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Freedom Flies (2005) by Chris Csikszentmihályi

Freedom Flies is a peaceful Unmanned Aerial Vehicle (UAV). While nearly all UAVs are developed and marketed for military applications, Freedom Flies is aimed at offering basic UAV technology to the independent media, journalism and human rights NGO communities. Typical UAVs cost on the order of $500,000 per system. In contrast, Freedom Flies is targeted at a few thousand, but more importantly it is open source. Hardware, software, and fabrication techniques are easily reproduced.

The unit itself is built from commonly available parts (a weed-eater engine, bicycle rim, water bottle, and kite-surfing kite), glides to the ground via a parachute in case of system failure, and travels quite slowly (30mph). It can carry over 15 lbs, allowing it to lift video, GPS units, pamphlets, water, food and other payloads.

Freedom Flies has been conceived as a reaction to the disturbing technological trend of using UAVs for "border security." It aims at helping migrants survive and monitors their encounters with militias and "border extremists", thus counteracting selective law enforcements that focus on immigrants but not on illegal proto-fascist activities.

Test flights have been conducted on the US/Mexico border, where since 2003 UAV technology has been used for "border security" by both the U.S. government (with its Predators) and private militia groups, such as the American Border Patrol (with its Border Hawk drones). Freedom Flies has been designed according to a countervailing set of priorities: to help migrants survive the desert and to look for evidence of anti-immigrant groups that are known to promulgate unlawful violence against political and economic refugees. The use of commonly available parts for its construction underlines its different sociotechnical identity: it is a drone devoid of military DNA.

http://www.m-iti.org/people/csik

https://github.com/jlev/freedomfliesonline

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Cover *Freedom Flie*s by Chris Csikszentmihályi

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Book Reviews

The Becoming Environmental of Computation
From Citizen Sensing to Planetary Computerization

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Abstract: In citizen-sensing projects, more extensively and democratically gathered data are typically presented as "the reasons for measuring air pollution", since it is through collecting data that everything from enhanced participation in environmental issues to changes in policy are hoped to be achieved. The impetus to monitor and gather data is bound up with established (and emerging) processes of understanding environments as information-based problems. Within citizen-sensing projects, data are intended to be collected in ways that complement, reroute or even circumvent and challenge the usual institutions and practices that monitor environments and manage environmental data. Data are seen to enable modes of action that are meant to offer effective ways to respond to those problems. With more data, potentially more accurate data, and more extensively distributed data, environmental problems such as air pollution are anticipated to be more readily and effectively addressed. Data are intertwined with practices, responses to perceived problems, modes of materializing and evidencing problems, and proposals for political engagement. But how are air-quality data constituted, whether through expert or citizen practices? How do differing practices of environmental monitoring inform the character and quality of data gathered, as well as the possible trajectories and effects of those data? What are the instruments, relations, and experiences of air-quality data generated through these distinctive engagements with environments and technology? And in what ways do environments become computational through the use of low-cost air-pollution monitoring technologies? I consider how citizen-sensing practices that monitor air pollution experiment with the tactics and arrangements of environmental data.

Keywords: Citizen sensing; air pollution; environmental sensors; environmental data; creaturing.

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1. Introduction

In addressing the STS Italia conference theme of "sociotechnical environments", I am drawing in part on my research into environments, environmental sensors and the increasing instrumentation of the planet[1]. I take up this topic in my book, *Program Earth* (2016), which addresses the programmability of the planet by focusing on the becoming environmental of computation. I understand computation to include computationally enabled sensors that are distinct and yet shifting media formations that traverse hardware and software, silicon and glass, minerals and plastic, server farms and landfills, as well as the environments and entities that would be sensed. In other words, I am attending to the extended scope of computation that includes its environmental processes, materialities, and effects.

Through discussing specific instances where sensors are deployed for environmental study, citizen engagement, and urban sustainability across three areas of environmental sensing, from wild sensing to pollution sensing and urban sensing, I ask how sensor technologies are generating distinct ways of programming and concretizing environments and environmental relations. I further consider how sensors inform our engagements with environmental processes and politics, and in what ways we might engage with the "technicity" of environmental sensors to consider the possibility for other types of relations with these technologies[2].

Environments, as I develop the concept in *Program Earth*, are conjugations of subjects and superjects, following Whitehead, entities can be approached not as detached objects for our subjective sensing and contemplation, but rather as processes in and through which experience, environments, and subjects individuate, relate, and gain consistency (1929, 15 and 41; 1938, 94 and 112). "Environment" as a term has multiple resonances and genealogies. Within this space of examining ubiquitous computing and sensor networks, I consider specifically how environments inform the development of sensor technologies and how these technologies also contribute to new environmental conditions. Not only do computational technologies become environmental in distinct ways, the environments they populate are also in process.

Environment is not the ground or fundamental condition against which sensor technologies form, but rather develops with and through sensor technologies as they take hold and concresce in these contexts. Distinct environmental conditions settle and sediment along with these technologies as they gain a foothold. These processes involve not just the

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[1] See Gabrys (2016). This text includes portions of an abbreviated reprint from *Program Earth*, courtesy of the University of Minnesota Press.
[2] For a more extensive discussion on technicity, see Simondon (1958, 152); Combes (2013, 60); Lamarre (2013, 92).

creation of the entities and environments that are mutually informed but also the generation of the relations that join up entities and environments.
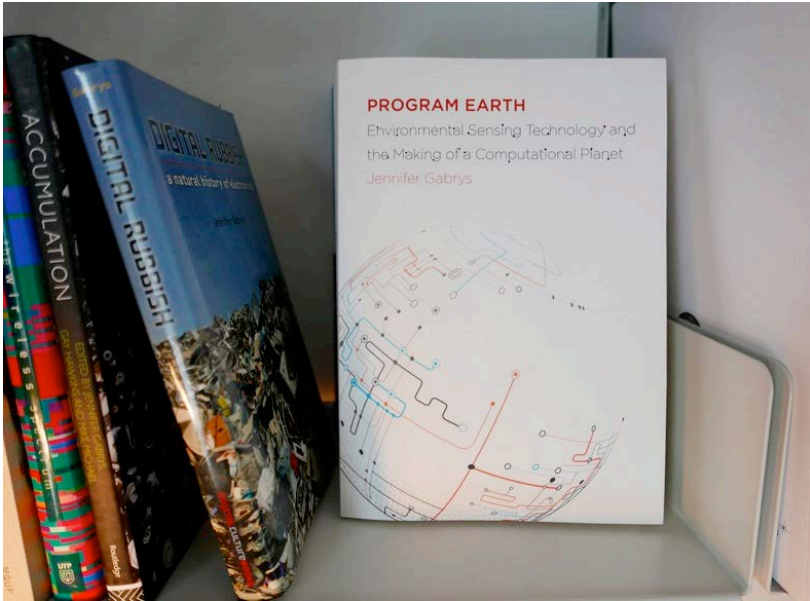
Fig. 1 – *Program Earth*, Jennifer Gabrys, 2016.

On one level, environmental sensors are input devices that facilitate monitoring, measuring, and computing. Yet on another level, environmental sensors can be described as engaged in processes of individuating by creating resonances within a milieu, where individual units or variables of temperature and light levels, for instance, are also operationalizing environments in order to become computable. Working across my *Program Earth* text and signaling toward the Citizen Sense research group's practice-based work on pollution sensing[3], in this article I specifically look at technological milieus and the creaturing of data in relation to air pollution sensing.

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[3] For more information on the Citizen Sense research project, see citizensense.net.

2. Sensing Air, Creaturing Data

If you should find yourself standing outside the Hobgoblin Pub on New Cross Road in the Borough of Lewisham, London, you might notice a grayish-white box approximately two-and-a-half meters high scrawled with a faded and cascading line of graffiti. Wedged in the space between buildings and facing outward toward the road, the air vent and monitoring equipment at the top may be one of the few details that betray the purpose of this structure, which is to measure air quality at this fixed spot in London.

Fig. 2 – The New Cross Gate Air Quality station (Citizen Sense, 2013).

One of the stations in the London Air Quality Network (LAQN) that covers thirty-three boroughs, this monitoring station contributes to the hourly indexes of air quality and news of pollution "episodes" in London. Detecting sulfur dioxide (SO_2), particulate matter 10 and 2.5 (PM 10, PM 2.5), as well as nitrogen oxide (NO) and nitrogen dioxide (NO_2), the station generates data that indicate whether the UK is meeting EU air quality objectives for both short- and long-term emissions of pollutants[4]. The

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[4] While all of these pollutants affect cardiovascular and pulmonary health, particulate matter (PM) is of particular concern. As the World Health Organization (WHO, 2014) notes in a fact sheet on air quality, "PM affects more people than any other pollutant. The major components of PM are sulfate, nitrates, am-

data also contribute to environmental science research and are managed and made available by the Environmental Research Group (ERG) at King's College London, where this network is managed and run.

