of the particular circumstances (social, geographical, economic) of the area in which the research centre is located, even if they are generally promoted by individuals wanting to implement particular activities for communicating science.

3.1. Who is (are) the public(s)?

From the data analysed it becomes evident that interviewees attempt to address different audiences. However, the segmentation is often poorly developed, since/because neither communication practitioners nor scientists seem fully aware of the need to differentiate their activities according to the group and stakeholder targeted.

Very few interviewees seem aware of the need to shape each S&S activity according to different segments of the public. Despite this lack of attention to the existence of many different publics, some interviewees show that a number of research centers made efforts to engage various kinds of atypical publics (i.e. politicians, particularly gifted children, persons aged over sixty-five, and so on) which do not belong among the categories most often targeted by S&S.

Contrary to what might be expected, the category of politicians and decision-makers is overwhelmingly understood as privileged in bridging the gap, or enabling mutual understanding, between scientists and the public, although not vice versa. Politicians are often seen as mediators between scientists and non-experts. Some interviewees explicitly mention politicians as one of the publics to which their research institution addressed its communication policies: according to this view, scientists must "convince" politicians (who in their turn will convince the voters) of the goodness of investing public money in research because they (politicians) are the people who can influence public opinion. In the words of a junior researcher:

> To receive funds, to get students to buy equipment and instruments or simply to have a pay check to go on simply doing what you do , you have to convince someone somewhere, and not directly the public (again, perhaps put this in the direct contact section, scientists long for a direct contact with the public but seek for a direct contact with politicians as mediators between them and the public, politicians need to respond to the public an= but someone who responds to the public, and this is a link between the public and the researcher. (JR, male, id10, biomedicine)

In this case, it is clear that in the view of scientists PCST and lobbying are blurred, although the pressure on politicians to get public funds to support research should be confined in an area quite distinct from PCST.

Only in one case does the public itself request and delegate scientists to study certain phenomena, exerting influence on the management policies of the research institution itself. In this particular case, the politicians do not act as intermediaries; on the contrary, it is the public that enable researchers to reach politicians in an attempt to affect policy-making. In another case, the interviewee recalls the important role played by the research centre in terms of policy-making and its ability to attract the attention of those who decide on specific issues:

> Prevention becomes a key element for the sustainability of the National Health Service (xxx)= we had an important role in raising public awareness on rare diseases.
>
> (D, male, id11, biomedicine)

Overall, however, politicians are an audience to be reached directly, either as part of decision makers who control research funding, or as intermediaries in the relationship with the general public which remains rather undifferentiated.

3.2. The scientists' role: reaching the public through direct or mediated contact

All interviewees emphasize the importance of direct involvement between the public and scientists. The S&S activities most frequently cited as examples of successful ways to engage the public are those in which direct contact takes place between researchers and the public, such as visits to laboratories, lectures or conferences: "Human beings do not want distance learning (x) screens" (SR, male, id9, biomedicine). The S&S initiatives cited, in fact, are primarily guided tours of laboratories, educational workshops conducted within or close to schools and open days. All these activities make it easier for the public to contact researchers, indeed often sharing the same space with them: "there is no substitute for having real scientists involved in public engagement. Professionals are mainly helpful as mediators or facilitators, but they cannot deliver authentic access to real scientific practice, or the latest expert findings" (Turney 2006, p. 88).

Research institutes active in the biomedical field stress that people should be more involved in matters concerning their bodies and their health. This is hardly surprising because biomedicine, more than physics, has been directly involved in research connected with health issues, sometimes inducing both scholars and the general public to re-consider and re-think notions of personhood. Science in this case seems literally able to touch the public in their bodies. Interestingly, interviewees use the word "touch" both in its literal and metaphorical meaning. In fact, they refer to the way a scientific concept can touch the public in the sense of reaching the audience's interest and imagination, and to the way can touch the public as something that is felt through the body, via a bodily feeling or sensation. In this second case, the word "touch" has a literal meaning being an actual contact between the body and then concept. For example, all four of the interviewees working at the same biomedical research centre recall a conference organized on the topic of the stomach. The evening did indeed touch many people: "in your daily life you do not think of having a brain= but you are <u>always</u> in contact with your <u>stomach</u>" (SR, male, id9, biomedicine). In this context, direct contact means the possibility to experience a scientific concept with and through the body. Many interviewees at physics research centers, on the contrary, propose the public interest in the origins of the universe as a means for scientists to touch their audience.

The main opportunities for direct encounter between scientists and the public are open days and visits to laboratories. Besides activities planned with schools and universities, open days and visits to research institutions are two key events where the general public – not solely youngsters – can meet scientists in their working environment: "the visitors' appreciation of an encounter with 'science in reality' or, in other words, of authenticity as the crucial quality of the visits also seems to interrelate with visitors' views that the visit programs are seen as a kind of demonstration of the research centre's openness to the public" (Neresini *et al.*, 2009, p. 24).

Opportunities to access and visit laboratories are crucial for communicating with and involving different audiences, whilst open days do not seem particularly significant in engaging the public, even though they are certainly the most popular means by which research spaces and activities are available to all those interested. In particular, although at least half of the interviewees consider open days important for communicating research and enabling encounters between scientists and the public, open days are considered rather expensive and their effectiveness has to be demonstrated with suitable evaluation tools. Notwithstanding the large amount of energy and money invested in the organization of an open day, there is no certainty about its results in terms of PCST and/or PE. In fact, whilst the majority of interviewees describe open days as occasions that people "like a lot" (HC, female, id3, physics), there is no agreement on numbers or on the ability to attract audiences not already involved in scientific research. For example, the head of communication at one of the research institutions says that "4,000 visitors a year are a significant number of visitors" (HC, male, id12, physics), whereas the director of the same institution stated that "the numbers are very low" (D, male, id12, physics).

The main reason for criticising open days is their explicit spectacular dimension (a word frequently used was "magic") often proposed to the people taking part in them:

> Science is often seen as something that can provide all the answers (x) what scientists are classically trained to do is to look for alternative explanations (xx). Talking more about the methodology, the rational, give people a greater understanding of what science cannot tell you. (JR, male, id7, physics)

Researchers seem particularly worried about this aspect, but some of the communication practitioners interviewed also asked "what is the value of an open day?" (HC, female, id6, biomedicine). Again, "openness is about allowing people to interact ((articulating words)) rather than opening for a day" (D, male, id6, biomedicine). Furthermore, some interviewees note that open days tend to always attract the same audience, generally represented by people already interested in science, whereas occasional initiatives designed to reach other, more specific, audiences may be more successful:

> There are always the same people, families and so on at the open days, we should make effort to attract new visitors" (JR, male, id5, physics); "the photographic competition was successful because it really managed to involve new people , I mean not the same we already saw during the open days. (HR, male, id3, physics)

In contrast to open days, educational activities are regarded as essential. This may stem from the predominance of the deficit-transmission model of science communication. The interviewees see training and teaching activities as important for three main reasons: first, as one of them points out, educational activities are gratifying for researchers because they can "confront them with a new and fresh vision" (SR, female, id2, biomedicine). Second, these initiatives enable

highly-specialized scientists to contextualize their research in a broader setting: "scientists sometimes lack the overall picture" (JR, male, id7, physics) and thereby "remember why I chose ((laugh)) this caree:r" (JR, female, id1, physics). Finally, young researchers can decide whether they want to continue with research or to engage in science education and communication. This latter option indicates that research and science communication are perceived by interviewees as two separate activities requiring different skills, and which cannot be undertaken simultaneously – a belief that we will investigate later.

3.3. Space as medium

The concrete space of the scientific laboratory has always been represented by the media as a fascinating and mysterious place capable of attracting the lay public. According to this imagery, the doors of the lab are kept closed in order to protect the research undertaken inside. To gain access to this space means to gain access to knowledge, to share (sometimes to steal) knowledge with those who produced it – the scientists. The curiosity and the strangeness of the equipment often present in the laboratory drives visitors as an interviewee explains: "It's the curiosity of going inside hidden spaces, it's the possibility to see odd things. Like the machines we have in the experimental lab" (SR, male, id12, physics).

In the words of the interviewees, however, "space" is used also to denote those rooms devoted to visitors of the research institution. The availability of spaces suitable for welcoming the lay public (a visitors' centre, a dedicated area, or even a simple lobby) is regarded as essential for a fruitful engagement with the public. Most of the interviewees, whether scientists, communication officers or directors, were aware of the role space played in creating a fruitful exchange between scientists and the public. In one case, for example, the research centre has neither an obvious entrance nor a hall for welcoming visitors. A senior scientist stresses that it is always necessary for someone to "accompany" visitors, whereas if there were a reception room with posters, brochures, and other illustrative materials, the visitor would not need a guide to feel comfortable and would start understanding the general kind of research undertaken at the institute.

The notion of space is too often dismissed in discussions on how to engage the public, or it is defined only in terms of the presence of a museum within the research center. By contrast, the interviews demonstrate that the particular organization of space can empower and emancipate the visitor.[2] The head of communication at one of the research organizations, for example, stresses that the centre in question has a space specially designed to welcome visitors with tables and chairs arranged in a circle to encourage horizontal interaction between scientists and audience: "it is important to have a space where people can feel comfortable

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[2] A contemporary theoretician who has closely examined the role of space in emancipating people is the French philosopher Jacques Rancière, especially in his *The Politics of Aesthetics* (2004).

in (x) even just a simple room with chairs in a circle" (HC, female, id6, biomedicine). Researchers and visitors sitting around a table can enable an exchange between the two actors where the roles are not already assigned and kept static.

The lay public can emancipate itself from being passive receptors of a message or knowledge transmitted by those who know (scientists) and those who do not know by sitting side by side with scientists in the same room or by gaining access to spaces that are normally kept closed. A research institution can question traditional roles assigned to researchers and visitors not for the purpose of turning visitors into scientists but with a view to empowering them, assigning them a role in dialogue and exchange with scientists. This can be done, for example, when spaces of play and experimentation are maintained, such as the open-days or the photographic competition organized by one of the research institutions surveyed. In this second case, the photographs of the lab taken by the lay public became a sort of neutral territory, an area of interest not completely monopolized by either scientists or non-experts, an area in which the public(s) enters. The photographs taken by participants showed a reality of the space of the laboratory very much different from what one would expect, a photographic representation that thwarted people's expectations. Furthermore, through photography, participants gained access to previously inaccessible spaces. As the head of communication explains, that competition furnished an alternative image of the spaces of the laboratory, spaces that were not "clear", "empty", "ordered", "glossy" as is often the case with corporate communication campaigns, but instead more truthful about the real life of a laboratory – messy, creative, full of objects, wires and busy people.

In one case, an interviewee described the transformation of the research laboratory into a television studio where two episodes of a popular television program were recorded. This moment in the history of the research institution, is remembered as being:

> particularly funny creating disarray and amusement (xx) those people came fore by with the crew , there were cables everywhere ((amused moving the hands to convey the sense of mess)) , their cables with ours, a total mess = we even got involved a school class from Turin who was just visiting us by chance. (HC, male, id12, physics)

Space plays an even stronger role when the interaction between researchers and the public(s) gives rise to misunderstandings and controversy. Assigned roles and possibilities can sometimes also be inadvertently thwarted. Presenting research findings or new technological instruments in front of a specific audience is sometimes highly influenced by where the presentation takes place. One interviewee gives an example of a lecture held in the research centre to explain to a female audience the future installation of a diagnostic instrument. In this case, there was a clear gap between the words used by the researcher to describe the project which were reassuring about the technology, highlighting the fact that it was safe and user-friendly, and the physical reality of the space where the meeting took place: "what people saw at that time were steel tubes, rather messy ca-

bles everywhere" (D, male, id12, physics). As a consequence, the interviewee remembered, one of the women said: "You don't want to put a woman in here, do you ? ((mocking the gestures and facial expression of those women)) It's far too dangerous" (D, male, id12, physics).

Scientists, however, can also have contact with the public in a mediated way.

3.4. The media and the web

Media in general, and more specifically television and newspapers, are largely dismissed by interviewees as ineffective means to engage with the public. They are perceived much more as communication tools useful to advertise scientific findings, but often at the expense of correct interpretation. This is hardly surprising, given that other studies and reports have shown that scientists have a generally negative view on the quality of news coverage of scientific issues (Peters *et al.* 2008). Some interviewees explicitly use the word "quality" when discussing the role played by media in science communication. The presence of the research institution in the media arena does not seem *per se* to assure the quality of scientific communication, which seems instead to depend on the capacity to develop and maintain good relationships with journalists or PR officers. At the same time, the majority of interviewees regard the quality of the scientific information conveyed by the media as rather more important than its quantity.

Another indirect means to reach the public is the World Wide Web and its related modalities: sections of the research organization's website dedicated to the public, newsletters, interactions with existing social networks, scientists' blogs, and so on. But in the majority of cases, the website of a research institution is not a medium privileged over print and television. Only in one case does the website play a crucial role in providing real-time information, and it does so for people seeking information in special circumstances such as natural disasters. One respondent stresses the importance of the website for reaching the audience of fellow scientists, and considers the website a communication channel of limited effectiveness compared with visits: "there are obviously special cases to be displayed on site of ((name research institution)) as highlights of research, but I think the most important thing is visits by people"(JR, male, id3, physics). Direct contacts therefore seem to ensure the quality of the relationship between scientists and the public: "stronger contacts for a smaller number of people" (SR, male, id12, physics). In only a few cases interviewees working in communication and PR departments call for greater use of the Web, as well as for its renewal, especially in terms of design and social networking. Only one research centre of the twelve surveyed gives the Web a prominent role in providing researchers and science communicators (also those working at other research institutions) with materials to engage the public: "we support researchers to do communication that we do not tend to do ourselves" (HC, female, id6, biomedicine). It is therefore easy to conclude that the Web and social networks are still in their infancy as

means for PCST and PE by those who run communication offices at scientific research institutions.

The preference for direct contact should not be interpreted, however, as an instance of a participatory model for reaching the public(s). It can be deficit-oriented, hiding the will to control what kind of information is released and the reaction of the public, without trusting science communicators and journalists as mediators.

3.5. Evaluation

Despite the lack of agreement on what outcomes should be sought in terms of communication and public engagement, all the interviewees personally involved either in research or specifically in PE and PCST state that the outcomes of S&S, i.e. the long-term impact and effectiveness of those activities, should be detected, measured and evaluated. Furthermore, outcomes, not outputs, are a means for interviewees not to waste resources in terms of budget, staff and time:

To have at our disposal feedback and evaluation tools might be important to understand what we do and how we can improve what we do. (HC, female, id8, physics)

I would like to have more feedback (xx) it is really difficult to evaluate how it goes. (SR, male, id6, biomedicine)

We need to have reliable indicators that would allow us not to waste resources. (SR, male, id12, physics)

Evaluation is a very interesting topic , it's good that you work on that because we need to get better (xxx), there is so much money spent in this field , blasted into papers that are not read , that don't have an impact at all. It's much more important to analyze what really is working and functioning (xx) so to analyze the impact and the long-lastingness of information that you pass on. (D, male, id4, physics)

In referring to evaluation during the interviews, some interviewees explicitly use the word "quality" in conjunction with terms such as "engagement" and "interaction" referring to the need to measure the impact of efforts undertaken by research centers to engage with the public: "Depth of engagement, quality of engagement and quality of interaction are key factors to measure the success of S&S activities" (HC, female, id6, biomedicine); the majority of interviewees, however, introduce the word "quality" when talking about the personal capacity of scientists to know their own topic thoroughly and be able to explain it to the general public: "Quality means knowing what you are talking about and making it understandable" (D, male, id11, biomedicine).

On considering types of evaluation and feedback tools, the interviewees seem skeptical concerning quantitative methodologies like questionnaire-based sur-

veys. They prefer focus groups or other - not further specified - qualitative methodologies applied to evaluation: "Questionnaires are excessively used nowadays in our society (x) they don't give anything back to me (x) they are <u>so reductionist</u> in interpreting reality" (SR, male, id5, physics); "Questionnaires are <u>too</u> didactic, too rigid, focus groups are better" (HC, female, id6, biomedicine); "Focus groups . a more interactive evaluation would be more interesting" (HC, male, id11, biomedicine). This distrust of quantitative research methods is coherent with the interviewees' opinions concerning the need to evaluate the quality of S&S activities rather than measure the general level of agreement of participants.

Insistence on the importance and necessity of evaluation seems, however, to conceal different meanings. On the one hand, evaluation can be seen as an opportunity to re-think what has been achieved or to think about what has been not considered from the outset; it can also enable reflection on the meaning that scientists and science communicators attribute to S&S activities, to their roles as professionals, and to the role played by their research institutions. On the other hand, evaluation is often evoked as a tool primarily intended to measure the impact of S&S activities upon an addressee, which is the public(s).

In this second case, the change of perspective envisaged by interviewees regards the public alone, whilst scientists and communicators are extraneous to processes that they too contribute to creating. A conception of evaluation focused on the idea of the impact on a (passive) public and determined by the joint efforts of (active) scientists and communicators may reinforce the bases of the deficit model (Neresini and Pellegrini 2008). Nevertheless, the two meanings attributed to evaluation as illustrated above should not be understood in purely oppositional terms. In fact, evaluation of the impact exerted by S&S activities can be used for reflexive analysis of how resources have been employed (efficiency); on the other hand, reflexive evaluation (the re-thinking of PE and PCST processes in light of the initial goals) may remain trapped in the deficit model if those objectives are not dialogue-oriented; nor are they able to engage all the actors involved, including scientists and communicators.

Despite these ambiguities, the interaction between scientists and public(s) may encourage self-reflexive processes. This is perceived by most of the interviewees without relevant differences among the various categories (junior and senior researchers, communication practitioners, high-profile managers/directors of the research institution) and across the two scientific areas surveyed (biomedicine and physics). S&S activities therefore become opportunities for researchers and communication practitioners to rethink their roles.

In this respect, it becomes evident that S&S activities are not highly regarded by scientists in comparison with research. Some interviewees, in fact, think that carrying out S&S activities makes it possible to pursue a career in science communication rather than in scientific research: in this case only those who realize that they are not particularly good as scientists might decide to dedicate themselves to science communication and public engagement. Many of the science communication practitioners interviewed describe themselves somehow as 'unfulfilled scientists': that is, they realized that they would rather continue their

careers within the communication field, either because they felt themselves unsuited to the lifestyle required of a scientist (too long working hours, flexibility which is difficult to combine with a family, etc.), or because they felt they were not good enough as scientists:

> I realized I was not going to win the Nobel Prize (xx) ((laughing))= I was not as goo:d a scientist as I wanted to be. (D, male, id6, biomedicine)

From this point of view, S&S activities might sound like the negative counterpart in defining the researcher's professional identity.

4. Deficit model, but…

 The variety of positions that emerged from the interviews clearly indicates the impossibility of incorporating into a single definition the expression "science and society". However, there is one point on which all interviewees, both senior and junior researchers and communication practitioners, seem to agree without exception: the requirement that S&S should communicate the results of research work to the public. The frequent use of terms like "duty" and "responsibility" sometimes goes together with the awareness of the role of science in advancing society and in particular:

> We do good science and we want to bring society forward (x) showing humanity that we gather new knowledge" (HC, male id4, physics) or: "we have three tasks (x) to undertake research, to teach new researchers and to disseminate science. (D, male, id11, biomedicine)

However, the relationship between science and society weights much more on the first term in the expression:

> Society needs science, society lives with science, science is a tool for society. (…) the other way around is probably not obvious? There is a direct need from the society's point of view to have science, to understand science, to make it more accessible. Whether science needs society I don't know (x) well, in principle obviously we need society otherwise we wouldn't exist (x) nobody would finance our research? But the impact is less obvious. The public needs to understand science. (SR, male, id4, physics)

But researchers, in contrast to communication practitioners and directors of research institution, tend to ask the public to be more active, to demand the right to be both informed and involved by scientists.

In only one of the twelve research centres the interviewees define S&S as "the capacity to promote and facilitate debate" (HC, female, id6, biomedicine) without considering the transmission of knowledge as one of its primary tasks:

> To facilitate a debate without taking it personally and being able to see the others' point of view ? is not something that comes naturally (xxx)in this sense we have a course which is called (x) 'science and society'. So now science communication is now science and society.

How do you engage and involve your audience and offer opportunities for interaction and debate? (D, male, id6, biomedicine)

Certainly, other research organizations have researchers and communication practitioners who understand S&S as a participatory-dialogical relationship: these, however, are exceptions that do not represent the institutional policy adopted by the research centre as a whole.

In some cases, the emphasis is on the transmission of knowledge in order to bridge the gap between science and society: "S&S means the overall aim to bridge the gap between scientific research and society" (HC, male, id5, physics), trying to disseminate scientific contents so that they are accessible:

Complexity is not understandable (x)((shaking head)) it needs to be reduced (x), it is important that the <u>outside</u> world understand what we are doing" (D, male, id4, physics). Again: "we can provide updated scientific information (x.) it is really difficult to <u>translate</u> these data into something understandable = unfortunately , it is not written in the statute that we must undertake public understanding of science. (HC, female, id7, physics)

Interviewees frequently used the word 'translate' to describe the communication task. This reveals the persistence of a transmission-oriented concept of communication that, unavoidably, relegates the public to a subordinate – if not entirely passive – role.

In other cases, a specific S&S activity means at the same time stimulating the curiosity of the public by providing information and urging it to ask questions and decide: "to awaken in the listener <u>the desire</u> to discover (xx) to offer opportunities for people to <u>form</u> an idea (x.) have a basis to decide" (SR, male, id5, physics); "You have to hit people in the head" (SR, male, id9, biomedicine). The conceptual movement enacted thanks to S&S activities incorporates an emotional, a cognitive and a social moment: it starts off from the desire to know, the possibility to formulate an idea, a concept around an issue to move, then, to forming a decision, to take a position. In one case in particular, the term 'debate' was explicitly used to state that all the activities called S&S coincide with "the capacity to promote and facilitate debate" (D, male, id1, physics). The interaction between scientists and the public, even when its purpose seems only to remedy a shortage of scientific knowledge in the public, may thus become a tool for 'empowerment' which turns the public into an active player.

As a consequence, the experiences and activities cited by the interviewees as examples of S&S do not fit neatly into any of the existing theoretical models of science communication and public engagement. Actions whose main goal seemed initially to be the transmission of science and the filling of the knowledge gap between scientists and the public could then become projects that fostered dialogue and participation as well. According to several interviewees, especially researchers, the transmission of scientific knowledge is essential in so far as it enables the public to develop adequate awareness of its responsibility to form an opinion about technoscientific issues. By contrast, scientists often regard S&S as compris-

ing communication activities that recall the deficit model of transmission from the experts to the general public.

Although the large majority of the research institutions surveyed enacted strategies of public engagement in science that were deficit and transmission-model oriented, even in those cases there were signals of more differentiated, complex, and multifaceted attempts to engage the public with science. These may have been minority discourses, but their presence is nevertheless encouraging (Davies 2008). Moreover scientists and even communication practitioners may not be fully aware of the potential novelty of the activities that they implement and the approaches that they adopt, such as, for example, role-playing in S&S activities, nor aware of the impact of controversies in challenging transmission/deficit-based models of science communication, or of the relationship between gender issues and S&S. The main theoretical models describing the science and society relationship – referable, in general, to the opposition between deficit/transmission model and participatory/dialogical one (Bucchi 2004, 2008; Brossard and Lewenstein 2009) – are certainly useful for understanding what research centres do under the heading "science and society" and how they interpret their role in this context. However, these models do not accurately reflect the variety of orientations and activities actually implemented by the various scientific institutions. Furthermore, different approaches often co-exist within the same institution and within the same subject, even if one model tends to dominate the others and determine the types of S&S activities implemented.

Furthermore, the research centers are engaged in an intense search for new tools, strategies and activities able to ensure or enhance the long-term impact and effectiveness of science communication and PE. The problem is that this apparent dynamism of tools is not matched by an equal dynamism of objectives: the long-run goal, in fact, remains that of communicating scientifically sound contents to those who, not being scientists themselves, are believed to be in need of becoming more scientifically-informed. In this regard, the situation of leading research institutions across Europe appears to still be characterized by the deficit model, despite some isolated cases where a dialogic and participatory-oriented model is in place.

Scientists, as well as communicators, tend to have a generic understanding of the public as a largely undifferentiated entity from which only two categories can emerge: those of students and politicians. In the case of students, it is evident that they are perceived as "young, still in the learning phase" and this confines them to a subordinate position; in the case of politicians, they are more often recognized as interlocutors if only because they are often seen either as decision-makers who determine the availability of important resources for research, or as a mean to communicate with the general public.

Scientists assign themselves a prominent role in the context of the relations between science and society: it is their responsibility to take the initiative, it is they who have something to offer (scientific knowledge), and others have to change. Conversely the public, especially when understood in a generic sense, is defined as a passive interlocutor both to be solicited in order to make it ready to

receive but not to give, and to be observed to see if, appropriately stimulated, it changes knowledge and attitudes in the direction hoped for. Scientists, but not infrequently also communicators, perceive themselves as actors involved in a process that should fall under their control. Therefore, they prefer direct contact with the public, while they somehow distrust mediated contact. The media are seen – often quite naively – as mere instruments of transmission, although inclined to betray the expectations when they simplify or embellish, when they attempt to translate the knowledge that scientists possess.

All this, however, tends to clash with a problem that emerges repeatedly whenever the interest in the relationship with the public and the importance that is attributed to it materializes in a concrete commitment. Scientific institutions, in fact, scarcely recognize SiS activities as part of the profession of scientist, often leaving them to individual goodwill and confining them in marginal sectors. This is why many of the scientists interviewed know little or nothing of what their research institutions do in the field of SiS. On the other hand, the organization of space within the research centers testifies to a general lack of attention to the fact that the same space is used by persons who are not engaged in scientific research work.

5. Conclusions

According to our data, the concrete and everyday practices of staff working on SiS activities at research centers are still regulated by a deficit-oriented model, rather than by a model organized around dialogic communications and strategies of active engagement with the public. With a few exceptions, in fact, most interviewees, regardless of whether they were scientists or communication/outreach practitioners, understood the two terms in the expression "science and society" as being regulated by a top-down relationship.

Despite the prominence of the deficit-oriented model, different practical solutions are at work in the activities of communication and engagement carried out by research institutions. Although this general orientation prevails, it seems that there is enough flexibility capable of fostering more dialogue-based and participatory activities. Furthermore, owing to the research institution's specific sociocultural context, the deficit model is necessarily cross-fertilized with other theoretical models of science communication (the dialogue and the participatory ones, for example), thus fostering forms of public communication and engagement different from those usually associated with science (Brossard and Lewenstein 2009).

The range of activities and strategies described by the interviewees as means to communicate with the public demonstrates that direct contact with the public is preferred to other, more mediated, forms of communication. This is also one of the reasons why the interviewees were generally sceptical concerning the role of the media in reaching the public in a fruitful way. Scientists may not be enthusiastic about the need to consider science communication and public engagement

as part of their research activities, but they are willing to take responsibility for them, especially the former. Scientists trust themselves more than any other actor in creating and maintaining a relationship with the public. According to the interviewees, opportunities to interact with scientists either through direct contact during an open day or through virtual contact via the Web, or through mediated contact via a third actor, are capable of revitalising the scientist/public relationship. This relationship usually becomes stronger when it comes under strain, for example because of a controversial situation in which both actors feel compelled to start a confrontation.

Scientists trust themselves as authoritative interpreters of S&S activities. Simultaneously, however, they perceive their commitment on this matter as an adjunct to their research work, something that takes up time and resources that should instead be devoted to research. On the one hand, therefore, scientists want to be directly involved in the relationship with the public; on the other, this involvement may seriously hamper their work/careers as scientists. This contradictory situation is determined by the fact that while scientific institutions and the organization of research activities do not recognize SiS as part of their efforts, scientists are increasingly required their direct involvement in such activities, both by institutions that support scientific research financially, and by society as a whole. The contradiction just outlined is currently being resolved by relegating SiS activities at the margin of the work of scientists, and by leaving the burdgen to invest in them to scientists' willingness. Clearly, this appears to be a precarious solution which poses serious obstacles to the development of PCST and the PE.

Also for that reason, despite the difficulty of classifying within a single theoretical model both the SiS activities carried out by research centres considered and the way those activities are interpreted by scientists and communicators, without question the deficit model maintains a dominant position. This substantial immobility, however, flies in with an interest in experimenting with new ways of designing and implementing initiatives of PCST and PE. This constant search for new means to achieve the same goal – namely to render the public scientifically literate – is not contradictory and does nothing but provide further validation of the elements suggested by Young and Matthews (2007), that scientists like to maintain a position of control even when scientific knowledge comes into play in the context of everyday life and thus directly implicates other social actors.

From this point of view the fact that scientists give a positive evaluation of their relationship with the media is compatible with their negative judgment towards the way the media talk about science; similarly, the preference given by scientists for the direct interaction with the public is easier to understand (i.e. in those occasions in which the scientists' presence can guarantee the goodness of what is communicated). On the other hand, the persistence of the deficit model is a significant element in the transmission metaphor that underlies the idea scientists have of communication. Consequently, instead of recognizing that communication always has uncertain outcomes, they prefer to place

responsibility for the unsatisfactory results of PCST on media professionals and imagine that the direct interaction between scientists and the public could improve things.

However, if opposing the dynamism of means to the immobility of goals might seem a contradiction at a first look, there is, on the contrary, a real contradiction, because the personal commitment of scientists in SiS activities conflicts with the recognition that they do not have the time, or, rather, that they should take time away from their "real" activities: doing research. Interaction with the public becomes a task to be delegated to others or is a marginal occupation compared to the 'core business' of doing research. In this way the importance of the institutional factor emerges, namely the lack of recognition by research institutions of undertaking SiS activities as an integral part of the profession of the researcher.

APPENDIX: Transcription Conventions:

Punctuation markers are not used as grammatical symbols but for intonation:

.   "dot" is used for falling intonation
?   "question mark" is used for raising intonation
,   "comma" is used for raising and falling intonation
:   "colon" indicates that the prior syllable is prolonged
// "double oblique" indicates the point at which a current speaker's talk is interrupted by the talk of another
=   "equals" sign indicates no interval between the end of a prior and start of a next section of talk
(xx) "numbers in parentheses" indicate intervals without speech in tenths of a second
_   "underscoring" indicates stressing of a word or of a group of words
() "empty parentheses" indicate talk too obscure to transcribe. Words or letters inside such parentheses indicate the transcriber's best estimate of what is being said or who is saying it.
(( )) "words in double" parentheses indicate transcriber's comments, not transcriptions

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Scientificamente provato?

Controversie biopolitiche nel trattamento dell'iperplasia surrenale congenita

Elisa A.G. Arfini

Abstract Negli studi socio-antropologici, l'intersessualità è spesso assunta a caso paradigmatico: una "naturale" smentita della "naturale" differenza tra i sessi. Nell'Occidente contemporaneo, il contesto socio-culturale a cui è delegata la costruzione, assegnazione e stabilizzazione del sesso è in primis il campo biomedico. La costruzione del sapere medico sull'intersessualità attraversa attualmente un momento di grande instabilità, causata in parte dall'intervento di soggetti non appartenenti all'establishment tecno-scientifico. Questo contributo si propone di mappare una particolare controversia, relativa alla sicurezza e opportunità di utilizzo di un farmaco che è in grado di prevenire, nei soggetti femmina, la virilizzazione dei genitali causata da un'anomalia congenita.

Keywords controversie tecnoscientifiche; intersessualità; costruzione del sesso; patologizzazione; gruppi di pazienti.

> L'anomalia o la mutazione non sono in se stesse patologiche.
> Esse esprimono altre possibili forme di vita.
> Georges Canguilhem

1. Introduzione

L'intersessualità ha ricevuto molta attenzione nelle scienze umane. Fin dallo studio seminale condotto nel 1990 da Suzanne Kessler (Kessler 1990; 1998), si sono cimentati con la ricerca sull'intersessualità sociologi della scienza (Fausto-Sterling 2000), antropologi (Karkazis 2008), storici (Dreger 1998; 1999; Daston e Park 1995; Reis 2009), etnografi (Preves 2000; 2003), teorici *queer* (Butler 2004; Rosario 2009; Morland 2009a) e altri (Kraus 2010; Sytsma 2006; Hillman 2008; per una rassegna recente si vedano: Holmes 2009, a cura di, e Morland, a cura di, 2009). Nonostante sia una realtà emergente all'interno di un discorso prettamente medico, dove comunque occupa lo status marginale, incerto e multiforme

di malattia rara, è negli studi di genere che l'intersessualità occupa un posto d'onore e onere (Butler 2004; Monceri 2011; Fausto-Sterling 2000). Generalmente, al di là dei differenti posizionamenti disciplinari delle autrici e autori che ne trattano in ambito socio-antropologico, l'intersessualità è assunta a caso paradigmatico in quanto "naturale" smentita della "naturale" differenza tra i sessi. La naturalità dei sessi in un quadro costruzionista è il risultato di un'interazione sociale. Il contesto culturale in cui avviene questa interazione, perlomeno nell'Occidente contemporaneo, è il campo biomedico. Quando in sala parto si annuncia "congratulazioni, è una bambina!\è un bambino!", si dà inizio alla catena di enunciati performativi che stabilizzano il genere. Quando non è possibile enunciare il genere con la sufficiente certezza, il processo di costruzione del genere è interrotto, disturbato, esposto. Dal momento che la risoluzione dell'incertezza deve giocarsi nel campo in cui è prodotta, ne consegue che l'establishment biomedico sarà il principale attore nel processo di normalizzazione dei generi non conformi.

Il fatto che nascano esseri umani e che questi vengano assegnati a un genere in concomitanza della nascita[1] è generalmente assunto come dato a-problematico. Anche il mantenimento di una coerenza al genere assegnato lungo il corso di vita è generalmente dato per scontato e uniformemente imposto all'interno degli ordini discorsivi (Arfini 2007). Tale a-problematicità è ciò che naturalizza il genere, lo ammanta di inevitabilità e lo ancora a una serie di costrutti naturali: i due sessi esistono negli esseri umani proprio come nel regno animale e sono le condizioni imprescindibili per la capacità riproduttiva, e dunque per la sopravvivenza della specie. Può non essere facile decostruire questi assunti, dal momento che la naturalizzazione è costantemente prodotta e mascherata da Natura (Arfini 2011b), ma è una operazione necessaria per mettere in luce il carattere costruito e situato della differenza di genere, per ampliare quindi la conoscenza del mondo sociale, delle sue differenze e del modo in cui queste diventano diseguaglianze.

Questo contributo[2] si occupa di un'anomalia congenita (l'iperplasia surrenale congenita) che coinvolge aspetti legati alla definizione del sesso e della sua gestione in quanto patologia nell'ambito biomedico. L'anomalia in questione presenta un quadro fisiologico complesso: coinvolge sia aspetti legati alla definizione

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[1] Ma sempre più spesso prima della nascita, grazie alle tecnologie che consentono di "vedere" il sesso a un livello sempre più microscopico, per esempio a livello del DNA delle cellule, o a quelle più diffuse che consentono di vedere il feto tramite ecografia.

del sesso (ovvero la virilizzazione dei genitali), sia aspetti che riguardano la salute sistemica del soggetto portatore (quali la perdita di sali). Questi ultimi richiedono attenzione medica e terapie di controllo. Gli aspetti legati alla definizione del sesso, invece, benché anch'essi medicalizzati, non rappresentano un rischio immediato alla salute del soggetto. È questa porzione dell'anomalia la più complessa, perché riguarda la gestione medica di un fatto sociale (ovvero la definizione del sesso) soggetto a decisa naturalizzazione discorsiva. L'aspetto dell'anomalia legato alla definizione del sesso, inoltre, è il polo più controverso e contestato da parte di soggetti non appartenenti all'area medica. Questo contributo si propone di mappare una particolare controversia emersa con l'entrata in scena dei gruppi di pazienti e degli esperti laici nel movimento *intersex*, controversia relativa alla sicurezza e opportunità di utilizzo di un farmaco che è in grado di prevenire l'aspetto dell'iperplasia surrenale congenita legato alla definizione del sesso (la virilizzazione dei genitali). L'opportunità di utilizzo del farmaco è contestata sulla base di diversi livelli e retoriche che questo contribuito intende mappare: sono mobilitate considerazioni sui possibili effetti collaterali del farmaco, sui protocolli etici di somministrazione sperimentale, sul rapporto rischio\beneficio, ma anche sul significato sociale della medicalizzazione di genitali anomali.

Dopo una nota che esplicita alcuni presupposti teorici sulla costruzione sociale del sesso e della scienza, e che rende conto dei principali strumenti metodologici e materiali utilizzati, procederò a introdurre i termini della controversia che, per essere compresa, deve però essere accompagnata da una breve descrizione sulla natura dell'anomalia, redatta in base a quelle che sono le conoscenze scientifiche attualmente stabilizzate. Successivamente, inserirò questo particolare caso nel quadro più ampio dell'intersessualità così come è concepita nel paradigma biopolitico contemporaneo (Rose 2006). Continuerò quindi con la vera e propria analisi della controversia, per passare infine ad alcune conclusioni.

2. La costruzione del sesso come stabilizzazione della verità scientifica.

L'intersessualità è un ibrido natural-culturale o material-semiotico (Latour 1991; Haraway 1990). Che cosa conta come intersessualità può dipendere da assetti legislativi, tecnologie di visione biomedica, politiche di costruzione e mantenimento del binarismo di genere, disponibilità di tecniche di manipolazione chirurgica del corpo umano, valutazione morale, scientifica e politica dell'omosessualità, possibilità di sintesi di determinate molecole nonché dai termini che si usano per designarla come fenomeno, dal classico "ermafroditismo" al più recente "disordini dello sviluppo sessuale". È quindi un campo molto complesso da seguire. La sua notevole fluidità ontologica la rende un buon esempio di fatto esistente non in quanto essenza ma in quanto risultato di una rete di relazioni che coinvolgono retorica e materia. La sua ontologia ha storicamente attraversato profonde modificazioni a seconda dei paradigmi biopolitici secondo i quali è stata definita. Identificare chi detiene l'autorità per definire

l'intersessualità come tale in una determinata configurazione sociale è importante perché tale soggetto coinciderà con chi ha l'autorità di definire il sesso di tutti gli individui, nonché i parametri che definiscono chi conta come uomo e chi conta come donna. Questa autorità è detenuta, nella nostra società, dall'istituzione medica che produce il sapere scientifico sui corpi umani. La definizione di intersessualità quindi, dipenderà da fattori tanto disparati quanto la concezione di omosessualità nella psichiatria e la velocità operativa delle tecnologie di screening genetico, la stato globale del mercato farmaceutico e gli equilibri di potere tra diverse specialità cliniche.