Passersby may experience, in a potentially fleeting way, the connection between this station, the local air quality, and the data it generates, which typically circulate in spaces of environmental science and policy. The air quality data that are generated at this fixed site are black-boxed and located in spaces somewhat remote from experiences of air quality on the street. Air quality data are not typically present at the point of encounter with this station, but instead are located in more distant spaces of laboratories and servers, where data are gathered and processed to influence the management of environments and air quality.

In order to make air pollution data gathered by this station and the approximately one hundred other stations in the LAQN more accessible, King's ERG has designed a London Air app to allow people to observe emissions levels at key monitoring sites and to make inferences about their own personal exposure when passing through these sites. While this strategy moves toward making the data of fixed sites more accessible through an air quality app, the pollution that individuals experience in their everyday trajectories may be quite different than the types of pollution that are captured through fixed monitoring sites generating data that are averaged over set monitoring periods. The New Cross Road station, for instance, typically records an annual exceedance of NO_2 at this fixed point – a pollutant formed through combustion of fuel that is largely the result of high levels of automobile use in the city[5]. Yet all along New Cross Road individual moments and locations of exposure may give rise to a far different set of pollution "episodes", with much different consequences for urban dwellers in these areas.

Inevitably, the question arises as to how individuals may generate data about their own mobile exposure to air pollution, which is likely to differ from the fixed sites of the official monitoring stations. As discussed throughout this study, environmental monitoring is proliferating from a project undertaken by environmental scientists and governmental agencies to a practice in which DIY groups and citizen sensors are now en-

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monia, sodium chloride, carbon, mineral dust and water. It consists of a complex mixture of solid and liquid particles of organic and inorganic substances suspended in the air. The particles are identified according to their aerodynamic diameter, as either PM (particles with an aerodynamic diameter smaller than 10 µm) or PM (aerodynamic diameter smaller than 2.5 µm). The latter are more dangerous since, when inhaled, they may reach the peripheral regions of the bronchioles, and interfere with gas exchange inside the lungs." See WHO, "Air Quality and Health."

[5] The EU air quality objective (2008) indicates that there should be no more than 40 µm/m3 of NO2 per year. The New Cross Road station (in the borough of Lewisham) recorded 51 µm/m3 of NO2 in 2013. Also see the London Air Quality Network (LAQN) and the European Commission "Air Quality Standards".

gaged. Many recent citizen-sensing projects that deploy lower-cost digital sensors and smartphones have focused on monitoring air quality levels in ways that attempt to make environmental data more immediate and connected to experienced conditions. One of the primary ways in which such citizen-sensing projects have sprung up is through direct engagement with monitoring environmental pollution. While some citizen-sensing projects use the itinerant aspects of individual exposure to environmental pollution as a way to experiment with mobile-monitoring practices with which fixed sites of detection cannot compare, other projects, suggest that official or government data may not always be available or trusted, so that alternative data sources may be necessary in order to gauge exposure to pollutants of immediate concern.
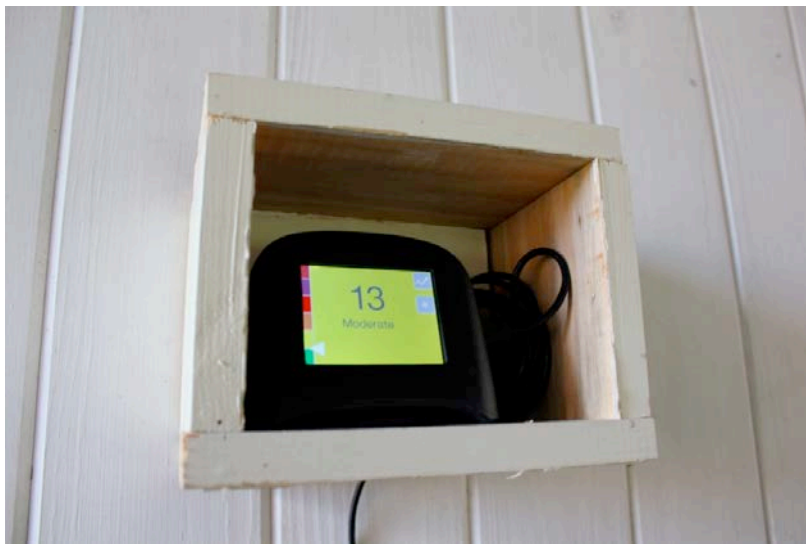
Fig. 3 – DIY air pollution sensing (Citizen Sense, 2014).

Whether displaying pollution levels or developing platforms to make pollution information more readily available, many citizen-sensing pollution projects attempt to make the details of environmental pollution more instantaneous and actionable. An even more extensive range of pollution-sensing projects have turned up in this area, from devices that use low-cost electronics, including Speck (for PM 2.5 sensing) and AirBeam (for NOx sensing), as well as Citizen Sense kit using Shinyei PM 2.5 sensors. Citizen sensing is a strategy that often attempts to translate practices of monitoring pollution from the spaces of "expert" scientific and government oversight into practices and technologies that are available to a wider array of participants. As the EPA has noted in its work on surveying and assessing the rise in citizen-sensing practices and low-cost monitoring

equipment, air pollution monitoring is no longer confined just to official networks and the professional practices of scientists and technicians, but is proliferating into new types of uses that might, they anticipate, even begin to "supplement" regulatory approaches to air pollution. "New breakthroughs in sensor technology and inexpensive, portable methods", one U.S. EPA (2013, 2) report notes, "are now making it possible for anyone in the general public to measure air pollution and are expanding the reasons for measuring air pollution"[6]. With these citizen-sensing practices, data shift from having to meet a regulatory standard to ensure policy compliance to proliferating and indicating change, hence perhaps instigating different citizen-led actions.
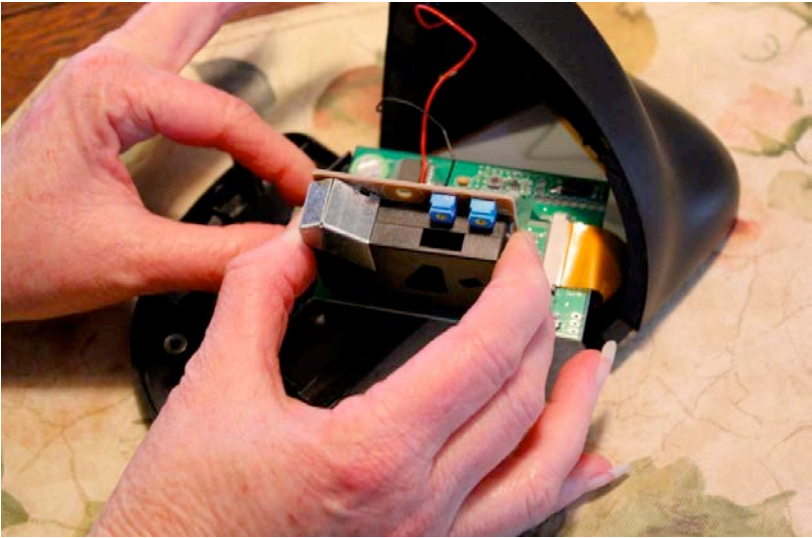
Fig. 4 – The PM 2.5 sensor (Citizen Sense, 2014).

In citizen-sensing projects, more extensively and democratically gathered data are typically presented as "the reasons for measuring air pollution", since it is through collecting data that everything from enhanced participation in environmental issues to changes in policy are hoped to be achieved. The impetus to monitor and gather data is bound up with established (and emerging) processes of understanding environments as information-based problems. Within citizen-sensing projects, data are intended to be collected in ways that complement, reroute, or even circumvent and challenge the usual institutions and practices that monitor envi-

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[6] See also Snyder *et al.* (2013).

ronments and manage environmental data. Data are seen to enable modes of action that are meant to offer effective ways to respond to those problems. With more data, potentially more accurate data, and more extensively distributed data, environmental problems such as air pollution are intended to be more readily and effectively addressed. Data are intertwined with practices, responses to perceived problems, modes of materializing and evidencing problems, and anticipations of political engagement. But how are air quality data constituted, through expert or citizen practices? How do differing practices of environmental monitoring inform the character and quality of data gathered, as well as the possible trajectories and effects of those data? What are the instruments, relations, and experiences of air quality data generated through these distinctive engagements with environments and technology? And in what ways do environments become computational through the use of low-cost air pollution monitoring technologies?