L'ambiguità generata dall'intersessualità mette in crisi e in luce la produzione strutturale del sesso. Infatti, in un quadro costruttivista – debitore dei concetti di decostruzione (da Derrida), performatività (da Butler), rete (da Latour) e significato posizionale (da Sassure), possiamo dire che: il sesso non esiste, esistono solo le differenze tra i sessi; il sesso, cioè, non esiste al di là delle norme che definiscono il confine tra le due entità (maschio e femmina), che tuttavia non hanno caratteristiche intrinseche che consentano all'una di esistere senza l'altra. Se la conoscenza scientifica è conseguenza non del pensiero ma della socializzazione, è possibile seguirne le tracce, anche se essa si presenterà sempre come "già fatta". Tutte le affermazioni scientifiche che in questo lavoro vengono presentate come "verità", sono tuttavia anch'esse il risultato non di una scoperta, ma di una verità stabilizzata. Per visualizzare questo concetto Latour (1984: 12) ricorre alla figura del Giano bifronte: una faccia parla con la voce della scienza già fatta, l'altra con la voce della scienza in costruzione. Il quarto motto di Giano recita: "se le cose sono vere restano valide" \ "se le cose restano valide, cominciano a diventare vere"; ai fini della nostra analisi il quarto motto di Giano verrà così modificato (Fig. 1):
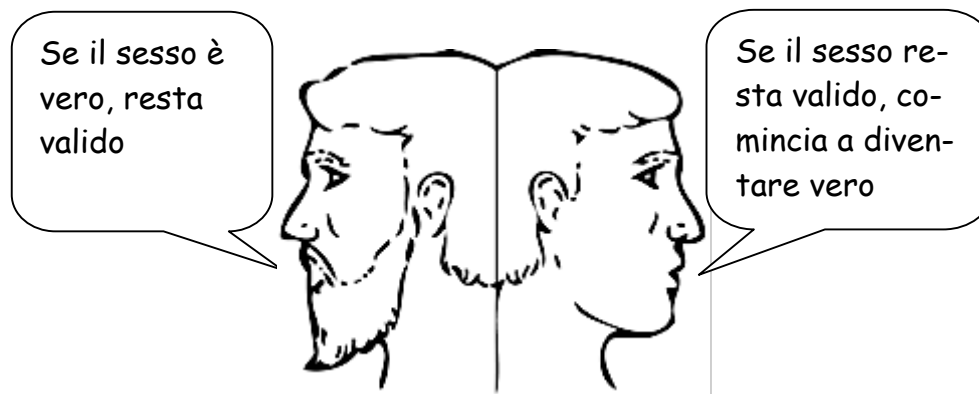

Fig. 1 – La costruzione scientifica del sesso.

La medicina, in quanto "pratica dell'eterogeneo" (Bruni 2008) è il nodo maggiormente responsabile della creazione scientifica del vero sesso. In questa analisi seguiremo da vicino, fornendo una lettura ravvicinata, una descrizione fitta, una particolare controversia che ci consentirà di sbirciare nella scatola nera dell'intersessualità e vedere cosa accade quando, come dice Giano, il sesso comincia a diventare vero.

Nello studio di una controversia, che è sostanzialmente una disputa sulla verità (Engelhardt e Caplan 1987), ma più profondamente è una lotta per la definizione della realtà, possiamo seguire la mescolanza di *fatti* e *valori*, ormai non più ordinatamente separabili, che crea la scienza (Law e Williams 1982; Pinch 1981). Come sostengono Fujimura e Chou (1994 1022, trad. mia): "diversi poli della controversia parlano diversi linguaggi di verifica […] usano e fanno riferimento a diversi stili per assegnare la 'verità' ".

Il presupposto fondamentale di una prospettiva sociologica sulla produzione del sapere scientifico è il principio di simmetria nell'analisi. Questo principio venne formalizzato già dal cosiddetto "programma forte" della sociologia della conoscenza scientifica di David Bloor (1976). Nonostante il programma sotto molteplici aspetti sia stato totalmente riformulato da Latour e la prospettiva ANT[3], il principio di simmetria rimane un suggerimento prezioso nel caso di studio di una controversia perché impone l'utilizzo dei medesimi strumenti per valutare le affermazioni di verità che provengono tanto dal versante scientifico quanto dal versante laico. Mentre una posizione positivista dà per scontata la validità delle affermazioni provenienti dal pulpito della scienza, e si riduce a dovere spiegare perché il polo costituito dagli attori laici (es.: la pubblica opinione, i gruppi di pazienti) persiste nell'errore, una posizione simmetrica non dà per scontata la coincidenza di verità e scienza, nonostante il versante degli esperti credenzializzati abbia maggior credibilità scientifica e autorità cognitiva. Bisogna notare però che la simmetria di metodo non necessariamente si traduce in una neutralità di posizionamento: riflessivamente anche la conoscenza sociologica sarà *situata*, più o meno vicino a uno dei due poli. Inoltre, come notano Brian Martin e altri (Scott, Richards e Martin 1990; Martin 1998), la conoscenza prodotta dall'analista della controversia potrà essere usata dalle stesse parti in causa, e solitamente viene usata dalla parte laica perché è quella dotata in partenza di minori credenziali, mentre il polo scientifico è solitamente più sensibile alle intrusioni di esperti provenienti da altri campi. Ciò porta Chubin e Restivo (1983) a concludere che è necessario ora proporre un "programma debole" della sociologia della conoscenza, il quale possa dare riflessivamente conto del coinvolgimento dell'analista – con il suo bagaglio valoriale e politico – nell'analisi, consapevoli del precetto pragmatico secondo il quale "l'obiettività nell'analisi non implica […] la neutralità nelle conclusioni" (Musiani 2010).

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[3] Per un sommario delle rispettive posizioni si veda il commento di Bloor all'opera di Latour apparso su *Studies in History and Philosophy of Science* (Bloor 1999) e la relativa replica di Latour sullo stesso numero (Latour 1999).

3. Il sapere sull'intersessualità nel paradigma biopolitico contemporaneo

La costruzione del sapere medico sull'intersessualità attraversa attualmente un momento di grande instabilità, causata in parte anche dall'intervento di soggetti non appartenenti all'establishment tecno-scientifico. Molti soggetti sono infatti implicati nella produzione di conoscenze sull'intersessualità: dai ricercatori in campo biomedico ai medici ospedalieri, dai pediatri di famiglia ai rappresentanti dell'industria farmaceutica. Più recentemente, con l'entrata in campo dei gruppi di pazienti[4], alcuni soggetti hanno voluto mettere l'accento sulla componente politica del fare scienza e del praticare medicina. In maniera non dissimile da quanto fatto dalla comunità GLBT negli Stati Uniti in relazione all'epidemia di HIV (Epstein 1998), i gruppi di pazienti hanno, da un lato, messo in evidenza come le verità scientifiche sull'intersessualità siano costruite in concorso con le verità culturali sul genere e, dall'altro, hanno acquisito i saperi esperti necessari a dialogare con l'istituzione medica. Questo dialogo ha incominciato a destabilizzare in maniera evidente il campo dell'intersessualità solo molti anni più tardi, rendendo malfermi i sigilli della "scatola nera" (Latour 1998, 5 e 349). Alla difficoltà d'analisi derivante da tale instabilità si affianca però la possibilità di studiare la costruzione di un fatto scientifico prima che esso venga definitivamente chiuso nella scatola nera che ne annulla la storicità rendendolo naturale.

Nella storia recente di queste revisioni, il 2006 è considerato (Hughes *et al.* 2007; Hughes 2010; Pasterski, Prentice e Hughes 2010) un anno di svolta nel campo dell'intersessualità. In quell'anno vengono formalizzate le linee guida per la diagnosi e la cura di questa serie di condizioni, che assumono anche una nuova terminologia, diventando Disorders of Sex Development. Il *Consensus Statement on Management of Intersex Disorders* (Huges *et al.* 2006) viene raggiunto anche grazie alla pressione di associazioni e gruppi di interesse, che insistevano da tempo per una revisione dei parametri. Le principali innovazioni introdotte nella pratica possono essere riassunte in quattro punti:

a) Revisione della terminologia. È stata adottata pressoché universalmente una nuova terminologia che sostituisce "intersessualità" con "DSD", "Disorders of Sex Development": il nuovo termine viene considerato scientificamente più preciso e corretto, perché fa riferimento all'eziologia della condizione e non alla sua presentazione fenotipica.

b) Revisione della classificazione: la revisione della terminologia in campo medico non è una mera operazione di facciata ma porta con sé anche una revisione ontologica, che modifica quindi non solo il modo in cui viene chiamata una determinata condizione, ma anche cosa conta come condizione patologica. Il *Consensus Statement* ha prodotto un ampliamento delle categorie diagnostiche, che

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[4] Tra le prime e più importanti associazioni di questo tipo va menzionata almeno la Intersex Society of North America che, fondata nel 1993, è rimasta per molti anni un punto di riferimento globale per le politiche *intesex.*

aumenta quindi il numero totale di casi che ricadono sotto la categoria DSD, così come la varietà di condizioni rappresentate

c) Multidisciplinarietà: il *Consensus Statement* raccomanda che la cura dei DSD sia affidata a un team multidisciplinare. Questo rappresenta un cambiamento rispetto alle pratiche passate, in cui era principalmente il chirurgo a gestire i casi di ambiguità genitale, conformemente al paradigma di cura allora predominante che assegnava priorità all'aspetto esterno dei genitali. Attualmente ci si è invece orientati verso una teoria multifattoriale, in cui l'identità di genere è considerata l'aggregazione degli effetti di una pluralità di fattori – genetici, ormonali, ambientali, etc., ciascuno dei quali deve essere preso in cura da diverse specialità.

d) Interventi conservativi: uno dei temi su cui associazioni e gruppi di pazienti si sono battuti più apertamente è la pratica della chirurgia genitale normalizzante. Indubbiamente il settore più controverso, nonché paradigmatico, dell'intersessualità – la chirurgia – ha subito un notevole ridimensionamento. Nonostante l'intervento precoce sia comunque preferito per ragioni tecniche (maggior facilità di manipolazione dei tessuti), vengono ora valutati altri parametri oltre alla fattibilità tecnica, in primo luogo la possibilità che il paziente possa fornire il proprio consenso, e quindi l'opzione di deferire gli interventi in età per lo meno pre-adolescenziale. Vengono in generale effettuati meno interventi alla nascita, e viene preferita ove possibile un'ottica conservativa, in cui l'effetto cosmetico viene messo in secondo piano rispetto alla funzionalità. Sono inoltre sperimentate nuove tecniche che consentirebbero una più facile revisione qualora il\la paziente in età adulta chiedessero il cambiamento del genere assegnato.

La Consensus Conference di Chicago segna, almeno a livello narrativo, la definitiva archiviazione del modello paternalista e normativo della medicalizzazione dell'intersessualità, che – identificato con la scuola di John Money e il suo modello dell'Optimum Gender Rearing (OGR) (Money 1968) – era caratterizzato da un approccio principalmente chirurgico in quanto privilegiava la valutazione estetica dei genitali e l'intervento precoce[5].

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[5] L'OGR è anche la ragione per cui in caso di ambiguità genitale il paradigma Money tendeva ad assegnare il genere femminile; è infatti (tuttora) più facile ri\costruire chirurgicamente genitali esterni femminili piuttosto che maschili. In base all'OGR, l'identificazione di genere si sarebbe sviluppata correttamente in accordo con i genitali "forniti". La clamorosa smentita (Diamond e Sigmundson 1997) di questa teoria in seguito al famoso caso di David Reimer (un paziente di Money il cui trattamento di riassegnazione fu fallimentare) arrivò nel 1997 quando il paradigma (e il personaggio) di Money era già comunque in declino in seguito alle nuove scoperte in campo genetico e endocrinologico. Per una ricostruzione giornalistica della vicenda Reimer, anche nota con lo pseudonimo clinico Jon/Joan, si veda Colapinto 2000.

4. Nota metodologica

Il mio posizionamento metodologico ed epistemologico prende le mosse dalle letture socio-antropologiche dell'intersessualità che si collocano nel solco della teoria femminista e GLTBQ (Kessler 1990; Karkazis 2008; Morland 2009a), influenzando la mia lettura e la mia condotta sul campo. Riporterò un estratto di conversazione con un ricercatore, che rende conto di che cosa accade durante l'interazione tra i rispettivi *bias* socio-culturali e scientifici. L'argomento della conversazione è la correlazione tra esposizione agli androgeni in utero e virilizzazione del comportamento. Per valutare questo aspetto sono generalmente usati dei test in ambiente controllato in cui bambini e bambine vengono fatti giocare con giocattoli più o meno "maschili" (es. un camioncino) o "femminili" (es. una bambola) o "neutri" (es. dei pennarelli) (Nordenström et al. 2006). Il ricercatore raccontava di come le bambine esposte ad alte dosi di androgeni nel periodo prenatale mostrassero una chiara predilezione per i giocattoli "maschili":

Ricercatore scientifico: [quelle bambine] giocavano solo con il meccano, il che è interessante. Sapevano esattamente cosa fare, sapevano esattamente come montare i pezzi e come dovessero essere combinati.
Sociologa (io): il che suggerisce che avessero già una certa familiarità con quel tipo di gioco?
Ricercatore scientifico: o forse che possiedono un'elevata abilità spaziale tri-dimensionale.

Di fronte a una determinata performance, a seconda del posizionamento è stato considerato determinate il fattore ambientale oppure il fattore congenito. Il dato rimane lo stesso, ma, "affermazioni, teorie o fatti, sono 'veri in base' a insiemi di tecniche auto-autenticanti che hanno luogo all'interno di particolari stili di pratica scientifica" (Fujimura e Chou 1994, 1017, trad. mia). A seconda di come e da chi sono mobilitati, gli stessi dati possono "essere interpretati in modi diversi al fine di sostenere versioni diametralmente opposte" (Fujimura e Chou 1994, 1017, trad. mia): troveremo in questo studio un ottimo esempio costituito dalla citazione selettiva delle linee guida (vedi § 7). Estenderei l'argomentazione verso l'ipotesi che i dati stessi, o meglio cosa conta come dato, è costruito in base al gruppo da cui viene utilizzato (per un gruppo di pazienti l'esperienza di un altro genitore può essere molto preziosa, per un gruppo di ricercatori un trial a doppio cieco vale sicuramente di più). Il dibattito su quali tipi di "prova" possano essere considerati validi in base al paradigma della medicina basata sulle evidenze (EBM) è sintomatico della natura costruita di ciò che viene considerato un "dato"[6].

Ho appreso i primi strumenti necessari a leggere la letteratura bio-medica tramite la rassegna della letteratura sia biomedica che socio-antropologica. Successivamente ho acquisito le conoscenze minime per poter sostenere una conversazione tecnica sul tema e seguire così anche gli attori in campo biomedico, prin-

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[6] Per una dura critica, di stampo deleuziano, ai meccanismi escludenti dell'EBM, si veda Holmes *et al.* (2006).

cipalmente tramite la frequentazione di convegni nazionali e internazionali sul tema, che sono stati anche l'occasione per effettuare una prima mappatura del vasto e multidisciplinare campo dei DSD. In seguito ho trascorso un periodo di ricerca sul campo presso un centro di eccellenza di cura dei DSD situato in Svezia[7].

Dal punto di vista empirico questo studio è stato condotto con quello che Venturini (2009) identifica come un certo minimalismo teorico e metodologico ben riassunto dalla laconica frase che pare Latour pronunci a chi chiede lumi sui metodi di studio delle controversie: "just look at controversies and tell what you see" [guardate le controversie e dite cosa vedete] (Latour cit. in Venturini 2009, 2). Se Venturini nel suo articolo mette in guardia dall'apparente semplicità delle parole "*just*" e "*controversies*", qui vorrei soffermarmi sulle parole "*look*" e "*see*", ovvero sulla costruzione della visione.

Per poter maneggiare il numero e la complessità delle interazioni tra gli attori coinvolti, ho prodotto, in conclusione all'analisi, una mappa della controversia (Fig. 4). L'immagine è una mia elaborazione visuale degli attori e dei nodi mappati nel presente saggio, ordinati in base alla relazione di supporto o conflitto con la materia oggetto del contendere. Sono stati rilevati tre assi di analisi. In primo luogo il rapporto di conflitto o cooperazione, che individua la modalità con cui gli attori sono mobilitati gli uni rispetto agli altri. In secondo luogo è indicato il campo a cui afferiscono gli attori (campo biosociale per le associazioni di pazienti, campo bioetico, campo della ricerca medico-scientifica). Infine, secondo la sensibilità tipica dell'approccio STS, sono segnalati gli attori umani e non-umani (il nodo Lajic S., Nordenström A., Hirvikoski, T. è stato indicato come ibrido in quando rispetto a Svetlana Lajic rappresenta colleghi di ricerca mentre rispetto a fetaldex.org rappresenta un testo citato).

Ho inoltre trovato utile visualizzare il posizionamento di alcuni dei ricercatori all'interno della propria rete relazionale di ricerca. A questo fine si può fare ricorso alla rappresentazione grafica delle co-citazioni di autori in campo biomedico. Si può produrre accedendo al database biomedexperts.com. Sebbene il sito sia pensato più come strumento di collaborazione e networking tra gli esperti del campo, può essere utile anche per avere un primo, rapido quadro della posizione di un attore che si sta seguendo.

Esistono certamente strumenti più sofisticati per mappare le controversie nell'era di Internet. Lorenzet (2010) ne indica svariati. Dal momento che la controversia oggetto di questa analisi si è svolta in parte anche sul web, potrebbe es-

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[7] Il quadro più ampio in cui si colloca questo studio è una ricerca condotta presso il Dipartimento di Scienze Storiche dell'Università di Ferrara nell'anno 2011\12 e in parte condotta all'estero grazie a un finanziamento della Fondazione Fornasini, Poggio Renatico, Ferrara. Durante il mio soggiorno, ho condotto nove interviste a medici e ricercatori, e numerose conversazioni informali, oltre a interviste con rappresentati di gruppi e associazioni che si occupano di intersessualità in Svezia.

sere interessante analizzare una mappatura del suo svolgimento on line, che per ragioni di spazio non è possibile offrire in questo contributo[8].

Proseguiremo invece fornendo i presupposti della controversia, ovvero un breve quadro sul farmaco oggetto della contestazione. Quali aspetti dell'anomalia consente di prevenire? Perché il suo uso è contestato? I presupposti del dibattito consentiranno di identificare in primo luogo i diversi livelli sui quali si svolge la controversia: quello scientifico relativo alla sicurezza del farmaco e quello culturale relativo alla normalizzazione dei sessi.

5. La controversia: tra instabilità scientifica e normalizzazione sociale.

La controversia che andremo ad analizzare ruota intorno all'uso del desametasone (DEX), un farmaco corticosteroide utilizzato, a partire dalla metà degli anni '80 (David e Forest 1984) per il trattamento prenatale di una sindrome legata all'intersessualità detta "iperplasia surrenale congenita" o, meglio, non della sindrome in sé, ma di un suo particolare effetto: la virilizzazione dei genitali esterni. Come anticipato, l'anomalia coinvolge svariati aspetti della fisiologia dei soggetti portatori. Alcuni sintomi sono molto pericolosi per la salute del paziente: per esempio la crisi surrenalica acuta è potenzialmente letale. Il desametasone non tratta questi aspetti, ma agisce esclusivamente sulla virilizzazione dei genitali.

In alcuni soggetti XX (che generalmente chiamiamo "femmine"), possono essere talmente virilizzati da far sì che questi soggetti vengano, alla nascita, assegnati al sesso maschile. In quei casi in cui invece si intende mantenere congruente il dato genetico con l'assegnazione di genere, i neonati XX che presentano genitali virilizzati possono essere sottoposti a interventi chirurgici volti a normalizzare l'apparenza dei genitali. Questo tipo di intervento è il più controverso dal punto di vista politico: rappresenta, nella storia dei gruppi di pazienti e di attivisti, il simbolo dell'azione normalizzatrice dell'istituzione medica. Per preservare una conformità di genere dettata non da esigenze di salute ma da norme culturali, gli attivisti hanno denunciato gli innumerevoli effetti collaterali delle chirurgie, che vanno dall'esperienza stigmatizzante alla perdita di sensibilità erotica. La chirurgia genitale su neonati intersessuati, e in particolare la chirurgia femminilizzate, è

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[8] È disponibile presso l'autrice una mappatura ricavata tramite il tool IssueCrawler (servizio che viene offerto gratuitamente, dietro registrazione, dalla Govcom Foundation di Amsterdam). Tale mappa fornisce una resa visiva della vicinanza o distanza dei vari attori online, nonché degli attori che occupano la posizione dei nodi centrali. Nel caso di questa controversia, il nodo verso il quale è indirizzato il maggior numero di link (pediatrics.aappublications.org) corrisponde al documento del Consensus Statement di Chicago, confermando così il ruolo delle linee guida nelle controversie: ovvero quello di fornire valore di prova a più di un polo della controversia, in base alla selettività delle citazioni che i gruppi ne fanno.

stata inquadrata dagli attivisti come la versione occidentale della mutilazione genitale femminile[9], e come una violazione dei diritti umani[10].

Il trattamento proposto quindi, consentirebbe di evitare il ricorso a queste pratiche così controverse. Tuttavia, a partire dagli anni '90 con studi sul modello animali e più recentemente in seguito ad alcuni studi longitudinali su soggetti umani, parte della comunità scientifica ha cominciato ad adottare posizioni via via più cautelative sui possibili effetti collaterali a lungo termine di questo trattamento. Il rapporto rischi\benefici di questo trattamento è inoltre difficile da valutare perché, per ragioni tecniche, i soggetti a rischio vengono trattati *prima* che si possa sapere se il feto sia effettivamente affetto della sindrome, in una ratio di 1 a 8 (statisticamente su 8 feti solo 1 è affetto, 7 vengono trattati a breve termine senza che siano portatori). A queste incertezze scientifiche si è aggiunto l'intervento di alcuni attivisti e gruppi di pazienti, che hanno pubblicamente ed esplicitamente attaccato sia l'opportunità terapeutica offerta, sia i presupposti culturali normalizzanti che ne sottendono l'amministrazione.

Il caso del trattamento prenatale della CAH illustra bene un tipo di questione che emerge come controversia puramente scientifica in cui la verità che si intende aggiudicare ha a che fare con la valutazione di sicurezza di un determinato farmaco. Questo livello della controversia si dipana tramite l'utilizzo di stili di argomentazione e tipologie di evidenza tipicamente biomediche: esperienze cliniche, studi longitudinali (*follow up*) su pazienti trattati, esperimenti su modelli animali, e così via, che vengono mobilitati per rispondere alla domanda: il farmaco è sicuro? Esiste però un ulteriore livello su cui si può articolare la controversia, e che presuppone a monte una disputa culturale, ovvero: sono accettabili genitali virilizzati in un soggetto XX? L'analisi della controversia non consentirà di rispondere alla prima domanda, ma chiarirà invece le ragioni sottostanti alla seconda.

Prima di addentraci nell'analisi, però, in ragione del principio di simmetria, dobbiamo fornire un breve sommario della condizione che sta al centro della disputa: si chiarirà l'eziologia della sindrome, si metteranno in evidenza gli aspetti legati alla definizione del sesso e verrà fornito un sommario sul trattamento prenatale che è oggetto della controversia.

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[9] A tale proposito possiamo rinviare a una recente petizione proposta dall'associazione per la tutela legale dei pazienti Advocates for Informed Choice al Segretario di Stato Hillary Clinton, in cui viene sollecitata una presa di posizione sull'argomento proprio sulla base dell'impegno storico del Segretario Clinton contro la pratica delle mutilazioni genitali. http://www.change.org/petitions/hillary-clinton-call-for-an-end-to-cutting-intersex-girls-genitals-in-the-us (consultato il 25/11/2012).

[10] Tra i gruppi che usano esplicitamente il frame dei diritti umani per orientare la propria azione possiamo citare Zwischengeschlecht, basato in Svizzera, e Genital Autonomy, basato in Inghilterra.

6. L'iperplasia surrenale congenita (CAH)

L'iperplasia surrenale congenita o iperplasia adrenale congenita[11] (ovvero CAH - *Congenital adrenal hyperplasia*) è una sindrome genetica autosomica recessiva (Childs *et al.* 1956) (ovvero, sono sintomatici solo gli individui che portano alterazioni in entrambe le coppie del gene) caratterizzata dall'iperplasia (crescita di volume di un organo derivante dall'aumento del numero delle cellule che lo compongono) delle ghiandole surrenali. Notiamo quindi in primo luogo che la denominazione della sindrome non fa accenno ad aspetti legati al sesso, che in effetti sono solo uno dei livelli in cui si esprime la sintomatologia della sindrome. Il termine italiano più diffuso per definire questa condizione prima che il Chicago Consensus Statement proponesse l'aggiornamento della terminologia era "sindrome adreno genitale" (SAG); l'uso di questo termine, tuttavia è (o dovrebbe essere) in declino in accordo con la nuova politica terminologica dei DSD che intende assegnare minor rilevanza alla variazione fenotipica dei genitali (ovvero al loro aspetto) e maggior attenzione all'eziologia delle specifiche condizioni (ovvero alla causa della condizione); pertanto, si parla ora di 46,XX CAH e 46,XY CAH. Possono infatti essere portatori o affetti sia individui XX, la cui assegnazione di genere è solitamente femminile (ma esistono casi di assegnazione dubbia), sia individui XY, questi ultimi sempre assegnati al genere maschile.

La CAH è una sindrome caratterizzata da notevole variabilità, ascrivibile, nel 95% dei casi, a varie mutazioni del gene CYP21A2 che causano un deficit di produzione di un enzima. A causa di questo deficit il complesso processo di biosintesi degli ormoni risulta alterato in modo tale per cui avviene un accumulo di androgeni, comunemente detti "ormoni sessuali maschili".

A seconda del tipo di mutazione possono presentarsi varie forme della sindrome, in ordine di gravità queste sono:

- forma classica con perdita di sali
- forma classica virilizzante semplice
- forma non classica ad insorgenza tardiva

Nella forma con perdita di sali il deficit enzimatico è totale, ed è questa la forma più pericolosa. Nei casi più gravi il neonato può andare incontro a shock da disidratazione e squilibrio elettrolitico che possono essere letali; è solo a partire dagli anni '50, quando il team di Lawrence Wilson, pioniere dell'endocrinologia pediatrica, introduce la terapia cortisonica, che i neonati affetti da questa grave forma possono sopravvivere (Auchus 2010; Wilkins *et al.* 1950). La sintesi chimica del cortisolo era allora storia recente, infatti divenne disponibile solo nel 1944 grazie alle scoperte del chimico statunitense Lewis Ha-

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[11] La prima descrizione della sindrome viene fatta risalire al 1865 ad opera di Luigi de Crecchio, un medico italiano (de Crecchio 1865). Ha un'incidenza stimata intorno a 1:10.000, 1:15.000 nati vivi (Therrell, 1998; Merke e Bornstein 2005).

stings Sarett per la casa farmaceutica Merck & Co (Grumbach e Shaw 1998, 216). Solo in seguito all'entrata nella rete di questo attore molecolare la ricerca sulla CAH è veramente fiorita, perché ha consentito ampia disponibilità di un materiale fino ad allora raro e di scarsa qualità. Grazie agli ormoni di sintesi quindi, i neonati portatori di forme più gravi possono superare crisi altrimenti fatali. Con la crescita, anche in ragione alla collaborazione attiva del soggetto affetto, le terapie risultano generalmente efficaci nel prevenire i sintomi più pericolosi della malattia. Riassumendo quindi, possiamo dire che, a parte la forma con perdita di sali, le altre mutazioni con cui si presenta questa sindrome non presentano rischi immediati alla salute e, anzi, la forma tardiva spesso non viene diagnosticata, mentre nei soggetti 46,XY anche la forma semplice può rimanere asintomatica.

6.1. Cosa c'entrano le ghiandole surrenali col sesso?

Questi sono gli aspetti medicalmente più rilevanti della condizione. Non hanno a che fare quindi con il genere o la sessualità, ma con il rischio di crisi surrenalica acuta che può presentarsi nelle prime settimane di vita, e che tuttavia può emergere anche successivamente in casi particolari (quali episodi febbrili, infortuni, anestesia generale, o a seguito di vomito o diarrea). Si conferma così l'ipotesi già avanzata da scienziati sociali (Dreger e Herndon 2009) e attivisti (Chase 2003), ovvero che l'intersessualità sia in primo luogo un problema di stigma e trauma, causato dalla patologizzazione di genitali anomali, patologizzazione che a volte mette paradossalmente in ombra la "reale" patologia, ovvero lo stato di salute del soggetto al di là dell'aspetto dei suoi genitali.
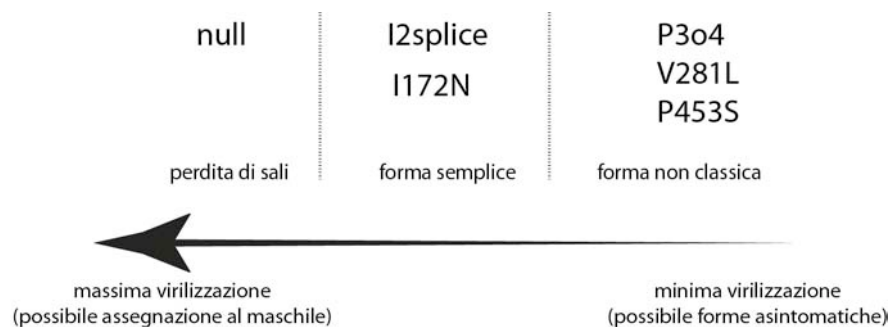

Fig. 2. – Schema della correlazione tra mutazione genetica e presentazione clinica (adattato da Lajic *et al.* 2004)

L'aspetto della CAH che è ragione dell'inserimento nella categoria dei DSD è l'iperandrogenismo, dovuto all'aumentata esposizione agli androgeni sia in utero che successivamente; si presenta alla nascita sotto forma di virilizzazione dei geni-

tali esterni nei soggetti 46,XX; nella forma non classica può presentarsi anche successivamente sotto forma di diagnosi di irsutismo, acne, alterazioni del ciclo mestruale (McLaughlin *et al.* 1990; Hassiakos *et al.* 1991).

Il grado di virilizzazione è molto variabile, ma è stata rilevata una correlazione abbastanza precisa tra tipo di mutazione genetica e presentazione clinica. La forma più grave della sindrome si ha nel caso della delezione completa ("*null*"), in cui il grado di virilizzazione è maggiore e in cui avviene la perdita di sali. La gravità è via via minore nelle forme derivanti dalle mutazioni I2splice e I172N, che sono dette "forme semplici". Le forme dette "non classiche" (P3o4, V281L, P453S) sono le meno gravi, al punto da essere in alcuni casi asintomatiche.

Questa caratteristica della sindrome è rilevante per uno studio sociologico della costruzione del sapere scientifico sulla CAH; le singole mutazioni infatti possono essere considerate degli attori molecolari che consentono la formulazione di ipotesi del tipo "grado di virilizzazione=f(x)" ovvero tra grado di virilizzazione e variabili dipendenti considerate significative. Con grado di virilizzazione si può intendere, nella letteratura medico-scientifica, non soltanto l'aspetto dei genitali ma anche tratti comportamentali quali la caratterizzazione di genere del comportamento e l'orientamento sessuale. Le ricerche progettate in base a queste premesse formulano ipotesi di correlazione calibrate sull'asse quantitativo, collocandosi nel solco di quel quadro teorico in base al quale la "maschilità" è effetto esponenziale dell'esposizione ad androgeni.

6.2. Trattamento pre-natale della sindrome

La virilizzazione dei genitali di soggetti 46,XX portatori di mutazioni *null*, I2splice e I172N, generanti la forma con perdita di sale e la forma semplice, può essere prevenuta tramite la somministrazione al feto di desametasone attraverso la madre. Il desametasone, a differenza di altri glucocorticoidi, è in grado di attraversare la barriera placentare e sopprimere così l'eccesso di androgeni che va a causare la virilizzazione. Il desametasone si è rivelato molto efficace nell'attenuare questo aspetto della CAH, minimizzando del tutto la virilizzazione dei genitali nell'85% dei casi trattati (Joint LWPES/ESPE CAH Working Group 2002). Tuttavia, e nonostante non ci siano prove evidenti di effetti collaterali concomitanti il trattamento a breve termine, studi sul modello animale (Nyirenda *et al.* 1998; Uno *et al.* 1990; Slotkin *et al.* 1998; Celsi *et al.* 1998) e ipotesi teoriche (Benediktsson *et al.* 1993) hanno messo in luce il rischio di effetti collaterali a lungo termine (Seckl e Miller 1997), in particolare per quanto riguarda effetti sul metabolismo e lo sviluppo cognitivo e psicologico; i pochi studi su soggetti umani non hanno consentito finora di poter trarre conclusioni definitive sulla sicurezza del trattamento, ma hanno messo in luce alcuni punti degni di approfondimento, sufficienti a raccomandare cautele (Meyer-Bahlburg *et al.* 2004; Trautman *et al.* 1995; Hirvikoski *et al.* 2007; Hirvikoski *et al.* 2008; Hirvikoski *et al.* 2011; Lajic *et al.* 2004; Lajic *et al.* 2008 Lajic *et al.* 2011; Joint LWPES/ESPE CAH Working Group 2002) e quindi installare quello stato di "incertezza condivisa" (Macospol

2007, 6 cit. in Venturini 2009) che accompagna l'aprirsi della scatola nera e di una controversia.

L'opportunità di impiegare il DEX è particolarmente difficile da valutare anche perché i feti a rischio vengono trattati – sebbene per un periodo limitato di tempo – *prima* che si possa sapere se il feto sia effettivamente portatore di CAH. Questo modifica radicalmente il rapporto rischi\benefici. Si tratta quindi di decidere se il farmaco è sicuro non solo per quei feti che potrebbero effettivamente beneficiarne, ma anche per quelli che verranno trattati solo sulla base di un'ipotesi di rischio. Ciò dipende da ragioni tecnologiche. Il trattamento infatti, per essere efficace, deve iniziare entro la sesta settimana di gravidanza, ma è possibile effettuare il test genetico per le mutazioni legate alla sindrome sul DNA fetale tramite villocentesi solo a partire dalla undicesima settimana. Questo è l'unico strumento attualmente disponibile in grado di selezionare i feti portatori della mutazione e i feti 46,XY. Infatti, l'iperplasia surrenale congenita è una sindrome di cui possono essere portatori anche soggetti 46,XY. Nei maschi, la sindrome può causare iperpigmentazione e aumentato sviluppo dei genitali (ma evidentemente negli uomini l'eccessiva virilizzazione non è motivo di preoccupazione medica) per cui i feti 46,XY non vengono trattati a termine. Pertanto tenendo conto dei casi in cui il feto non è portatore più quelli in cui è 46,XY (portatore o meno), 7 feti su 8 (l'85.7%) verranno trattati a breve termine per una condizione di cui non sono portatori[12].

0 sett. Concepimento

6-7 sett. Conferma gravidanza - Inzio DEX

11 sett. Villocentesi ⟶ Cariotipo se XY = STOP

se XX = Test DNA   DNA negativo = STOP

DNA positivo = continuazione DEX

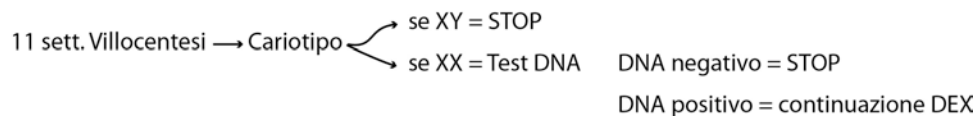Fig. 3 – Tempistica e diagramma del trattamento DEX pre-natale.

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[12] Questa stima si basa sul dato che la CAH è una sindrome autosomica recessiva, pertanto se entrambi i genitori sono portatori, la possibilità statistica di generare figli affetti è di 1 a 4. Considerando che i feti maschi, affetti o meno, non verrebbero trattati, la possibilità di generare figlie femmine affette arriva a 1 a 8.

7. La controversia tra scienza e bioetica

Nell'era post-Chicago, dopo la revisione della gestione medica dei DSD in ottica consensuale e centrata sul paziente, i protocolli di cura dei DSD sono sottoposti a più stretto scrutinio. L'atteggiamento generale è diventato certamente più prudenziale e meno sperimentale, più negoziato con i pazienti e meno direttivo; in questo quadro la discussione sull'uso del DEX oltrepassa i confini della comunità medica, diventando materia di discussione nei gruppi di pazienti e studiosi nelle scienze umane. Anche se preoccupazioni sugli effetti collaterali del trattamento sono state espresse almeno fin dal 1985 (Pang 1985), è solo recentemente che la costruzione del fatto scientifico esce dalla fase dell'applicazione prudenziale e arriva allo status di controversia. Questo passaggio è avvenuto anche grazie all'intervento di attori esterni al campo bio-medico.

Nel febbraio 2010 Alice Dreger, storica della medicina e bioeticista, autrice di un importante studio (1998) sull'ermafroditismo a partire dal tardo diciannovesimo secolo, studiosa in contatto – a volte anche problematico[13] – con vari soggetti politici nella comunità *intersex*, firma un lettera aperta (AA.VV. 2010), assieme a Ellen Feder, bioeticista, e altri 33 accademici, tra cui alcune voci autorevoli della ricerca sui DSD in ambito storico, filosofico e sociale, come Elizabeth Reis, Katrina Karkazis, Suzanne Kessler e Anne Fausto-Sterling. La lettera aperta, assieme a documentazione correlata, viene pubblicata su un sito web appositamente creato, chiamato fetaldex.org. La lettera è indirizzata al Food and Drugs Administration Office of Pediatric Therapeutics, al Department of Health and Human Services Office for Human Research Protections, e tre Università presso le quali la dottoressa Maria New, eminente pediatra endocrinologo, autrice di più di 600 pubblicazioni e tra i massimi esperti mondiali in materia di CAH, esercita o ha

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[13] La relazione di Dreger con la comunità intersex è controversa fin dal suo coinvolgimento nel processo di revisione della terminologia che è stato poi consacrato con il Consensus Statement del 2006, un documento di cui alcuni gruppi (in particolare il gruppo internazionale OII) sono molto critici. La situazione è poi precipitata in seguito all'affare Bailey, un'altra interessante controversia in cui Dreger si è trovata nel ruolo del difensore. La polemica scoppiò in seguito alla pubblicazione del libro di J. Michael Bailey – psicologo e docente presso la stessa Università a cui è affiliata Dreger, la Northwestern University – intitolato *The Man Who Would Be Queen: The Science of Gender-Bending and Transsexualism* (Bailey 2003). Il libro, in cui si espone la teoria in base alla quale la transessualità si configura come esito di un'inclinazione erotica e non come identificazione con il genere opposto, è stato aspramente criticato da alcune studiose e attiviste trans (Conway 2008). Le critiche mosse a Bailey non hanno riguardato tanto il contenuto della ricerca, ma piuttosto la modalità con la quale è stata condotta e presentata, attaccando in particolare la condotta etica sul campo dello studioso. In un corposo saggio (Dreger 2008) pubblicato nel monografico degli *Archives of Sexual Behaviour* dedicato alla vicenda, Dreger ha proposto una ricostruzione dei fatti contestati e si è schierata in netto supporto di Bailey, attirando così nuovamente le critiche anche da parte di soggetti legati alle politiche *intersex*.

esercitato in passato[14]. Quasi contemporaneamente, un documento molto simile viene redatto dall'associazione Advocates for Choice (2010), un'organizzazione di tutela legale per pazienti, ex-pazienti e i loro famigliari. In questa lettera aperta i firmatari esprimono preoccupazione per le pratiche di trattamento a base di DEX messe in atto dalla dottoressa Maria New, che al momento della pubblicazione opera presso la Mount Sinai School of Medicine.

Questi due poli, formati da Dreger, fetaldex.org, Advocates for Choice da un lato e Maria New dall'altro, rappresentano i contendenti espliciti della controversia e occupano le posizioni più nette rispetto al trattamento DEX, l'una apertamente contraria, l'altra palesemente a favore.

Bisogna notare però, che nonostante il posizionamento sostanziale di questi poli sia concepibile come "pro" o "contro" l'uso della materia oggetto di controversia, da punto di vista delle retoriche ci si oppone e si supporta esplicitamente non il trattamento in sé per sé, ma piuttosto il protocollo etico in base al quale viene somministrato. Nella lettera aperta, infatti, il problema del DEX viene identificato come una questione di consenso informato: a quanto risulta il trattamento di New non è somministrato dietro preventiva approvazione del comitato etico di riferimento delle istituzioni presso le quali la dottoressa esercita (IRB – Institutional Review Board), pertanto non c'è garanzia che le madri trattate ricevano un'informazione adeguata alla formulazione del consenso per un trattamento sulla cui sicurezza la comunità scientifica non si è mai pronunciata in maniera definitiva, ma rispetto al quale ha anzi sollevato diverse note cautelative.

È importante notare che, nonostante la lettera aperta rimandi a una serie di accreditate pubblicazioni scientifiche che assumono toni cautelativi nel confronti dell'uso del desametasone su feti umani e, nonostante si metta in luce la *ratio* particolarmente sfavorevole di trattamenti somministrati a breve termine senza effettiva necessità (7 feti su 8), l'inquadramento della controversia adottato dai firmatari non è di tipo scientifico, ma di tipo bioetico. Ciò che vogliono dimostrare i firmatari, quindi, non è che il trattamento della dottoressa New sia dannoso, ma il fatto che non sia eticamente corretto. Tuttavia, nel corso della controversia, i due livelli tenderanno a confondersi perché sia le critiche che le difese procedurali implicano e hanno come presupposto implicito una diversa valutazione di ciò che è accettabile come *embodiment* sessuato corretto e di che cosa è lecito rischiare per ottenerlo.

Dopo essersi consumata tra siti web, blog e mailing lists, la controversia approda infine nell'agosto del 2010 sulle pagine del prestigioso *American Journal of Bioethics*. Qui tutte le parti in causa prendono la parola, inclusa Maria New (New 2010), e ha luogo uno scontro frontale tra Alice Dreger e colleghi (Dreger, Feder e Lindemann 2010) e un gruppo di studiosi che ha come primo autore il bioeticista Laurence B. McCullough (McCullough *et al.* 2010a).

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[14] È rilevante notare che sono state chiamate in causa tutte le istituzioni presso le quali la Dr. New ha prestato servizio, perché i firmatari contestano la condotta del medico su un periodo piuttosto lungo.

In un breve articolo, Maria New rigetta categoricamente le accuse esposte. La difesa di New è costruita in un registro misto tra lo scientifico e il biografico: evidenze derivanti da ricerche mediche sono accostate a conclusioni tratte dalla propria personale esperienza di conoscenza di madri e pazienti. Con il primo tipo di retorica, New assicura di far parte di una più ampia comunità scientifica e di essere inserita in una catena di autorità che convalida il suo operato. Con il secondo configura una rappresentazione di sé umana e compassionevole; inoltre, sostenendo di "essere rimasta in contatto" con le proprie ex pazienti, trasforma lo spettro di un *follow-up* medico non autorizzato (paventato da Dreger) in un interesse per il benessere generale dei propri pazienti.

Dal punto di vista dell'argomentazione scientifica, New incomincia con l'elencare le più comuni complicazioni derivanti dalla chirurgia genitale, ovvero una sessualità compromessa (fattore correlabile anche al basso tasso di maternità, esso stesso annoverato tra le complicanze), la possibilità di formazione di tessuto fibrotico in sede vaginale, e l'occorrenza di fistole uretro-vaginali[15]. Vediamo quindi che la strategia qui scelta da New è quella di preferire un rischio a un altro.

Il rischio che il DEX abbia effetti collaterali non è definitivamente dimostrato mentre il rischio di complicanze derivanti da interventi chirurgici è ormai noto e quantificabile.

In questo breve ma paradigmatico articolo, New sembra incarnare perfettamente il ruolo della medicina nel quadro della biopolitica contemporanea: una disciplina altamente integrata in cui i confini tra salute e malattia, normalità e devianza, cura e potenziamento, normalizzazione e adattamento, sofferenza fisica e sofferenza sociale, si fanno sempre più sfumati. Il punto cruciale che mette in luce i presupposti culturali di questa controversia è rappresentato dal fatto che nonostante la posizione di New sia sostanzialmente critica della chirurgia genitale e scettica rispetto ai risultati che essa promette, tuttavia non viene minimamente scardinato l'assunto di base, ovvero che *genitali anomali devono essere normalizzati*, in un modo o nell'altro. La svalutazione della chirurgia genitale è meramente funzionale alla costruzione di una narrazione positivista che presenta un trattamento come l'evoluzione del precedente. Entrambi i poli della controversia sono contrari alla chirurgia genitale, ma per ben diverse ragioni. Chi sostiene il trattamento prenatale considera la chirurgia genitale un trattamento obsoleto, mentre chi si oppone alla normalizzazione genitale in tutte le sue forme (chirurgiche o farmacologiche) considera la chirurgia un trattamento inutile e scorretto. Per New, invece, il trattamento farmacologico è l'evoluzione tecnologicamente più avanzata della medesima ratio terapeutica che giustifica la chirurgia genitale.

La tappa successiva del processo evolutivo, adombrata dall'articolo di New, consisterebbe nello sviluppo – attualmente in corso – di un metodo di *screening*

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[15] Su quest'ultima complicanza New si sofferma con un inserto autobiografico, evocando l'immagine disturbante di tutte quelle donne da lei conosciute che sono "costrette ad indossare tamponi per assorbire la perdita costante di urina" (New 2010, 50).

fetale applicabile già dalla 6\7 settimana di gestazione; uno sviluppo narrativo e una ipotesi di ricerca che va quindi non nella direzione della *valutazione* del rischio, ma nella sua *minimizzazione*: una strategia che tutela e preserva i protocolli attuali.

Se l'articolo di New era finalizzato a consolidare l'autorità dell'autrice e a chiarire modalità e finalità del trattamento, il saggio principale redatto da McCullough analizza la lettera aperta di fetaldex.org in maniera, potremmo dire, chirurgica. La scelta di una lettura molto ravvicinata, che non sconfina mai oltre i limiti del testo pubblicato è una strategia che ha come conseguenza l'*isolamento* del nodo contestato e che al contempo rafforza il proprio nodo inserendolo in una rete il più possibile ampia di autorità connesse. La strategia retorica impiegata nell'articolo è quella del discredito tramite ragionamento sillogistico. Non si colloca appieno né in una cornice medica, né in una cornice bioetica, ma piuttosto in una cornice nominalista e minimalista che ha come scopo quello di screditare l'accusa, e dedurre a partire da inaccuratezze formali l'invalidità generale del documento di denuncia.

Nel proprio articolo e nella breve replica (Dreger, Feder e Lindemann 2010) concessa a Dreger sulle pagine della rivista, vengono rimbalzate varie accuse di citazione selettiva. La più interessante riguarda l'uso del testo delle linee guida del 2002 redatte dalla Lawson Wilkins Pediatric Endocrine Society and the European Society for Paediatric Endocrinology (LWPES/ESPE). Il testo di McCullough, per esempio, cita dalle linee guida che "esistono sostanziali divergenze di opinioni nel considerare o meno il trattamento prenatale della CAH come progetto di ricerca" (Joint LWPES/ESPE CAHWorking Group 2002, 4049, trad. mia) a supporto della tesi per cui il trattamento DEX non è sperimentale e quindi non richiede l'applicazione di particolari supervisioni etiche. Eppure, nota Dreger nella sua replica (Dreger, Feder e Lindemann 2010, 47), sulla stessa pagina del medesimo documento si prosegue con un'affermazione che va decisamente nella direzione opposta, ovvero di stretta supervisione di questo tipo di trattamento: "Crediamo che questa terapia, specializzata e impegnativa, debba essere amministrata da appositi gruppi, sulla base di protocolli approvati a livello nazionale o internazionale, e soggetta all'approvazione di commissioni di revisione istituzionali (IRB) o di comitati etici in centri riconosciuti" (Joint LWPES/ESPE CAHWorking Group 2002, 4049, trad. mia). Il ricorso alle linee guida, dovrebbe, nell'era della medicina basata sulle evidenze, potere portare alla risoluzione di qualunque conflitto. Ma la citazione, che nella rete della controversia è essa stessa un attore, può agire in modalità opposta a seconda dell'uso a cui viene piegata.

Un altro interessante esempio di attore che occupa una posizione cruciale ma ambigua nella controversia è rappresentato dall'associazione CARES Foundation, un gruppo creato per favorire la ricerca sulla CAH e fornire supporto alle famiglie e ai pazienti. Pur essendo un gruppo appartenente all'area della biosocialità e di esperti laici, così come i firmatari della lettera aperta contro l'uso del DEX, non si contrappone alla posizione di New, ma anzi la supporta, anche se in maniera non del tutto evidente.

La natura di questo rapporto di collaborazione è illustrato dalla voce di un ex membro dell'associazione (Green 2010), che riporta sul numero del *American Journal of Bioethics* una breve testimonianza a proposito della relazione tra New e CARES. Tale relazione è dipinta come ambigua e poco trasparente, ed è indicata come esemplare di una più generale posizione di soggezione della fondazione nei confronti dell'istituzione medica.

Così come non è corretto presumere che i gruppi biosociali siano sempre contrapposti all'establishment medico, altrettanto affrettato sarebbe concludere che un'associazione come la CARES occupi una posizione di sudditanza rispetto all'autorità scientifica. Di certo sappiamo che il gruppo CARES è uno dei luoghi di disseminazione, e probabilmente di reclutamento, della ricerca di New. Un breve articolo, datato 2003, è presente sul sito della fondazione, a firma di Elizabeth Kitzinger (di qualifica non specificata, ma affiliata alla Weill Medical School della Cornell University, la stessa istituzione presso la quale New lavorava prima di spostarsi presso il Mount Sinai). L'articolo annuncia la disponibilità del trattamento: un'opportunità preziosa la cui disponibilità si auspica possa essere diffusa al maggior numero possibile di famiglie. Il trattamento, si precisa, è amministrato di routine presso il reparto della dottoressa New. L'autrice consiglia di rivolgersi solo ad istituzioni che abbiano simile esperienza. La pagina web è attualmente corredata da un'avvertenza ad approfondire con ulteriori articoli sempre presenti sul sito, la conoscenza su questa materia definita ormai "controversa".

Uno di questi articoli di approfondimento è a firma di Svetlana Lajic, ed assume toni decisamente più cautelativi. La cautela di Lajic è ben giustificabile se si considera la rete di ricerca in cui è inserita. Lajic, infatti, fa parte del team che ha tra i primi condotto in Europa una serie di *follow-up* sui trattamenti DEX. Le conclusioni di questi *follow-up* raccomandano di somministrare il farmaco solo in ambito sperimentale. Questa posizione e i risultati dello studio di Lajijc e colleghi (Hirvikoski *et al.* 2007; Lajic *et al.* 2011) sono abbastanza critici da essere stati usati nella lettera aperta di fetaldex.org come evidenza della pericolosità del farmaco.

Anche se la posizione della fondazione è diventata più sfumata relativamente al trattamento, in particolar modo con la scelta di dar voce alle posizioni di Lajic, il rapporto di collaborazione con New rimane saldo e viene definitivamente consacrato proprio nel 2010 con l'assegnazione alla dottoressa Maria New del "Pioneer Award"[16], un riconoscimento assegnato dalla fondazione stessa ai quei soggetti che si sono particolarmente distinti per l'avanzamento della ricerca nel campo della CAH. Attualmente, sul sito della Fondazione sono presenti inviti a partecipare a vari studi clinici, in nome dell'avanzamento della ricerca a beneficio di

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[16] http://www.caresfoundation.org/productcart/pc/fundraising/gala10/honorees.html (consultato il 25/11/2012).

tutta la comunità, e tra essi figura anche uno studio[17] condotto ancora dalla stessa New, che ha come finalità la determinazione precoce del sesso e della mutazione genetica che causa la CAH; la finalità prospettica dello studio è consentire di ottimizzare il trattamento DEX sospendendone la somministrazione a feti maschi e non affetti il prima possibile. Si può quindi dedurre che il posizionamento della CARES, benché abbia adottato una rappresentazione del trattamento più sfumata, rimane tuttavia sostanzialmente in favore di un'applicazione controllata del farmaco e non ne mette in discussione i presupposti terapeutici di normalizzazione genitale.

7.1. Limiti della bioetica e confini del corpo

Una posizione peculiare sulla mappa della controversia è quella occupata da Emi Koyama (Koyama 2010), portavoce di una associazione – Intersex Initiative – che si occupa di politiche *intersex* adottando un'ottica emancipatoria, che critica le pratiche esistenti promuovendo l'autodeterminazione e l'informazione corretta. Intersex Initiative si oppone alla chirurgia genitale infantile normalizzante e di conseguenza al desametasone prenatale. Tuttavia, lamenta Koyama in un testo pubblicato a breve distanza dalla lettera di fetaldex.org, la critica alla pratica terapeutica è stata fin qui inquadrata in maniera errata. Innanzitutto, la critica di Koyama sottolinea che la retorica di protezione incondizionata del feto che sostanzia la posizione bioetica di opposizione al DEX mette da parte il ruolo e la posizione delle madri, che vengono così rappresentate come incubatrici, più che come soggetti già sottoposti a pressioni e ansie (ricordiamo che, se a una donna è proposto il trattamento, questa è già madre di un figlio\a portatore di CAH – e anche la posizione dei fratelli ma soprattutto delle sorelle maggiori che non hanno "beneficiato" del trattamento andrebbe presa in considerazione), mentre il rischio viene ipotizzato sempre per il feto e non abbastanza per le madri, che tuttavia pur presentano effetti collaterali[18].

Secondo Koyama l'errore più grave dell'inquadramento bioetico che abbiamo visto, e che ha guidato le opposizioni di Dreger e Advocates for Choiche, è il fatto di mettere in secondo piano il problema della finalità terapeutica e di concentrarsi invece sulla correttezza procedurale e sulla sostenibilità del rapporto costo\beneficio. Questo inquadramento rischia di spuntare le armi dell'opposizione perché una volta risolte le tecnicalità contestate, i trattamenti controversi non so-

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[17] Study to Determine Sex and CAH status of Your Child in Early Pregnancy, http://www.caresfoundation.org/productcart/pc/sex_cah_status_early_pregnancy.html (consultato il 25/11/2012).

[18] Effetti collaterali sulle madri, che includono: aumento di peso, smagliature, irritabilità, insonnia, instabilità emotiva, edema, intolleranza gastrointestinale, aumento della pressione sanguinea, mal di testa, proteinuria, obesità facciale, e malessere generale. Un terzo delle donne oggetto dello stesso studio non si sottoporrebbe nuovamente al trattamento qualora rimanesse nuovamente incinta (Lajiic *et al.* 1998).

lo continuano, ma continuano con rinnovata autorità e consolidata legittimità; la legittimità così acquisita rischia di convalidare a sua volta quelle assunzioni sottostanti (in questo caso, l'inammissibilità sociale di genitali anomali) che non sono state direttamente contestate. La critica inquadrata in una cornice bioetica così, rischia di diventare complice proprio del sistema che si proponeva di modificare.

Per illustrare la sua posizione di scetticismo nei confronti del campo bioetico, Koyama fa riferimento a un altro caso controverso che recentemente è stato molto discusso in ambito bioetico e politico; ha mobilitato anch'esso nozioni relative ai limiti del consenso e dell'intervento disciplinante sui corpi ed è conosciuto come il caso di Ashley X.

Ashley è una bambina nata nel 1997, portatrice di una grave patologia dell'encefalo, congenita e irreversibile: senza assistenza, non è in grado di muoversi autonomamente, di manipolare oggetti, parlare o mangiare. Benché reagisca agli stimoli esterni, non è in grado di elaborare la comunicazione in termini linguistici visto che la sua età cognitiva è stata dichiarata equiparabile a quella di un'infante di tre mesi. All'età di sei anni e mezzo la bambina ha incominciato a entrare nella pubertà, e i genitori hanno deciso di adottare una serie di interventi che avrebbero dovuto migliorare la qualità della vita di Ashley, soprattutto in previsione del futuro (Gunther e Diekema 2006). Alla bambina sono stati rimossi utero e seno ed è stata sottoposta a una terapia ormonale che ne ha bloccato la crescita; si stima che la sua crescita in termini di peso sia stata attenuata del 20% e in termini di altezza del 40%. Le motivazioni che hanno portato i genitori di Ashley a sottoporre la figlia a questo trattamento sono soprattutto di ordine pratico: un corpo piccolo e leggero è più facile da spostare, inoltre, assieme all'assenza del seno, riduce il rischio di piaghe da decubito in una paziente totalmente priva di mobilità. La rimozione dell'utero, poi, elimina gli effetti collaterali del trattamento ormonale, e così anche il problema di gestire il ciclo mestruale e i possibili dolori ad esso associati.

È interessante notare come anche in questo caso l'aspetto della costruzione e gestione medicalizzata del sé sessuato abbia assunto grande rilevanza. Il fatto che impedire a una bambina di diventare donna abbia a che fare con la sessualità e non solo con la routine di cura del corpo, è comunque ammesso dagli stessi genitori della bambina; in questo modo, sostengono, Ashley sarà meno vulnerabile all'abuso sessuale da parte di chi si prenderà cura di lei quando i genitori non ci saranno più. Questa posizione, oltre a riconfermare a livello strutturale il panico sociale associato alla sessualità delle persone disabili – che, si suggerisce in questo caso, potrebbero essere causa del proprio abuso perché irresistibilmente vulnerabili – è anche poco efficace nel prevenire proprio ciò che si propone di ostacolare; molti studiosi nel campo degli studi sulla disabilità, infatti, (in particolare Fine e Ash 1988) hanno mostrato che in molti casi le cosiddette misure di prevenzione dell'abuso sessuale su bambine e donne disabili (quali la sterilizzazione) sono efficaci non tanto nel contrastare, ma piuttosto nel nascondere i segni lasciati dall'abuso stesso, soprattutto quando i segnali di disagio che eventualmente emergono sono interpretati come una conseguenza di minor capacità comunicativa derivate dalla disabilità e non di un possibile abuso.

La razionale dell'intervento è stata per i genitori, invece, soprattutto utilitaristica. Avere utero e seno – sostengono i genitori della bambina – sarebbe stato un peso inutile perché in ogni caso Ashley non avrà mai figli e mai alletterà al seno. Tuttavia è proprio su quest'ultimo aspetto dell'intervento che l'istituzione operante (lo University of Washington's Seattle Children's Hospital) espone il fianco a maggior critiche. Infatti, riporta Koyama, il gruppo di avvocati Disability Rights Washington nel 2007 riesce a dimostrare che il trattamento è in violazione delle leggi dello stato di Washington che condannano la sterilizzazione senza previa autorizzazione del tribunale. È a partire da questa contestazione che l'istituzione biomedica si mobilita per adeguare il trattamento Ashley alle norme vigenti in fatto di bioetica. In conclusione, anche grazie alla collaborazione di alcuni bioeticisti, e nonostante le aspre critiche da parte degli attivisti disabili[19], il "trattamento Ashley" viene ormai presentato non solo come misura straordinaria ed *ad hoc* ma come un vero e proprio protocollo di cura che va ormai sotto il nome di "attenuazione della crescita".

I genitori di Ashley[20] sostengono che questo trattamento non porta solo beneficio a chi fornisce cura al soggetto, ma anche al soggetto stesso perché ha il vantaggio di avvicinare il sé cognitivo al sé corporeo. Ma l'eventuale incongruenza, si sono chiesti i critici (vedi nota 18), a chi provoca disagio?
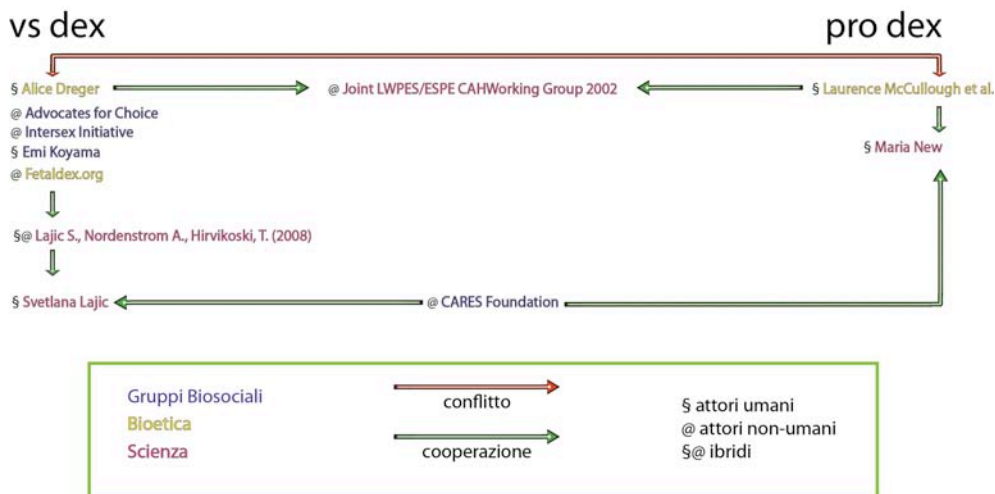
Fig. 4. – Mappa della controversia.

[19] A questo proposito si possono consultare le dichiarazioni rilasciate dalle associazioni Feminist Response in Disability Activism (http://www.ourfrida.org/old-campaigns/ashley-x-and-the-american-medical-association/) e Not Dead Yet (http://www.notdeadyet.org/docs//Growth_AttenuationPR0107.html) (consultati il 25/11/2012).

[20] Che hanno diffuso un documento in cui spiegano il percorso affrontato con Ashley intitolato "The 'Ashley Treatment' for the wellbeing of 'Pillow Angels' ", http://pillowangel.org/AT-Summary.pdf (consultato il 25/11/2012).

8. Conclusioni: dall'anomalia alla patologia

Chi soffre? È la stessa domanda che a partire dagli anni '90 gli attivisti *intersex* hanno cominciato a fare riguardo a genitali non conformi. La "sofferenza sociale" che così indefinitamente circola nella letteratura scientifica, è causata sì da genitali non conformi, ma le vittime di questa sofferenza non possono essere bambini e bambine poco più che neonati che ancora non hanno appreso quali genitali siano corretti e quali no; le vittime della sofferenza causata da genitali non conformi sono piuttosto i genitori che devono presentare il nuovo nato alla rete parentale, convivere con il senso di colpa per non aver generato una prole perfetta e placare l'ansia genitoriale di fronte a un'anomalia che in alcuni casi coinvolge anche la salute; e sono anche i medici stessi, la cui autorità e capacità vengono messe alla prova da casi clinici che sono rari e di difficile gestione terapeutica, che richiedono di ipotizzare, orientare e sostenere decisioni terapeutiche spesso rischiose, nonché la responsabilità della formazione del consenso riguardo a quadri clinici di grandissima complessità.

Il fine di questa analisi non è risolvere il dilemma etico, ma mettere in luce i presupposti culturali che consentono al dilemma di apparire come tale e alla controversia di formarsi. Nel caso Ashley, per esempio, il dato più rilevante è la risonanza tra un trattamento medico eseguito per ragioni pratiche e il più ampio processo di de-sessualizzazione delle persone disabili (Arfini 2011a). Se la nostra società fosse ossessionata dai denti tanto quanto lo è dal sesso, ad Ashley sarebbero certamente stati rimossi, adducendo ragioni pratiche concernenti il fatto che, di base, non le servono, dato che viene alimentata tramite sondino, semplificando così l'igiene orale in una paziente non collaborativa, ed evitando così tutta una serie di conseguenze potenzialmente dolorose (carie), senza contare il processo fisiologico dell'eruzione dei terzi molari (denti del giudizio), o le complicanze in età avanzata, e così via.

Analogamente, nel caso dell'intersessualità e in particolare dei genitali normalizzati chirurgicamente, l'analisi socio-antropologica si è concentrata su quelli che sono i parametri che definiscono i confini dell'accettabilità di quei corpi che gli esperti in campo biomedico hanno definito anomali rispetto alla norma, e sul conflitto operativo tra la scoperta del vero sesso e la creazione del sesso migliore per il paziente.

Il trattamento prenatale di femmine portatrici di iperplasia surrenale congenita tramite desametasone cura un sintomo non pericoloso per la salute, ovvero la virilizzazione dei genitali[21]. È quindi una cura che consentirebbe di evitare un altro tipo di trattamento, ovvero la chirurgia femminilizzante, un tipo di intervento politicamente controverso, i cui rischi ed effetti collaterali sono valutati sempre più negativamente man mano che aumenta il numero di rivalutazioni sulle pazienti operate negli anni '70-'80 (Creighton 2004). La terza via, ovvero non prevenire in fase pre-natale, né intervenire in seguito per vie chirurgiche, non è par-

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[21] Ricordiamo che il sintomo più pericoloso per la salute, cioè la perdita di sali, non è prevenuto con questo trattamento.

ticolarmente popolare in ambito scientifico, in quanto la sofferenza psicologica derivante da genitali non conformi (sofferenza, abbiamo visto, condivisa da genitori, pazienti *e medici*) è ancora valutata come sufficientemente grave da giustificare il rischio di un intervento, chirurgico o farmacologico che sia.

Sono state espresse da più parti, in ambito bioetico, biosociale e scientifico, obiezioni sulla sicurezza del farmaco. La controversia iniziata dal punto di vista della conformità al corretto protocollo etico dell'operato di un endocrinologo pediatra, Maria New, si è risolta con la conclusione dell'investigazione da parte della preposta autorità statunitense, che era stata allertata dalla contestazione di un gruppo di bioeticisti. Il rapporto della Food and Drugs Administrations conclude che l'operato di Maria New è sempre stato corretto relativamente al profilo etico. Il trattamento DEX, infatti, non deve essere considerato "ricerca clinica" (uno status che richiederebbe particolari scrutini e aderenza a regolamentazioni federali), ma un trattamento messo in pratica in base alla discrezione dei singoli medici, che poi indirizzano le pazienti a Maria New, la quale si occupa solamente del *follow-up* (New 2011, 68).

Dal punto di vista scientifico, però, la controversia non è ancora risolta. Il report dell'FDA conclude che non è possibile, con i dati attualmente a disposizione, fornire raccomandazioni definitive sull'uso del farmaco. Analogamente, le linee guida più recenti della Endocrine Society sul trattamento della CAH consigliano di considerare il trattamento DEX come sperimentale, in quanto controverso sia dal punto di vista scientifico che dal punto di vista etico (Speiser et al. 2010: 11-14).

Curare i feti invece dei bambini può sembrare uno sviluppo positivo verso la de-patologizzazione dell'intersessualità, ma, come abbiamo visto, si tratta di un trattamento che lascia intatti i presupposti normalizzanti che erano propri della chirurgia, limitandosi a spostarne l'applicazione al periodo pre-natale. Questa interpretazione è coerente con gli studi storici (Dreger 1998; Foucault in Barbin 1978; Daston e Park 1995) che hanno mostrato come l'intersessualità sia un fenomeno in cui le tracce di "precedenti" concezioni continuano ad agire a livello implicito in maniera piuttosto persistente.

Avvicinandosi a questa controversia in maniera simmetrica si è voluto evitare di costruire il campo medico come esclusivamente normalizzante e il campo laico come esclusivamente docile. Diversamente, una lettura paranoica[22] della gestione medica dei DSD finisce per sortire l'effetto opposto a quello voluto: costruisce l'establishment medico come attore onnipotente e priva pazienti ed ex-pazienti di ogni forma di *agency* che non sia il rifiuto completo del trattamento medico. Nell'ambito di una gestione trasparente, consensuale e auto-determinata della cu-

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[22] Uso questa dicitura seguendo Eve Sedgwick (2003), che la caratterizza come una modalità di lettura di stampo foucaultiano in cui le affermazioni di verità sono analizzate a partire da un posizionamento affettivo paranoico. Questa modalità di lettura tende a voler "esporre" (sia nel senso di portare in luce, sia nel senso di denunciare) le modalità invisibili del potere che producono discriminazione e esclusione attraverso la produzione di saperi normalizzanti.

ra dell'intersessualità, il trattamento prenatale rappresenta allo stesso tempo un progresso, se visto come modo per evitare l'intervento chirurgico, e un stallo, se visto come continuazione di un paradigma normalizzante. È ipotizzabile che soluzioni farmacologiche, soprattutto pre-natali, saranno sempre più ricercate, in ragione sia del declino del paradigma chirurgico e della sua discutibilità, sia in ragione della sempre più dettagliata conoscenza dei meccanismi di sviluppo embrionale che portano alla differenziazione sessuale. Questa evoluzione rappresenta un'evoluzione tecnica anche se non paradigmatica.

A livello strutturale, il trattamento pre-natale dell'intersessualità rispecchia il tentativo di *trasformare l'anomalia in malattia.* Infatti, nota George Canguilhem: "dal momento in cui l'eziologia e la patogenesi di un'anomalia vengono conosciute, l'anomalo diventa patologico" (Canguilhem 1998, 108). Per comprendere questo importante passaggio, dobbiamo innanzitutto distinguere tra anomalia, una differenza che si manifesta rispetto all'insieme, ovvero a livello spaziale (es.: un individuo anomalo tra molti) e malattia, una differenza che si manifesta a livello temporale (es.: un individuo prima è sano, poi è malato). Mentre l'anomalia, quindi, rappresenta una variazione essenziale, la malattia rappresenta una variazione temporale, che può essere pertanto ricondotta allo stato originario, sano. In questo senso curare i feti significa *installare la malattia già a livello embrionale,* e, assieme ad essa, la loro patologizzazione. La malattia interrompe un corso di vita regolare e si presenta come momento critico che richiede immediata attenzione per riportare il soggetto alla normalità. L'anomalia invece è un fatto costituzionale, congenito, intrattabile. Inserire l'insorgenza dell'anomalia nel divenire dell'embrione significa installare la possibilità di evitare l'anomalia, ovvero di *curare* la malattia.

L'establishment medico ripone particolare fiducia in *follow-up* sempre più ampi, rigorosi e dettagliati per poter risolvere questo e altri dilemmi nella cura dei DSD. Esistono però notevoli ostacoli specifici alla produzione di evidenze scientifiche a breve termine nel campo dei DSD; innanzitutto c'è il problema della scarsa consistenza numerica dei campioni, perché si tratta pur sempre di condizioni rare; inoltre esiste il rischio di un alto tasso di *drop-out* conseguente il lungo lasso di tempo che deve intercorrere tra trattamento (es.: trattamento prenatale, intervento fatto alla nascita, cure in età pediatrica) e rivalutazione adulta (es.: performance scolastica, sessualità attiva, statura); questa temporalità lunga, inoltre, implica l'obsolescenza tecnologica delle tecniche valutate: alla luce dei rapidi progressi in campo biomedico, qualunque tecnica risulterà insoddisfacente alla luce del progressi intervenuti nel lasso di tempo tra intervento e rivalutazione. Questa temporalità lunga unita alla scarsità numerica del campione implica minor competitività nel reperimento dei finanziamenti – anche privati – fondamentali per gestire rivalutazioni multicentriche (ovvero effettuate in più strutture, scelta obbligata se si vuole raggruppare un campione significativo). La difficoltà nel raccogliere prove statisticamente significative è una delle ragioni principali per cui la controversia del desametasone prenatale è esplosa, ma anche per cui tutto il campo della cura dei DSD è in generale controverso anche all'interno dello stesso campo biomedico. Uscendo poi dal settore biomedico, il campo dei

DSD rimane controverso al di là della disponibilità di dati statistici più o meno corposi: è il presupposto culturale che sta alla base della giustificazione di trattamenti normalizzanti sul sesso ad essere messo in discussione. Il fatto che i trattamenti siano più o meno efficaci, più o meno sicuri, è secondario rispetto alla critica sul loro impiego che viene mossa all'establishment medico da parte di attori laici appartenenti al campo politico, bioetico e dell'associazionismo. Nonostante le numerose e autorevoli linee guida e dichiarazioni consensuali, è quindi evidente che il consenso, ovvero la risoluzione delle controversie, rimane in questo settore il risultato di una complessa dinamica che coinvolge attori umani e non, scientifici e laici, in misura molto maggiore – o forse soltanto molto più evidente – rispetto a quei campi in un cui la consistenza numerica conferisce una più efficace e incontestabile produzione dell'evidenza.

La verità del fatto oggetto della controversia analizzata non è ancora "scientificamente provata" sia perché la produzione della prova è ancora in corso di stabilizzazione, ma soprattutto perché la prova non potrà essere convalidata solo scientificamente. Infatti, la comunità biomedica conta che la controversia scientifica sia risolta da un fatto scientifico, ma è probabile che fattori esplicitamente politici intervengano prima e con più forza.

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Abstract Intersex is often seen as a paradigmatic case in socio-anthropological literature: it can serve as the "natural" confutation of the "natural" difference between the sexes. In contemporary Western societies, the construction, assignment, and stabilization of sex take place – first and foremost – in biomedical socio-cultural contexts. Currently, the construction of medical knowledge about intersex is going through a time of great instability, partially due to the intervention into the debate by lay subjects not affiliated with the techno-scientific establishment. This essay provides a map of a controversy surrounding the use of a drug the can prevent, in females, virilization of genitals caused by a congenital anomaly.

Keywords technoscientific controversies; intersex; sex construction; patologization; patient groups.

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Financial Markets, Climate Change and STS

Giuseppina Pellegrino, Tonino Perna, and Iacopo Salemmi

Abstract Departing from a fascinating analogy between financial and climate fluctuations proposed by Tonino Perna under the category of "extreme events", this conversation addresses crucial issues in contemporary society, such as the relationship between financial capitalism and real economies, the controversies around alternative development models, and the role of the media in fabricating emergencies and crises. Whereas Perna interrogates macro-economic historical trends, Pellegrino and Salemmi put forward an STS approach into the topic, in order to frame the role of information infrastructures, controversies and the media (Pellegrino) and questioning the primacy of Economics as objective science through the hypothesis of economical medicalization of our society (Salemmi).

Keywords: extreme events; financial markets; climate change; information infrastructures; economic medicalization.

Money and CO2: Convergences and Divergences between Financial Market and Climate Fluctuations

Tonino Perna

The hurricane Sandy which stroke the US East Coast at the end of October 2012 put once again the issue of climate change at the centre of the stage. According to the majority of climatologists, this change depends on the increasing impact of CO_2 we release in the atmosphere. At the same time, the financial crisis which since 2007 impacted strongly on the real world economy is far from ending. No feasible exit from the public debt which puts at risk the whole system of Western economies has been identified until now.

Both the financial and the climate shocks manifest themselves as turbulences, "giant oscillations" which witness the breakdown of the equilibria of our devel-

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opment model as well as of the ecosystem. "Extreme events" have always happened but in this historical stage they became more and more intense and frequent.