In the process of monitoring air pollution, citizen-sensing practices experiment with the tactics and arrangements of environmental data. These monitoring experiments, however, are not just a matter of enabling "citizens" to use technology to collect data that might allow them to augment scientific studies or to act on their environments. Rather, as I suggest throughout *Program Earth,* computational-sensing technologies are bound up with the generation of new milieus, relations, entities, occasions, and interpretive registers of sensing. The *becoming environmental of computation* describes this process. Sensor-based engagements with environments do not simply detect external phenomena to be reported; rather, they bring together and give rise to experiencing entities and thereby actualize new arrangements of environmental sensing and data. The production of air quality data through environmental monitoring generates distinct subject-superject entities and occasions for generating and making sense of that data – as scientific facts, matters of concern, or even as inchoate patterns produced through unstable technologies or sporadic monitoring practices.

As a central point of focus, this lecture then crucially asks in what ways environmental sense data emerge not through universal categories or forms but as concrete entities – or *creatures* – that concresce through processes of subjects participating in environments and environmental events. "The actual world is a process", Whitehead writes, and this "process is the becoming of actual entities. Thus actual entities are creatures; they are also termed 'actual occasions'" (1929, 22). Actual entities are creatures, or lively meetings of entities that form routes of experience. In this sense, the process of gathering air pollution data might be identified as more than documenting static facts of air quality at any given time or place and instead be approached as a practice that gives rise to entities and modes of participation that transmit data in particular ways and along distinct vectors of environmental participation.

Working with this Whitehead-inspired analysis of how concrete enti-

ties of environmental data materialize through pollution sensing, I then consider how environmental-sensing projects are processes of what I call *creaturing data,* where the actual environmental entities that come together are creations that materialize through distinct ways of perceiving and participating in environments. These creatures may have scientific legitimacy. Or they may form as alternative modes of evidence presented in contestation of scientific fact. But in either or both capacities, they are *creaturely* rather than universal arrangements of data.

The point of attending to the creaturing of data is to at once draw attention to the concrete actual entities of data – even the "accidents" of data, as Whitehead would have it – and to take into account the "conditions" that give rise to and sustain these creatures of environmental data. Creatured data are not an abstract store of information or something to be coherently visualized, but rather are actual entities involved in the making of actual occasions and material processes. Data may typically appear to be the primary objective of environmental sensing projects, which focus on obtaining data to influence environmental policy and practices, but along the way the relations and material arrangements that data gathering sets in place begin to creature new entities that concresce through monitoring practices.

Fig. 5 – Air quality sensor prototype.

The general ethos of many DIY- and citizen-sensing projects has been that by enabling and democratizing the monitoring of local environments, it may also be possible to achieve increased engagement with environmental concerns. These projects test, experiment with, and mobilize alternative modes of environmental citizenship. Yet in what ways do practices of environmental monitoring with sensing devices give rise not just to experimental modes of participation and civic engagement but also to different modalities for experiencing environmental pollution through monitoring practices that generate air quality data? Within these projects, how does the experience and experiment of air pollution and air quality data become a site of political, as well as potentially affective, engagement? How do the creatures of environmental data become points of attachment for influencing and in-forming environmental concern and politics?

3. Citizen Data and Environments of Relevance

While in *Program Earth* I discuss a range of citizen sensing projects as a way to engage with these questions, I also take up these questions specifically discussing the creatures of data that could be seen to emerge within Citizen Sense research. Within this abbreviated discussion of the "pollution sensing" aspects of the Citizen Sense research project, I consider how the generation of citizen data became entangled with the creation of environments of relevance, which were required in order for citizen data to take hold and have effect. I take up a more extensive discussion of these aspects of the Citizen Sense research in collaboratively written project articles on citizen and collective forms of monitoring, and in an investigation of the "just good enough data" that citizen monitoring mobilized in order to make claims to policymakers and regulators[7]. But to briefly mention this Citizen Sense research work here, I would note that the processes of citizens gathering data through kit that we collaboratively developed did not only involve working with sensors to tune in to air and emissions. These processes also involved arranging data as evidence, putting together data stories that were ways of "figuring" the problems of air pollution and the worlds that might come together in order for this air pollution to register, and of forming extended social environments in and through which citizen data could gain a foothold and become relevant for addressing problems of air pollution.

As citizen sensing and citizen data collection practices demonstrate, defining what counts as air pollution is not always a straightforward matter. This is particular the case when attempting to establish evidence of

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[7] For a more extensive discussion of these aspects of Citizen Sense research, see Pritchard and Gabrys (2016) and Gabrys, Pritchard and Barratt (2016).

harm or possible harm[8]. Institutional and governmental monitoring networks typically identify pollutants of concern in response to health research that provides evidence for levels of harm caused by particular pollutants. As part of the Global Burden of Disease 2010 study, outdoor air pollution was identified as a leading cause of death, contributing to heart, lung, and cardiopulmonary disease, which are now particularly linked to PM 2.5 exposure, which are also less evident as pollutants[9]. In many ways, health research influences environmental policy, which sets targets in relation to which monitoring networks set criteria for monitoring, as well as providing air quality forecasts, management, and mitigation.

While the impacts of air pollution on human health are one of the key motivators for establishing air quality standards, often the means of monitoring and enforcing these standards can miss the localized pollution experienced by individuals. Environmental and individual health are bound up with articulations of what does and does not count as a pollution *episode* and what may constitute an excessive level of pollutant *exposure*. Emissions of a certain pollutant at a given site in a city may be within an acceptable range, but individual exposure may vary considerably. Air, noise, and water pollution are local if distributed environmental disturbances that many urban dwellers experience on a regular basis, although for some more than others since sites of pollution are often concentrated in lower-income urban areas. Emissions and exposure mitigation have then been identified as two different ways in which to monitor and manage air quality: one addresses fixed sites and reductions of air pollutants; the other attends to how individuals may manage their individual experience to lessen air pollution exposure, such as monitoring and taking alternative routes through cities, although not necessarily attending to overall reductions of air pollutants.

Articulations of personal, urban, and environmental health shift across these different strategies for addressing air pollution. Practices of monitoring pollution at the citizen or individual level is a way to counter or re-

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[8] For established limits for common pollutants, see the U.S. EPA National Ambient Air Quality Standards (NAAQS) Table (https://www.epa.gov/criteria-air-pollutants/naaqs-table) and the European Commission "Air Quality Standards". For a discussion of the ways in which legal disputes become entangled in establishing both the matters of fact and concern of air pollution, see Jasanoff (2010). For a discussion on how exposure and harm become increasingly difficult to link within newer regimes of chemical living, particularly in relation to indoor air quality, see Murphy (2006). For a forthcoming discussion on evidencing harm through citizen-sensing practices, see Gabrys (2017).

[9] Ambient PM pollution contributes to 3.2 million deaths annually, and there are increasing levels of heart disease, lung cancer, and cardiopulmonary disease in association with PM 2.5 exposure. See Lim et al. (2012). The WHO (2014) suggests that "exposure to air pollutants is largely beyond the control of individuals and requires action by public authorities at the national, regional, and even international levels."

dress the possible gaps in data, but there is more to these projects than this, since in mobilizing sensors to bring environmental monitoring into a more democratic, if often individual, set of engagements, new material-political actors, engagements, and experiments concresce – along with new political (im)possibilities. The question arises as to how data become relevant. Air pollution data might become relevant through health research that establishes high levels of morbidity due to particular air pollutants, or through scientific monitoring networks that identify pollutants exceeding accountable limits, or through concerns for certain environmental effects, from acid rain to eutrophication, which unfold with excessive levels of pollutants.

Relevance is a term that Whitehead uses to address the ways in which facts have purchase, and the "social environments" that are set in place in order for facts to mobilize distinct effects (1929, 203; cfr. Stengers 2011, 259). Relevance is a critical part of the process of creaturing, since creaturing involves the ways in which creativity is conditioned or brought into specific events and entities. The ways in which creatures gain a foothold, in other words, is an expression of relevance. Social environments are integral to the immanent processes that condition and give rise to creatures – they do not exist without the formation of creatures, and they continue to co-evolve as the situations in which creatures make "sense" and have effect.

Environments, as understood within Citizen Sense research and throughout *Program Earth*, are then at once an "object" of study as well as a mutually in-formed and coproduced relation through which monitoring practices and gathered data take hold and gain relevance. The relevance of air quality data is not determined through absolute criteria, since these criteria shift depending upon modes of governance, location, and more. If data are understood instead as perceptive entities, it then becomes possible to attend to how data are differently mobilized and concresce within and through practices.