This article departs from stating an "analogy" (see Marzo 2012; Melandri 2004) between the markets and the climate behaviour over the last thirty years. The aim is to find out a common matrix to the two phenomena, which are at first analyzed as independent. Then possible relationships between them are explored notwithstanding their apparent diversity, in order to propose urgent measures to face with such unprecedented changes and transformations.

1. The great fluctuations

"The Misbehavior of Markets" by Mandelbrot and Hudson (2004) has recently enhanced my interest and understanding of financial market and climate fluctuations. Using his fractal tools, Mandelbrot describes the volatile, unforeseeable and dangerous properties that few financial experts account. For Mandelbrot, markets have turbulences as rivers have whirlpools. On the basis of the Gaussian curve, we learn that fluctuations are always possible even if there is little probability of oscillations. Despite the fact that Mandelbrot's statement does not explain why today's financial crisis is one of the worst since the time of the Great Depression of 1929-32, it is still an important contribution to our understanding of the high risks associated with financial markets. If we consider the data provided by Andriani (2006) within the period 1987-2002, we learn that we have gone through at least seven financial crises. They include the 1987 Wall Street crash; the 1989 Japan financial crisis; the Europe monetary crisis of 1992; the 1994 Mexican economic crisis or "peso crisis" associated to the so called "Tequila effect"; the 1997 Asian crisis; the 1998-99 financial crisis of Brazil and Russia that caused the drastic devaluation of the ruble; the crash of the dot-com bubble in 2000-2001 linked to the "growth over profits" mentality and the aura of "new economy". In practice, we could say that financial crises have become, in a short period of time, a regular occurrence around the world as never before (see fig. 1 & 2). In fact, looking at the evolution of the Dow Jones index during the last century, it appears clearly that it has repeatedly registered great fluctuations during the last two decades. More in general, the oscillatory evolution of stock prices is showing that the bear market[1] has entered a new acute phase. And this might not be the last one.

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[1] In the Stock Trading jargon, a market in which prices are falling.

Fig. 1 – Dow Jones Index 1916-2002 (Mandelbrot and Hudson 2004)
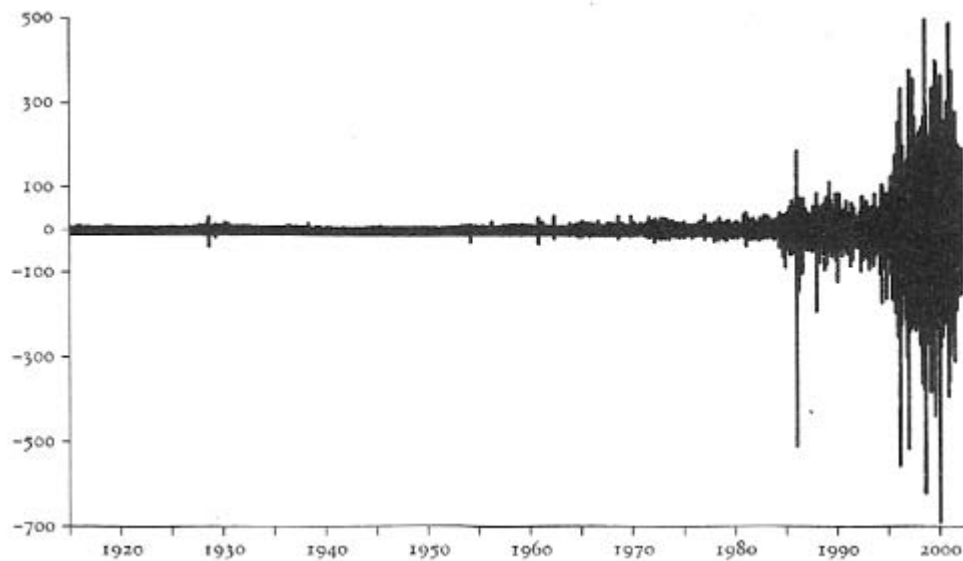
Fig. 2 – Dow Jones daily variations (Mandelbrot & Hudson 2004)

To better understand those anomalous fluctuations, determining contribution comes to us from Nobel Prize Prigogine in his work on "far-from-equilibrium dissipative systems". His thesis is that areas of turbulence (Prigogine and Stengers 1979) are registered over a certain velocity which generates fluctuations that can influence the whole system. The system itself loses equilibrium to a point

where its properties become completely different than those of hydrodynamic-type systems. Fluid dynamics studies those variations.

Unlike Prigogine, I believe that non-equilibrium reactions or "giant oscillations" within a system are related rather with acceleration than velocity. Prigogine speaks of "a certain velocity" that brings the system to a critical point where areas of turbulence are observed. In other words, under the pressure of unbalanced driving forces, there is a critical point from where the system becomes instantaneously off balance. My understanding is that acceleration within the system determines its far-from-equilibrium properties.

When it comes to financial markets, the stock exchange is one of those primary entities from where to observe money motion and market prices fluctuations. For instance, if we consider the stock market exchanges of the last two decades, we see that GDP (Gross Domestic Product) and DJIA (Dow Jones Industrial Average) show great fluctuations and a clear disconnection between financial and real economy.
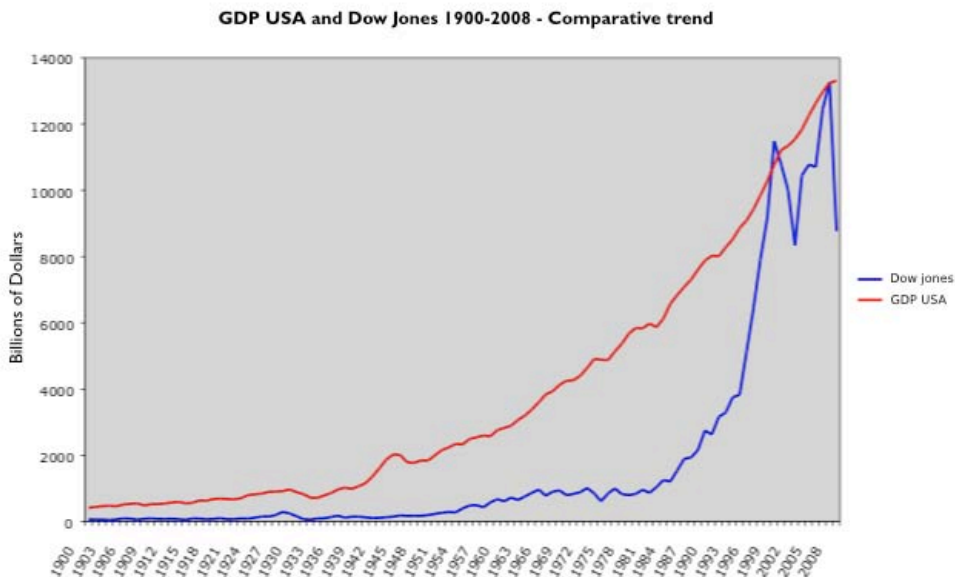
Fig. 3 - GDP USA and Dow Jones 1900-2008 - Comparative trend.

In figure 1, we see that DJIA endures a pulled up curve since the middle of the '90s. We also see that while the index of correlation between GDP and DJIA turns out positive till 1995 (and is equal, in average, to 0,8), from 1998 to 2008, there is no correlation anymore. In fact, the index is equal to 0,2. This means that for the first time in one century there is a clear gap between GDP and DJIA in the US, which signs a period of great discontinuity and instability – something that was not seen since the Great Depression. In the '20s, during the period that precedes the Wall Street crash, the correlation between the two indexes was still quite high (0,8).

Then one question comes to our mind: what does cause the gap between financial and real economy which seems to have become one of the main features of today's capitalism?

If we look at the main macroeconomic parameters, we do not find any significant fluctuation compared to the past. The only singular event is the long period of growth that has signed the Western economy after World War II. Of course, there have been times of recession during that period, but these were minor and short-term events. There was no sign of absolute inversion.

Applying the outline of "Kondratieff", a systemic crisis was predicted at the clash between the '70s and the '80s.. Kondratieff's cycles have an average duration of fifty years and depend on cyclical trends of big technological innovations which create new production and consumption sectors.

The cause of such instability could be found in the continuous emission of money, coupled with its "acceleration". This phenomenon is represented by the succeeding financial crises during a short period of time (1987, 1989, 1991-92, 1994, 1997, 2001-02, 2007-09). An overwhelming monetary mass has been created at global level with estimates that speak of 1 million billions of dollars. In contrast, GDP is only 60,000 billions of dollars (Fig. 4).
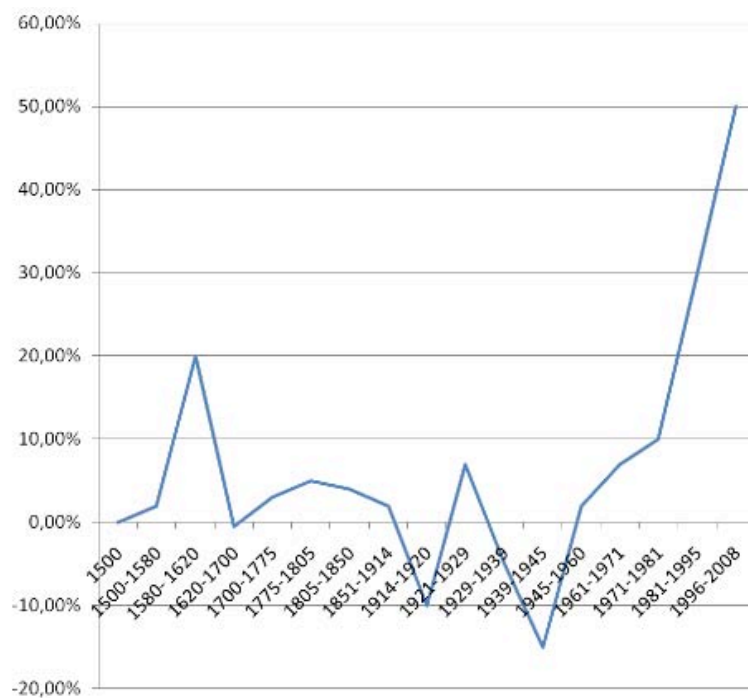
Fig. 4 – Average monetary growth per year (1500-1850 measured in gold and silver; 1850-2008 measured in currency and bonds). Author's elaboration from various historical sources.

The fluctuations of market prices registered during the recent economic crisis of 2008 have followed a similar trend.

It is quite interesting to note that, as Keynes has pointed out (Keynes 1931), market prices remained stable for almost one century – between 1826 and 1914 – with oscillations that never exceeded 30%. One reason might be that this was a period where the emission of bank notes was limited by the adoption of "gold standard". In fact, since the removal of the last vestige of such standard by Richard Nixon in the beginning of the '70s, the world has been awash with paper money. Another reason is that the products of the so-called "creative finance" did not exist at that time.

A similar reflection could be made about CO_2 emissions. The continuous increase of CO_2 emissions in the atmosphere during the last fifty years has produced reactions of permanent non-equilibrium as witnessed by extreme weather events. Such events are not caused by the accumulation of CO_2 emissions but by the acceleration of the accumulation process. In other words, if CO_2 emissions had been accumulated during a larger period of time, the self-regulation of the biosphere would be more efficient (Fig. 5 and Fig. 6).
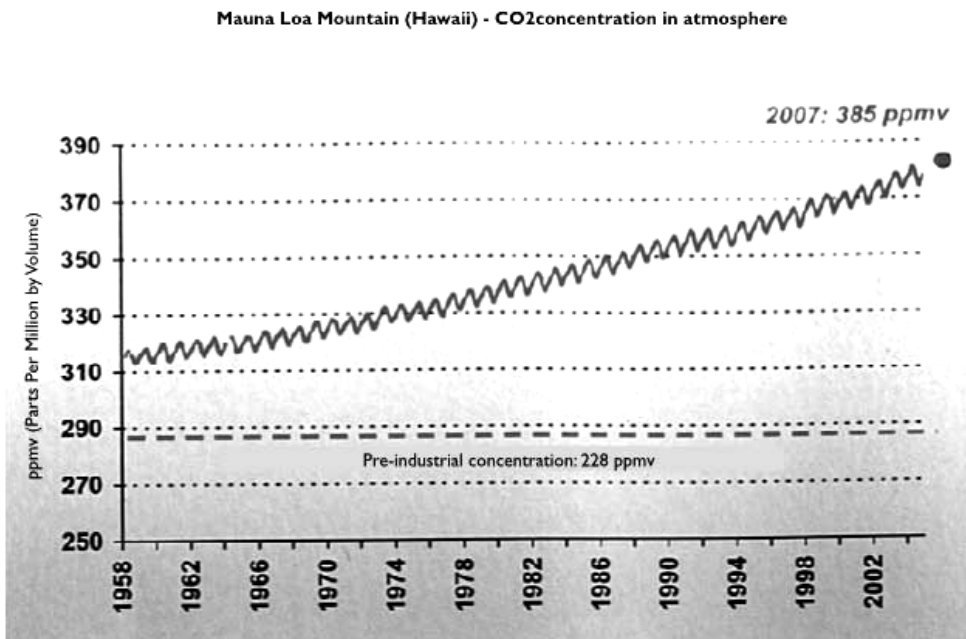
Fig. 5 – CO_2 concentration in atmosphere (Mercalli 2008, 48).
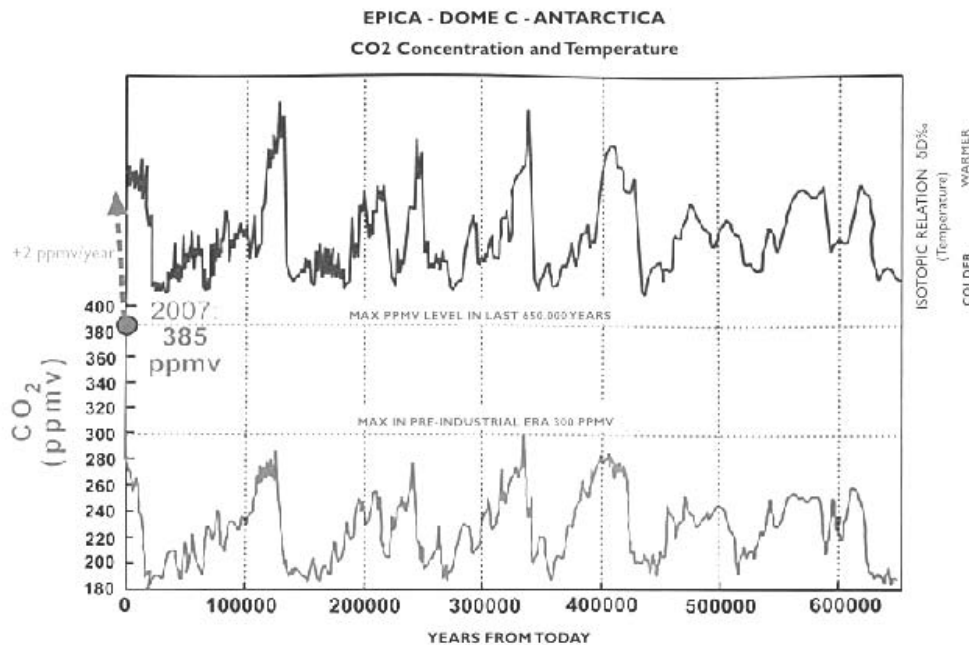
Fig. 6 – CO2 concentration and temperature (Mercalli 2008, 48).

We do know that large temperature variations in the troposphere might cause traumatic and dramatic damages to the bio-systems on which life depends. Nicholas Stern (Stern 2007) who collected data from the best studies on the matter has offered various scenarios on economic risks associated with global warming and climate change. His conclusions have been widely reported in the press and received particular attention. They helped to build awareness on the issue, but at the same time generated some confusion. Not all the scenarios seem to fit reality. Sea level rise for instance might cause damages to small islands and coastal populations. However, being a slow process, it gives time to find appropriate answers.

Stern hypothesized different scenarios by 2050 according to the degree of Earth average temperature increase, calculating the consequent economic losses, environmental refugees, agricultural waste and so on.

While such studies give us important inputs to better understand the economic dimension of climate change, they unfortunately lack information about ecological and human costs. For instance, sea level rise is a fact and should mobilize our attention. But we should not underestimate the "giants oscillations" that are associated with such phenomenon and are already in motion. The growing impact of human activities on the environment will continue to produce extreme events and natural hazards like tornadoes, floods, droughts, cyclonic storms.

Natural Catastrophes Trend in XX Century

Number of catastrophes per year

The increase of natural catastrophes observed from 1940s to 1980s is partially due to the improvement of data collection techniques. However, the improvement does not sufficiently explain the multiplication of disasters observed in last decades, whose trend is growing. It leads to think that climate change due to human intervention is far from being unrelevant.

Moreover, confronting curves of different disasters, we observe that earthquakes, that are merely geological phenomena, are quite stable. Instead, natural catastrophes such as hurricanes and floods, that might be due to the greeenhouse effect, are constantly increasing. Furthermore, we can also notice a sharp acceleration starting from the 1990s.

Source: Em-Dat, database Ofda/Cred on disasters - Catholic University of Lovanio (Belgium)

* Earthquakes, volcanic eruptions, violent oceanic currents, floods, hurricanes, drougth, cold and warm waves, insect invasions, landslides, fires and famine.

Fig. 7 – Natural catastrophes trend in the 20th century.

Meteorologists are on the front line to observe weather and temperature variations. In Chicago, in March 2007, temperatures varied from 20 C° to minus 15C° within only two days, and in 2009 they went down by 23C° within only twelve hours. In Italy, the ground station of Pizzoli in Abruzzo (Italy) registered a variation of 30° C from one day to another on December 22, 2009. Various examples

of this kind can be given. Larger surface temperature variations will most probably be registered in a near future and those new extreme occurrences of weather phenomena will be added to the list of historical weather records.

In an article published in the international weekly journal of science Nature (August 2009), two American universities supported the thesis that stronger and more frequent hurricanes, typhoons and tropical storms are hitting the Caribbean. Processing data over a period of thirty years from now, they came to the conclusion that those weather events rose by 31% and that their origin can be found in the overheating of ocean waters – that are producing a greater energy quantum. While the period of observation is too short to make a trend, it is still a sign of change. Extreme weather events have been registered all over the world. Exceptional snowfalls swept the Guangdong province, Southern China, in March 2008, while the Perito Moreno glacier in Argentina was melting at unprecedented rate. In August 2007, exceptional snowfalls were registered in Buenos Aires and Johannesburg. In Australia and India, high temperatures reaching 55C° were recorded in January 2008.

Antonio Navarra, director of the Euro-mediterranean centre for climate changes, asserts the following:

"We are registering important temperature variations from one year to another. Core-drilling projects through the ice cap in Greenland have demonstrated a similarity with what happened thousands of years ago."

2. Regulation of financial flows and terrestrial temperatures

For almost two hundred years, since trading of stocks began on a stock exchange, financial flows were regulated by monetary and political authorities. Today, all financial analysts agree that the explosion of speculative bubbles is the result of a lack of regulations and vigilance.

The self-regulatory system of the Earth's temperature is a bit more difficult to understand. From data collected during ::core-drilling projects through the ice cap in Greenland and the Antarctic, it seems that, at both poles, periods of cold and heat alternate. In other words they do not happen in synchrony. Until now, we do not have any scientific explanation for this phenomenon.

If we compare the Earth to a living organism, the first question to be asked for is about the location of the Earth's thermo-regulatory center. The thermo-regulatory center of warm-blooded animals, including humans, has been found in the hypothalamus. In case of serious diseases, dysfunctions of the hypothalamus can cause death. Within a very short time, important body temperature variations ranging from 35° to 40° are usually registered. It is quite clear that the Earth does not look like a warm-blooded and homeothermic organism with arms, legs, claw and a brain. However, we think that the Earth should be considered as a living organism with two thermo-regulatory centers – one located at the North Pole and the other at the South Pole. Each of them works independently from the other

but their activity is coordinated and well balanced.

When it comes to periods of heat and cold, scientists have made the hypothesis that the diachrony between the two poles' activity is depending on ocean water streams. Unfortunately, until now, this hypothesis has not been proved scientifically. However, it is clear that the diachrony exists. And we believe it is not a casual event but the result of a self-regulatory mechanism aimed at reducing the risks of extreme temperature variations. A recent article based on satellite data from September 2012 (Stone 2012) shows which the Arctic ice mass keeps melting so hitting a negative peak. At the same time, the ice mass on the Antarctic side has been increasing.

By analogy, we could say that the two poles act as the cerebral hemispheres of our human brain. If one of them is under stress, and loses some of its functions, the other one can complement it in some way. Of course this is only an analogy, not the demonstration of a scientific truth. The alternate temperature variations between cold and heat at the two poles on a geological time scale could suggest that the Earth's average surface temperature is the result of the combined activity of these two "hemispheres".

The massive emission of CO_2 in the atmosphere could produce temperature variations inducing unforeseeable effects in the North and the South hemisphere, so bringing about increasing damages to ecosystems, especially to agriculture.

The financial speculation exploits the climate change like – in the real economy – governments exploit the "natural" disasters to strengthen their power. In the period 2008-2011, we registered very strong "oscillations" on the prices of principle foodstuffs, such as rice, wheat, corn, etc.. This phenomenon has produced a strong impact on traditional agriculture, which is the main defense of the ecosystem equilibrium – as Barroso, President of the UE Commission said – and as a consequence it increases the "greenhouse effect". Once again we have a further confirmation of the relationship between "extremes events" in the financial world and climate change. This means that the increasing frequency and intensity of "extreme events" (intense rainfalls, drought, hurricanes, and so on), put in crisis natural cycles of traditional agriculture. At the same time these events bring about financial speculations of basic products (rice, corn, grain) contributing to the economic collapse of small peasant farms, able to protect the biodiversity of the ecosystem, and having a low environmental impact. All this advantages big mono-cultural companies having a high environmental impact (CO_2 emissions). Such a process has a clear consequence, namely the increase of gases which foster "extreme events", in both the financial and the climatic field. Similarly, the "extreme events" caused by climate change produce increasing economic damages (about 250 billions dollars only in 2011) impacting on public expenditure and raising the fiscal crisis of the State, so fostering further financial speculation.

On the other hand, in debt countries are pushed to exploit even more intensively natural resources (forest cutting, unlimited drilling, shale gases) while cutting programs of CO_2 reductions and environmental protection. All this contributes to worsen the environmental disequilibrium, according to a perverse, self fostering mechanism.

We do know that such events will take place more and more frequently. Symptoms of non-equilibrium are clearly visible. Unfortunately, the availability of data is still insufficient to both predict where extreme weather events will take place and understand how these two thermo-regulatory centers work. How the Earth will regulate itself is still a mystery. Dis-equilibrium is evident and "extreme events" increase in their frequency and intensity. However, we cannot foresee when and how much a specific area will be affected and which areas will be saved from the impact of these events.

We personally think that global warming projections produced in recent years by Intergovernmental Panel on Climate Change (IPCC 2001; 2007) are not totally reliable, mainly because they do not take in consideration Gaia's reactions (see the increase of Southern Pole glacier mass). Based on our hypothesis, one should not exclude the possibility of a compensating effect of one of the poles aimed at contrasting global warming. For sure, the number of extreme weather events will increase, both in intensity and frequency.

3. The impact of "giant oscillations"

How to make the world a safer place for the population in less technologically advanced countries, is one of the key political issues of the future – and not only from the point of view of food security. The poorest populations of Africa, Asia and Latin America have as limited capacity in front of extreme weather events as in case of harsh economic recession – when for instance they cannot afford the prices of first necessity goods like it happened in 2008. On the other hand, typhoons or tornadoes make more victims in Central America than in North America. In short, the poor are the first victims of "giant oscillations" – being them either economic and financial or climatic.

Jeremy Rifkin (see also Cianciullo 2008) states that there is a strong correlation between climate change and economic crises. He easily speaks of the growing risks for insurance companies represented by agricultural damages caused by global warming. We know that insurance companies' fortunes are directly tied to the accuracy of their environmental-risk projections. In The Stern report (Stern 2012), the framework of this analysis is much larger and considers the link between human activity and global warming, offering a plethora of data and examples too. The correlation between both phenomena exists.

The long-term economic effect of climate change should put in question our development model in the same measure that "extreme events" and "giant oscillations" recall our attention in case of financial crises. Human and environmental dimensions of such phenomena should not be ignored.

From our point of view, if the excess of money and CO_2 is provoking great damages at both the social and environmental level, the only remedy is to reduce their emission. It is neither a simple nor immediate operation, but there is no alternative.

A drastic reduction of CO_2 emissions will not have immediate effects. It will

take many decades to see positive changes in the biosphere equilibrium. Similarly, a drastic reduction of the global monetary mass might positively impact stock market giant fluctuations. The challenge will be how to curb speculation trends that affect land and oil prices, and weak currencies.

It is, therefore, necessary to think of a new global security policy that will put the highest priority on targeting the poor and bringing changes in the North-South relations. At the moment, the main priorities for industrialized countries seem to be the provision of appropriate technology to reduce greenhouse gas emissions in developing countries. This is only part of the solution. The risk is that such measure will only benefit the market of the green economy which is growing in the West. For the poor, climate change means higher prices for necessity goods, harvest loss, desertification and drought, floods and hurricanes.

To some extent climate changes have the same functioning of hyperinflation: their major impact affects the poorest who cannot transfer the increased prices to anybody else. The 25.000 dead for hotness in France (Summer 2007), in Russia (Summer 2010) or the 16 millions of environmental refugees in Pakistan (Autumn 2010) were mainly poor, elderly, disabled people, without any economic resource to escape from extreme events.

A policy able to tackle poverty in those areas of the world should include:
- the creation of effective disaster prevention and management systems of the risks associated with extreme weather events;
- the creation of mechanisms to ensure food security, including for instance the creation of food stocks to be co-managed at regional and subregional levels;
- the activation of measures that will keep the provision of goods and services of primary necessity (food, water, etc.) out of the market place.

To answer the challenges and risks associated with "giant oscillations", giant political steps need to be taken. This means a drastic, radical revolution in development patterns as well as the elaboration of alternative conceptual frames able to handle with complex, interlinked and extreme events and their impact on our future.

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Speculations, Catastrophes and (selective) Amplifiers: Handling "Extreme events" through STS

Giuseppina Pellegrino

Introduction

Saying that the world we live in is deeply interconnected seems to have become a taken for granted, not questionable statement. An assumption and an obviousness that rarely comes to proof and exemplification.

Perna's account of "extreme events" (see Perna 2011) goes beyond this mere statement, pursuing the effort to show how very diverse phenomena (in surface) can be compared by analogy and, therefore, re-thought in the light of a common frame.

The aim of this contribution is to propose a more micro-level of analysis to account for financial and environmental crises, complementing the macroeconomic tools with specific STS insights, which immediately re-frame the phenomena in question and look at them from a different perspective.

First of all, both financial markets behaviour and environmental shocking events are far from being as "natural" as they appear at a superficial glance. At least listening to the mainstream media news covering both the issues as "first headlines", we could infer that there is very scarce room to escape from the "index dictatorship" of financial Capitalism (at least so depicted by the media) as well as the unforeseeable (but more and more frequent) chain of hurricanes, tornados, flooding and the like at different latitudes and corners of the globe.

Indeed, at least from a conceptual viewpoint, this is only one small portion of the whole picture. This is what the media think relevant to amplify, as it will be argued later in this article. Behind and before, there is much more than this.

Speculations on financial markets and real economy crises, environmental catastrophes due to extreme events and their amplification by the media are altogether bits of a mosaic whose background is technoscience – and sociotechnical relations constituting it. In the light of a technoscientific approach, what ties together the "extremeness" of all these phenomena is their being just the emergent part of a broader, sunk world of relations. In other words,"extreme events' are only the tip of the iceberg and what lies beneath (the classical STS "black box") is a dense texture of relations based on the common ground of shared classifications, namely what STS approaches have defined as "information infrastructure" (Bowker and Star 1999; Star and Bowker 2006). Therefore, when adopting a phenomenological stance (Schütz 1945), extreme events are the emersion of what is otherwise taken for granted and not questioned anymore (in this case, well working financial markets, and ordinary weather forecast).

Crisis or interruption or breakdown – that means, little or big "holes" in the

texture of infrastructure – make visible the working (of) infrastructure itself, stressing the stability of its installed basis and putting into tension its inner components.

In what follows, it will be argued that financial markets can be interpreted, going back to STS approaches other than SSF (Social Studies of Finance, see Preda; Salemmi in this issue), as information infrastructures/bounded objects. This brings about interesting consequences in terms of how they work and what they require to their users.

On the other hand, "natural catastrophes" question about our categories of nature and culture, as they show how much uncertainty and controversy is at stake when handling only partially foreseeable events and hitting the limits of what would be called, in kuhnian terms, "normal science". Stressed financial infrastructures (based on speculation) and climate change controversies, however, would not have the role they play nowadays if the selective amplifier of the media did not make them "the" issue to think, talk and decide about.

Such a "triadic" model (markets as infrastructures – environmental controversies – the media) is proposed as a way to handling with "extreme events" pointing to STS and the role technoscience plays in making ordinary everyday life of markets, climate and society an "extraordinary" chain of events.

If, as Perna points out, frequency and intensity of such "extraordinariness" makes it less and less exceptional, this means the established classifications (and forecasts) need to be urgently updated, and consequences taken up; not to "accept", but at least to "domesticate" the "torqueing" which individual and collective biographies (Bowker and Star 1999) have to stand to survive to extreme events.

1. Financial markets as information infrastructures and bounded objects

Adopting an ecological-infrastructural approach to analyze financial markets means to take in consideration their general working prerequisites as information infrastructures and bounded objects (Star and Griesemer 1989; Bowker and Star 1999; Star and Bowker 2006). More than looking at the specificity of the financial markets mechanisms and dynamics as done by SSF scholars and literature (see Preda; Salemmi in this issue), such an approach emphasizes those characteristics which make financial markets well working infrastructures. It also identifies conditions of their breakdown and interruption.

Financial markets seem to share at least some crucial dimensions with information infrastructures, such as embeddedness, transparency, visibility upon breakdown (Star and Bowker 2006). Until market indices (which can be assimilated to the standards of finance world) increase their performance, there is a "virtual" invisibility of the markets. They are composed of "missing masses" (see Latour 1992) created by the big accelerations and giant oscillations which make the infrastructure tissue more complexly structured and opaque.

It is when performance does not reach or hit a positive value that visibility starts changing and the installed basis of market infrastructure (the mathematical models, algorithms and related information systems) becomes an issue for the media to select and "feed" public opinion. The word "spread" (belonging to the financial market jargon), this way, has been divulged, popularized and made a major pre-occupation across all social classes and groups in Western countries over the last year or so.

Beside being concurrently elicited by the media, speculation is based on the very possibility to manipulate classifications in order to orient future performance accordingly to expectations related to current and future behaviours. Not by chance the name of financial products which embed this manipulation is "Futures".

In turn, financial market indices are bounded objects used themselves as standards to compare and evaluate other collective bodies' performance (GDPs, public debt rate, unemployment rate and so on).

All of these data (indeed, numbers and figures) are then subject to the "definition power" of regulatory bodies such as international rating agencies, which seem to be the primary actor in the arena of financial capitalism, not being affected by the material and reputation "bankruptcy" of investment banks that led the current global crisis. Even worse, they have been profiting (and contributing) to the crisis through their evaluations, approvals and rejections (see Gallino 2011).

Proliferation of indices and standards, their instability and oscillation behaviour, all this signals that the very texture of the infrastructure is as much ecological as fragile (see Star and Bowker 2007).

However, it is when analyzing consequences of financial speculations and of the unbalanced relationships between real economy and financial markets that the interpretive adequacy of the ecological-infrastructural approach is even more evident. From individual savers and families who lost everything they had, to countries under constant scrutiny, financial markets infrastructure shows its "torqueing" power, the power to exert an unbearable pressure not only on lived biographies of individuals but also on the present and the future of entire populations and countries. The Greek case is the immediate example of what enforced compliance to the requirements imposed by financial markets can bring about.

Furthermore, following Perna's argument, it can be asked if the speculative collapse of financial markets is an "internalized" behaviour, based on instability as a basis for the financial system to keep controlling (and taking over) the real economy system. If the breakdown is more and more frequent, then it can become a routinary approach, so reversing the relationship between visibility and invisibility, installed basis and breakdown, as well as the usual boundaries among social groups working around financial indices.

In the end, it is not irrelevant to recall that whereas classifications are in theory self-consistent and not contradictory, standards are such because they are shared across different social worlds/actors/groups, which using them can interact among each other. The breakdowns (in Perna's terms, financial storms) signal an unsatisfactory working of these standards, testified by consequences (both in

quantity and quality) of exclusion for myriads of individual and collective bodies. If fitting the standard becomes more and more an undertaking, it could be an issue to re-discuss boundaries among social worlds and the very working of infrastructure. Current indices and evaluation mechanisms of financial markets (are) put in crisis, so that Ordinary maintenance is not enough. Sometimes, a new piece of infrastructure has to be implemented to start with different categorization mechanisms, able to re-include the "orphans" generated by continuous infrastructure breakdowns.

2. Climate change as controversy and fabrication

A tacit *fil rouge* between financial and environmental storms, beside Perna's analogical argument, is the fact that weather forecast is another case of built-in information infrastructure, based itself on stochastic and statistical models, that means mathematical applications to foresee uncertainty and make it manageable. In this sense, financial markets and climate (in the shape of weather forecast) are two examples of "domesticating" (sometimes abusing) the laws of probability, "betting" on the short term future behaviour (of prices and of climate, respectively).

And also here, speculations or fabrication of more or less false catastrophes – "breaking news' in the old and new media - start emerging as a "structural" issue in weather forecast as a business and a show-biz (Livini 2012). To the extent that also in Italy private agencies of weather forecast seem to play a major role in delivering more or less "home-made" forecasts via web, marginalizing the scientific role and legitimacy of the institutional national agency in the public perception and opinion. It is enough to say that 300 million users were connected to weather.com on Sandy's day (Livini 2012). Furthermore, environmental issues are handled through mechanisms of classification and regulatory bodies which are based on standards. The case of earthquake/tsunami risk classification is a classic one, whose limits and consequences are once again evident through counter cases, like the Emilia Romagna (Northern Italian region) earthquake in May 2012. An extreme and unexpected event, due to the very low risk attributed to the area by current mappings.

However, there is more than this. Climate and environmental "giant oscillations" are the controversial outcome of a controversial scientific issue, which can be labelled as "climate change" and sometimes declined as "global warming". This is a typical example of what Social Studies of Science have identified as a controversy, that means a persistent, continuous and relevant disagreement on a scientific theory/phenomenon, which involves many social groups, first of all the scientific community and scientists, then the broader public, and the media, whose role has become increasingly and widely crucial in the dynamics and outcomes of technoscientific controversies (see Engelhardt and Caplan 1987), even more in light of the Internet centrality (see Lorenzet 2010).

"Major controversies, then, can be regarded as a microcosm in which the interactions between science and technology and the rest of society can be conveniently observed and studied" (Giere 1987, 126).

Technoscientific disputes can then reach a closure but this depends on how all of the actors in play (scientists, the public, the media and so on) will interact among each other, and how much the media contribute to foster uncertainty on the issue at stake.

In the case of climate change/global warming, an effective closure does not seem to be close in time, at least because of the major role played by the media and non-scientists. Such a role has been multi-faceted. On the one hand, as US popular press did for some years, uncertainty was fostered and built up to de-legitimate lay knowledge and re-legitimate the primacy of scientific truth (Zehr, 2000). on the other hand, as made clear by the two docu-movies which have fostered the dispute and jeopardized the discussion arena (Gore 2006; Durkin 2007), political issues and politicization of the debate seem to be still very important in framing the thesis of the anthropogenic global warming and the role of CO_2 emissions in worsening life conditions and environmental equilibria. To the point that the "fabrication" thesis has been put forward, stating that science and scientists would have deliberately "built up" the global warming data.

Even if this was not a key issue in the recent Obama's presidential campaign, the public perception that climate is radically changing with unforeseeable consequences has been increased and reinforced by the intensity and frequency of hurricanes, of which "Sandy" is the latest destructive example. Furthermore, the "Denial Propaganda" built up around climate change has been very recently addressed by another docufilm (Kehoe 2012) aimed at providing a critical perspective on the issue and supporting the urgency of climate change as a social global problem.

As Perna suggests, self regulatory mechanisms seems acting to contrast with the "giant oscillations", but they are not effective enough, and the same happens in the case of financial markets. Still, it is in question how to face with these phenomena. Is it possible to think of a global contrastive action? The failure of political initiatives like Kyoto agreements and the contradictory role of IPPC do not encourage such a perspective. Others have seen in a micro-level of action and engagement the key to face with the problem, and here again, the role of the public perception, awareness and intervention would be crucial, as more participatory approaches to science (e.g. Public Understanding of Science – PUS) state.

The dispute continues, in the meanwhile human and non human costs increase and the World Weather Agency warns that in 2011 the CO_2 in the atmosphere hit the highest concentration recorded by now (Gualerzi 2011).

3. The Media as Selective Amplifiers

It is not trivial to go back to Orson Welles's "The war of the worlds" (30th October 1938) to talk about the media power in more depth than above. This radio-drama episode, beside securing the film maker and actor's fame, is still a powerful example of how simulation, deception and selective amplification can be carried out by the media (at that time, the radio).

Since then, Media Studies have become a field of study interacting with many others, making it clear that there is more than manipulation and propaganda to the media constitution and construction, often to the extent of proposing an integrated perspective to balance the apocalyptic approach (Eco 1964). To the scope of the argument of this contribution, one of the most interesting theories developed by (Mass) Media Studies seems to be the "Agenda Setting" one (Cohen 1963; McCombs and Shaw 1977). Its classical statement is that the mass media tell what topics to think about, more than simply saying "what" to think about. Part of this theory's merit has been the analysis of newsmaking mechanisms and dynamics (e.g., "news values" and "newsability" rules, which are another form of classification and evaluation system). Then, the agenda "metaphor" is salient to represent negotiations and conflicts between the media, the public and politics on the issues to be "thought about".

Such a theory seems still adequate to describe the role of selective amplification pursued by the media in technoscientific issues such as global warming/climate change, financial speculations, and other controversies, remembering that the current mediascape (Appadurai 1996) is even more complex and that the media have an ecological infrastructure in which the old and the new are always in play (Marvin 1994; Pellegrino 2008).

Media coverage (or its absence) makes a crucial difference in constructing the world as we know it, in telling us what to think/talk about, what worries and problems to address in everyday life and beyond. In the end, the informal golden rule of journalism for which "bad news is good news" is still working out extremely well.

In the case of technoscience, such a difference is even more important because of the discursive frames the media put in play to make sense of what is labelled as "new", "innovative" and sometimes "revolutionary" (Iacono and Kling 2001). This "rhetoric of the new" is particularly evident when new technoscientific phenomena are the issue at stake, especially new technologies on which horrors and hopes are constantly plotted (see Sturken et al. 2004).

Financial speculations and environmental catastrophes effects would not be the same without the media action. Extreme events are extreme not only because of their consequences and impact on the global economic and ecologic systems, as clearly shown by Perna. Their extremeness as a quality and an attribute is "fabricated", "constructed" and "amplified' selectively, according to changing interests, continuously negotiated by the media in front of other actors such as

scientists, opinion makers, citizens' associations, politicians, regulatory bodies.

To overlook such a construction and constructive process, which is constitutive of the arena of extreme events and of their consequences in terms of awareness and visibility, means to forget one of the driving mechanisms of this arena, as well as the potential to partly change the selective amplification through counter discourses elicited by the new media, namely the social web and its coordination power exploited by grassroots movements (e.g., "occupy wall street").

Conclusions

To sum up, what can STS say about "extreme events" and their cogent role in contemporary society?

This contribution has been an attempt to complement the macro (economic-ecologic) perspective proposed by Perna with a different kind of focus on financial markets and climate change. Three key words have been analyzed as conceptual axes of an STS approach: (information) infrastructures, controversy and selective amplification. Indeed, the infrastructural dimension seems to be the most powerful line of continuity between financial markets, climate change and their media coverage. All of the phenomena rely on a complex sets of classification, standards, rules for heuristic evaluation which show their limits when speculations, catastrophes and collective panicking (or ignorance) break down the ordinary working of infrastructure. It is then that a new categorization and boundary work is needed. When any infrastructure excludes so many individuals and collective instances, stressing their lived existences because of a blind orientation towards self reproduction and maintenance, then it is time (and space) to think of alternative infrastructures. This means alternative classifications and standards, able at least to reduce the consequences of permanent uncertainty, routinary extremeness and dominion of exclusionary categories. This would be a minimum goal, still hard to reach but not secondary to other types of challenges technoscience deals with.

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The Economical Medicalization: Objectivity, Measurements and the Primacy of Economics

Iacopo Salemmi

Introduction

The conclusions of Perna's article "Money and CO2: convergences divergence between financial market and climate fluctuation", are extremely important.

The need for a new policy to prevent disaster effectively, in light of recent events, increases everyday; to focus on poverty issues and risk management is more urgent than we can image.

Our world is moving through "Giant Oscillations" and rather than accepting them as a given reality, we need to resist and react. Those extreme events such as the economic crisis, pollution disasters, and poverty's exponential growth need to be strictly implemented on the political agenda. The cases that Perna reviews show perfectly how brutal and unpredictable those shocking situations are.

Moreover, we need to examine those cases through "different lenses", to ensure good input material for new analysis and hopefully new solutions.

For this reason I would suggest also to examine these assumptions through an STS lens, in particular focusing on the idea of objectivity and performativity of the economic science. Before assuming upon risk oscillations, idealistic problematization and risk calculation, I would criticize the perspective and the imaginary that economics is suggesting to us.

My idea and concern regard not only the problematic aspect of those giant economic crises, that are draining our world and life styles, but also the prospects behind this drama, that could be portrayed as the economical medicalization of our society. By economical medicalization I mean the state in which we encounter, incorporate, and recreate an imaginary of ourselves based on constructed capacities, limitations, prospective and dreams as depicted by the scientific production of facts in economics.

The economical medicalization is an explicit intervention in our mind sets and in our national and economical imaginaries; indeed this process forges a feeling of acceptance towards changes and reforms justified by economical figures, even despite these changes worsen our everyday life. This economical medicalization is defining the rules of the game and our identity through constructed formulas, numbers, statistical analysis, and traded or negotiated objectivity.

Before going deeper into my thesis I will deconstruct the concept of financial markets rather than simply investigate their behaviours, regarding non-equilibrium reactions. By deconstruct, I mean to dismantle the concept of financial markets to its point of origin, going beyond the economics perspective and paying attention to the main actors involved: numbers and objectivity.

1. Deconstructing financial markets and economics as objective science

My deconstruction will go through four main steps. First, I will address the important issue of numbers, and especially measurements; secondly, I will illustrate the criticalities of economical objectivity. I will then reassemble the concept of Economics so to eventually configure more carefully the financial markets.

Measurements have become a figure of standardization and objectivity over the years. Porter (1995), in his book "Trust in Numbers", argued that there is a crucial importance given to measures and numbers and how those measures create and shape continuously our imaginary. He underlined that while this makes things easier to laypeople who are unfamiliar to the economics jargon, on the other hand it is dangerously a convenient reduction of meanings to numbers. On the other side, this "convenient communication" through the usage of measurements is essentially a loss of information. Porter pointed out that in some cases this loss of information, as it happens with accounting and statistics, seems largely irrelevant but such an attitude presupposes that at the bottom of this process there is a clear determination through the activities of summarizing by measuring. Instead, as Porter (1995) suggested, measurement creates new things and transforms the meaning of old ones.

Measurements are a pillar of economics as a discipline. Neoclassical economics depended heavily on mathematical physics for the theoretical structure that the pioneers imposed on their disciplines; such imposition has been the basis to translate the practices and praxis into a scientific methodology. This assumption is perfectly logical and coincides with Lord Kelvin's statement for which

"When you can measure what you are speaking about and express it in numbers, you know something about it, but when you cannot measure it in numbers, your knowledge is of a meager and unsatisfactory kind" (see Porter 1995, p. 72).

In fact, measurements and numbers are the most used tools in economics to sustain the argumentation of the discipline. However, this kind of measurements, in particular the economical political neutrality – as well as the simplification behind it (see Otway and Wynne 1989) – are strongly connected to practices of abbreviation and description which are eventually "simplified representations". It follows that economics is not as neutral and objective as the Neoclassic perspective argued. Then adopting a constructionist viewpoint, Economics and financial markets are not immune to distortions and personal biases, so that they become a constructed environment and a place to be investigated through different lenses and perspectives, such as STS. The crucial consequence is that measurements and objectivity, as well as the primacy of economics, have deep political implications.

2. Financial markets, economics, and the world behind those identities

Following an STS approach to financial markets, Knorr Cetina and Preda (2005), MacKenzie et al. (2007), Sheila Jasanoff (1986; 1985), and Philip Mirowski (1994) have showed how fascinating and complicated is this unique constructed environment, which is more than ever becoming one of the most important issues of our everyday life.

As illustrated by Knorr Cetina and Alex Preda in their edited book "The Sociology of the Financial Markets" (2005, 6):

"The world economy was born with the dawn of international trade, and foreign exchange trading has played a role in this economy from this time onward […]. Financial markets can only be assumed to exist when there are routinized, systematic forms of trading, relatively stable settings, a minimal degree of standardization of financial securities, and established cognitive procedures for their evaluation".

Financial markets nowadays are characterized by the tendency of globalisation. In simple words, today we assist to the globalisation of every possible market through the localization of algorithms and calculations of the trade routines of Wall Street; that could be, "arguably considered as the global system of financial markets" (Knorr-Cetina and Preda 2005, 5).

Apparently, financial markets seem to be un-localized (e.g. bonds, shares etc.), however economy is typically a localized issue. In fact the dilemmas, issues, concerns and problems of the singular national financial market have consequences on the economies of other nation states and on their populations. This means that markets are localized and embedded physically and economically into the society of that specific nation. Despite this, they are simply unpredictable as showed by the different case studies of the economical crisis in the 20th century.

Crucial to the globalisation issue is the research on national bonds. While currency markets are inherently transnational markets, bonds are not. However, national bonds have become increasingly global in the most recent wave of globalization. Every country has its bonds, which reflect the value of cross-border transactions in bonds and equities as a percentage of GDP in the financial markets.

The important frame that we have to integrate in this context is also strongly related to the different criticism STS authors such as Callon (1998), Garcia et al. (2004), MacKenzie et al. (2007), and Hacking (1983) expressed towards economics assumptions and its performativity.

According to MacKenzie (Mackenzie et al. 2007) in economics the epistemological perspective is represented by knowing the world more or less accurately, whereas the ontological perspective is the production of the world, and the ability to reconfigure and transform it. The author points out that economics seems to be a tool for direct action or for strategy of intervention. MacKenzie also pro-

poses the performativity theory as an approach to economics and economies to analyse their messy materiality and complex networks. The performativity theory, as Merton and Wolfe (1995) suggested, is a self-fulfilling prophecy, namely a situation which is redescribed and redefined to make a false conception come true. Besides these assumptions MacKenzie (2007) strongly underlines that market efficiency is strictly connected to the available information that the market and other actors can reach.

This unopposed power of the economical performativity is shown perfectly by Callon (1998) and describes how economics is more than a mere observing tool, rather a machinery to shape and perform our society. This point is particularly important to contextualize the issue behind economics. Hacking (1983) as well posed this assumption by underlining how economics does not represent a certain environment but it does intervene on environment itself.

Also Garcia *et al.* (2004) followed the same path and ideas, showing how those economical numbers are constantly creating assumptions and decisions based on clamorous approximations; indeed the economical science is selling us an ideological perfect market, which instead should be more criticized.

These critical statements on economics will be the basis to analyse and perceive how the Spread is affecting our environment and not only describing it.

I also propose to connect MacKenzie's idea of Economics as a strategy of intervention more than a description to Foucault's governmentality (1973), according to which numbers have often been an agency to exercise power over individuals, since numbers turn people into objects to be manipulated. Indeed connecting those two theories we could understand and perceive how the power of economical numbers and decisions is exercising on us a constant intervention and manipulation of our behaviours, attitudes and mind-sets. At least this theoretical frame should shed light on the possibility that economics and its tools as percentages, measurements, numbers, and indicators are enacting the social by planning it.

Furthermore, as mentioned by Alexander Zinoviev (2000), we need to take into account that predictions are simply impossible; still what cannot be predicted through tools, could be planned. Therefore, the economics tools are not predicting our future; instead they are largely planning it every day.

To conclude, we need to introduce the issue of risk; Knorr Cetina and Preda (2005) showed the possibility to see and understand how much economics is constructed and how through this science emerges the issue of constructed risk, which nowadays is empowered constantly in our society. Knorr Cetina underlines how numbers for economic standards have been produced by standard setting organizations. The issue of economic risk is really important to understand because the risk *per se* is one of the strongest tools that can shape and recreate a certain imaginary.

3. The Economical medicalization

After this de-construction it is now possible to better understand my concern regarding the economical medicalization that is behind financial markets and also the current financial crisis. All the dilemmas of objectivity, politicization, neutrality, and risk communication are more than ever present in this field. The concept of economical medicalization could be also supported by Mirowski's (1994) "social induction process", which underlines how human ability to adapt to the most stressful environments is constantly making up our imaginary. Furthermore, in this way we cannot anymore perceive our "natural" environment, which becomes literally invisible to us.

To strengthen the economical medicalization assumption, I will show how the case of the objective self-fashioning, described by Joseph Dumit (2004), could reasonably relate to the case of the spread indicator in Italy, and how through this frame it could be interpreted as a pure medicalization.

The relation between experts, mediators, and laypersons is broadly studied and described through the STS literature. Dumit (2004) mentioned how this threefold relation could bring a sort of redefinition and production of the scientific facts, so recreating an objectivity that will be suitably accepted by the public. The objectivity depicted in Dumit's self-fashioning theory (2004) is an example of how our minds as well as our body capacities are constructed through what we read and listen to. The self-fashioning theory underlines how certain issues and behaviours are so much embedded in our society that they cannot be analysed outside of it. Dumit's analysis of the PET case shows how theories, machineries, and assumptions regarding the brain scans are transforming and recreating a complete new imaginary about our minds. Eventually we are strongly influenced by those medical assumptions, so that PET outcomes affect our behaviour and decisions.

A further example, Miller's syphilis case study. As stated by Miller (1975) the diagnosis/analysis approach in the case of syphilis, appears to fit particular problems, but those methods are constructed to fit in those problems, by creating results constructed and made up as objective. Those tools are clearly techniques of self-governing and intervention, which recreate an imaginary of technicality, purity, and objectivity.

After arguing about the problematic sides of economics, I would like to propose and analyze a relevant economic example that could be understood and analysed in the same way of Miller's syphilis or Dumit's PET.

4. The spread as economical medicalization

The example to illustrate the phenomenon of economical medicalization is the Spread, a well-known buzzword in Italy as in Spain, Greece, Portugal, and Ireland. Knowledge about the Spread has been growing over the past three years; the interest rate Spread is mainly used to subtract the Federal funds rate (the rate

that banks charge one another for overnight loans) from the yield on the 10 year of every nation Treasury bond. The interest rate named as Spread is a mathematical difference between a risk-free investment, such as a Treasury security, and a risky investment, such as a corporate bond. The Financial institutions define the interest rate "Spread" as the difference between the interest rates paid on deposits and the higher interest rates charged for various loan products.

In few words, the Spread is the interest rate that should foresee recession. In Europe the Spread is mostly used as the differential between Germany and the other European nations. And it is constructed from the difference between a given nation (Italy, Spain, France, Greece and so on) Treasure bonds and German Treasure bonds. The German bonds are indicated as the most valid and less risky Treasure bonds in Europe, and for this reason they are used as the term of comparison with all the other European nations.

My claim is that this indicator is a constructed tool that produces results and assumptions made to fit in our society and used to shape it. This is an explicit example of economical medicalization: no matter what policies or decisions will be taken, economics will make up them through its simplifications, representations, numbers, and measurements. Rather than representing the (constructed) objectivity of economics, the Spread could be seen and understood as an explicit example of technique of self-governing and intervention, aimed at recreating an imaginary of technicality, purity and objectivity.

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Formatting Culture.

The Mpeg group and the technoscientific innovation by digital formats

Leonardo Chiariglione and Paolo Magaudda.

Abstract This conversation reconstructs the process of technoscientific innovation of digital formats pursued in the '80s by the MPEG group led by Leonardo Chiariglione. Through a historical and cultural frame provided by Paolo Magaudda and the very words of the main character of this technoscientific story, Leonardo Chiariglione, the contribution gives fresh insights into the relationship between sociotechnical standards and the digitization of media culture.

Keywords: digital formats, standards, innovation, MPEG group, music industry.

Chiariglione, the Mpeg group and the process of standardization of digital formats

Paolo Magaudda

1. Chiariglione, digital standards and the Italian tradition of innovation

In this issue of "Tecnoscienza", we host a reflection by the Italian engineer Leonardo Chiariglione, who in 1988 founded the Moving Picture Experts Group (MPEG), the standards committee that has created digital standard for video and audio within the ISO (the International Standards Organization), and has since been in charge of the international process of standardization of digital media and formats for distributing contents. The work at Mpeg has produced some of the most important digital standards for consuming digital culture, such as the Mpeg standard for video and the even more famous Mp3, which ruled the spread of digital music, initially through diffusion of file sharing and then with the triumph of portable players such as the iPod. In sum, as founder and director of the Mpeg, Leonardo Chiariglione was one of the protagonists of some of the most delicate, yet unrecognized, process of technology transition from analogue to dig-

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[1] This conversation is an expanded and edited version of the plenary session at the 4th STS Italia Conference "Emerging Technologies, Social Worlds" (Rovigo, 2012, June 21-23).

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ital encoding of culture.

It is for these reasons – the importance of the Mpeg's work, the lack of information about these processes, and the fact that Chiariglione represents one of the most important Italian innovators – that the Italian STS Society invited him to give a speech at the IV STS National Conference, held in Rovigo on 21 and 22 June 2012, and titled *Emerging Technologies, Social Worlds*. On that occasion, Chiariglione explained to the audience some aspects of the Mpeg's work and the text that follows in this section is an adaptation from his Rovigo's speech.

Although much of the work developed as Mpeg has been carried out at international level and it is only marginally linked with the Italian context, nevertheless Chiariglione represents the ongoing trajectory of a prestigious and important, even if partially forgotten, Italian tradition of innovation in the field of communication technologies. Graduated in 1967 at the Polytechnic of Turin, after a PhD gained in Japan in electrical communication, Chiariglione started his career at the end of the sixties at the CSELT, *Centro Studi e Laboratori Telecomunicazioni* [Center for Studies, Laboratories for Telecommunication], founded in Turin in 1964 within the STET group, the main firm involved at that time in developing new technical systems for telecommunications, later absorbed by the Telecom Italia Group (see Mossotto 2011).

With this professional origin, Chiariglione is without doubt a representative of a «golden age» of the Italian innovation in telecommunications. This was mostly rooted in the city of Turin, where there has been a strong focus in this area of research and still well-established institutions are located, such as the National Electrotechnical Institute Galileo Ferraris (founded in 1934) and the Center for experimental research (founded in 1930) inside the Rai, the Italian public radio-tv broadcaster. Especially, we cannot overlook the fact that Turin is also the province where the most important Italian producer of computers had his headquarters: Olivetti. Olivetti has a relevant role in early computer history, having created in 1965 what is often credited to be the first personal computer, the Programma 101 (Zane 2008; De Marco et al. 1999). Thus, the trajectory and the work of Chiariglione is significant not just for his involvement in the shaping of digital standards, but also because he represents the continuation of an important Italian tradition in the sector of telecommunication technologies, today unfortunately in decline from the technical point of view and often forgotten in public portraits of Italian cultural and industrial history.

However, the importance of Chiariglione's profile is not just central for the history of Italian technology. Over the decades, he has been involved in many projects and activities that have been relevant for development of the digital technology environment, although not all of them have been successful as the Mpeg group did. One less fortunate case was Secure Digital Music Initiative (SDMI), a forum started in 1998 and sponsored by the US recording industry, which aimed to develop specification that would enable new ways of doing business with digital music and where Chiariglione was named Executive Director (see Chiariglione 2003). Unfortunately, as narrated by media scholar Tarleton Gillespie (2008, 144-154), the project failed, having been not able to find an ef-

fective technical solution and a consensual outcome.

Considering this last failure and, more in general, how complicated is to develop collaborative processes within the entertainment industry, is thus even more interesting to analyze the instances highlighted by Chiariglione about the successful work of the MPEG working group. Hence, this *Conversation* represents a direct insight, highly significant for scholars in the social history of digital media and culture.

2. The MPEG group and the standardization of digital formats

For different reasons, it is common to recognize, among social scientists involved in media history, a scarce interest on the actual technical processes behind standards, which are often considered as transparent, mostly taken for granted tools for communication. It is surprising to note that, despite over last ten years the Internet has been subject to significant research on its history and social implications, very few analysis has been done about the actual processes that led to the creation of digital standards, formats and protocols. These forms of standardization constitute the invisible and hidden technical bases for the evolution of the internet and have deeply influenced the shaping of contemporary markets for digital culture. Among these standards and protocols, the Mpeg standards for compressed video and audio have certainly been decisive for the emergence of digital circulation of culture in the ways we today know it.

The standardized infrastructure of digital communication has often been seen as the outcome of political or strategic social processes, connected with structural powers fighting within society, as it happens in the big picture drawn by Castells (1996) about the rising of the network society or, in different way, through the goffmanian-inspired interpretation of the electronic media's effects traced by Meyrowitz (1985). In media studies we have just small niches of scholars who have focused on the materialities and technicalities of media artefacts and infrastructures (i.e. Sterne 2003; Gittleman 2006). This has meant that the history of the media has often overlooked not only emerging technologies, but also the interrelationship between their technical and material shape and contents, structures of power and social changes generated from the diffusion of media technologies.

On the other side, also STS scholars have scarcely contributed on the processes of generation of digital standards and how they affected the shaping of digital society. Even if STS have rightly recognized that information infrastructures and standards are a privileged terrain on which to develop analysis of socio-material processes and practices, STS scholars have mostly tended to focus on situations related with production and organization, rather than on phenomena directly intertwined with media, cultural consumption and cultural industries. As Wajcman and Jones have recently pointed out on this matter, "while STS has developed into a major field of social science over the last 30 years or so, media or communication technologies have not been as central a topic for it as have bio-

technologies, for example." (Wajcman and Jones 2012, p. 674). This is certainly another part of the reason why STS have not being really proactive in the analysis of standardization related with video, music and other digital cultural stuff.

This is a pity, because the study of standards of digital culture may find fruitful concepts and ideas within the STS toolbox. Looking at the role of formats and standards in shaping digital culture, STS potentialities can certainly draw from the whole theoretical framework connected with the study of infrastructures and classifications, a major trajectory in the STS field (Star and Ruhleder 1994; Bowker, Timmermans and Star 1995; Bowker and Star 1999). However, as part of the broader STS "productivistic bias", the study of informative infrastructures has privileged professional and productive contexts and it has just rarely found applications to the study of media and cultural contents (with some kind of exceptions, such as Christine Borgman's book on digital libraries, 2003). With Chiariglione's collaboration, the focus on the Mpeg experience could offer an opportunity to put in a new perspective the relationship between STS, media studies and the generation of standards for digital culture and consumption.

As Tarleton Gillespie (2008, 280) has argued in his book on the relationship between technology, copyright and digital culture, the analysis of digital flows asks us to consider as crucial those processes by which digital contents are "closed" through algorithms, formats, standards, protection systems. These processes touch the heart of the debate about which culture we want to support in the transition and translation to the digital environment. And all this implies to force media analysis to consider more carefully the heterogeneous processes – at the same time technological and commercial, institutional and social, ethical and cultural – of construction of standards, protocols and algorithms that materially shape and set the boundaries around digital culture.

3. Chiariglione and the MP3 birth

One of the rare scholarly attempts to frame the relevance of the MPEG group's work for the standardization of digital culture comes from the sociologist of sound media Jonathan Sterne, who has dedicated to this issue part of his recent book *MP3: the meaning of a format* (Sterne 2012). In this volume, the author traces the history of the mp3 music format, from the nineteenth century advancements in perceptual techniques to the present days, with several pages discussing the contribution of the Mpeg group to the digital music history. Let's see shortly what Sterne says on the Mpeg.

We are back in the eighties: the Compact Disc is gaining its *momentum*, and no one thinks that digital compressed audio would revolutionize music industry. At that time, many big companies were working in algorithms to compress the audio, but no one seemed achieving a truly satisfying solution. It is in this context that Chiariglione founded the Mpeg group to develop a decision-making process for digital compressed formats by starting a completely new procedure in the history of music industry formats, where people were used to establish new formats

trough strong, fierce commercial fights and aggressive commercial strategies. In opposition to this usual pattern, the Mp3, as Sterne writes, was instead "the result of international standard and exercise, complete with rules for participation and debate, elaborate testing systems with well-documented results." (2012, 134).

The output of the Mpeg initiative has been a strange format, originated outside of the full control of music industry and consumer electronic industries, and open to be distributed freely, even if owned by someone (the German Fraunhofer Institute, which gave the strongest technical contribution to the algorithm, has owned several patents included into the format). Mp3 peculiar features derived from the fact that the Mp3 standard incorporated practices and procedures coming from at least three distinct technical standard traditions: for consumer general devices, for broadcasting and at a lesser degree standards for computers. Three professional sectors that have been historically very different both for the relationships between their main actors and for what a "standard" was for them.

As observed again by Sterne, "the MPEG standard devised approved in 1993, "did not put to rest matters of industrial competition, nor did it ultimately settle questions of sound quality in perceptually audio codecs. But it marked an emergent, crystallized set of understandings, practices, protocols, and industrial relationships" (Sterne 2012, 146). Further details in the development of the MP3 make it clear that the process that led to the standardization of audio compression algorithms into the mp3 produced huge consequences on the shape eventually assumed by digital music.

The originality of the work carried out at Mpeg has scored a major break with the traditional paths of innovation in the field of music formats and, consequently, it has generated disruptive effects on the industry stability. Historically, patterns of innovation in this sector have been characterized by the selection of standard through forms of conflict between companies (or consortia of companies) in competition between them, or the so-called "war of formats" (see Millard 2005; Greenberg 2007). The different way represented by an open consensus process embedded by the Mpeg group led to the creation of a format, the mp3, that not only has different characteristics in terms of how it can be appropriated and used, but that also gave rise to a real revolution in the musical industry.

While in the course of the twentieth century, musical formats have been one of the tools in the hands of large corporations to control markets, technical innovation and cultural contents, in about ten years the Mp3 generated the loss of control of market by established music industry. Moreover, Mp3 was also the basis for the emergence of a new powerful actor in the music business, the Californian computer company Apple, which, while it was not in the music business as far as 2003, today controls 75% of the digital music sales in Us, more than one third of the whole music sales in that country: it is much more than how a single music company has ever controlled in recording music history. In short, when we look at the process of standardization of mp3 and at the work performed by Chiariglione's Mpeg group, we have the opportunity to see how the work of standardization has been crucial, and still remains so, in the evolution of a specific dimension of contemporary digital culture.

4. Chiariglione's perspective on MPEG work

Although it is just a perspective from a distinct protagonist of this process – thus carrying with it his biases on this matter – the following text of Leonardo Chiariglione goes through some of the points considered so far: the history of the MPEG working group, certain ideas that animated the group, some of the procedures adopted. Moreover, in his text Chiariglione also describes some of the new areas on which the group is actually at work on, including new standards for broadcasting and the new standard Media Transport (MMT) for the management of the distribution of contents to multiple devices simultaneously.

It is probably useful to highlight some of the most interesting points raised by Chiariglione. The first point he remarks at the beginning of the article is about the definition of what is a "standard". First of all, a standard is a reference "that is established by consent" and not "by authority". This subjective view reflects one of the aspects that have characterized the differences between the Mpeg work and the patterns of innovation that preceded it, focusing on the features of decision-making in establishing the standard.

He thus writes that standards are "codified agreement between parties who recognise the advantage gained from the fact that the members of a group do an agreed number of things in the same way" and that this was useful because it allowed "to convert the traditional battle between competing solutions in the marketplace to a battle between experts in a standards committee." Here we can see some of the key argumentative tools that contributed to allow the emergence of a different process of standard generation: consent, collaboration and the possibility to avoid market battles, usually cause of huge overall losses for electronic industries.

The report by Chiariglione around the Mpeg activities and practices could maybe appear a very positive and idealistic perspective, also concerning initial motivations and goals obtained by the group. For example he does not make references to conflicts and battles presumably occurred also among Mpeg members. However, as Sterne pointed out in his Mp3 history, even if Chiariglione "casts the history of computer standards in a sunnier light then probably warranted […] his idealism certainly is part of the reason MPEG worked at all" (Sterne 2012, 132). But Chiariglione would certainly tell the matter differently. As he has commented reading these notes, even if his perspective could be referred as idealistic, it is however better to make reference to "realism". Indeed – he commented – only by isolating Mpeg from the rest of the world it has been possible to overcome complexity, also highlighting that who tries to bring complexity into the business of standards is doomed to fail.

Digital Media Standardisation and Society: The MPEG experience

Leonardo Chiariglione

1. Introduction

We define digital media as digital representation of information primarily used for generation and consumption by humans. The history of mankind is dotted by many attempt to represent such information: for thousands of years handwritten characters have been engraved on all sort of physical carriers; printed characters and fonts came to the fore some 500 years ago; photographs were the result of chemical processes, characters were represented by dashes and dots; audio and video were carried on physical and immaterial carriers and so on. But the digital representation of information made possible by the latest generation of technologies has incomparable power.

The greatest attention has been dedicated so far to digital media for eyes and ears (audio, speech, video, still images, natural and synthetic graphics), but increasingly other senses are also being served (touch, smell, taste) and possibly even beyond that.

Digital media is the cleanest form (so far) of disconnection between the carrier and the information carried. To some extent that was already true of magnetic tape and cassette, to a much lesser extent it was true of radio and to an even less extent of vinyl. It can be said that before digital the carrier had so much analogue influence on the information. This paper will study some of the effect of digital standards on society and the important part of society called market.

2. About standards

There is not a single form of digital representation of information and this, again, was true also of the analogue world: posterity should be spared the epic battles between PAL and SECAM, Philips and Bosch audio cassette, VHS and Betamax, Philips/Sony and RCA Compact Disc.

A specific information representation is called format. The history of consumer electronics (but not only) is littered with "format wars". There are sufficient examples now to state that a format war is a lost opportunity for all parties engaged in the war and, primarily, the consumers, who are unwilling casualties in the battle. A format is, in the end, a form of standard, a much abused word that it will be of great help give a proper definition.

We start from the Webster's which provides not one but two definitions: "a conspicuous object (as a banner) formerly carried at the top of a pole and used to

mark a rallying point especially in battle or to serve as an emblem" and "something that is established by authority, custom or general consent as a model or example to be followed". These two definitions convey an important message: a standard is a "reference" that is established, forget by "authority", but by "consent".

The *Encyclopaedia Britannica* uses a definition that concentrates on one of the benefits of a standard because it calls a standard a technical specification "that permits large production runs of component parts that are readily fitted to other parts without adjustment".

To remove any ambiguity I would like to make reference from now on to my definition of standard:

"codified agreement between parties who recognise the advantage gained from the fact that the members of a group do an agreed number of things in the same way".

Four issues deserve some attention:
1. The actual process (*de jure* or *de facto*) that produces the agreement is irrelevant, provided it is fair to all parties concerned (otherwise it is market distortion) and carried out to match the needs of users (otherwise the result may not be very useful);
2. The process of setting standards may be very different, even though the "status" of some agreements may be "higher" than that of other agreements;
3. The means to decide whether an implementation conforms to the agreement are part of the agreement;
4. The means to enforce the agreement are not part of the agreement.

It may also help to identify the entities in charge of defining standards for information representation. Since about 150 years the need for standards bodies with the task to ratify and sometimes develop "formats" has been recognized. Today they exist at the international, regional or national level; designed to serve the needs of specific industries or, more rarely, across industries; tightly overseen by or largely independent of governments. Here are some examples at different levels:

- International
  - International Telecommunication Union (ITU), with two branches: Telecommunication (ITU-T) and Radio (ITU-R);
  - International Organisation for Standardisation (ISO);
  - International Electrotechnical Commission (IEC).
- Regional
  - European Telecommunication Standards Institute (ETSI).
- National
  - Institute of Electrical and Electronic Engineers (IEEE);
  - American National Standards Institute (ANSI).

Standards bodies typically produce standards for certain areas. This is true also at the international level where ITU deals with "telecommunication standards", IEC deals with "electro-technical standards" and ISO deals with "everything else". Also the juridical nature of standards bodies is different: ISO and IEC are not-for-profit organisations registered in Switzerland, ITU is a Treaty Organisation and a UN agency, ETSI is an association under French law and IEEE is a professional organisation of electrical and electronic engineers. Before moving to the next chapter it is useful to dig a bit more into what is and is not a standard.
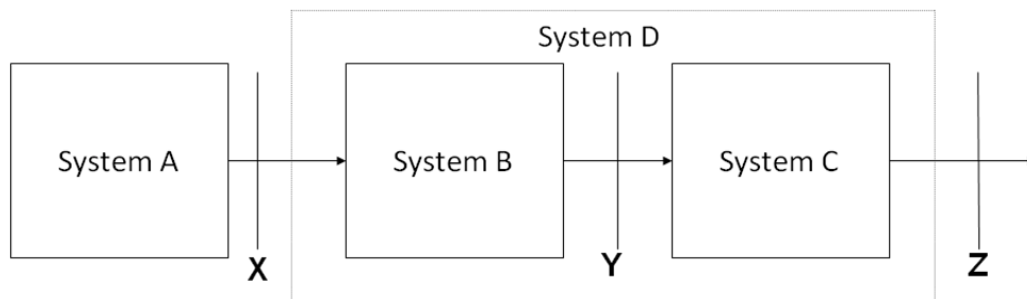

Figure 1 – Standards and interfaces

In general a standard addresses interfaces. System A interworks with System D via Interface X. System D may be subdivided in two subsystems: B and C. They are separated by interface Y. An implementation of System D may or may not implement interface Y. In the former case the interface is exposed, in the latter case nothing is said of the internals of System D, but conformance to interfaces X and Z is mandatory.

3. Enter MPEG

The MPEG idea was born toward the end of the 1980's from the consideration of the maturity of the digital audio-visual compression technology, the desirability of "audio-visual information representation" standards that were application neutral and of a global scope. Such standards would put in touch billions of communicating people without barriers and would stimulate manufacturing of communication equipment and services. The body that would carry out this task should also act as a preferential channel between research and standardization. Indeed it could only be expected that, as digital media standards were deployed, more investment in research would create more technology suitable for standardisation.

Finding a place where this grand vision could be implemented was not easy because the panorama of standardisation environment at that time was quite complex:

- In ITU-T[2], "SG XV WP 1" dealt with transmission of speech and "WP 2" with transmission of video
- In ITU-R, "SG 10" with broadcasting of audio and "SG 11" with broadcasting of video
- In IEC, "SC 60 A" dealt with recording of audio, "SC 60 B" with recording of video; "TC 84" with audio-visual equipment, and "SC 12A" and "G" dealt with receivers
- In ISO, "TC 42" dealt with Photography, "TC 36" with Cinematography and "TC94/SC 2" with Character sets.

The choice fell on the Joint ISO/IEC Technical Committee 1 (JTC 1) on Information Technology recently (1987) established by concentrating in one Technical Committee various Information Technology related standardisation activities of IEC and ISO, particularly "ISO TC 94 Data Processing".

MPEG started as an Experts Group of Working Group 8 Coding of Audio and Picture Information of Subcommittee 2 Character sets and information coding.
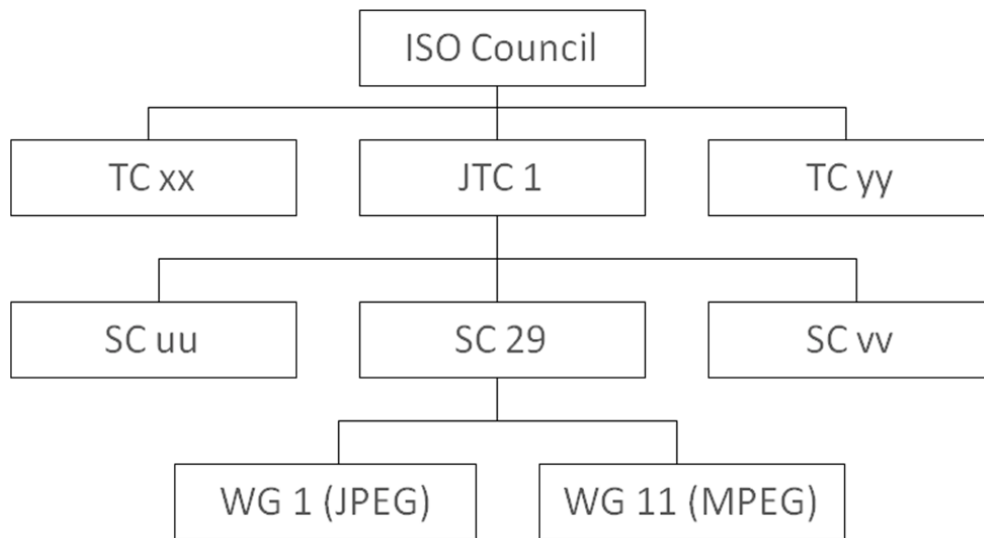

Figure 2 – Simplified ISO hierarchy.

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[2] ITU-T and ITU-R stand respectively for the "T" Branch and "R" branch of ITU.

Having a body that was sufficiently neutral vis-à-vis the various industries with a stake in digital audio and video was essential to achieve the goal of making different competences add and different agendas mutually neutralize. Moreover, as digital audio and video were largely based on software it was possible to convert the traditional battle between competing solutions in the marketplace to a battle between experts in a standards committee. A fight between technologies is less expensive than a fight between assembly lines and the result is also better in terms of technology cost, functionality and performance.

The current position of MPEG in the ISO hierarchy is given in Fig. 2.

Before moving on it is important to note that decisions in MPEG are not taken by the force of numbers, but by the force of technical arguments based on which "consensus" is reached on a decision. This means that participants come to meetings with a background of intense home work to be used to fight for their arguments. Sometimes that is sufficient, but rarely there is a need to make (impose) a decision. Here is the ISO definition of consensus:

«Consensus: General agreement, characterised by the absence of sustained opposition to substantial issues by any important part of the concerned interests and by a process that involves seeking to take into account the views of all parties concerned and to reconcile any conflicting arguments.». (NOTE: Consensus need not imply unanimity).

4. How MPEG works

The MPEG philosophy can be summarized by the following list:
- develop standards for converging media;
- integrate the required technologies using research results from multiple sources;
- act as a bridge between academia/research and industry;
- develop software implementations of the standards as a platform for peer review and optimisation;
- verify the performance of the standard.

This philosophy is executed by a body with some remarkable figures:

- meeting frequency: 4 meetings/year;
- number of meetings: 102 until October 2012;
- attendance: ~500 experts;
- countries actively represented: ~25;
- industries represented:
  o Academia;
  o Broadcasting;
  o Computers;
  o Consumer Electronics;
  o Content;

- o   Research;
- o   Services;
- o   Telecom;
- o   …

It is interesting to study the workflow through which MPEG develops its standards:
- • Identify the need for a new standard:
  - o   Identify the need for a standard;
  - o   Approval of a new standard project.
- • Explore the field:
  - o   Seek Industry experts;
  - o   Open seminars;
  - o   Search for required technology.
  - o   Develop requirements:
  - o   Establish scope of work;
  - o   Call for Proposals.
- • Competitive phase:
  - o   Study response to Calls for Proposals;
  - o   Initial technology selection.
  - o   Collaborative phase:
  - o   Core Experiments;
  - o   Working Drafts.
- • Approval:
  - o   Committee Draft;
  - o   Draft International Standard;
  - o   Final Draft International Standard;
  - o   International Standard.
- • Assessment of performance:
- • Verification Tests.
  - o   Maintenance:
  - o   Corrigenda;
  - o   Amendments;
  - o   Withdrawal.