Data in one context might have the status of facts, and in another context might galvanize a much different set of a/effects. As the U.S. EPA has expressed in its analysis of new modes of environmental monitoring, "types of data" and "types of uses" are interlinked (2013, 2-5). Data typically only become admissible for legal claims when gathered through specified scientific procedures and with quite precise (as well as expensive) instrumentation. There may also be situations in which data are "just good enough" for establishing that a pollution event is happening, for instance.[10] Yet it remains a relatively open question as to what the uses and effects of data gathered through citizen-sensing technologies might be, since these creatures have arguably not yet settled into entities for which relevance is expressible. In other words, how do citizen sensors undertake

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[10] For a more extensive discussion of the concept and practice of "just good enough data", see Gabrys, Pritchard and Barratt (2016).

actions with and through air pollution sensing practices and data? Could it be that the environments of relevance for this data are still in formation? This is something that the Citizen Sense Data Stories attempt to work with and through, in order to understand not just environments of relevance on a descriptive level, but also to contribute to practice-based formations of such environments through citizen sensing engagements.

4. Conclusion

At this point, it might be easy enough to make a statement about the ways in which environmental monitoring technologies "construct" the air and the problem of air quality. While this inquiry works in a way parallel to constructivism, it also attempts, following Stengers, to think of constructivism not as a process of making *fictions,* but rather of making realities concresce and take hold – or gain a "foothold", (2011, 163-164, 518). Sensors are part of generative processes for making interpretative acts of sensation possible and for attending to environmental matters of concern in particular ways. The environments, arrangements, and practices that are bound up with how facts take hold and even potentially circulate with effect are then a critical part of any study into how expanded and differently constituted air pollution data and data-gathering practices might have relevance and be able to make claims upon that data to effect change.

This approach to constructivism is different from a poststructuralist rendering, since ideas and language do not *mediate* things, but rather things concresce as propositional effects (Stengers 2011, 252). As Whitehead notes, every fact must "propose the general character of the universe required for that fact" (1929, 11). Here is another aspect of *tuning,* which is not just a process of making particular modalities of sensing possible across subjects, environments, and experiences (cfr. Gabrys 2012), but also involves the tuning of facts and the conditions in which those facts have relevance. If facts require particular social environments in order to have relevance, this does not make them illusory (Whitehead 1929, 203; Stengers 2011, 259). Rather, it draws attention to the conditions needed for facts to have effect. In this way, facts are creatures, since, as Whitehead (1929, 20) elaborates:

> "Each fact is more than its forms, and each form 'participates' throughout the world of facts. The definiteness of fact is due to its forms; but the individual fact is a creature, and creativity is the ultimate behind all forms, inexplicable by forms, and conditioned by its creatures."

The creatures of facts – and data – constitute entities that bring worlds into being – and also require worlds for these processes to unfold. Sense data are productive of new environments, entities, and occasions

that make particular modalities of sensibility possible. A social environment then plays a formative part in conditioning and supporting creatures of fact and creatures of data[11]. These are creatures of data because they are involved in creative processes in bringing sensing to possibility and of in-forming the environments where these modes of sensing have relevance.

A process of creaturing data then attends to the ways in which data are not fixed objects gathered through universal criteria but instead are entities through which forms and practices emerge as creatures, and through creaturely processes. As discussed throughout *Program Earth*, perceiving subject-superjects combine as *feeling* entities through actual occasions. These entities might otherwise be termed creatures, since they are formations of conditioned creativity. Furthermore, the "datum", as Whitehead discusses it, is not simply an external array of objects awaiting conceptual classification by a human subject. Instead, the datum is that which subject-superjects feel, and through this experiencing (and so processing and transforming) the datum, generate actual entities, or creatures.

Data are always felt and experienced by and as creatures, which through feeling further give rise to distinct forms of data. A process of transforming the datum into felt experience is a process of creaturing data because what issues through this process are subjects-superjects involved in processes of being and becoming creatures. Perhaps in the most concisely stated version of this insight, Whitehead writes, "An actual entity is an act of experience" (1929, 68). Feeling the datum is a process of transforming the datum into experience, which concresces as an actual entity or creature. Creaturing is then the description of this process of *feeling the datum,* where creatures are the actual entities formed through creaturing the datum.

If we consider the "data" that digital sensors generate, then these devices might be understood less as technologies for gathering (particularly quantitative) data and more as technologies for processing, transforming, and creaturing data – as a felt form of the datum. While it may be easy enough to query the assertion that more data and more democratically gathered data might lead to action and engagement, an approach to creaturing data suggests that it might be relevant to attend to the ways in which data are taken up, felt, experienced, taken into account, gain relevance, and attain "power" as the process whereby particular perceptions

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[11] As Whitehead notes: "The data upon which the subject passes judgment are themselves components conditioning the character of the judging subject. It follows that any presupposition as to the character of the experiencing subject also implies a general presupposition as to the social environment providing the display for that subject. In other words, a species of subject requires a species of data as its preliminary phase of concrescence... The species of data requisite for the presumed judging subject presupposes an environment of a certain social character" (1929, 203).

or modes of prehension involve or prevail over others (Whitehead 1929, 219). These processes require the formation of social environments in order for data to have effect.

Why is this important? Because on a concrete level in order for citizen-generated data to be taken seriously and to inform environmental policy and politics, it is necessary to consider the infrastructures, environments and practices that are bound up with the creaturing of data in order to understand how to make citizen-generated data (among other forms of data) relevant in ways that can effect change. In other words, this requires tuning our attention to which modes of experience count, and for which purposes. Citizen-sensing practices are in-formation as experimental practices that test not just how environmental monitoring data might be differently gathered but also how such data might be mobilized within distinct environments of relevance, and to what (political) a/effect. Within this space, the modes and practices of data – the creaturely entities in and through which data manifest and give rise to worlds – are arguably an area yet to be fully explored, since data are so frequently presented as the abstract and dematerialized evidence of environmental fact.

In this context, what does it mean to "sense" or experience air pollution with computational sensors? Monitoring air pollution with digital sensors is not just a way of obtaining a "result" or fact about a particular environment but is also about the ways in which data are creatured and mobilized, the social environments that concretize and allow those facts to have relevance, and the additional attendant data practices that might come together to generate a/effects. Creaturing data is an approach that asks how we might consider much more than the "facts" gathered, since the extended social environments, practices, and speculative relations required to bring facts into a space of relevance are crucial to the creatures of data that materialize. Creaturing data is a way of attending to the processing and transforming of environmental data. This is not simply a matter of attending to the extended capacities of generating data but instead involves considering the creatures of data, the entities and situations that form and take hold, whether to solidify, experiment with, or change environmental practices and politics. As Whitehead (1929, 50) writes:

"We find ourselves in a buzzing world, amid a democracy of fellow creatures; whereas, under some disguise or other, orthodox philosophy can only introduce us to solitary substances, each enjoying an illusory experience".

These creatures, as Whitehead (following James) has reminded us, then settle into "a democracy of fellow creatures," where the shared experiences of air, pollution, and possibilities for engagement might even bring us into inventive modes of solidarity.

Acknowledgments

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The Network of Experts and the Construction of Cultural Heritage
Identity Formation in Contemporaneity

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Abstract: This paper presents the most important findings of a research project on the expert processes that mediate in the construction of a sense of belonging through cultural heritage in the context of the Basque Country. Drawing from a theoretical framework based on Post-structuralism, Science and Technology Studies (STS), as well as other contemporary and classic sociological schools, this paper uses a qualitative approach (interviews and participant observations) that led to the analysis and description of the main expert processes involved in the construction of a relationship between cultural heritage and the community, group or society that considers it as part of their own identity.

Keywords: Actor-Network Theory; Basque Country; cultural heritage; experts; identity.

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1. Introduction

We live in an epoch where the processes of meaning construction and the modern institutions are under scrutiny. In the social sciences and the humanities this climate of crisis is reflected on formulations such as the *postmodern condition* (Lyotard 1984), the *liquid modernity* (Bauman 2000), the *era of emptiness* (Lipovetsky 2004), the *risk society* (Beck 1992) and the *crisis of meaning* (Berger and Luckmann 1995).

Hence the question arises: How do we produce meaning – a sense of belonging, identity, community – in a context where the production of meaning is problematic? This text tries to answer this question by analysing one of the social, political, and cultural mechanisms devised to over-

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come this conundrum at the beginnings of the post Second World War era: cultural heritage. This article is then about how social meaning is constructed in contemporary society.