MPEG standards have changed the landscape of media, as this brief summary shows:
- • MPEG-1, -2, -4 are used in hundreds of million devices;
- • Video CD players;
- • MP3 players;
- • Digital TV set top boxes;
- • DVD players;
- • Photo cameras;
- • Mobile handsets;
- • Movie players.

5. An overview of some MPEG standards

MPEG-1 started from expected promising markets: interactive video on CD and Digital Audio Broadcasting (DAB). The product drivers were: Compact Disc Interactive (CD-i), Digital Compact Cassette (DCC) and Digital Audio Broadcasting (DAB). However, the result were quite discomforting: CD-i is dead, DCC is dead and DAB is (almost) dead.

By relying on the wisdom of product departments MPEG thought that:

1. Compact disc interactive would be *the* product. Instead CD-i failed but Video CD (VCD) thrived. Lesson to learn is the "Keep It Simple, Stupid" (KISS) principle.
2. Digital Audio Broadcasting would be the service but what actually happened is "mixed results". Lesson to learn is that it is hard fighting against the good enough (FM radio).
3. Digital Compact Cassette would be the product, but DCC failed. Lesson to learn is that it is hard to sell new wine in old barrels.

Still it would be hard to say that MPEG-1 is a failure, because Video CD thrives because it is a "better" VHS with hundreds of million players and billions of titles sold, admittedly as a result of industrial policy of some governments; MP3 thrives because it provides new ways of experiencing music and billions of MP3 files have about the same quality of CD.

From the technical level one could also add that, although MPEG-1 is composed of 3 parts (Systems – Video – Audio), the parts can be used independently, because it is good to give a single package as a solution, but some users may only need one or two parts. Moreover, MPEG standards only define syntax and semantics that can apply to any value (picture resolution, frame frequency, audio sampling frequency etc.) but products need "maximum parameter values". So MPEG-1 defined the Video "Constrained Parameter Set". Also, not everybody needs the same amount of technology, so MPEG-1 defines audio "layers" where to a higher layer number corresponds more performance (and complexity).

Focusing on audio, MPEG-1 teaches a few more lessons. Some thought that high compression digital music (layer III) was too complex and would never fly, but what actually happened is that MP3 is all over the place. The lessons to learn are:

1. The power of software that allowed thousands of people to develop their own software encoders and decoders, but also the power of silicon to make inexpensive devices.
2. It is very hard to stop a technology that tears down walls, particularly when the result is a cheap substitute of the original.

Speaking of cheap substitutes, some thought pay music will never fly, but

what actually happened is that a company that used to be on a drip has become the most valuable company in the world. Such is the power of packaging and the power of the faithful. The recording industry was taken by surprise by the MP3 phenomenon because, with MP3, people can find and play any song any time anywhere on any device over and beyond the "vinyl/CD straightjacket". Unfortunately, instead of giving their customers more of what they wanted, they brought them to court... The result? Today the recording industry is worth one half of what was worth in 2000.

MPEG-2 is a proof that, if you try hard, devil and holy water can live together.

MPEG-2 is also largely a 3-part standard:

1. For Systems, some wanted it ATM-friendly (ATM was a telco-sponsored broadband technology that was superseded by the Internet), some wanted it interfaced with physical channels and some wanted it storage-friendly.
2. For Video, European broadcasters and telcos wanted scalable video, American broadcasters wanted non-scalable and high definition video and Japanese broadcasters wanted non-scalable and standard definition video.
3. For Audio, some wanted it backward compatible with MPEG-1 and some wanted it independent of MPEG-1.

MPEG managed the challenges: Profiles allowed different groupings of technology serving different purposes, and Levels allowed the definition of sets of application-driven parameter values.

It is fair to say that MPEG has provided the means for the television business on air, cable and satellite to migrate from the analogue to the digital age and today there is virtually no broadcasting system that is not based, at least partially, on MPEG standards. MPEG has achieved this through a collective effort where representatives from the entire spectrum of the broadcasting world provided their requirements.

We should not underestimate the creation of packages of patent licenses (developed outside of MPEG, because MPEG only deals with technology, not licensing). These gave the means to anybody to legally use MPEG standards through open and non-discriminatory royalties.

The MPEG-7 standard is about description of audio, video and multimedia. It was a new type of coding for MPEG: not coding of assets, but coding of its descriptions. The standard has not encountered the success of MPEG-1, -2 and -4, because there is too much conservatism in incumbents. Even today few, if any, textual metadata accompany television programs, while metadata is the enabling technology for doing business with digital media.

The MPEG-21 standardisation project was born in October 1999 with the "goal to enable diffuse trading of content where every human is potentially an element of a network involving billions of content providers, value adders, pack-

agers, service providers, resellers, consumers ...". The basic elements are:

- Digital Item: a structured digital object with a standard representation, identification and metadata.
- User: a Creator, an End User or an Intermediary interacting in the MPEG-21 environment or making use of Digital Items.
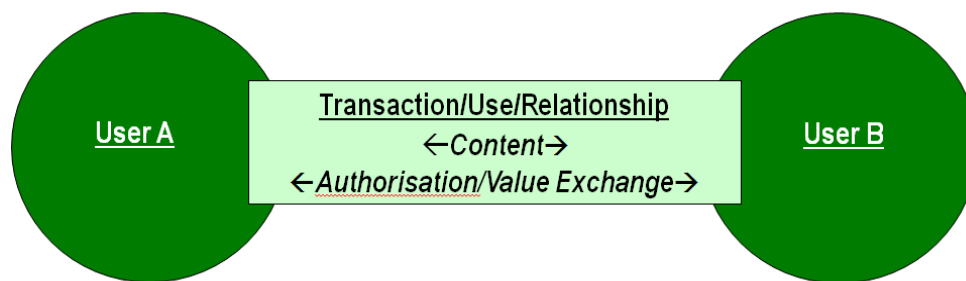
Figure 3 – The MPEG-21 elements

Unified Speech and Audio Coding was developed with the goal to achieve a single coding technology that could encode mixed content (Speech, Music and Speech mixed with Music) while being consistently as good as the best of: AMR-WB+ (state of the art speech coder) and HE-AAC V2 (state of the art music coder) in the range of 24 kb/s stereo to 12 kb/s mono.

6. Looking to the future

So far MPEG standards have addressed the problem of defining syntax and semantic of bitstreams that represent a given source of information (audio and video), like depicted in the figure 4 in the next page:
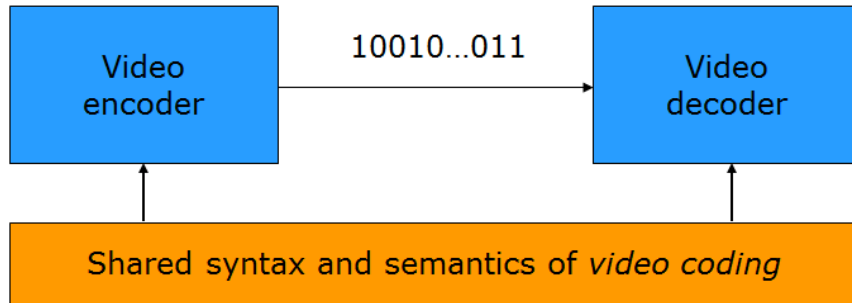
Figure 4 – Transmission of encoded video stream

The next stage in the development of technology lies in defining syntax and semantic of the algorithm used to compress the signal.
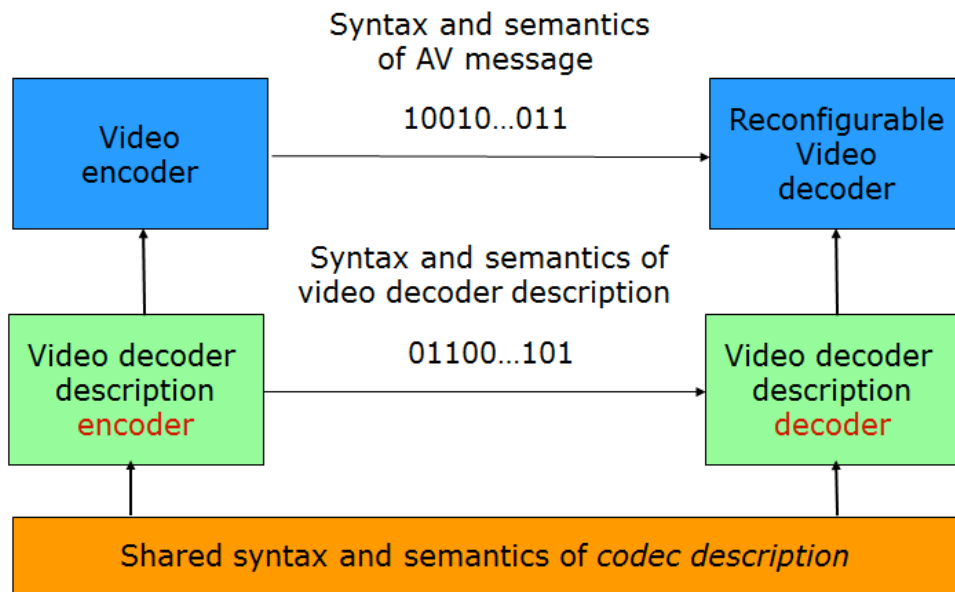
Figure 5 – Transmission of decoder description

Some of the more recent efforts are directed at extending the user experience. For instance in the figure in the next page:
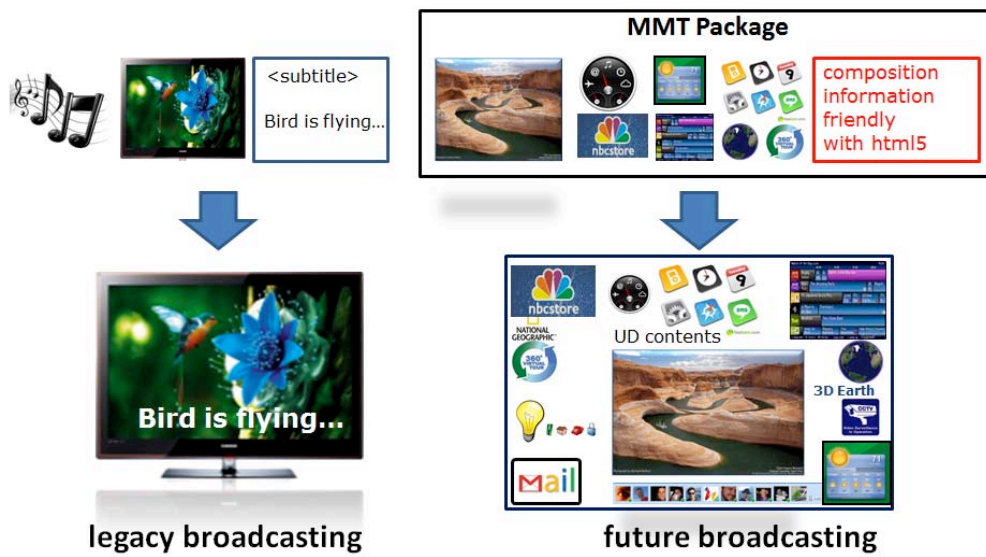
Figure 6 – Multimedia in broadcasting systems

The left hand side represents what can be achieved with today's broadcasting technology, where the delivery of a multimedia package is rather primitive, while the right hand side represents the ability to send real multimedia information offered by the emerging MPEG Media Transport (MMT) standard.
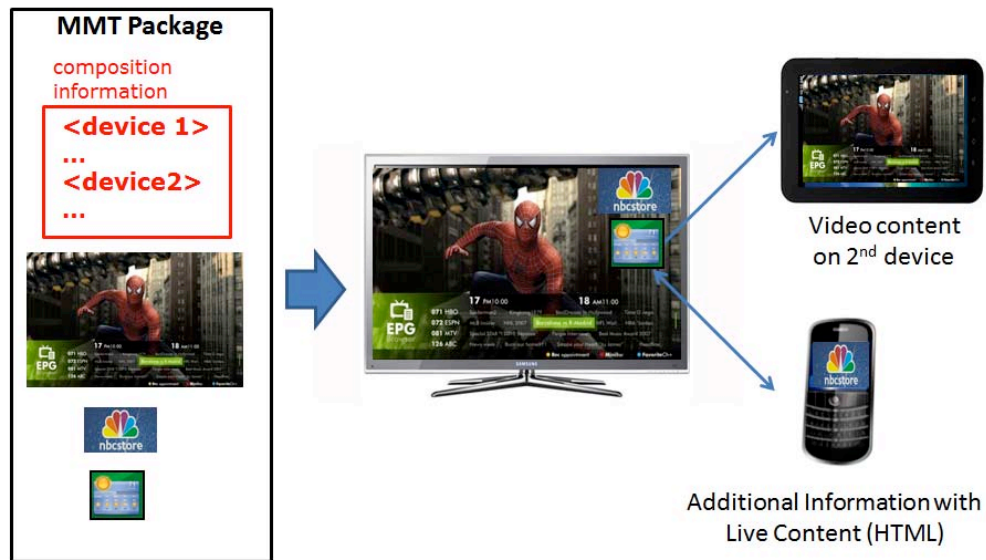
Figure 7 – Multimedia in broadcasting systems

The figure above depicts the possibilities open to the definition, on the broadcaster's side, of how content is best presented on multiple screens.

Television has undergone several stages: in the 1950s analogue, backward compatible colour TV was introduced; in the 1990s Digital TV and the transition from SD to HD required a new infrastructure ; in the 2010s it is expected that 3D Television will have a mass deployment.

The underlying 3D Video technology is rather complex. The MPEG plans can be described by the figure 8.

At the source the information from a limited number of cameras is compressed, transmitted and reconstructed at the receiving side to provide left/right images for stereoscopic displays or an arbitrary number of views for auto-stereoscopic displays.

Another area for standardization is the definition of a package of information that includes, in addition to the usual audio and video in different forms, also olfactory and various other tactile and positioning information.

Figure 8 – 3D Video modes.

Figure 9 – Transmissions of other sense information

7. The role of software

Most MPEG standards are expressed with a combination of a human language (English) and a computer language (pseudo C-code). Most MPEG standards were developed using software and mos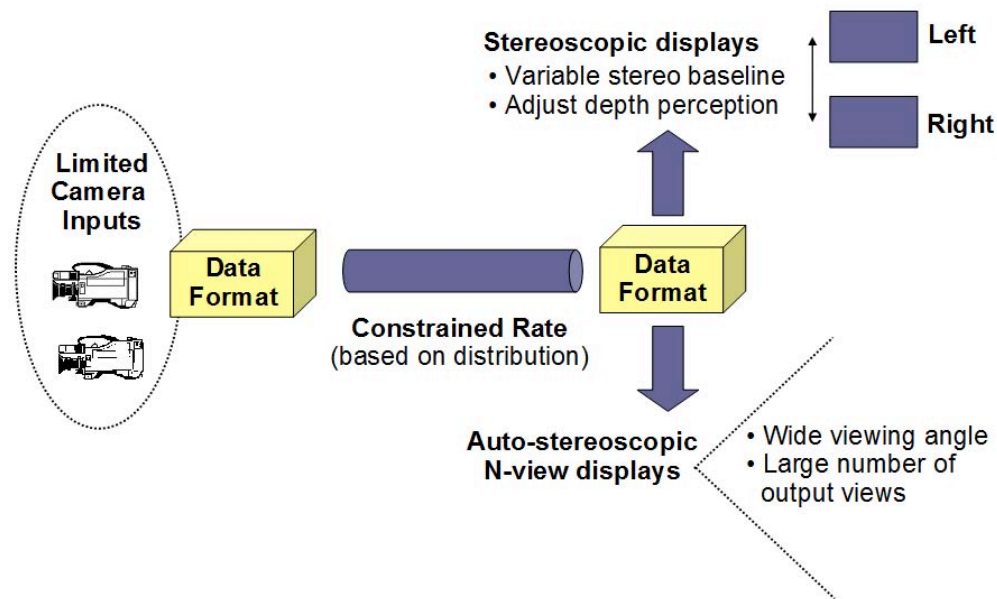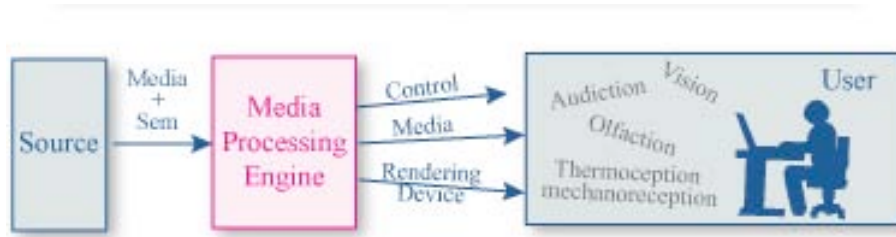t MPEG standards have reference software. The MPEG-1 and MPEG-2 development process (ca. 1990) followed a rather simple (but at that time very innovative) process. MPEG members collaborated to produce the text of the standard and active members translated the standard into their own version of the software used to develop the standard.

The originators of technology proposals were requested to translate the relevant portions of their software back to text and "donate" the relevant portions of their software for the ISO reference software. But with MPEG-4 (ca. 1995) a new world took shape because software was no longer just a tool to develop the standards but also a tool to make conforming products.

Priorities changed: there was still a need for standards in textual form (we are humans), but the "real" reference was expressed in a programming language with the same normative status as the textual part. The reference software was developed collaboratively (because it is easier to compare results), improve quality of the standard (because there were two different manifestations of the standard) and accelerate adoption (because there was an implementation already available).

Looking more in detail into the process one can see that the rules of the MPEG-4 reference software are comparable (with some notable differences) with those of the "Open Source Software":

1. Each component of the standard is to be implemented in software:
   o Normative (decoder);
   o Informative (encoder).
2. A code manager is appointed for each portion of the standard;
3. for each accepted proposal software must be provided;
4. discussions on software happen on open email reflectors;
5. only MPEG members can decide;
6. copyright of reference software is assigned to ISO;
7. ISO grants licence of the *copyright* of the code for products that con-

form to the standard;
8. Those donating code need not donate patents that may be required in an implementation.

8. We need more than digital media technology

Digital Media in Italia (dmin.it) is an interdisciplinary, open, not-for-profit group established in November 2005 whose members are professionals and representatives of companies, institutions and associations. The goal is to explore and identify opportunities for Italy *to play a primary role in the exploitation of the global "digital media" phenomenon*.

How can we get there? By maximising the profitable flow of digital media.

The lever to achieve that acts on the offer of/access to content; broadband network; payment/cashing services, while balancing the requirements of the different parties:

- *Author:* "I want to be able to offer my works".
- *Intermediary:* "I want to be able to choose and play my role".
- *Consumer:* "I want to be able to find, access and use the content I need".

Dmin.it has concentrated on three legs:

- iDrm: to manage and protect digital media (technology was selected and several demo applications were developed).
- iNet: to access broadband digital networks (relevant IETF standards to achieve this were identified).
- iPay: to pay and cash micro amount effectively (specification and reference software were developed).

9. Conclusions

Media is what enriches human life. Digital media, because of its flexibility, is what comes closest today to human perception and processing, and its impact on society has already been proven. Standardisation plays a unique role for an orderly introduction of more effective communication means and its ties with society should be strengthened.

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HeLa. Reconstructing an Immortal Bio

Sara Casati, Stefano Crabu, Marialuisa Lavitrano, and Mauro Turrini

Abstract Henrietta Lacks died of cervical cancer in 1951 at 31, but a cell line from her tissues is still alive and reproducing for scientific purposes. Her dramatic biography and her fundamental (although unwitting) contribution to the development of scientific knowledge went unnoticed until Rebecca Skloot's "The immortal life of Henrietta Lacks" [New York, Random House, 2010, 384 pp.] was published. The political, scientific, social and technological entanglement of Henrietta's account by Skloot is an original and vivid science narrative of clear relevance for Science and Technology Studies. Stemming from Henrietta's story and Skloot's book, Stefano Crabu, Mauro Turrini, Marialuisa Lavitrano and Sara Casati reflect and discuss on the relation between society and medical research, its ethical dilemmas, as well as on the way technoscientific processes can be accounted for.

Keywords: immortal cells; research ethics; medical science; bio-objects; science narratives.

HeLa Cells: a Biomedicine Keystone and its Ethical Dilemmas

Marialuisa Lavitrano and Sara Casati

Scientists know her as HeLa but she was Henrietta Lacks. Mother of 5 children from a poor Afro-American family, she was 31 years old, when she discovered she had a malignant epidermoid carcinoma of the cervix (cervical cancer) from which she died some months later. During her radiation treatments, two samples of her cervix were removed — a healthy part and a cancerous part — without her consent, so that she never knew that her cells became a cell line that would be widely used in science. Then, as now, there was no requirement to inform a patient, or their relatives, about such matters because discarded material, or material obtained during surgery, diagnosis, or therapy, was the property of the physician and/or medical institution (currently this requires ethical approval and patient consent, at least in Italy).

The cells from Henrietta Lacks cervix were processed by a researcher, George Gey, who discovered that they were something extraordinary: they were different, they could be kept alive and grow. Before this, cells cultured from other cells would only survive for a few days. The cells from Henrietta's tumour reproduced an entire generation every 24 hours and never stopped. HeLa cells have an highly altered genetic asset, characterized by supernumerary and/or modified chromosomes (they have got a chromosome number of 82, with four copies of chromosome 12 and three copies of chromosomes 6, 8 and 17): this asset makes unique Hela cells. These were the first human "immortal" cells ever grown in a laboratory: they do not die after a few cell divisions; they could be propagated indefinitely *in vitro*; they can divide an unlimited number of times in a laboratory cell culture plate as long as fundamental cell survival conditions are met; they were not subjected to senescence; they could be frozen and thawed and used in various ways. The infection with human papilloma virus 18 had modified an enzyme: this enzyme elongated the telomeres after chromosomes are copied, so the cells could multiply continuously. These cells would become the HeLa immortal cell line, a commonly used cell line in biomedical research. They proved to be an invaluable resource for scientific research.

George Gey distributed them to other scientists across the world to experiment. Gey freely donated both the cells and the tools and processes his lab developed to any scientist requesting them, simply for the benefit of science. By 1954, the HeLa strain of cells was being used by Jonas Salk to develop a polio vaccine. To test Salk's new vaccine, the cells were quickly put into mass production in the first-ever cell production factory. Demand for the HeLa cells, at this point, quickly grew. HeLa cells were sent to many scientists to perform research into cancer, AIDS, the effects of radiation and toxic substances. They also went up in the first space missions to see what would happen to cells in zero gravity. At the origin of the first cloning experiments and vitro-fertilization, the cells have furthered our understanding of cancer, HIV and cell physiopathology in general, and are still extensively used to grow viruses and to test anti-tumour medicines. For instance Tamoxifen, one of the first anticancer drugs, was based on them. The cells were later commercialized. It has been estimated that the total number of HeLa cells that have been propagated in cell culture far exceeds the total number of cells that were in Henrietta Lacks' body. Scientists have grown some 20 tons of her cells and at present more than 74.000 scientific papers have been published and there are almost 11.000 patents involving HeLa cells.

Until a few years ago no one knew the history of Henrietta; Rebecca Skloot investigated and told it to us. Before, the Lacks family never understood how the cells would be used and that was not explained to them. This led to a lot of anxiety and strain on the family: Henrietta's son were subjected to long observations and analysis from scientists

They were exposed to unwanted intrusion and attention, they were under the eyes of all without knowing it and without being able to choose.

Behind a human cells line there is an individual with his/her story, with his/her family and the future generations: the process of naming cell lines has changed

since the 1950s to prevent people finding out who cells come from. Today, cell lines are anonymized so they can't be traced back to a named person. But the Lacks' family were harmed by the use of their mother's tissue for research and much is made about the fact that neither Henrietta Lacks or her family was asked for permission to use her tissue in research.

Lack of informed, explicit consent and confidentiality can generate important consequences on people involved and Lacks' story shows that in no circumstance it might be ethically admissible to use residual tissue (collected for other clinical purposes) in research without asking permission: it makes more vulnerable individuals at stake, it would harm them. This is due to the nature of the samples, and their "relational" nature as we said before. This starts up a second set of bioethical and public policy questions, and not just about the kind of consent required (from patient, from family, from both?).

The big question is: do the tissues belong to someone? And related: to whom do the financial benefits generated from research belong?

The Lacks family were unable to afford healthcare in the USA. Henrietta Lacks, as she was African American, had to travel miles to a segregated hospital to be treated. And racial discrimination and the resulting partial access to care deserve a separate discussion.

George Gey did not profit from the cells when he sent them to other scientists. Yet, some pharmaceutical businesses cultured HeLa cells and have profited by their manufacture and continue to make lots of money. At the same time, Lacks family has remained profoundly poor.

Many researchers, institutions, and companies have benefited from the HeLa cells, but the family did not receive anything in return for their "donation". This was and continues to be the norm in research in the USA (a precedent set in case law by Moore *versus* Regents of University of California that research subjects do not have property interests in their body parts and are not owed any compensation). This model has influenced also the European perspective.

We could have a society in which people freely "donate" their tissue to research without expectation of compensation because of an understanding that the treatments and cures that result will benefit us all. We can share that we are together in the development of science and committed to the common good. But it is also clear to us that for it to work, it needs to be fair. We should imagine circumstances where benefit sharing might be an obligation and compensation goes back to collectivity at least: we need an open conversation on this.

Post scriptum: one of the things we do not want people to take from the story of HeLa cells is the idea that tissue sampling and cell culture are bad. So much of medicine today depends on this. Instead of saying we do not want that to happen, we just need to look at how it can happen in a way that everyone is confident with.

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Immortal Cells and a Dead Woman. On attempting to bridge the gap between medical sciences and society

Mauro Turrini

Rebekka Skloot's *The Immortal Life of Henrietta Lacks* is much more than a well-documented and captivating reconstruction of one of the most prominent achievements of the 20th century life sciences: the creation of the first immortal human cell line ever grown outside of an organism. The attempt to cross the enormous gap between the two main (human and "non-human") actors of this scientific event makes this a poignant work for the STS audience.

The scientific saga begins with a cervical cancer biopsy, whose cells proliferated with "a mythological intensity" in the artificial environment created in the laboratory. But this story has also another protagonist, Henrietta Lacks, a cancer patient who died eight months after some doctors snipped a piece of tissue from her cervix in the Johns Hopkins hospital ward for "coloured" people, without her knowledge or consent. The official storyline tells the remarkable success of this clinic in establishing a human immortal cell line *in vitro*, whose role in the life sciences of the 20th century cannot be overemphasized. The other less known storyline introduces us to a vivacious 31 years-old Afro-American woman, who left a tobacco farm to move to a poor area on the outskirts of Baltimore, where she lived with her five children. On the one hand, a living technology known, bought, sold and shipped to labs all around the world. On the other, the sudden, precocious death of a woman who, due to the suspect of being a victim of sorcery, did not receive a proper burial rite and was forgotten by her true relatives.

Skloot tries to unveil the human costs hidden in this story. This leads the reader to discover unexpected ramifications of science in social arenas, such as those of economically disadvantaged African-American communities. The relevance of political questions, such as racism and human tissue ownership, is one of the driving forces of this gripping non-fiction science narrative. Undoubtedly, Skloot succeeds in raising important questions for a larger public audience. However, her story has many pitfalls, regarding both her relationship with the victims whom she intends to reward, and the ways in which the debated questions are framed. She intends to compensate for the systematic misconduct of science, but her attempt to bridge or at least reduce the enormous gulf between medical research and society is lacking.

1. There is no available information about Henrietta Lacks, apart from one black and white picture, which usually appears in biology textbook captioned just with her name (which is sometimes the wrong one). As a college student in

biology, Skloot perceives this puzzling empty space in the story of such an important medical achievement. Once become a science journalist, this indifference leads her to an indefatigable ten-years quest for the hidden story of "the woman in the photograph". Since Henrietta Lacks did not leave many traces behind, Skloot decides to turn to her husband and descendants. In a brilliant example of extra-academic, creative use of ethnography, Skloot gains the trust of this family and, particularly, of Deborah, Henrietta's daughter. Along with her, Skloot identifies the social environment where Henrietta Lacks and her family had lived growing up. The reader is brought through a weird and fascinating journey made up of ex-slaves, semi-abandoned villages of tobacco farmers in Virginia, poor industrial African American neighbourhoods, old asylums for black people, and top class hospitals and laboratories. Deborah's and the Lacks' memories, opinions and beliefs are used to provide an evocative perspective through which one can reconsider biomedicine and scientific research.

From the Lacks' point of view, the HeLa story is presented as a scientific and medical crime. At its core lies the social, economic and cultural distance between medical researchers and patients and their relatives, who in this case have been persistently and deliberately kept away from this story. In this regard, it is very interesting to note that George Gey – considered "the father" of HeLa (in the traditional version of this story) – did plot to keep the identity of the donor as secret. When the cells met with success, he decided not only to release an invented name to the press, Helen Lane, but also demanded that his colleagues and collaborators use the fake. Only after his death was permission given to his assistant to release Henrietta's real name, but she never did. Neither of them had economic interests in the HeLa cells, since they had never been patented. However, they actively wanted to keep the family away from them. The Lacks became acquainted with HeLa twenty years after Henrietta's death, due to the initiative of a young reporter in search of a scoop. Some years later, Johns Hopkins laboratory researchers contacted the Lacks, but not to provide information about their relative. They wanted blood samples of Henrietta Lacks' children. In that period the contamination of hundreds of HeLa cell lines around the world was discovered, and so a more detailed genetic characterization of the HeLa cells was required to determine exactly which cells were contaminated. During this operation, the Lacks family was provided with no information regarding Henrietta Lacks, HeLa cells or the purpose of the tests they were doing. Moreover, the Lacks' genetic profiles were later published in scientific journals without any consent.

Skloot does intend not only to criticize the deliberate strategy of Johns Hopkins to breach any bound of fairness and even respect. She also tries to provide relief for the recurrent violations and persistent exploitation that the troubled family had undergone for half a century. In the final chapters of the book, the two different stories of HeLa and the Lacks seem to merge together. Thanks to Skloot's dedication, Deborah and her brother Zakaryia are invited by a prominent biologist to visit the HeLa cells in the Johns Hopkins laboratory. They saw "their mother's cells" at work, and were given a suggestive picture of them as a compensatory gift,

which they preserve with care and pride. This episode is an emotionally intense passage. At the same time, it evokes a pacification and a new understanding between Johns Hopkins and the Lacks which could be metaphorically expanded to the relationship between biomedicine and society. However, some of the political indications it offers are at best ambiguous.

2. Even if the Lacks are at the core of the narrative, the politics implied by scientific practice makes this book much more than a portrait of the emotional ordeals of the Lacks family. I think that both the richness and the limits of this book can be found in the ways in which these issues are approached. The relevance of racism is contextualized as a general issue of U.S. medical research in the decades after the World War II. Until fifty years ago many American hospitals did not accept African Americans, and others, such as Johns Hopkins, did so only in special wards for "coloured". In the same period, there were several cases of exploitation of black people as experimental subjects, including cruel clinical experimentation whose meaninglessness recalled Nazi experiments on Jews.

Another means used to articulate the issue of racism is the parallel between Henrietta and her family. Their opinions, beliefs and practices in daily life offer a unique perspective on American biomedicine that Skloot describes vividly with all of their contradictions. For example, Skloot recalls a recurrent tale in black oral history that she overhears in a family conversation, which tells of black people kidnapped by "night doctors" for research. Another racial familiar episode that the Lacks experienced regards the asylum where Henrietta Lacks' eldest daughter lived and died, called tellingly "the hospital for the negro insane". The author also decides to visit this ex-clinic (currently abandoned) along with Deborah.

The evocative conflation of Henrietta Lacks and her family history leads Skloot not only to denounce the systematic racism in biomedicine, but also to discover an authentic, intimate description of Henrietta Lacks. The HeLa cells story is presented not only as a scientific crime, but also as the personification/animation of Henrietta Lacks. HeLa cells are considered as an inestimable, although involuntary, gift to science, which confers Henrietta Lacks immortality. In an attempt at authenticity, Skloot is particularly concerned with the Lacks' deviations – sex abuse, drug, prison, illness, and eating disorders. Unfortunately, relating these dysfunctions to Henrietta Lacks' exploitation, Skloot loses tracks of Henrietta and her relatives as full human beings. At one and the same time, the personification of the cells as an immortal entity has obscured Henrietta Lacks, as Landecker (2000) points out, as well as, we can add, her family. If the characters within the family are not fabricated, they are surely "made up" (Littlefield and Pollock 2011), in that they are entirely functional to Skloot's narrative framework.

Even if in the course of the book the author describes well the contradictory and multifaceted feelings, emotions and judgements of the Lacks, at the end and at the beginning she mentions these opinions which completely agree and support her journalistic, scientific mission. In a fine example of bad ethnography, in the final words of the book, the voice of Sonny, one of Henrietta's children, is literary ventriloquized.

"I don't want to cause problems for science", Sonny told me as the book went to press. "Dale wouldn't want that. And besides, I'm proud of my mother and what she done for science. I just hope Hopkins and some of the other folks who benefited off her cells will do something to honour her and make right with the family" (Skloot 2010, 328).

Finally, Skloot's personal perseverance, which led her heroically through the poor, uneducated and even threatening black side of America, has been finally rewarded. She is able to bring conclusion to her initial goal: to redeem the racial violence of medical research, by honouring Henrietta Lacks and making right with the family. Publicizing an "otherwise-hidden-and-lost" story of racism seems to work as a way to make the family understand the scientific importance of their mother, and to withdraw their aversion to medical science and especially to Johns Hopkins. However, in its concern to hail the benefits of science (and scientific journalism), the book turns out to contribute to Henrietta Lacks' and her family's invisibility and, so, to dismiss the contemporary relevance of racism. It is striking, for example, that Skloot does not mention those Americans who earn a life by volunteering as an experimental subject moving from clinic to clinic. Moreover, racism is now become a globalized phenomenon in medical research. The outsourcing of services to off-shore locations regards also clinical trials, which are used by developing countries such as India as a major avenue to become a global player in medical biotechnologies (Sunder Rajan 2006).

3. The second issue raised by Skloot deals with the economic dimension of Henrietta Lacks' unwitting donation. Skloot presents the situation as an ironic contradiction between the scientific and economic relevance of both Johns Hopkins and the HeLa cells, and a family living poverty. As Deborah Lacks-Pullum (quoted in Skloot 2010, 9) puts it:

I always have thought it was strange, if our mother cells done so much for medicine, how come her family can't afford to see no doctors? Don't make sense. People got rich off my mother without us even known about them taking [sic] her cells, now we don't get a dime.

As opposed to how she deals with racism, which she discards as a rather obsolete problem, Skloot frames tissue ownership and patentability as a growing contemporary issue, where human tissues have become the raw material in the expanding industry of medical biotechnologies. In particular, she uses the *Afterword* to explain why the issue of property and patentability of human tissue does not regard uniquely the Lacks family, but has become an urgent, general question within the fast-pace development of biotechnologies. In the course of the book, she also describes the landmark case of John Moore, a patient with leukaemia whose cancer was developed into a cell line that was patented and commercialized. John Moore took legal action against the Medical Centre where he was treated, but the Supreme Court of California rejected any claim of extending any propriety rights on human tissue for the fear of hampering medical research. Commenting on this sentence, Skloot underlines that the expropriation of human tissue is not just about scientific and medical progress, but also interests the profits of private companies. Pharmaceutical and biotech firms regularly

patent, buy, and sell cell lines as well as other human bodily parts. Tissue collections, once treated as special waste, are nowadays an extremely profitable source in biomedical industry and research. Thus, Skloot recognizes the contradiction implied in the two opposing economic regimes that govern the exchange of human bodily parts either as gifts or as commodities. However, her emotional, sensationalistic approach to the HeLa ends up narrowing her perspective based on the (improbable) claim of economic rewards for Henrietta Lacks' descendants. Actually, as shown clearly by Catherine Waldby and Robert Mitchell (2006), in contemporary ownership the double movement of public expropriation and private appropriation of human tissue (organs, blood, cells, and even DNA fragments) is continually subject to the regulation of biomedical research and health service. The extension of patentability to engineered human tissue has to be understood as part and parcel of a more general extension of intellectual property rights to an ever-increasing number of objects, including human tissue.

We do not intend here to defend the sentence against John Moore, but rather to reconsider this unwitting donation as part of a more general interchange between medicine and society. It seems to me more interesting to understand the relentless request for patients' bodily parts as health-related information as a new form of labour, a "clinical labour" (e.g. Turrini 2011), which is as necessary for the bio-economy as workers' activities are for the manufacturing industry. Insisting on economic compensation for the Lacks' family seems to me a rather blind perspective, especially after John Moore's case. It is not by accident that the character who originally endorsed it, was a fake lawyer who dogged the Lacks family for several years and who is harshly criticized as a recidivist cheater. Skloot herself does not seem to really believe that the Lacks should be economically rewarded by Johns Hopkins. In general, her criticism works well as a literary strategy that highlights the ironic parallel between biomedical grand achievements and socially disadvantaged people. However, it does not respond adequately to the political issues indicated at the start of the book.

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We are so crafty: we make bio(s) immortal! Or the emergence of an STS Novel.

Stefano Crabu

Doctors took her cells without asking. Those cells never died. They launched a medical revolution and a multimillion-dollar industry. More than twenty years later, her children found out. Their lives would never be the same (The Immortal Life of Henrietta Lacks, by Rebecca Skloot).

Luisa is a junior researcher. She works as a contract employee for an Italian public institute, which is leader in the research and treatment of neoplasia. Together with three colleagues, Luisa is setting up a new laboratory of molecular biology. Luisa's glowing face bursts into the room that houses the experimental bio-analytical activities. She turns to Gina, who is a laboratory technician well respected by the colleagues: "We have got our line immortalized: the flasks are full and the little cells look indeed beautiful to me. Do I put away a part of HeLa to test the carbon nanotubes?". Gina smiles, she nods a "yes" and puts back into the fridge her DNA samples (Author's fieldnotes).

Nothing seems more uprooted from the technoscientific repertoire than the concept of immortality, which is often considered a characteristic *topos* of the mythological and romantic fictions and it is usually evoked and related to diabolic pacts (i.e. Dorian Gray and Devil) and divination activities (i.e. the meeting between Ulysses and Circe). This *topos*, which uses either the grammars of superstition, of alchemy, or of paganism and religion, is able to confer an endless vital feature to biological substances and bodies that would be exposed to the time, contamination, disease and death. However, immortality was not only narrated. In fact, alchemy – whose proto-scientific experimental grammar founded modern Chemistry – has been cultivating without success the project of materialization of immortality. According to some legend, the Philosopher's Stone has been considered along the ages to have the property to revive eternal youth to body's erosion (Tenney, 1934). Therefore, it should be noted that these grammars do not properly fit with what Ludwik Fleck has defined as scientific practice of "thought-style" (Fleck, 1979).

However, in 1951 something relevant happened: science, and in particular biomedicine and life sciences, began to address the concept of immortality, or better to say of "immortalization". As Rebecca Skloot – who is specialized in the field of science narrative writing – reported in her novel *The Immortal Life of Henrietta Lacks* (2010), what really happened during the 1950's was certainly not a pact with the devil. It was, rather, a successful innovation that even today, as it emerges from the opening fieldnotes, still affects the life of thousand of laboratories in a remarkable way; for instance, inside a cutting edge research

centres which clinically experiments the most innovative possibilities offered by biotechnologies for treating neoplastic pathologies. The emblematic story, which is narrated in Rebecca Skloot's novel, belongs to the not so distant 1951, when in the United States of America the racial segregation and the Ku Klux Klan had a significant impact on the political and the social arenas. During those post war years, the Rockefeller Foundation lavished massive financial investments in the dawning molecular biology, which supported the American research program from 1932 to 1959 with 25 million dollars.

Rebecca Skloot' s novel is focused on Mrs. Henrietta Lacks, a poor Afro-American farmer who worked in the tobacco fields like her enslaved ancestors and then died at the Johns Hopkins Hospital of Baltimore, in Maryland, because of an aggressive cervical cancer. The Johns Hopkins Hospital, which was founded in 1889 as a charity hospital for the caring of indigent people, was ranked one of the best hospitals in the United States of America. This prestigious institution was located just a few kilometres from Henrietta's house; besides, it was the only institute within a hundred kilometres radius that accepted Afro-American patients.

At that time it was not common to speak openly about cancer, even if fifteen thousands American women died every year because of the same disease that tormented Henrietta. For many years biomedical scientists had been trying to test samples of malignant cells in order to monitor their growth *in vitro*, that is outside the human body, with the aim to give a valuable contribution to the research on the oncogenesis and cancer treatment. In carrying out this task, they attempted to discover a procedure which allowed the human cells to become immortal, to continuously reproduce themselves and never die. George Gey, director of the cell culture laboratory at the Johns Hopkins Hospital – who loved to define himself as "the world's most famous vulture, feeding on human specimens almost constantly" (Lacks, p. 46) – had been trying to grow some cells thirty years, but all of his attempts systematically failed.

Just before Henrietta died, a doctor named Richard Wesley TeLinde – who in 1951 was involved in a heated controversy regarding the treatments of uterine tumours at the Hopkins Centre – took, without any authorization, a sample of tumorous tissue from her uterine cervix in order to give it to George Gey's wife; then, that sample was put on culture inside a Petri capsule containing some chicken blood. This praxis became routine and it was repeated several times either without success or the donor's consensus. One day an extraordinary event occurred, Henrietta Lacks' cells began to multiply, showing an unprecedented resistance to contaminations; these outcomes not only demonstrated that Henrietta's tumorous tissue could become immortal, but also contributed to transform and innovate the procedures through which the biosciences have been conducting clinical experimentations and researches.

Thanks to research work which lasted 10 years, Rebecca Skloot has reconstructed the genealogy of the first and most important immortal human cells, namely "HeLa", which are the initial letters of Henrietta Lack's first name and surname. Surprisingly, the author of this novel is not a STS scholar, as currently intended in the academic world. Arguably she might be described as a "STS

spontaneous scholar" for the way in which she was able to restore the linkages between the cultural, social and technoscientific dimensions which have allowed HeLa to become a fundamental technological infrastructure within the biotechnological field. The HeLa cells, due to the centrality in biomedical laboratory experiments, have acquired the features of a situated technology. In fact, the HeLa cell line represents a relational infrastructure that supports the work of biologists, clinicians and researchers. Such an infrastructure is the "biotechnological background" and "pathological model" par *excellence* in which cancer research is articulated even today, structuring the experimental activities of bioresearches and enclosing laboratory routines (Star, 1999).

It is worth noting that HeLa cells represent one of the main progresses of biomedicine, such as the detection of the polio vaccine, the definition of the new chemotherapy regimens, the cloning and the mapping of the human genome, the *in vitro* fertilization as well as the venturing into outer space to study behaviour of human cells in the absence of gravity. Those same "immortal" cells have travelled from 1951 to the XXI century crossing laboratories and research centres throughout the continents, as well as the most recent convergence with nanotechnologies, which are considered the last frontier in the fight against cancer.

Skloot's book is a complex "novel" where the author – mirroring the fashion in which Michel Foucault described the history of insanity in the age of reason (Foucault, 1961) – never uses the concept of "immortalized cancer cell lines" as a category of intelligibility. This is a style of investigation that eschews the banal historical reductionism, which consists in studying social phenomena with universal categories that are often taken for granted, and not put in question in their historical process.

In this way, Rebecca Skloot has observed the biographies, the life stories and the biotechnological objects (medical records, biopsies, cells, test tube, chemical reagents, etc.) in order to track a common technoscientific subtext, which is tagged as HeLa only at the end of a long stabilization process. Thus, it emerges a precise theoretical and methodological statement – peculiar to Foucault's genealogical approach (Foucault, 2004) – which consists in assuming that there are no universal categories taken for granted (the disease, oncologist, patients with cancer, cells, DNA, etc.), which the traditional sociological analysis, like the historical one, usually adopts to account the processes of technological innovation. On the contrary, in the text historical sources and data are examined to identify whether these, in their process and historical convergence, return something that might be definable as "immortal human cells". In other words, the genealogy of situated practices is preferred as a lens to interpret the process of biotechnology innovation, instead of using universal categories such as grids of intelligibility required to deduce some concrete phenomena.

Rebecca Skloot's text works both on the analytical or the narrative level, and these two dimensions which apparently seem to be distant surprisingly here are masterly interwoven. In fact, the plot manages to link together two different biographical levels: on the one hand, there is Henrietta Lacks' biography, and on the other, one can find closely interwoven the biography of a biological object,

which is characterized by an ineffable epistemological statute. The final result emerges from an implosion of nature/culture (Haraway, 1997), as a sort of "cyborgbiography" of the first immortal human cells. This biography, where the biological element is constantly compared and entangled with the technological object, is constructed through a symmetrical and relational narrative style that goes beyond technicalities and focuses also on social dimensions. Therefore, this type of biotech object, named HeLa, may be interpreted and imagined as an invisible infrastructure that interweaves sociotechnical connections, and at the same time it is able to involve human actors and technological objects as well. In this sense, Rebecca Skloot seems to have assumed in her rhetoric the theoretical challenges set by biotechnologies and elected as fieldworks by the Science and Technology Studies.

The author, in little less than a four hundred page novel, tells us about her "vagrancy" across mental asylums, hospitals, clinical case histories, biopsies, research laboratories and Nobel prizes, swindlers, criminals and small shops, salesclerks. This type of research reminds us of what in the literature has been defined as multi-sited ethnography (Marcus, 1995) or, in more evocative terms, "vagrant ethnography" (Bruni, 2008); a vagrancy of ten years that has permitted the author to collect more than one thousand hours of conversation in order to provide an account which can make the "global and the cellular" communicate (Franklin and Lock, 2003). It should be noted that Skloot's study intersects the dimensions of gender, class and race. She deeply analyses the ways in which some white clinicians of the John Hopkins Centre dispossessed the body of a poor black woman, without informing her family – who discovered the fact after twenty-five years of experimentations on Henrietta's cells – and without asking for any kind of authorization. Therefore, one could argue that this dispossession of a portion of human tissue has been incredibly profitable in the production of biocapital from which where Henrietta's family has been excluded.

The perspective which is used by the author – without succumbing to the rhetorical expedient of the inventor hero that characterizes the popular narrative about science and technology – confers rigour and profundity to the narrative structure; moreover, the author masterly put together the alignment processes and the relational ecology that characterize a particularly 'technoscientific story'. Skloot's novel pays great attention to the definition of those asymmetrical powers that the North American culture and society harboured during the 1950's. The text reports an unusual story of a successful innovation by tracking the genealogical features and knots of the networks which have brought stabilization to a new biological object named HeLa.

The author has chosen a rhetoric that might be comparable to what Latour defines as 'infra-language' (Latour, 2005). In this specific case, it is a description – using typical "coloured" words of the Afro-American vocabulary – which makes connections between knots and actors, and allows the reader to place him/herself within the processes and the activities of the construction of the network – that is from the cellular to the global.

Skloot, by tracing the connections ranging from the cellular to the global, draws

a multiform biopolitical geography where the reader can explore the mutual reshaping between human subjectivity, institutional arrangements and processes by which individuals and technologies assemble each other in technologically dense environments. The emerging outcome is a thick description of the connections and the development of an unknown phenomenon (immortalization of human bios) which in the STS debate is also defined as an "emergent form of life". According to Fischer, this concept identifies the cultural and symbolic morphology assumed by the social representations of life *tout court* (1999, 2003). In the end, the reader can grasp: firstly the interrelations between the different places where knowledge is produced; secondly the ethical and moral controversies; and finally the appropriation and valorisation mechanisms which, through specific political and cultural dynamics, have brought to the surface emergent forms of life.

Rebecca Skloot's study explores and analyses the technoscientific social worlds with a vivid and smart narrative that I would define as *STS Novel*. This dramatically styled narrative is able to overturn the rigid canon that characterizes the scientific academic production and to stimulate new perspectives in social research in order to investigate the technoscientific social dimensions. This genre of writing could represent a style of inquiry that tacitly complies with multi-sited ethnography and defines a technoscientific history which is able to reflect all levels of the social, cultural and political theory. The main challenges and perspectives that an *STS Novel* offers are: firstly, the methodological implications, namely the need to adopt multi-local technique as a way to access the various strategic places of production and sharing of scientific knowledge; secondly, the possibility of using a mode of polyphonic representation of social phenomena, which restores the agency to all social actors and technologies involved within an ecology of relationships for mapping the situatedness of knowledge; finally, the chance to construct a multi-audience text which keeps rigor and precision, without dissolving in technological determinism, or reductionism, the complexity of the social investigation of technoscience.

Arguably, this was certainly not the intention of the author. However, as usual, all the artefacts, books included, are constantly subjected to continuous processes of translation during their life time and circulation. What happens is a form of situated reconstruction and recontextualization through which the entities, ideas and artefacts acquire meaning through the relations with other entities, whether human or not. It is certainly true that the ideas which are contained in an abandoned book on one shelf cannot circulate. It is equally possible that a book that goes hand in hand acquires new energy and new meanings in virtue of the fact that social actors will change and adapt it to their research or intellectual project.

To summarize, an *STS Novel* is a narrative multi-audience artefact, which stimulates the reflexivity and deconstruction of technoscientific representations. Such a narrative artefact allows us to acknowledge a multiplicity of conflicting discursive reconstructions of social phenomena entering into a stream of representations. For this reason, it is important and desirable to juxtapose and integrate different genres of writing, thinking and working with historians, novelists, literary critics, science journalists, scientists in order to produce polyphonic texts which are able to inve-

stigate the implosion of nature/culture from which technoscientific contexts emerge.

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The Study of Technoscientific Imaging in STS

Manuela Perrotta

Abstract In the last few years a flourishing debate has developed on visualization processes and practices of representation in technoscience, fostering an interdisciplinary approach to the study of the production and dissemination of images. This *Scenario* outlines some of the current examples of research in this area, introducing the turn from the study of scientific representation to that of (techno)scientific imaging and visualization. Three main areas of research are discussed: technoscientific imaging in practice; images as evidence; images, imaginations and imaginaries. Finally, some further questions and challanges concerning the future study of technoscientific imaging are raised.

Keywords scientific representation; technoscientific imaging; visualization practices; visual knowledge production; visual logic; imaginaries.

Introduction

Forms of representation as diagrams, graphs and images have always been central in scientific practices. In the last decades, moreover, the development of increasingly sophisticated visualization tools has made the use of images more and more relevant in illustrating scientific results. Images, in fact, seem to have a particular potency for communicating scientific ideas that make them more understandable to a broader professional and non-professional community. For this reason, pictures are used not only in their production sites (usually specific labs) but they travel within the scientific community and beyond. Therefore, appealing scientific images have been spread in the popular culture through magazines, artistic performances and even television series.

In Studies of Science and Technology (STS) a flourishing debate has developed on visualization processes and practices of representation in technoscience. This debate has its origins in the so-called *Laboratory Studies* that have investigated the use of images in the making of science (Latour and Woolgar 1979; Knorr-Cetina 1981; Lynch, 1985a, 1985b; Latour 1986, 1987). A real milestone in this strand of literature is *Representation in Scientific Practice*, a book

edited by Michael Lynch and Steve Woolgar in 1990. This collection has been a classic in the STS literature on visualization and a "starting point for studying the cultural embeddedness of the practices of the making and handling of visual representations and of the shaping, distributing, applying, and embodying of scientific visual knowledge" (Burri and Dumit 2008, p. 300).

Thereafter the debate on visualization in science and technology has exploded in the last twenty years (quoting only a few examples Traweek 1997; Lynch 1998; Beaulieu 2001; Dumit 2004; Joyce 2005, 2006; Prasad 2005a, 2005b; Burri 2008; for a review see Burri and Dumit 2008). A new version of the latter collection, which will brings together recent work on representational technologies in contemporary scientific work, will be co-edited by Catelijne Coopmans, Janet Vertesi, Michael Lynch and Steve Woolgar (forthcoming) and published as *New Representation in Scientific Practice*.

The main aim of this debate has been to overcome the widespread understanding of scientific images as static and "neutral" elements; natural objects independent from cultural and social processes. In the hard science discourse, in fact, often imaging tools are considered as photo cameras able to catch the reality rather than measurement devices. According to an STS perspective, instead, images – as well as scientific representations in general – have a little definite meaning or logical force aside from the complex activities in which they are situated. Representational practices in science, therefore, need to be studied as situated processes of knowledge production. The STS literature developed on the basis of these assumptions illustrated how images assume meaning and fixed interpretation in the complex activities in which they are situated, and in relation with other forms of representation (other data, numbers, graphs, observations, and so on), according to the socio-material practices and processes of knowledge production in which they are embodied.

Nowadays, this field of study is increasingly flourishing, fostering an interdisciplinary approach (Fyfe and Law 1988; Nowotny and Weiss 2000) to the study of the production and dissemination of images. Interdisciplinary conferences have been dedicated to this topic (such as *Visualization in the Age of Computerisation*, held in Oxford in 2011 and *Images and Visualization: Imaging Technology, Truth and Trust*, held in Norrköping in 2012) and a special issue on "Visual Representation and Science" (Gross and Louson 2012) has been recently published in *Spontaneous Generations: A Journal for the History and Philosophy of Science*.

This body of work is thus extremely diverse, and its boundaries are difficult to demarcate. Therefore, any attempt to synthesize the various strands would necessarily be reductive and selective. Instead this *Scenario* will try to outline some of the current examples of research findings in this area in recent years. In the next sections I will introduce the turn from the study of scientific representation to the so-called (techno)scientific imaging and visualization. Following the distinction proposed by Burri and Dumit (2008) I will discuss then three main areas of research: technoscientific imaging in practice; images as evi-

dence; images, imaginations and imaginaries. Finally, I will raise future questions and directions concerning the study of technoscientific imaging.

1. From representation to scientific imaging and visualization

Scientific visual representations have been studied from a variety of different theoretical and disciplinary perspectives. They vary across multiple important dimensions, such as production, use, and type of content (for a detailed account, see Pauwels 2006).

According to Daston and Galison's reconstruction (2007), early modern science has built on an idea of "good" representation which takes for granted the absence of human agency. They described this phenomenon as "mechanical objectivity", the search for a representation that is as automatic and unhampered by personal vision as possible. This alleged purity of scientific representations and the ways in which it is constructed have been unmasked by contemporary science scholars (Daston and Galison 2007; Hacking 1983), as well as those examining everyday practices of scientists (Latour and Woolgar 1979; Latour 1986; Amann and Knorr-Cetina 1990) have underscored that instruments do not produce representations alone.

Accordingly, Burri and Dumit call for a turn to the study of scientific imaging and visualization, which focuses "on the social dimensions and implications of scientific images and visual knowledge rather than inquiring into their nature" (2008, p. 298). The study of scientific imaging and visualization aims to investigate the specificity of the visual as a form of scientific knowledge and therefore it follows the practice turn in science studies (Pickering 1992) and social theory (Schatzki *et al.* 2001). Turning toward the study of scientific imaging and visualizations means to focus on the epistemic practices of the production, interpretation, and use of scientific images.

In their review essay Burri and Dumit organized their discussion around what they defined "three artificially separated topics: the production, engagement, and deployment of visualizations" (2008, p. 300). They claim that this distinction is more relevant in terms of what STS scholars focus on than on the scientific practices involved. Their three categories grasp a core aspect of the *study* of scientific imaging and visualization, i.e. its focus on the visual practices of science.

According to the authors, the study of image *production* deals with "how and by whom an image is made" (p. 302), while studying *engagement* means to focus on "how images are used in the course of scientific work and are made instrumental in the production of scientific knowledge"(p. 302). Finally, the study of *deployment* refers to the analysis of how images leave their production sites and travel to nonacademic environments, i.e. the social world.

In this *scenario* I will use "updated" versions of these three categories and I will take into account the domain of technoscience. Scientific imaging and visualization, in fact, are clear examples (as many others) of technoscience. There is no strict division between the scientific and technological aspects of scientific and

research practices, as they rely upon technological intervention as an irreducible element. Therefore, I will explore the current development of the literature concerning the study of technoscientific imaging in STS.

For reasons of space, I will focus attention on recent studies, which will allow me to discuss theoretical developments in the analysis of the production, engagement, and deployment of visualizations. Similarly to Burri and Dumit (2008), I will discuss in the next sections: the technoscientific imaging in practice, focusing the attention on visual logics and styles of representation; the use of images as evidence in the production of scientific knowledge; the relation among images, imaginations and imaginaries. In order to take into account the more recent research findings I will use research examples from the last few years. My aim is not to produce an exhaustive overview of recent literature, rather to explore what best illustrates the challenges within studies of technoscientific imaging in STS.

2. Technoscientific imaging in practice

The study of image *production*, i.e. how images are actually "made" in their production sites, is one of the cornerstones of the study of scientific imaging and visualization in STS. Recent approaches have highlighted the "technoscientific" (rather than scientific) processes of imaging. Even though the attention to actual (and often invisible) work made inside laboratories to explore science in action is rooted in the tradition of Laboratory Studies, the increasing focus on the technical and instrumental aspects of scientific imaging makes me lean towards the term *technoscientific imaging*. For instance, Mody introduces the idea of *instrumental communities*, "a network of individuals who view their involvement with a particular type of instrument and/or instrumentality as ratifying their connection to other nodes in the network" (2011, p. 10).

Similarly, I take for granted that technoscientific imaging is going to be studied from a practice perspective, i.e. studying the practice of imaging and visualization and observing image practices ethnographically. This assumption has recently been criticized (Garforth 2012) arguing that the observational methods rooted in *Laboratory Studies* might devalue "invisible work", i.e. the aspects of knowledge work that are more private and solitary, such as office work.

Even though taking new angles to the study of technoscientific imaging is a core issue in the advancement of this debate, I want to underline what such a perspective can illustrate about the production of images.

For doing so, I will start from a first example coming from the recent sociological debate on "visual rationalities". Through an ethnographic study of medical images, Burri (2012) explores how imaging practices are shaped by what she defines a "visual logic". She claims that social practice is intertwined with a visual logic: the latter shapes medical practices, but at the same time it is (re)produced by social practices. The concept of visual logic has been elaborated from ethnographic research in medical imaging sites. On the methodological

level, a multitude of visual logics can be observed. In their empirical form the author defines them as visual rationalities. Reconstructing and analyzing these visual rationalities by investigating how they work in practice is the task of a sociology of images.

Burri (2012, p. 53) argues that there are three different visual dimensions of images that play a role in social practice and are crucial for a sociology of images. These three visual dimensions "emerge from and shape social practice just like any other epistemic category".

The first dimension concerns the *visual value*, which allows a simultaneous perception of visual information. Burri (2012, p. 50) defines it as "the surplus value of images; it makes images different from auditory, olfactory, flavourful, or tactile signs. The visual value is constructed in social practice; it serves as a phenomenological criterion to distinguish images (as visual signs) from other signs, such as numerical or textual signs. It also underlines that images cannot entirely be transformed into textual or numerical signs without losing some of their advantages".

The second dimension deals with the *visual performance*, i.e. what is depicted in the image, and it emphasizes that the way images are represented is a result of social practices of image production and interpretation. The aesthetic appeal of images is an important issue in medical practice, but it is not purely objective, rather contingent and situational, and it is shaped by local sociotechnical arrangements and institutional contexts. In other words, it is always a social and cultural achievement.

The third dimension refers to the *visual persuasiveness*, which regards the power of images in being perceived as objective and true depictions of reality and as able to prove something. I will explore more in depth the topic of images as evidence. Interestingly, Burri (2012, p. 53) notices that "scientific images are especially persuasive because they are both authoritative and seductive": authoritative because of their evidential power; seductive because they build on appealing aesthetics, evoke emotions, and impact actors' perceptions. This persuasive power is even more relevant considering that images are widely used in daily medical practice: "in talks with patients or colleagues to underline an argument and convince others of a diagnosis or research finding" (p. 52).

The last dimension of visual logic is directly related to the second example of research that I want to present in this section, namely *styles of representation*. In his ethnographic study of Italian clinical cytogenetic laboratories, Mauro Turrini (2011, 2012) investigates some examples of divergences in representational practices through which chromosomes are displayed in cytogenetics. According to the author, this field is still considered to be one of the most artisanal among the biological disciplines. Notwithstanding, since the study of chromosomes is involved in several medical areas, cytogenetics is not only well established, but also widely diffused. Turrini explores the "differences in style that coexist in the same period and are recognized within a scientific community as traditions, genre conventions, and the specific circumstances of the production process, skills, and preferences of the scientist. These stylistic diversities – even though they can be

defined *scientific*, since they are based principally on scientific procedures perfected by the empirical method of trial and error – are not unique to the lab, but respond to varied aesthetic ways to visualize and view the same scientific object" (2012, p. 3). A crucial feature of representative styles is related to the role of aesthetics and aesthetic judgment, which is not amenable to a mere personal taste, but rather refer to local and situated practices of visual construction of scientific data (Goodwin 1994, 1995). Therefore, diverse styles of representation "at the same time entails *what* to visualize and *how* to view it. The distinct strategies of visualizing and viewing specific objects are the final outcomes of an articulated and stratified process of negotiation among biologists, aesthetics, procedures, reagents, laboratory devices and so forth" (Turrini 2012, p. 15).

To sum up, it can be said that styles of representation illustrate that, even in the same scientific discipline, there can be many different ways to visualize the same objects. However, this does not diminish the scientific representativeness of the images produced, but leads to the topic of the next section: how images are constructed and used as evidence in the process of scientific research.

3. Images as evidence

In a recent article, Emma Frow claims that nowadays images and illustrations are treated "as essential for the communication of knowledge claims in scientific publications, providing 'external' references that complement the written text and help to focus the reader's attention on those aspects of the natural world that the author is trying to make visible" (Frow 2012, p. 370). If the idea that scientific images allow readers to 'witness' natural phenomena at a distance is not new (Shapin 1984), the development of instruments for digital imaging (and the possibility of manipulations that they offer) makes the role of images even more critical. On the one hand, this produces a frantic search for aesthetically pleasing images; on the other hand, a growing concern regarding the use of digital image-processing software and instruments in preparing illustrations challenges the credibility of images in scientific research.

Examining image-processing guidelines and journal commentaries on this topic Frow (2012) analyses how journal editors are drawing lines for the scientific community regarding acceptable and unacceptable practices in image production. The high-profile science journals under examination are not so much concerned with intentional fraud, but rather with routinely alteration of digital images. However, the production of best-practice guidelines raises a number of longstanding ambiguities inherent to the production, circulation and interpretation of digital images in scientific publications, but do not resolve them.

Furthermore, recent ethnographic studies (Carusi 2008, 2012; Monteiro 2010; Spencer 2012; for a review see Perini 2012) show how scientists themselves have doubts about the scientific value of images and how they often express negative assessments of the part that images should play in the accomplishment of good

research. As an example of this distrust, I will report an excerpt from Spencer's ethnographic fieldwork with a group of computational physicists:

"Images lie," says one scientist. "It is much better to work with numbers." A colleague of hers commented that "there is a substantial percentage of scientists, maybe even 10 percent, who will see a pretty picture and just want to use it, without even knowing how it is validated. I think that is just disturbing." More strong language from a third source: "I think pretty pictures are an utter waste of time" and a fourth: "Images tell you nothing" (Spencer 2012, p. 34).

According to Carusi (2012), the distrust of images and "the visual" is still commonplace because it is seen as subjective, and therefore in opposition to objective. The gold standard in science is still the numerical investigation precisely because it replaces subjectivity by objectivity and promises a neutral view. This is due to the traditional distinction (rooted in hard sciences, but widespread also in the social sciences) between qualitative and quantitative data. Interestingly, Carusi notes that huge quantities of data are made tractable through qualitative visual renderings. Moreover, qualitative/quantitative reversals are the characteristic feature of digital visualizations of all kinds, since there is a "continuous interplay between data in quantitative form, the algorithms for processing the data and producing the visualization, and the qualitative visual evaluation of the progress of the algorithm formation" (2012, p. 109). This interplay, moreover, is not only related to the instruments but refers to the actual use of visualizations in scientific practices. The typical screen display, for instance, is not only of a visual still or movie, but will also contain interfaces with quantitative settings and parameter displays.

Despite negative assessments, it is undeniable that images play a key role in conducting contemporary scientific research and that visualization is an indispensable technique, especially within the intermediate stages of the investigative process. For instance, on the basis of his ethnographic observations of a multidisciplinary team's weekly work meetings, Marko Monteiro (2010) analyzes how scientists produce scientific evidence through constructing and manipulating scientific visualizations. Monteiro focuses on how scientists build on "digital objects", which are constructed through embodied practices of interpreting and visualizing numerical evidence. As Montero claims "these digital objects as reliable renderings (and sometimes replacements) of natural objects or phenomena. The idea of "digital objects" seeks to conceptually locate their "materiality" in the relationship established by scientists between the phenomena they seek to explain/represent/model and the digital objects they work with during their research practices" (2010, p. 336). Therefore, these digital objects are also compelling images not only because they fascinate the viewer, but also for their perceived mechanical objectivity. The core potential of digital objects, however, is their possibility of manipulation as a way to directly handle data once available only through numbers. Scientists manipulate these digital objects in order to

produce meaning or check for data reliability. Therefore, these manipulations become part of the scientific process of producing evidence.

As we have seen in the previous section, in the scientific communities' rhetoric it is often underlined that – in order to make these data scientific (i.e. objective, and therefore trustable) – instruments have to be used professionally by experts who are able to interpret the data. This process of visual enskillment produces "skilled visions" situated in diverse communities of practice (Grasseni 2004, 2007). However, developments in visualization digital tools have fostered the use of scientific imaging in the communication of science, both inside and outside the scientific community. The use of digital images as evidence in the research practices and communication can bring the non-scientific audience to embrace the idea that these instruments are able to pick up the "reality". In the next section, I will deal with the relation among images, imaginations and imaginaries.

4. Images, imaginations and imaginaries

The spread of visual displays and representations in science communication crosses the boundaries of the scientific community and reaches, often through the media, the audience of non-experts. However, the lay public tends to consider the images presented by the media (including artistic and fantastic) as the actual evidence of existing objects, even though they are invisible and inaccessible to direct observation (Maestrutti 2008).

This phenomenon is particularly relevant in the increasing interest on nanotechnologies and the diffusion of images from this field. As it has been argued by the research examples I have presented in the previous sections, technoscientific images are epistemologically problematic. In the case of nano images this problematic is even more evident, since pictures of an atom or a molecule cannot possibly "look like" an atom or a molecule (Moriarty 2010). Among the nano images, moreover, images of atoms and molecules are accompanied by pictures of imaginary nanoscale machines that might or might not become real in the future, such as nanobots (i.e. nano-robots) that navigate within blood vessels, acting as mechanical shovels to remove plaque, or nanobots that grasp blood cells. As Nerlich (2008) has argued, artistic depictions of nanobots are meant to make the unfamiliar features of nanotechnology seem familiar to broad audiences and to make things that do not exist seem as if they might soon exist. According to the author, this is because nanotechnology will seem normal if people accept pictures of nanobots. However, Nerlich claims, nanobots have captured public *imagination*.

Exploring different types of images from Nanotechnology Image Galleries, de Ridder-Vignone and Lynch (2012) have analysed the relation between *images* and *imaginations*. They argue that all the types of nano images they have investigated distinctively challenge the viewer's imagination, while drawing upon what is familiar: they are at the same time "realistic" in their appearance (as una-

dorned, monochromatic or black-and white, micrographic images can be) as well as they involve distinctive modes of imagination. The authors even argue that "the most ostentatiously imaginative images often deploy the most conventional means to depict nanoscale reality" (2012, p. 447).

As Toumey and Cobb (2012) argue, the two interweaving families of nanoscale images (i.e. pictures of atoms and molecules and pictures of imaginary nanobots) raise a number of questions about our knowledge of reality at the nanoscale. On the basis of a survey in the U.S. the authors illustrate how epistemology meets public interpretation in the case on nano images: "We see how a depiction of an object that is not real now and may never become real nevertheless affects public attitudes about the health and medical implications of nanotechnology" (Toumey and Cobb 2012, p. 464).

The imaginaries of nanotechnology, moreover, are strictly related to the imaginaries of body transformations (Maestrutti 2011a). Accordingly, I will move my attention to the technoscientific imaging of the human body, which seems to be an extraordinary example of the relation among images, imaginations and imaginaries. As argued by Maestrutti (2011b) one of the main characteristics of technoscience is the creation of what she defines as "techno-imagination", which develops around the body. The body seems to be one of the more fruitful *loci* for the development of techno-imagination for two main reasons: on the one hand, it is a site of experiment and transformation of life and organic materials; on the other, it is a *locus* of construction of new forms of identity.

In order to explore the relationship between the production and diffusion of appealing scientific images and new imaginations and imaginaries of human bodies, I will present a last example of research on the technoscientific imaging and visualization of human reproductive cells (Lie 2012). Through the example of the website of a Norwegian governmental organization for information on biotechnology and bioethics, the author investigates how new images of the human body (in this case mainly egg and sperm cells at the moment of conception) may affect the understanding of human bodies (and human reproduction), contributing to change imaginations and imaginaries of the body itself. The website under scrutiny, as many others intended for the lay public, displays images of egg and sperm cells related to techniques of assisted reproduction.

Technoscientific imaging can transform human cells into astonishing and aesthetically appealing images. Cells, and even their interior, are depicted via medical visualization technologies and become concrete bodies. Cells are cleaned (i.e. organic matter is removed) and colours are added to distinguish various aspects: the result appears as images of real human cells. Through this "manipulation" a cultural transformation is also achieved and cells reappear as individual and autonomous entities. As Lie (2012, p. 19) argues, once cells "are detached from the self, they can be studied, discussed and referred to at a distance, and once they have a shape or description they are identifiable and manageable". When gametes are de-contextualized from human bodies they become detachable, usable properties. This cultural transformation fosters the re-imagination of the "facts of

life". The new imaginations and imaginaries of the human bodies, directly affect our sense of self, body and humanness. When cells are understood as autonomous entities, rather than fragment of a whole body, the same biological material can assume a different ontological status according to the sense-making process in which it is embedded (for a detailed discussion, see Perrotta 2013).

5. Conclusions: future studies of technoscientific imaging in STS

The array of studies presented in the previous pages is not an exhaustive review, although it represents some of the most interesting studies in the recent STS literature on technoscientific imaging. I decided to focus on the three strands of analysis which best represent the state of the art: technoscientific imaging in practice; images as evidence; images, imaginations and imaginaries.

Through the literature presented, I have pointed out the role of visual logic and styles of representation, the relevance of aesthetics in the sharing and production of scientific knowledge, and the importance of images in the transformation of imaginations and imageries. Not by chance, some recent experiences of hybridization have shown a great potential for new future studies of technoscientific imaging. The call for a broader development of an STS approach to the arts (Benschop 2009), the study of the emerging area of BioArt (Yang 2011), and the increasing number of joint projects between STS scholars and (mainly bio)artists (Anker and Franklin 2011) can bring a new breeze to the future studies of technoscientific imaging.

Although the collaboration among artists and natural and social scientists has already provided interesting examples of research successes, the increasing hybridization between STS and art represents a challenge for future studIES of technoscientific imaging. The field of STS, as an interdisciplinary research environment, could afford new opportunities of collaboration between artists and scientists, as well as support further research efforts to explore technoscientific imaging.

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Book reviews

Davide Bennato
Sociologia dei media digitali. Relazioni sociali e processi comunicativi del web partecipativo
2011, Laterza, 177 pp.
by Fausto Colombo

Christian Kehr, Peter Schüßler and Marc-Denis Weitze (eds.)
Neue Technologien in der Gesellschaft. Akteure, Erwartungen, Kontroversen und Konjunkturen
2011, Transcript Verlag, 363 pp.
by Mareike Glöss

Marina Maestrutti
Imaginaires des nanotechnologies. Mythes et fictions de l'infiniment petit
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by Brice Laurent

Herman Galperin and Judith Mariscal (eds.)
Pobreza Digital. Perspectivas de America Latina y el Caribe
2009, CIDE, 213 pp.
by Gianluca Miscione

Kristin Asdal
Politikkens natur. Naturens politikk
2011, Universitetsforlaget, 304 pp.
by Håkon B. Stokland

Michel Callon, Pierre Lascoumes and Yannick Barthe
Acting in an Uncertain World: an Essay on Technical Democracy
2009, MIT Press, 287 pp.
by Maurizio Teli

Science, Design and Everyday Life

Donald A. Norman
Living with Complexity
2011, MIT Press, 298 pp.

and

Matthias Gross
Ignorance and Surprise. Science, Society and Ecological Design
2010, MIT Press, 240 pp.

by Francesco Ronzon

TECNOSCIENZA
Italian Journal of Science & Technology Studies

Davide Bennato

Sociologia dei media digitali. Relazioni sociali e processi comunicativi del web partecipativo

(*Digital Media Sociology. Social Relationships and Communications in Participative Web*)

2011, Laterza, 177 pp.

Fausto Colombo
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The book is divided into three major sections, linked by the attempt to describe and to understand why the web (or Web 2.0, or the participative web) allows to exchange ideas, opinions, interests, passions, values, thus creating a medium (articulated today in blogs, wikis, SNSs) in which "la caratteristica più evidente sono le persone" (p. IX) (translated by the reviewer "the most striking feature are people").

The first section shows how digital media force us to rethink in a new way some of the key issues in communication studies, such as broadcast, audience, media, relations between public / private. On the one hand this can lead us to come back to some classical theories, however, though shifting the focus to these new digital tools. In particular, Bennato describes the shift from analogue to digital media, from mass to social media (or, according to Castells, to "self mass communication") as a shift from broadcasting

to social-casting, following the most diverse steps, with the most diverse, temporary and sometimes overlapping names such as narrowcasting, web casting and data casting.

According to the author, social casting means the way of broadcasting which is peculiar to social or participatory web, in which distribution regards a community of people who autonomously decide to let circulate contents by exploiting the sharing opportunities of these new technological platforms. This definition encompasses both a technological dimension (i.e. web platforms), and a cultural and symbolic dimension (that enables sharing among people). For this reason, the author reviews those theories that have tried to describe digitization, and he considers the first achievements of media studies and then those of the Science and Technology Studies, showing which contribution these studies may offer to digital innovation, and which are the fundamental problems in their application.

In the second section, Bennato tries to define what we mean when we talk about digital media, showing the complexity of distinctions between the various galaxies in web universe. The basic thesis of this section is that many of the relational possibilities made available by digital media are inscribed in the technologies themselves, and are integrated in machines. The chapter traces the genesis of those terms mostly used today by researchers, journalists, marketing people and entrepreneurs to describe those technologies which have been

part of the shift in the third millennium.

The first term, taken into account by the author, is "Social Informatics" (study of the social aspects of computerization and ICT), whose main features regard that of problem solving in computing in the specific context of application, of attention given to institutional and cultural dimension, of integration between technological and social design. The second step consists of researches about "Computer Supported Social Networks" (e.g. Wellman's work), which distinguish between virtual communities, computer networks in work team and telework.

A further step is the "Cluetrain Manifesto", in 1999, when there was an attempt to redefine the markets on the basis of web impact, in corporate communication.