Focusing on the Basque society as an example, I will introduce in this article how different expert processes mediate in the production of a sense of belonging in contemporary society. My research was carried out within the limited but powerful field of the network of experts that maintains, manages, and produces cultural heritage in the Basque Country. This text focuses therefore on the description of the main expert processes that participate in the production of a very specific relation; the one that is established between an object – cultural heritage, understood as what belongs to us – and a subject – the heritage subject, understood as the group, community or society that appropriates that cultural heritage.

Firstly, I will outline the main characteristics of the study on which this essay is based, detailing the research context and the methods that were used during the investigation. I will explain why I chose the Basque Country and the network of experts as the case and object of study for my research and briefly introduce my theoretical and methodological approach: impressionist mapping. This approach explains the way I dealt with the empirical data collected from the interviews and observations and, above all, how the findings are presented from a narrative point of view. The essay will then explore the relationship between cultural heritage and identity. There is a broadly extended belief among cultural heritage scholars, reflected on their works, which assumes that cultural heritage emerges as an identity reconstruction tool in an era precisely marked by risk, nostalgia, and the crisis of meaning.

From this starting point, the article presents a conceptual map with the main expert mediations involved in the processes of identity formation through cultural heritage. Based on new and original empirical data from fieldwork carried out in the Basque Country, the map is introduced as an analytical tool that can be used to describe various situations within the framework of expert proceedings when it comes to dealing with cultural heritage. Not only is it useful to describe the Basque case, it also provides an example of impressionist mapping in action.

2. Network of Experts in the Basque Country and Impressionist Mapping

2.1 Case Study and Methods

In my research I studied how experts participate in the production of a sense of belonging through the construction of cultural heritage in the Basque Country (Spain). I chose the Basque case as a representative ex-

ample on how identities are constructed in contemporary societies based on three particular aspects[1].

Firstly, because identity has always been explicitly analysed at a political, social and scientific level in the Basque Country. Secondly, because the last three decades have witnessed a complex political development in the Basque Country, which has culminated in the creation of an autonomous space of self-government, along with a specific social and cultural framework for the Basque population (with the establishment of the Autonomous Community of the Basque Country). This process has turned the Basque society into a sociological laboratory, making the act of carrying out well defined and delimited observations easier. Thirdly, mainly due to the construction of this particular social reality, the Basque identity has fallen more recently within the meticulous scrutiny of experts, moving away from a more traditional political activism. Thus, militancy has not disappeared, but its role in reproducing and managing Basque identities is not as important as it was in the past.

When it comes to understanding the main reason why I decided to focus on the network of experts that work within the field of cultural heritage, it is fundamental to acknowledge the existence of a growing and consolidated expert culture. This plays an important role in defining and mediating broad aspects of social reality[2]. In this respect, the expert culture could be understood as the institutionalisation of the practices, discourses and products of expert knowledge in contemporary societies.

According to this, the network of experts – at the same time the product and foundation of expert culture – is a theoretical abstraction that is used in this text to encompass the heterogeneous set of agents that produce knowledge: on the one hand, the actors embodied in the role of scientists, technicians, academics, specialists, consultants and other expert agents; on the other hand, the non-human agents that join them, such as methodologies, rules, regulations, discourses, methods, objects, techniques, tools or experiences. They contribute to producing and managing specific realities by mediating between the elements that constitute them. It is outlined, thus, the idea of the network of experts as the fabric of actors, practices, protocols, methods, and technologies that helps create and maintain realities from the point of view of the experienced accumulation and application of knowledge.

The fieldwork was carried out using qualitative methods such as semi-structured personal interviews, a total of thirty, and two participant ob-

[1] An excellent introductory work on the Basque society from a sociological point of view can be found in Gatti, Irazuzta and Martínez de Albeniz (2005). For a more classic approach see Pérez-Agote (2006).

[2] Several social theorists have highlighted the importance of expert knowledge in the last decades: the *post-industrial* societies described by Touraine (1974) and Bell (1976), the *epistemic cultures* of Knorr-Cetina (1999), the *knowledge society* of Stehr (1994) or the *expert systems* in the works of Giddens (1991).

servations. The interviews focused on the experts' day-to-day tasks, the tools they used and the specific experiences they had in the heritage projects they were involved in. There were also more theoretical questions about their notion of heritage and the link between heritage and identity, but always as a way of observing how they handled those concepts in their work.

The observations consisted in studying the behaviour of different experts in projects related to heritage. The observation mentioned in this article consisted in following an expert who works at a hiking business while he was designing and executing an official path between two Basque localities. In the process, he highlighted different elements of heritage within the itinerary. The observation included helping him to place some signs and interpretative panels, an interview about his job, and a few informal meetings where we discussed his activities as a hiking technician, particularly about his ongoing project.

2.2 Impressionist Mapping of Social Mediations

The research was carried out within a theoretical framework based on *Post-structuralism*, *Science and Technology Studies* (STS), as well as other contemporary and classic sociological schools, with a particular focus on *Actor-Network Theory*. Drawing on a notion of social reality as the articulation of heterogeneous elements, this theoretical and methodological framework understands agency as the multiple, distributed and dislocated production of differences and transformations that can take a multitude of forms: a determined agent, actor or figure, where the "distinction between the agential capacities of humans and nonhumans ceases to be helpful" (Sayes 2014, 145). The proposal considers that the mediation – the trace that is left by the agency – is the unit of observation in sociology (Muriel 2016).

The idea of mediation (Latour 2007; Hennion 2002) functions as a guide that focuses our attention on the displacements, trajectories and transformations that are constantly giving form to the social. It is a key concept in the design and execution of sociological maps that sketch out trajectories and circulations beyond the more traditional (although necessary) spaces and objects. In short, if the social is defined as the articulation of heterogeneous elements – the result of the different agencies that compose it – then mediations are what configure the observable universe; they leave traces that can be followed and studied, and from which we infer everything else. John Law (2004, 161) defines "mediation" as "the process of enacting relations between entities that are, as a part of that process, given form". These are entities and relations that did not pre-exist, but are constituted in the moment that the process is carried out:

> Mediation is a turn towards what emerges, what is shaped and composed, what cannot be reduced to an interaction of causal objects and in-

tentional persons (Gomart and Hennion 1999, 226).

All these notions are made operational in a critical approach that addresses the reality being studied from this sociological prism: the impressionist mapping of social mediations. This impressionist mapping is defined as the ordered accounting of a set of mediations that lead to a concrete social reality based on the articulation of diverse traces and impressions. I attempt to reconcile two elements that in their intersection generate a lot of tension, if not a strong contradiction: mapping and impressionism. One is meticulous, detailed, precise and figurative: a map of reality; the other is composed of broad strokes, centred on appearance, blurred prints, formalist: leaving traces of reality. Thus, this subterfuge is built through simultaneous support from and leakage between these two cornerstones.

On the one hand, there is a sociology of mediations, based on concepts developed by *Actor-Network Theory* (Latour 2007; Latour 2013a; Law 2004) as well as other empirical tools, which permits us to construct detailed maps of the social. The problem is that this leads to descriptions that are strongly situated and localized. Given this difficulty, it is about making a less detailed map, more abstract, making it manageable on a sociologically acceptable scale. The leakage in this case is in the direction of the mobile, the comparable, the standard, the theory. The mapping becomes impressionistic.

On the other hand, there is a sociological impressionism (Simmel 2002; 2009; Frisby 1992; Zerubavel 2007), which permits us to focus on the fundamental forms of the social without being constrained by the historical, spatial and cultural specificities of concrete cases, while also being a more useful tool for capturing the changing flow of the real. The main pitfall of this approach is its connection with transcultural and ahistorical formalism, with universalist and essentialist pretensions. All of these characteristics are, however, smoothed over with mapping. The leakage here is in the direction of the local, the historically situated, the case. The latent formalism in impressionism becomes, this way, partially historical and situated.

Hence, the impressionist mapping is related to the efforts made by some scholars within STS to avoid being trapped inside the tensions that traverse what has been known as the "turn to ontology" inside the discipline (Lynch 2013, 445). This particular map drawn in an impressionistic fashion follows what Marres (2013, 423) identifies as an empirical conception of ontology: "the issue of what the world is made up of, is in actuality decided through specific, historical, cultural, technological and scientific interventions and as such, should be studied in empirical terms". Theory that only makes sense if it is enacted through an empirical approach; an empiricism that is able to inform contingent, liminal, theoretical frameworks.

3. Cultural Heritage and its Relationship with Identity

In this section, I will show the links between identity and heritage that are established by different social theorists. Considering the enormous differences between authors and how they approach that relationship, I do not directly address its nature: is heritage the mere expression of identity? Or does heritage participate in the promotion and creation of certain identities? Even though I prefer to see heritage as part of the processes and *dispositifs* that help produce identities, I simply want to highlight the idea that continuously connects heritage with identity in the academic literature.

In this sense, heritage is seen as part of a nostalgic response that, throughout modernity, is taking over the feelings of society by force of fundamental social changes. However, the last third of the 20th century is a period of time when nostalgia and its rhetoric have become "almost habitual, if not epidemic" (Lowenthal 1985, 4), the moment in which emerges a *preservation mania* (Samuel 1996, 139) and the "desperate desire to hold on to disappearing worlds" (idem, 140). In turbulent times for identity (Macdonald 2002), heritage would try to find points of anchorage, a way to face the issues of contemporary society that seeks to "neutralise the instability of the social" (García Canclini 2001, 164).

As an apparatus for reconstructing social meaning and as a nostalgic response to the climate of crisis and decline, heritage, according to these authors, allows the re-enactment of what belongs to a community and facilitates the production of a sense of belonging. According to this approach, heritage helps us make "links between past and present" (Macdonald 1997, 162), fostering the temporal connections that unite societies through history. This provides stability to the group and its "collective identity" (Arrieta 2007, 156) and heritage is considered as a tool in the present for "the creation of new identification referents that articulate a sense of belonging to a distinctive place, group or cause" (Anico 2009, 67). Heritage is, therefore, represented as a place where "some people feel better, more rooted and more secure" (Howard 2003, 147).

In this regard, heritage is seen as a powerful source of ethnic and cultural meanings destined to constitute a nation (Hall 2005); nations that construct their memory and identity by "selectively binding their chosen high points and memorable achievements into an unfolding national story" (Hall 2005, 25). Depicted as an entity that creates "a focus for ideas of civic or national identity" (Hewison 1987, 84), heritage is invoked, especially from the governmental sphere, in order to promote social cohesion (Mason and Baveystock 2009). Thus, heritage is playing a "decisive role in the definition and assertion of cultural identities" (Anico 2009, 63).

Heritage, then, is part of the processes that participate in the creation of the ideas of society and community, of the possibility of sharing common ideas, feelings and meanings: cultural heritage is necessary for the

reproduction of the "meaning we find when we live together" (García Canclini 2001, 184). One of the interviewed experts clearly defines what the heritage that is represented in her museum means to her, and how it is considered for those who visit it:

> I understand that they take it as part of our culture, that is, here it is shown a part of what belongs to us (Marta, head of museum).

Heritage is therefore conjugated in a plural form, because it always makes reference to *us.* And as we are speaking about a possession, something that we have inherited, we consequently say: *what is ours, what belongs to us.* Thus, the debate on heritage is usually carried out in terms of possession, in which the "possessive pronouns 'my' and 'our', 'theirs' and 'yours' are constantly deployed" (Howard 2003, 112). Heritage is, furthermore, an *explicit* articulation of what belongs to us: "recognised, designated and self-conscious" (idem, 148). With regard to this, an attempt to define cultural heritage could be as follows: *the explicit articulation of what belongs to us as individuals, citizens, a community, a group, a nation or a society.*

Heritage is often put at the same level as identity in the discourse of social scientists. An identity that remains in time and space and belongs to someone: a subject, a group, a society. The relationship between heritage and identity is often taken for granted:

> How the links between identity and heritage are developed and maintained, however, is an area that has not had much scrutiny in the heritage literature (Smith 2006, 48).

That is the reason why this article explores how those links are produced and managed from the point of view of the experts who work with cultural heritage. The aim of this paper shares Heinich's (2011) proposal to replace the *why* with the *how*, moving from an *explicative sociology* to a *comprehensive sociology* in order to understand how cultural heritage is made. Obviously, this approach does not exhaust all possibilities when it comes to studying the creation of those links, but at least gives a valuable insight into the issue. How the individuals and groups targeted by the experts' operations react is something that has not been dealt with in this text. In any case, the field of heritage makes possible to carry out a research project on how identities are reflexively produced in contemporary society.

4. The Expert Mediation in the Construction of a Heritage Relationship

Experts conceptualise heritage in terms of a possession relationship: their aim is to make individuals feel a set of symbolic and material objects – heritage – as their own. It is the subject-object heritage relationship.

The subject-object heritage relationship (shorten as the *heritage relationship*) can be defined as *the relationship that is produced in the heritagisation processes from which the cultural heritage object and the subject who makes it his own emerge.* It describes a relationship between a subject who possesses – the group, the community, the nation, the society, the individual, the citizen – and an object that is possessed – cultural heritage, all of which entail a sphere of what is typical, of what belongs to and define us.

In the same way identities and subjectivities are not an *a priori* because they are produced as the consequence of complex processes, the heritage relationship also relies on multiple and heterogeneous mediations: "objectivity and subjectivity are not opposed, they grow together and they do so irreversibly" (Latour 1999, 214). Hence, we should not understand this relationship in a canonical sense, that is, the existence of an active subject (the groups) and a passive object (cultural heritage). Both are entities with an active social existence.

Heritage is not a cultural and social inheritance that is inevitability transmitted in a spontaneous way. It demands hard work; experts deem that cultural heritage is a reality at which they must work explicitly:

> That was the objective (...), to make people aware, make them know and give value to their own heritage, to those things they have in their homes (Indira, lecturer).

That is the most important thing for the network of experts, to turn cultural heritage into what belongs to us, to make individuals feel that the legacies from the past "have become our very own" (Lowenthal 1998, 23). What comes below is mainly a description about how the network of experts participates in the process of making identities through cultural heritage (see table I), always in the context of the Autonomous Community of the Basque Country. Following the Actor-Network Theory tradition, I tend to use the same language used by social actors, which does not imply I agree with their opinions or I uncritically analyse their practice and discourse[3]. My main aim is to draw the map of expert mediations

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[3] The experts' point of view could be part of what Laurajane Smith call the authorised heritage discourse (AHD), the theoretical abstraction used to address the hegemonic discourse in the expert literature on heritage and the government institutions that usually support it. Even though my research has only focused on

that they carry out during their participation in the construction of the heritage relationship. This is a narrative mainly built from the point of view of experts and all the definitions are based on their work as they describe it. I leave to the reader to judge their activity and the consequences it might have.

	MEDIATIONS INTENDED FOR	CHAINS OF MEDIATIONS	OUTCOME
ORIENTATION TOWARDS THE OBJECT	Knowing and classifying cultural heritage	*Register*: to know what we have	It names and distinguishes heritage
	Protecting cultural heritage	*Conservation:* to protect what we have	It gives continuity and preserves heritage
ORIENTATION TOWARDS THE SUBJECT	Making cultural heritage understandable	*Interpretation:* to make what we have understandable	It gives meaning to heritage for the subject
	Socialising cultural heritage	*Activation:* to make what we have something that can be owned	It socialises heritage connecting it with the subject

Tab. 1 – Expert mediations in the construction of the subject-object heritage relationship.

4.1 To Know What We Have: The Register as a Process of Naming and Distinguishing Heritage

Completely focused on the selection of potential heritage, the first step requires knowing what we have. According to experts, this step focuses on the task of making a register, which consists in the group of taxonomic mediations aimed at identifying, selecting, recording, and classify-

the expert side, I have found that some distinctions usually made between authorised/dominant/expert and dissonant/subaltern/non-expert could be revised. For more information on the AHD, see Smith (2006).

ing the different elements that are part of heritage. The register is a group of routines, activities and practices that tries to give a name to heritage.

It can be understood as a basic list, which gives an account of the components that are part of a group, in this case, the elements than can be labelled as heritage. The register distinguishes aspects of the sociocultural inheritance in order to make them into objects that will be a recipient for subsequent actions. It is the expert mediation that starts the whole process through which a group appropriates a particular reality:

> We have to know what we have. We have to know what we are dealing with (Marta, head of museum).

This is how experts distinguish a particular reality – objects, buildings, customs, traditions, histories, and practices – in order to transform it into heritage. It constitutes a *sine qua non* condition for these experts; if we do not know what we have, it will be very difficult to construct a heritage relationship:

> If you enhance something you don't know, you are not enhancing it at all. Or rather, when we talk about heritage, the first step to enhance something is to know it (Jaime, lecturer).

Experts make inventories that originate from the knowledge available on the total amount of elements that are potentially part of cultural heritage. Thus, data management systems are created, taking the shape of catalogues and repositories, which feed archives and databases. After all, creating a register is to translate part of the sociomaterial reality into data, texts, codes, pictures and organised descriptions (based on categories such as kind of heritage, location, or name). Therefore, a register transforms the heritage reality into information that helps to construct inventories.