And finally the author tackles the notion of "Social Software" by Clay Shirky (2002), which gives rise to the birth of platforms such as MySpace and Flickr. In 2005, Tim O'Reilly coined the concept of Web 2.0. O'Reilly looked at the market performance in service markets in the web after the bursting of the dot-com bubble in the fall of 2001, and he argued that companies that survived the collapse have been reinforced in subsequent years, while those born after (almost all start-up at that point) tended to develop new and original market strategies. The term Web 2.0 at that point was already circulating for over a year, and O'Reilly by himself admitted that its semantics was still vague. However,

as we know, it managed to become the label for the whole world of social networking and of new services and platforms in the web.

The second part of this section gives an account of the consistency of these transformations and labels with some key concepts in theories of technological development such as Diffusionism and Social Shaping of Technology. The section later tackles a detailed analysis of various types of participatory networks: the first examples of wiki collaboration, experienced at the end of the last century, and then made famous by the creation of Wikipedia (2001, while the preliminary version is Nupedia in 2000); afterwards social network sites, or web services that allow to create a public or semi-public profile and a list of users to be connected with (the first, Sixdegrees, was in 1997, the famous Facebook was born in 2004, at the time of the boom of MySpace).

Finally, Bennato analyzes a wide range of "other" social media, such as YouTube, Twitter and Friendfeed. The third and shortest section of the book deals with the issue of values and ethics in digital media. Here the author's starting point is a philosophical (Heidegger) and anthropological (Gehlen) reflection about technique as a human place. In particular, the author reviews Jonas's discussion concerning relationships between technology and power in personal relationships, considering current technologies as a whole as challenging and problematic as those of genetic engineering (that's why

today we talk about techno-ethical harmony with bioethics).

Even though early signs of an interest in techno-ethics have come from Wiener's thoughts, at the end of the sixties (about limits and values in the emerging Computer Science), it can be said that this issue was finally opened in Moor's article, "What is Computer Ethics?" (1987), in which, prophetically, the author pointed out that the main ethical problems would come during the machine assimilation as part of humanity, and that this stage would be necessarily followed by a long period of technological development. Computer malleability was the main reason of its ability to change processes in which it was used. Before discussing some interesting cases (e.g. Simputer, Miss Bimbo) Bennato notes that an ethical perspective becomes crucial for social sciences, which are facing epochal changes in which the role of technology is undeniable.

This work by Davide Bennato looks like having two different sides: on the one hand a historical review of technological, social, scientific events; on the other hand a critical approach to the main theories concerning social media and Web 2.0, which, without a precise re-read of these labels, are now at risk of becoming buzz words. This ambivalence is an essential quality of this well organized book with a rich bibliography and lists of websites.

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Christian Kehr, Peter Schüßler and Marc-Denis Weitze (eds.)

Neue Technologien in der Gesellschaft. Akteure, Erwartungen, Kontroversen und Konjunkturen

(New Technologies in Society – Actors, Prospects, Controversies and Conjunctures)

2011, Transcript Verlag, 363 pp.

Mareike Glöss
(Uppsala University)

The here presented edited collection seeks to give an overview over new technologies in society, analyzing the multitude of actors and factors that are entangled with it.

The theoretical foundation is hereby building on social construction of technology (Bijker et. Al., 1987) as the editors emphasize in their introducing chapter. However, the approach this collection is taking analyzes technology as one of factors besides others and thereby rather shaped by the social than constructed (MacKenzie and Wajcman, 1999).

The work originated from a research project that was located at the German Museum in Munich. The main idea was to bring together scholars from social, philosophical, historical fields and discuss the different dimensions of new technologies along concrete case studies. At the same time the collection also includes contributions from actors of the discussed new technologies – natural scientists and

engineers – in order to "understand their motives, experiences and interests" (p. 17).

The idea of conducting a research project about the various social dimensions of new technologies that is not only involving scholars from social sciences but also representatives from those fields that are actually developing and working with these new technologies is at the same time appealing as well as challenging. The edited collection approaches new technologies by bringing together scholars from various disciplines in order to account for the heterogeneity of this field – and is to some extent successful in doing so.

The book is divided into five parts. While the first part is dealing with the concept of new technologies, the following parts are discussing different kind of technologies: Energy, information and communication technology (ICT), bio and nanotechnology.

The first part of the book offers different approaches for the conceptualizing of new technologies. Kornwachs (chapter 2) introduces this part with a discussion about the concept of "new". Thereby the very relevant question is discussed in how far new technologies can be really considered as new and how the perception of new technologies is changing over time. Radkau (chapter 3) continues this discussion but takes a more historical focus. The term 'new technologies' as a highly relative term has been discussed before and the historical focus has proven to be valuable for evaluating the percep-

tion of different technologies in society (Marvin, 1988). It is through this discussion that is taken up throughout the book – amongst other by Högselius (chapter 7), Heymann (chapter 10) and Barben (chapter 13) – that the collection is able to connect the discussed new technologies with their perception in society.

The second part deals with different aspects of energy, whereas a certain focus lies on how to meet the increased demand for energy in modern societies. After an introduction (Dittmann, chapter 6) that discusses the availability of energy as a central concept, Högselius (chapter 7) as well as Günter and Milch (chapter 8) are approaching nuclear energy from different directions. While both chapters ask the same question – if nuclear energy is the energy of the future – both come to different conclusions. Here the interdisciplinary approach – one contribution giving a historical perspective, the other coming from the Max-Planck institute for plasma physics – shows its potential by creating an insightful discourse between a more techno-deterministic and a more social-constructivist perspective.

Unfortunately this discourse of the first two chapters is not continued in part three. While Mainzer (chapter 12) gives a good overview over the development towards today's information and communication technologies, such as robots or smart grids, the following contributions present a rather unreflected descrip-

tion of some of these technologies. Herzog describes ubiquitous computing and the components it is built of but does not manage to reflect on the change of social perception of computing.

And even though Aumann (chapter 15) shows the complex relationship between public and science in regards to the perception of cybernetics and bionics, the whole part does not manage to reach a higher analytical level.

Part four – in contrast to the foregoing part – does provide a much more thorough image. Thereby the authors manage to work out public controversies around ethical considerations (Gill, chapter 16), economical significance (Müller-Röber and Weitze, chapter 17) and governmental funding policy (Wieland, chapter 18).

Similarly strong as part four is the fifth part that is dealing with nano-technology. Hereby the focus lays not so much on a mere description of new technologies but instead accomplishes to explore a variety of interesting aspects, such as Schummer's (chapter 20) discussion of nano-technology as a programmatic idea or Blümel's (chapter 21) analysis of Germany's research funding policies.

At the first glance the book presents a very broad perspective on new technologies from the point-of-view of a multitude of different disciplines. On a closer look it shows that the book has a strong focus on science and research policies in particular from a historical perspec-

tive and with a very strong emphasis on the German science landscape.

The interdisciplinary approach that is presented here shows its strength through its diversity. The chosen articles present a very wide range of different disciplines, but are very much focused on setting new technologies into their historical context. This creates a discursive character that is over wide parts very insightful.

On the other hand this interdisciplinary approach shows its weakness when it comes to embedding all contributions into a theoretical framework – in particular in relating it to the chosen socio-constructivist approach. Some of the chapters do not overcome their rather technological deterministic point-of-view. This is demonstrated for instance by the repeated uncritical reference to Moore's law (exemplified by MacKenzie and Wacjman 1999) and particularly in those contributions that are coming from the applied science. Setting those contributions into a stronger theoretical context could have enhanced this collection. However, the reader can compensate this deficit easily by keeping the critical mindset that is presented in some of the articles in particular in the first part. Then this collection will be very valuable to those readers that are interested in the contemporary German scientific landscape in the field of new technologies.

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Marina Maestrutti

Imaginaires des nanotechnologies. Mythes et fictions de l'infiniment petit

(*Nanotechnology Imaginaries. Myths and Fictions of the Infinitely Small*)

2012, Vuibert, 272 pp.

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An English translation of the title of Marina Maetrutti's book might be "Nanotechnology Imaginaries". The term "imaginary" (imaginaire in the original French) is central to understand the analysis of the "myths and fictions of the infinite small" (the subtitle of the book) that Maestrutti proposes. It allows her to identify pervasive tensions in technological discourses, and it suggests a path for the political analysis of scientific development. I will discuss these two points successively.

Marina Maestrutti bases her analysis on the description of nanotechnology as a field where the future is regularly referred to. An overlying discourse made of "industrial revolutions" is part and parcel of the development of the field, associated with elements coming directly from science–fiction. The book analyzes in details what many nanotechnology scholars have been concerned with in the past few years, namely the futuristic accounts that accompany the development of nanotechnology. Marina Maestrutti describes some of these accounts, including those grounded on self-replicating nano-machines, and the perspectives of radical social transformations based on human enhancement. She discusses them along three lines, examined successively in the three parts of the book: the major narratives that were produced with the development of nanotechnology, the visions of the future of nanotechnology, and the imaginaries of body transformations.

Throughout the book, the underlying philosophical themes of the control over nature, the making of utopia and counter-utopia, and the transformation of the human body are studied in details. The discourses related to nanotechnology then appear as re-activations of long-term issues in philosophical thinking. While analyzing these long-term issues, Marina Maestrutti elegantly describes the roots of argumentation regarding nanotechnology's applications, by pointing to a series of dichotomies that pertain to the constructing of meaning of

(nano)technological development.

Thus, tensions appear between the reference to the wonders of science, and the space it opens for public controversies about its potential negative consequences; between the call for the "new industrial revolution" and the fear of the transformation of society (or even mankind itself), as it is made explicit in the writing of some of the main nanotechnology proponents, such as Erik Drexler. Through the analysis of the two joint sides of progress and apocalypse, of utopia and counter-utopia, Marina Maestrutti convincingly links the discourses of technological development with philosophical and/or mythical traditions, such as the myth of Prometheus, or Descartes's vision of animated machines.

For all its analytical interest, the description of these dichotomies might leave the reader in a bit of a quandary. Marina Maestrutti contends that these pervasive dichotomies "structure our imaginaries and our symbolic representations of present and future" (p.144). Yet ultimately, these tensions in the visions of nanotechnology future development also raise a political issue: do "we", as observers or citizens, need to pick one or the other options? Are we condemned to choose between progress and apocalypse?

Answering these questions might be complicated, particularly in the case of the transhumanists discussed in the third part of the book. While one feels instinctively skeptical about the

technological development and the transformation of the human specie as transhumanist thinkers call for, wouldn't we rather be, to paraphrase Donna Haraway, rather cyborgs than god(esse)s? The alternative to transhumanism that the book presents is Leon Kass' perspective of human dignity, based on pre-given values and a taken for granted "human dignity", irrespective of any situated context. Marina Maestrutti made this tension explicit as she explains that the "debate is articulated around the opposition between bioluddites (or bioconserva-tors), who refuse the technological enhancement of humans, and bioprogessists (among whom transhumanists), who argue for the right to become 'more than human'" (p.212, my translation).

In this quote, it seems that the opposition cannot be overcome. Marina Maestrutti offers a path forward though, and I would like to argue that the very notion of imaginaries, provided it is developed as a systematic analytical lens, might allow the analyst to escape the dichotomies, and ultimately point to the political stakes of technological development.

Facing a two-side debate, it could be tempting to start the analysis (or, for that matter, the political discussion) by the examination of what nanotechnology "really is". Why trying to decipher the "good" from the "bad" if we do not know the technical, practical, material reality of nanotechnology? This is a position often adopted by many commenta-

tors of nanotechnology (or scientists wanting to tell "the truth" about nanotechnology). But this would be throwing out the baby with the bath water. For, as Maestrutti convincingly argues, the futuristic visions of nanotechnology are part and parcel of the development of nanotechnology, as a science policy programs expected to re-organize scientific research for the development of new projects. Calling for the examination of what nanotechnology "really" is would risk loosing this crucial component of the making of nanotechnology.

The book, while not systematically exploring the ways in which the above-mentioned dichotomies practically structure the making of nanotechnology objects and programs themselves, does suggest a path forward through the very concept of "imaginary" – as used in its title. The term "imaginary" comes from "image", and there are many connections indeed between Maestrutti's imaginaries and scientific (and non scientific) images, in a way that shifts a problem of representtation to a question of presentation, related to the actual making of the world being described. The book rightly discusses Lorraine Daston and Peter Galison's use of the notion of (re)presentation as a way of constructing an objectivity connecting the description of nature with the making of technical objects (p.58). The images of nanotechnology are the products of such processes, by which scientific instruments perform the material

reality they describe.

Nanotechnology images intervene at multiple levels. They are scientific, but also commercial, as they appear on the cover of scientific magazines and on the front page of science policy report. Marina Maestrutti discusses these images as devices enacting the visions she is interested in. This opens an interesting analytical path: the performance that these images do is also part and parcel of the making of nanotechnology as a political program. They connect the "visions", the discourses of "hype", with the concrete making of nanotechnology programs, in science policy offices and in the construction of research projects. They enact the making of nanotechnology as a new entity comprising laboratory practices and technological objects, future developments and articulations between research and industry, the description of materials and the intervention in their very making.

Following this perspective, one can contend that imaginaries are not about the description of a world already there, but as assemblages of instruments performing new realities. Understood as such, imaginaries connect the making of future visions with that of the actual construction of nanotechnology. They enact visions of progress or risks. They organize social identities (e.g. concerned publics, involved citizens, or transhumanists active in science policy arenas) and define forms of political legitimacy about acceptable technological developments (who

should decide, where and about what?). "Imaginaries", in this extended meaning echoing current works in the field of Science and Technology Studies (Jasanoff and Kim, 2010), then appear as powerful analytical tools for the description of technological programs, while also helping us locate the sites where the political issues of nanotechnology are made explicit. In this perspective, imaginaries are less pervasive "structures" defining our perceptions of the past and the future than instrumented assemblages, which practically construct technical objects and social practices. Understanding imaginaries as such relocates the political issues of nanotechnology at the heart of the making of objects and visions. It might offer a path for the practical elaboration of the "partnership" between the artificial and the natural with which Marina Maestrutti concludes her book.

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Herman Galperin and Judith Mariscal (eds.)

Pobreza Digital – Perspectivas de America Latina y el Caribe

2009, CIDE, 213 pp.

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I would like to start this review by situating my viewpoint. Likely, I was asked to read this book because of my long lasting interest to conduct research 'beyond' the digital divide. A decade ago, when I started my PhD research on a telemedicine system in the Peruvian upper amazon, it sounded 'exotic' -to say the least- to my colleagues and supervisors. Indeed, the digital divide problem proved to be "out there" as much as in the tacit empirical assumption that the amazon is not a relevant setting to study telemedicine from an organizational perspective. Subsequent success of that research proved that 'digital divide' is a 'real' problem (still in search for solutions) as much as a reflexive problem for research practice, often too slow in revising own assumptions.

This book addresses the former issue but overlooks the latter, which could be quite relevant for Tecnoscienza readership.

Overall, "Pobreza Digital. Perspectivas de America Latina y el Caribe" [Digital Poverty. Perspectives from Latin America and the Caribbean] focuses on an important issue, both for research and practice.

In fact, it is true that market economy has been contributing greatly to lifting out of poverty a remarkable portion of the world population, but it achieved that also exacerbating inequalities. Acknowledging this lays underneath the 'pro-poor' stance of this collection of works.

This book is articulated in six chapters. The first introduces the reader to the idea of digital poverty and puts down the cornerstones for its measurement. Key stakeholders (private sector, government, beneficiaries) are considered. Chapter two looks at the demand side of ICT and applies an econometric scheme to Peru'. This part is well done according to standard research techniques, but overlooks a key issue about ICT demand among poor people: how to identify demand? Is it based on expressed need? On actual need, perhaps derived by comparing to other average values? How to discriminate need from desire? It is known that in developing economies non-necessary goods may substitute basic services (I myself saw flat TV sets in accommodations without sanitation). Chapter three offers an overview on the changes across Latin American ICT markets, paying specific attention to big companies. Then, it is showed how the privatization of the sector contributed substantially to increased penetration of ICT in Latin American societies, especially with mobile phones. Chapter four seeks a balance by looking at micro, and often grass-root, initiatives. The

relevance of an adequate regulative environment is argued as determinant. Chapter five pull the treads of sustainability by articulating three different domains: basis, users and technology. Finally, chapter six proposes pro-poor ICT strategies and research. As argued later, policy makers are those who may benefit most by the research models and strategies proposed here.

An important aim of these works is to measure the unmeasured (Déjean et al.: 2004). This is not pursued according to a simple positivistic approach of finding what the reality is. Saetnan and colleagues (2010) ask "for whom the bell curves?" hinting at the mutual construction of statistics and society. Here, authors aim at curving the bell in a specific way: Authors are well aware that measures allow fostering pro-poor policy claims, therefore they can affect the agendas in policy making arenas.

In this sense, this book is quite articulated, chapter two in particular. So, the natural audience for this publication comprises policy makers and practitioners at all levels. Also Spanish speaking people approaching issues related to the digital divide may find this collection useful, even though they will have to look somewhere else to gain a more complete overview.

In my opinion, researchers interested in new understandings of digital divide would find the scope of this book a bit narrow. The problem I see is that critical assumptions are not questioned. Let me go into this

because I think that Tecnoscienza readers may find it relevant. The introduction to this book states that "authors of this book accepted the challenge of thinking in creative ways and of exploring novel strategies to help solving the problems that digital poverty creates in Latin America and the Caribbean" (p. 10). I have done quite some work in Latin America and the problem I pinpoint here is that poor people are depicted -or simply assumed- to be in lack of something. I do not deny it, but I find this a narrow view. The consequences are that homogenizing the problems results in homogenizing solutions. The risk is of what I call here "Engineering the other". Are all poor the same? Not always, not necessarily. ICT are not a panacea. Therefore, 'Where can ICT help?' "in which sectors?", "with what applications?", "in what kinds of organizations?" are among the discriminatory questions to ask.

I now take a different angle on the same problem. Is being connected via ICT good? It depends on who and what one connects to. For sure ICT allow novel organizational forms, but this does not mean that they are all good. There are plenty of services that are failures or a waste of time and resource, at least. Brazilian ex-president Lula stated, about the still unfolding economic crisis that "it has blue eyes", meaning that western experts had no idea of the risks of what they were doing promoting tight interconnections of markets. So, how to learn from mistakes? How to discriminate?

By assuming acritically that ICT are good, we would miss to realize how the digital divide is in the eye of the beholder also.

In conclusion I invite to reconsider the ageing notion of 'digital divide' (and a recent re-incarnation in 'digital poverty') without scrutinizing general concepts which showed limits, already. The consequences of a more open-ended approach can be far-fetched, but at the end of the day, this is what social studies of technologies are about.

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Kristin Asdal

Politikkens natur. Naturens politikk

(*The Nature of Politics. The Politics of Nature*)

2011, Universitetsforlaget, 304 pp.

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The title "Politikkens natur. Naturens politick" can be translated as "The Nature of Politics. The Politics of Nature", and reflects the dual ambition of the book. Kristin Asdal intends to say something about what politics is and how it gets done by analyzing the origin and later development of environmental politics in Norway. The book is in large part based on her doctoral thesis from 2004, which has been remolded to match a somewhat broader but still mainly academic Norwegian audience. It consists in six main chapters, which traces the development of Norwegian environmental politics by analyzing six defining cases in its history after world war two. Simultaneously, each chapter investigates the nature of politics by examining one political technology at the core of its analysis.

In developing her main approach for studying politics and more specifically the politics of nature, Asdal draws on Max Weber's studies of bureaucracy, Foucault's lectures on 'gouvernementalité', and actor-network theory. Weber treated bureaucracy as a tool for politics, and Asdal has found inspiration in his emphasis on the importance of technical devices and material arrangements in making the conduct of both bureaucracy and politics possible. Further, she has drawn on Foucault's insistence on studying government as practice, and his focus on governmental technologies and programs of government. In its treatment of the origin and development of a politics of nature in

Norway, the book has gained much from Foucault's argument that governmental practices creates new realities that in turn shapes society. Finally, Asdal mentions actor-network theory as an important inspiration, mainly because of its importance in making the fields of material technologies and the natural sciences relevant and accepted as fields of inquiry for the humanities. By drawing on these inspirations, Asdal examines how the politics of nature has been done by making what she has coined 'the technologies of politics' the center of her analysis. Asdal defines this term as the different ways in which scientific knowledge partakes in politics, and the technical arrangements and procedures that enables and shapes politics.

In tracing the history of environmental politics in Norway, Asdal's main focus is to examine how nature has been made relevant for politics by different political technologies. The origin of environmental politics it often assumed to lie in the so-called green revolution of the 1960s and 1970s, and the establishment of the Ministry of the environment in 1972. However, Asdal shows that controversy concerning pollution goes back to the early postwar years and the establishment of an extensive aluminum industry in a number of rural communities. At this point of time, however, the pollution controversy was not a matter of vulnerable nature or the environment – it was treated as a conflict between the business interests of industry and

the local farmers whose domestic animals got fluoride poisoning from the smoke emissions. A national board of smoke damage (røk-skaderådet) was established in the aftermath of this controversy, and pollution was made an object of national management and regulation. The board was, however, closely tied to industry interests. This organization of the board quickly turned the pollution issue into an industrial issue, and distanced the issue from the damages of pollution on livestock, woods and the agricultural landscape. The measurement and control of smoke emissions, not smoke damage, became the main regulatory strategy of the board. Emission numbers were easier to measure and control, but the disengagement of the issue from the damages made the emission level negotiable and hence the regulation weak.

Asdal argues that nature and the environment as relevant objects of government were created in the second half of the 20th century, and that they were formed in relation to industry and economic reasoning. The environment as a political issue, as well as an influential public opinion speaking on its behalf, originated in a controversy concerning an application to establish an oil-fueled power plant around 1970. This was not a controversial matter at first, but intense work by a few antagonists established relations between the potential power plant and the ongoing international negotiations concerning acid rain.

This relation made evident the damages the plant could cause in Norwegian landscapes, and the reinforced relation between pollution and damage engaged a larger public in the issue. Hence, the pollution issue as an industrial issue was challenged by an effort to make it an environmental issue. The effort paid off, as the plant was never built. The issue of acid rain was, however, not put to rest as the recently established Norwegian environment continued to take damage from other countries' emissions of sulfur dioxides. Asdal shows how a vulnerable Norwegian nature was created by the Ministry of the environment and scientists in the 1980s and 1990s, in an effort to ensure the prominence of ecology over economy and to make progress in the acid rain issue. As in the case of smoke emissions, the political technology that was created to attain this goal consisted in the measurement and control of numbers and levels. However, this time it was the damage that got measured, and the technology of the critical levels of nature was quite successful in generating a vulnerable nature as an opposition to economic growth, and in persuading other countries to commit to reducing emissions. The downside of this political technology of numbers was nevertheless that it was compatible with the economic reasoning of cost-efficiency, and soon economists were arguing that pollution levels should be raised enough to match the critical levels of nature as long as they did not exceed them. Further, Asdal argues that the

environmental issue became a full economic issue as the controversy of climate change replaced that of acid rain in the end of the 1980s. The vulnerable nature at the heart of the issue was transformed from national to global, and the political technology advocated by Norway in the international negotiations was a system of climate quotas based on marked economy.

In examining the history of Norwegian environmental politics, the book represents a new way of construing 20th century Norwegian history. By employing the term of political technologies to trace the history of environmental politics, Asdal investigates into the more general history of Norwegian politics. This relation to more traditional historical literature is important for her approach in that it not only involves the transportation of ideas from science and technology studies and the field of governmentality studies into the field of Norwegian history – it brings something back as well. Most importantly, and this is one of the definite strengths of the book, Asdal approaches the origin and development of environmental politics by studying its history in empirical detail. By doing this, she nuances and criticizes some of the more theorizing and philosophical work on politics and its relations to nature and science within both science and technology studies and the field of governmentality studies. By reference to Bruno Latour's argument that Nature by way of scientists short-circuits the political

process, Asdal argues instead that it takes a great deal of effort to make nature a relevant object of government. Further, she argues that nature, once established as a political object, is rather unstable and that it might very well get ignored in favor of for example economic considerations. Additionally, she shows empirically how nature and science can open a political process to new actors and even democratize a formerly closed process, rather than short-circuit it. Considering the political technologies of numbers, Asdal nuances the weight put by Peter Miller and much of the governmentality literature on the power of numbers as a powerful tool for government. She shows empirically how it might take a great deal of effort to establish such a political technology of numbers, and that it might not work as planned or work at all.

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Michel Callon, Pierre Lascoumes and Yannick Barthe

Acting in an Uncertain World: an Essay on Technical Democracy

2009, MIT Press, 301 pp.

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When I started reading the book by Michel Callon, Pierre Lascoumes and

Yannick Barthe with the idea of writing a review of it, my constant feeling was one of dealing with an extremely relevant theme, that is the relationship between delegations in representative democracy and techno-scientific issues that challenge the structure of delegations in its current shape. Moreover, the more I was engaging with the emergence of hybrid forums, the social spaces of relations between what the authors call "secluded research" and "research in the wild" where the consolidated knowledge and the political decision making are questioned, I was continuously attracted by the book argument as a theoretical tool to investigate the case of the High Speed Train between Turin and Lyon. That looks to me as a typical case of a "concerned group", a group of people "alerted by unexplained phenomena which concern and affect them, [that] decide to make problematic events visible and undertake a primitive accumulation of knowledge" (82). Referring to one of the books that the authors point to, Latour's Politics of Nature (2004), concerned groups are defined through their ability to act at the stage of introduction of perplexity on the possible worlds and collectives populating contemporary society. They do not limit themselves at the stage of perplexity because, through what the authors called "primitive accumulation of knowledge", that is the process of classifying unexplained phenomena "according to their similarities or dissimilarities" (81), they also engage

in the two processes helping to overcome uncertainties: the exploration of possible worlds and the constitution of the collective. According to the authors, the engagement of concerned groups in these processes, substituting secluded research (science and technology done by professionals closed in their laboratories and professional communities) with collaborative research (when research professional engage with research in the wild, the one emerging from people in context different from professionalism) and changing the process of construction of the collective, from a process of aggregation of the "formally identical" (votes) to a process of composition of what is "specific and singular" (voices), is what allow the passage from "deliberative democracy" to "dialogic democracy" (134-135). In one sentence, I can describe the book as entirely devoted to investigating such passage, both theoretically and with a rich set of examples, from nuclear waste to AIDS, and to show how the passage acts as a form of "democratization of democracy", topic that closes the book in Chapter 7 and that is taken over since the beginning of the book, that is dedicated "to all those who, by inventing technical democracy, re-invent democracy". But how do the authors develop their argument? They do that through seven chapters. In chapter 1, "Hybrid Forums", the author defines such forums as "open spaces where groups can come together to discuss technical options

involving the collective, hybrid because the groups involved and the spokespersons claiming to represent them are heterogeneous, including experts, politicians, technicians, and laypersons who consider themselves involved" (18). In this chapter, hybrid forums are seen as a result of actions undertaken by concerned groups in situations of uncertainty, one of the key concepts of the book, that is defined as the situations in which "science often proves to be incapable of establishing the list of possible worlds and of describing each of them exactly" (21), that is, to pick up one of the strongest definitions of the book, "We know that we do not know, but that is almost all that we know" (ibidem). In short, to pick up the topic of Chapter 2, secluded research, hybrid forums emerge when science faces overflows, when the knowledge of secluded research is unable to foresee all the states of the possible world and all the potential compositions of the collective. Concerned groups are the subjects able to make the overflows visible, to make them part of the collective, and to be debated and discussed at a level wider than the one of secluded research, that is to be discussed in the wild (the characteristics of research in the wild are discussed in chapter 3). Dialogic democracy is the form that the cooperation between secluded research and research in the wild can take, and it is explored in Chapter 4, in particular with one of the main take of the book: democracy is a matter of procedures, and hybrid

forums act on the mechanisms of delegation through rethinking the concept of representation. From the delegation to secluded research in order to establish the state of possible worlds to confrontation and cooperation, from the delegation to parliaments in order to aggregate the collective, to a process of composition of the collective itself, through the voices of concerned groups, therefore involved both in the research process and in the political one. Only fostering procedures that allow the emergence of hybrid forums, according to the authors, is possible to engage in the already cited "democratization of democracy", and to search for a "common world" (in fact, the title of chapter 4 is exactly "In Search of a Common World"). A question remains unanswered, that is "where does dialogic democracy intersect the process of research?", and here stands the more theoretically deep contribution of the book, unfolding between chapter 2 and chapter 3, that is conceptualizing research as a process of Translation, with a caps T, done of three minor translations: adapting the research problem in the world to the scale of the laboratory (translation 1), processing it through the laboratory work (translation 2), and bringing it back to the world at large (translation 3). The contribution of the book is to analyze how hybrid forums displace and enrich the process of Translation, and it is therefore a clear Actor-Network Theory account of the relationship between secluded research,

concerned groups, procedural and institutional arrangements.

What qualifies the advancement brought by the book is the introduction of the concept of measured action, to which is dedicated the entire chapter 6. Such concept is rooted in the fact that "actors avail themselves of the means to be able at any moment to return to abandoned options, and that evaluations are constantly revised in terms of new knowledge and points of view" (192) and it founds an empirical existence in what is known as the "precautionary principle" (ibidem), adopted as policy line in many EU contexts, and that applies to situation of uncertainty. This chapter is also the one that shows the weaknesses of the analysis carried out in the book. The whole chapter looks like the trial to convince the politicians (and the general public) to open up the space for hybrid forums, and dialogic democracy based on them, through the undermining of opposing arguments, more than through an empirically sounded discussion on under what conditions the hybrid forums can be established. Shortly, it is more advocacy than analysis. This is why, going back to the High Speed Train between Turin and Lyon, the book has a low explanatory and interpretative power: the conceptual tools it provides are good at describing the initial phase of the emergence of the concerned group opposing the train (like solving the uncertainties related to the effectiveness and the effects of the train itself) but they are insufficient in order to understand what were the conditions obstructing the strong concerned group in bringing a dialogically democratic process into the controversy, that remains in the domain of delegative processes.

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Science, Design and Everyday Life

Donald A. Norman

Living with Complexity

2011, MIT Press, 298 pp.

and

Matthias Gross

Ignorance and Surprise. Science, Society and Ecological Design

2010, MIT Press, 240 pp.

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New technologies do not just consist of artifacts but perform as social design acts, so shaping and re-ordering people's everyday life.

Current examples can be the Smart Phone diffusion, and in Italy the NO-TAV protests in Piemonte as well as the recent Referendum on nuclear plants.

The two books reviewed here make evident the multi-level analysis in play when inquiring the intertwining of society, human beings and technology. The joint reading and comparison of the two texts allows us to take in consideration the two poles of the debate: the micro-interactional and the macro-political level.

Donald Norman's book is clearly on the 'micro' side of the analysis. Following a successful approach started with The Design of Everyday Things – translated in Italian with the awful title "La Caffettiera del Masochista" – the author focuses on how interfaces of new technologies meet the users' needs. The book is pleasantly written as an exercise of sophisticated popularization. This makes it a smooth and interesting reading, even if slightly erratic and dispersive. The core of Norman's argument is in the question he poses: why is our technology so wrong-footing? To answer it, the author formulates another, more general, question: how do individuals cope with the world disorder from a cognitive viewpoint? The distinction between 'complex' and 'complicated' is introduced as a key to face with the questions. 'Complex' is a state of the world, whereas 'complicated' is a state of the mind. To quote an ironic motto from the book, 'complicated is something having a wrong-footing complexity'. Two further theoretical

arguments are then carried out. The first emphasizes the role of the underlying structure, which when works out, reduces complexity or makes it marginal. The second argument concerns design: how do technological artifacts make their underlying structure visible? .

Referring to fields such as psychological ecology (James Gibson), situated cognition (Jean Lave), distributed cognition (Edwin Hutchins), the book analyzes various notions and cases of daily technological objects. The recurrent theme is the cognitive role performed by social signifiers: the subtle signals offered by other people' activities as guides for individual action. According to Norman, individuals' actions have always side effects. They leave traces behind so that others can go back to paths and activities which have been performed in the environment. Artificial Life biologists and theorists label such a phenomenon as stigmergy: a type of indirect coordination based on traces of past activities. The existence of these signals leads and constrains future activities, so producing complex structures through a self-regulatory process which has no central orientation or planning. Such a digression allows the author to underline the conceptual difference between signifier and affordance. Criticizing the use of the concept of affordance by various designers, Norman circumscribes it to the practical and operational quality of a material structure towards a specific user. Then Norman proposes the

notion of 'signifier' to indicate the perceptible (visual, audible, tactile) dimension which makes the affordance visible. This notion is able to take into account the role of local practices and cultural traditions to interpret the traces in the user's perceptive landscape.

More than in Norman's previous work, the book reflections are not only theoretical but also explicitly practical. Beyond his socio-psychological research, Norman's consultancy work is at the boundary between user-friendly technologies and the human-centred approach to technology design. Stating that complexity is part of our world does not justify designing wrong-footing or misleading technologies. If a good technology design cannot handle complexity by producing less complex things, as complexity is necessary to certain activities, it can still manage it in an effective way. According to Norman the key to face with complexity is twofold. First, does the object have an internal logic which can be implemented without ambiguity to make it work? This dimension goes back to solutions such as structure adding (e.g. dividing a task in simpler modules) or re-conceptualization (to substitute a task with a simpler or more precise one). Secondly, how does the real user experience set up the object structure? Here Norman's usual critique to an 'engineering' approach to new technologies emerges. The cases presented in the book highlight how interface designers' logics are blind to real people life practices.

According to the author, the ideal, rational and omniscient user of ergonomics is an abstraction which does not fit the limited rationality, the scarcity of time and the situated cultural routines of real users. As a consequence, interfaces should be able to embed in their task structure the socio-cultural parameters of the historical, concrete user's practices.

Whereas Donald Norman's book focuses on the intimate sphere of the relationship between the individual and technology, Matthias Gross moves his analysis towards society at large, with particular reference to deliberative policies and strategies involved into scientific innovation.

The book is concerned with the current debate on reflexive modernity (Beck, Giddens, Lasch). In particular, it focuses on the management of unexpected processes of technoscientific innovation, change and invention. The leading idea is that "ignorance and surprise belong to each other". Due to its nature, scientific methods should allow researchers to surprise themselves and their peers. However, this produces an inevitable interruption of the continuum between accepted knowledge and future expectations. In this sense, as summarized in the 'expect the unexpected' slogan, any novelty includes elements of uncertainty and not- knowledge, which cannot be foreseen. The current explosion of knowledges and technologies typical of the so called contemporary knowledge society, therefore, has the following corollary: new knowledge also means broader

ignorance. In this perspective, learning to handle surprise and ignorance becomes constitutive of public decision making activities.

The other key assumption of the book draws from the work of the sociologist Howard Becker and is summarized as follows: "we don't have a conceptual language to discuss things we all know". In this respect, the author puts forward a double critique and a polemic remark. Notwithstanding uncertainties characterizing various scientific fields, Gross underlines how the ideal of truth and certainty offered by 'classic' science is still well present in official rhetoric. To ensure lay people, emphasis on further research or known uncertainties would be functional to state that risks in play are under control. According to Gross such an idea generates a cascade of uncertainty. For example, uncertainties in seismologic sciences are the bases for further uncertainties concerning emissions. This makes eco-sensitive intervention more and more difficult to anticipate, in turn generating uncertainties about how different social groups will react and so on.

The second polemic remark is instead directed towards those authors (for example Myers, Raffensperger), supporting the 'precaution principle' thesis in all cases where risks are scarcely known. Gross states that in practice the precaution principle has been often evoked only to prevent the government action in contexts of scientific uncertainty. Namely, it has been interpreted as a means to postpone or delay action. However, as Gross suggests, precaution concerns only what has not to be done, rather than what has to be done.

The first part of the book focuses on different types of knowledge gaps in science and everyday life, in the attempt to offer a more open and flexible approach to the issue. Departing from Georg Simmel's nichtwissen (not- knowledge), the author reflects on how unexpected occurrences can be embedded in a scientific model able to include an experimental management of 'surprises'.

In the remainder of the book, Gross develops his analysis of public management of surprise looking at the complex network of social interactions in the fields of landscape and ecological restoration. The analysis of ecological design as a social experiment outside the laboratory breaks common assumptions of certainty and predictability of science. In these fields the deliberative challenge very often stays in the fact that new knowledge and intervention projects create new options without providing new criteria to manage them. In particular, the book analyzes empirically the management of the unexpected in two cases: an ecological intervention in an urban context and a large scale landscape transformation in a post industrial area.

In the first case, Gross analyzes the story of the projects and interventions to transform the coast by lake Michigan in Chicago from the

19th century until today. It emerges that the appropriation of surprises has been the tool to produce more robust and reliable strategies of environmental design. The second case concerns interventions of revitalization of an abandoned area nearby Leipzig, previously used for coal extraction in the socialist Eastern Germany. In this case early success induced an increasing fragility of the intervention because of the minor attention given to the surprises emerging from the project.

The comparison between Chicago and Leipzig – as Gross states – is interesting for various reasons. Both the regions have been involved into public interventions of ecological requalification based on State funding. In both cases landscapes have been restored without any historical reference and interventions have produced a boundary work: a multi-voiced process of definition of social boundaries which distinguishes science from non science, as part of a rhetorical practice to gain epistemic authority and legitimation towards rival instances.

The whole frame points out that technoscientific interventions cannot be characterized as either a linear and top down activity, or a trial and error process of variations and selections. Rather, they are coordinated management processes of unexpected turns, able to take into account less or more rapid changes.

For the author the political morale of the issues inquired concerns knowledge production in what Beck and others have named as second modernity. In the contemporary world human societies started to understand that not all the risks of social action can be under control. Therefore, it would be necessary to develop strategies able to reflexively embed and face with those risks in development and planning policies. In the end, according to Gross, everyday life in the technoscience age is an inevitable, continuous and deliberate hazard.

TECNOSCIENZA

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