These catalogues and databases are the outcome of the efforts and research done by experts. Transformed into manageable data (inscriptions[4]), parts of the world (distinguished elements considered as heritage) are moved to those centres of calculation that are museums, heritage centres, archives, libraries, and websites. Materialised as data repositories, the inventories connect a reality that is difficult to cope with – a vast sociocultural inheritance – with another one much more easily handled: lists of ordered heritages. According to these experts, not only do inventories help to know what we have, but they also turn what we possess into something manageable and cognisable. From there, experts will be able

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[4] Inscription is "a general term that refers to all the type of transformations through which an entity becomes materialized into a sign, an archive, a document, a piece of paper, a trace. Usually, (…) inscriptions are two dimensional, superimposable and combinable" (Latour 1999, 306).

to carry out more mediations.

Furthermore, the expert production of inventories demands the compatibility between them. The power of expert knowledge and its growing importance in contemporary society lies in, above all, its ability to manage heterogeneous elements in order to organise and compare them in different ways[5]:

> The task of unifying the inventories was very difficult for us (...). If we call it "tower house", it's "tower house", not "tower", not "stronghold". So, that is the common language for the unification of languages. And then, in this way, all the inventories are compatible with each other (Sara, civil administration).

It is the task of constructing common languages to make the seams of heritage that are waiting to be utilised into a standard surface of action:

> The use of these thesauruses in the systems of information and dissemination of cultural heritage allows the normalisation of vocabularies among the cultural institutions and guarantees an agile and thorough recovery and exchange of data[6].

This is how experts work on heritage and issues related to identity formation: making them, at the same time, manageable, comparable and subject to singularisation. The expert knowledge facilitates, thus, the creation of registers that help find what is typical of a society through the construction of an expert shared language. The register gives a name, in an organised way, to heritage.

4.2 To Protect What We Have: The Conservation as the Process of Preserving Heritage

Once the aspects of the social and cultural inheritance which can be part of cultural heritage have been identified and classified, experts consider that it is necessary to protect them through a series of mediations that belongs to the process of *conservation*. The task of conservation is described by experts as *the set of preserving mediations that seeks to protect, maintain and, eventually, restore the different elements which have been identified as part of cultural heritage.* The conservation is closely tied to the material possibility through which a part of heritage might be appropriated in the future by a society or a community:

> As regards conservation, we try that the following generations know the existing heritage (Iker, civil administration).

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[5] In this sense, for instance, see Latour (1999, 1990) or Latour and Woolgar (1986).

[6] Source: http://tesauros.mcu.es/index.htm?operation=accept.

The future generations, then, are seen as virtual receivers of a heritage that belongs to them as part of their cultural legacy. According to these experts, this approach is justified by the moral imperative of protecting heritage assets, as survivors of the vicissitudes of time, in order to avoid their disappearance in the current context (Ballart Hernández and Juan i Tresserras 2005). An example of heritage conservation can be found in the activity of an expert geologist who worked inside the team that participated in the conservation of an emblematic theatre in the city of Bilbao.

The first step in this conservation process is the diagnosis, which analyses and evaluates the object's condition; in this case, a building. To this end, the expert draws a map of materials (see figure 1), which consists in translating the composition of the various types of rocks that are part of the theatre's facade into a map.
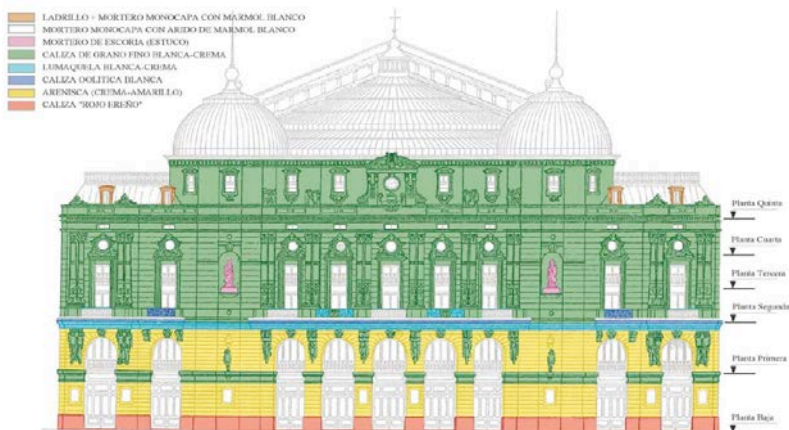
Figure 1. Map of materials. Source: Herrero and Gil (2000, 12).

The diagnosis entails, then, two mediations that transform the analysed object: on the one hand, the diagnosis translates the object into a flat surface which makes it easier to handle; on the other hand, the analysis takes the object apart according to some criteria (in this case, type of material) to create a surface of action that will guide the following steps within the task of conservation. All these efforts point to the idea of *keeping the social flat* (Latour 2007), by making different aspects of reality manageable. The construction of a map of this kind is based on diverse identification methods, ranging from a mere glance to more precise and complex approaches:

> Sometimes you have all the information with a little splinter, however, in other situations is necessary to take a bigger sample or we turn to exploration techniques and we extract a specific sample, what we call a witness (John, lecturer, geologist).

On this occasion, the act of moving the building is literal: they directly take samples from the theatre. Among the type of samples that can be identified, there are the *witnesses*: pieces of rocks that, after an extraction (a *survey* in their terminology)*, speak* to experts about the properties of the place from which it has been extracted. This is a movement that allows the expert to establish the characteristics of the theatre's materials without pulling it out from its foundations or having to move the laboratories to its location. In this way, even the tiniest details of the object that experts want to conserve are translated into a language that can be interpreted by them.

Once a particular heritage has been mapped, experts assess the condition of its materials. Their aim is to determine the physical capacity of that heritage to resist the passage of time and the elements which might damage it. Added to the observation of the chemical, mineralogical and petrological composition of materials – testing their resistance and durability, a study about the agents that cover the façade, agents who might erode the theatre, is also carried out. Thus, it is possible to determine the heritage's condition – level of deterioration and pathologies – and its prognosis.

Those agents, organic and inorganic, become relevant for the expert when techniques of visualisation appear and *force* them to emerge. In the specific case of salt concentration, it is used the diffractometer, a tool for analysis that shows the salt presence and its activity through spectrum peaks (see figure 2).
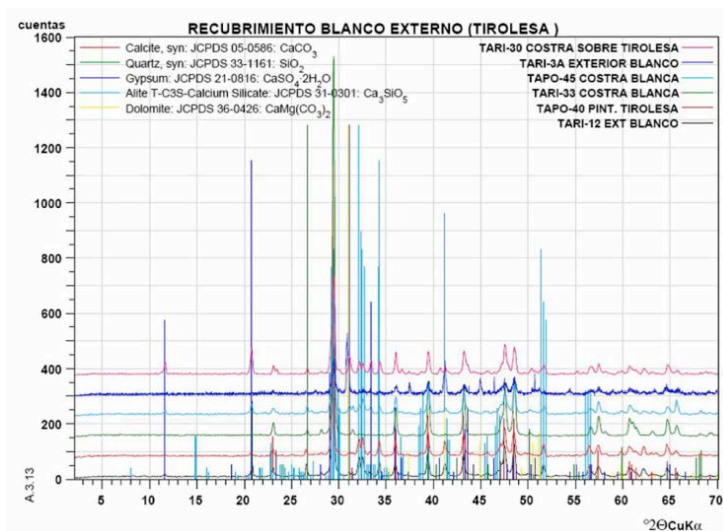
Figure 2. Diffractograms. Source: Herrero and Gil (2000, 8).

The expert mediation identifies those elements that are flawed and allows experts to act on the agents which put heritage in danger. If the first part of the diagnosis is centred on what kind of material heritage is made of, the second part consists in the delimitation of what can be understood, strictly speaking, as heritage, discarding everything that pollutes it.

All of it completes a diagnosis in which heritage is dissected as *bounded*, as an element "with identifiable boundaries that can be mapped, surveyed, recorded" (Smith 2006, 31). Even from the diagnosis within the tasks of conservation, experts are giving shape to heritage. After the diagnosis, experts can make recommendations to facilitate heritage conservation: how to clean, repair, and protect it.

Through this expert procedure that continually scrutinises, undresses, classifies, and cares about every part of heritage anatomy, experts, in their logic, are physically allowing the subjects who approach heritage to enjoy it in the present as well as in the future. The conservation process gives continuity to heritage by preserving it: it halts and, eventually, reverses the passage of time.

4.3 To Make What We Have Understandable: The Interpretation as a Process to Give Meaning to Heritage

The *interpretation* is, for experts, the *process that entails the mediations aimed at making heritage understandable to different groups in a simple, attractive and adapted way*. According to experts, the possibility that people accept as their own a specific heritage – and the way they do it – will depend, to a great extent, on the process of interpretation.

Even though the process of making a register helps to select and differentiate a vast inheritance by determining its most relevant elements and by naming them, while the process of conservation is focused on preserving that selection, they do not have, by themselves, any influence on an experience of *what is ours.* As a series of operations mainly oriented to the object of heritage (and not its subjects), both are practices which produce very technical *raw knowledge* and not very digestible:

> They give us that raw data, which is illegible for the general public, because it is very academic and people do not understand it. We transform that erudite text into something understandable, bringing it closer to the general public (Nadia, heritage management business).

The interpretation is understood as a practice in which a guide, a native or an expert explains to a foreigner, a stranger or a novice the idiosyncrasies of a place, a territory, or an object (Dewar 2000). Experts think the subjects of heritage do not have the ability to automatically identify that legacy. This is why they seek to convey that knowledge in an easy-to-understand fashion:

I think all that information and all that knowledge must be communicated and transferred to the citizen in a very didactic and participative way (Markel, civil administration).

Experts consider that the interpretation should be didactic in order to decipher why a specific heritage is important for any subject: accessible, empathic and attractive. Firstly, experts think that the interpretation should be accessible. When a script that reflects the content expressed in the interpretation of a particular heritage is carried out, it must contain texts that can be easily understood and do not overwhelm its readers:

It is not the same to write for a newspaper than to do it for an interpretation table: more or less, very simple phrases, very short; it must be easy to read and attract your attention (Joseph, hiking technician).

All of this is part of the expert's creed which claims that the heritage subjects need to understand quickly and efficiently their heritage, without apparent obstacles between them. The process of interpretation is all about transforming the expert content into "understandable, accessible and non-erudite texts" (Nadia, heritage management business).

Secondly, a way to let the individuals who approach heritage participate in its interpretation is to awake their emotions and lead them to known places in which they could easily recognise themselves or others:

When we do the guide tours, (...) I particularly insist on (...) the workers' life, especially because you can clearly see, in the paintings, the sacrifice made by these people (Elisabeth, head of museum).

A very efficient method to make heritage understandable is then to arouse the compassion and empathy of visitors. Experts seek to affect people in the elaboration of scripts that interpret heritage, and try to make those individuals identify more easily with the given representations (Ballart Hernández and Juan i Tresserras 2005).

Thirdly, experts state that the didactic interpretation should make what is being interpreted more attractive. The expert's narrative, which differentiates what is relevant when it comes to interpreting a captivating story for the public, is transformed:

To invent stories, to write stories about what the expert tells us, to narrate a story that is attractive and beautiful for the public (Nadia, heritage management business).

The idea of heritage emerges as something that can be easily understood in an attractive way, closer to the logic of entertainment. The head of a museum on the history of the Basque Country and its symbols relates the procedure they followed in the making of a script that interprets its heritage in a new way:

> We said to them: "we should try to raise a smile once in a while" (...), we wanted something close to entertainment (...) without being Disney (Marta, head of museum).

Choay (2007) negatively evaluates this kind of interpretations that uses sounds, discourses and lights. Targeted at the general public, these interpretations only work, according to her criteria, as a way "to distract and divert" (idem, 197) the subjects from the heritage interpreted. However, if we follow these experts' assumptions, the interpretation that becomes accessible, empathic and attractive, far from pushing away the subjects from their heritage, it gets them closer: it involves people in their heritage, attracted by interpretations that give meaning to it.

Another way to tell what is relevant about a heritage relies on adapting the interpretation to the different kinds of individuals (Ballart Hernández and Juan i Tresserras 2005). Not only does the general public not have to know the language used by experts in relation to heritage, but the individuals who are part of that general public are also diverse and their abilities to interpret the heritage they approach (and the way they do it) might essentially vary depending on their age, level of education, general culture, origins, relationship with the heritage visited, interest, or any other sociocultural variable:

> There are different targets of population and depending on who you are aiming at, the scope of the information varies. It depends on the level of knowledge or the visitor's profile (...). It is not the same to do a guided tour with children than doing it with pensioners or with middle age people who went to college (Iker, civil administration).

The scope and type of interpretations are adapted to the targets in which experts divide the population. Although heritage always has a collective dimension, this singularisation of population targets turns *what belongs to us* into something that is more and more adapted to the micro social or individual peculiarities.

> You put yourself in their shoes and try to make the product in a way that suits them. They are generally very different, but, well, you offer a diversified pace of expositions and presentations because you want to reach everyone (Nekane, heritage management business).

That seems to be the key of an adapted and diversified interpretation in experts' opinion: taking into account the heterogeneity of those at whom is aimed, and, above all, putting themselves in the visitors' shoes. Experts maintain that the interpretation is not carried out in a unidirectional way; it adapts itself to the diverse feelings and abilities of the targeted subjects. The objective is simple: to augment the probability that the interpretations given to the subjects are meaningful for them.

4.4 To Socialise What We Have: The Activation as the Process that Connects Subjects and Heritage

Once what we have is made understandable, experts can undertake the operations to socialise that reality already interpreted. Some of these experts refer to this process as the *activation*, which connects heritage to its subjects. It allows heritage to be visited, observed, assumed, consumed, and experienced.

The *activation* is understood by experts as *the process in which heritage is socialised through a staging that connects it to the subjects who appropriate that heritage*. Creating a space or a reality that enables people to approach representations of *what is ours*, the activation links – constructing them at the same time – heritage and groups. In this sense, the activation is *what belongs to us* in action; it is a proposal of a particular "world view" (Prats 2009, 80). Heritage is activated, according to experts, through three ideal types: adding value to heritage, re-enacting experiences of heritage, and standardising heritage.

Adding Value to Heritage

The activation of heritage can be presented in different shapes, for instance, the speech or the lecture, which allows a face to face interaction with the individuals who attend:

> I brought an archaeological object, which I think it is, at least, 40.000 years old (...). And everybody was "Ah, I want to touch it, then". Well, I think this link with the past (...) is fundamental (Jaime, lecturer).

When the very subject is the one who wants to touch that element, the bond with the past is directly established, invoking a feeling of continuity for the inhabitants of the locality. Furthermore, in experts' opinion, an extra value is added to this heritage: we are faced with a non-simulated piece, an *original*.

One of the most recurrent means to stamp a patina of authenticity to heritage activations consists in the use of *auratic* elements, that is, components of a particular heritage that are seen as *authentic* because they are "imbued with the magic of having been there" (Macdonald 1997, 169). The notion of the auratic comes from the idea that the "presence of the original is the prerequisite to the concept of authenticity" (Benjamin 2007, 220). This could be extended not only to objects, like archaeological remains, but also to the spaces, the people and the activities they perform:

> We always tend to recover authentic spaces, (...), we do not create a Museum of Cheese (...) in this building that has nothing to do with tradition or cheese. What we do is to go to the person who makes cheese, in

the field, bonded with the activity of a person (...), and that seems more realistic to those who come to visit (Arnaldo, head of museum).

However, stamping a patina of authenticity in a particular heritage representation depends not only on the originals or the auratic objects that can be collected; authenticity can also be obtained from the story that is effectively being transmitted during heritage activations. It is not important where the artefacts come from in a heritage staging, but they should be capable of conveying a suitable message. In this sense, diverse mediations are used to confer that authentic appearance to heritage: presenting the narrative as if it were contrasted facts, eliminating dissonances, using realistic three-dimensional constructions, or utilising techniques such as the audio guide, which ties the story seamlessly and avoids the discussion with other visitors (Macdonald 1997).

Whether auratic objects or not are shown, "authenticity of appearance is all" (Howard 2003, 143). Far from philosophical or historical debates, the question of authenticity is approached within the area of heritage like any other technical issue, as part of a representation that helps socialise heritage by adding value to it.

Re-enacting Experiences of Heritage

One of the fundamental ways in which heritage is represented is through processes that recreate and transmit the knowledge about a heritage reality, including its feelings and experiences.

In the locality of Labastida, there are routes with performers in its old town. In those routes, the lifestyle of medieval times is re-enacted using actors who perform daily life scenes of that period next to the monuments and architectonic remains still present, which are part of the urban landscape of the town (see figure 3 on the next page). The city council promotes them as follows:

You will find interactive and dynamic visits, where visitors will enjoy and understand the past, experiencing live some of the key moments of the history of Labastida (City Council of Labastida[7])

The staged re-enactment makes it possible for the subjects to experience *live history*. The anachronism contained in the statement shows how the network of experts fulfils its mediation during the construction of a heritage relationship. This works as a channel between the subject, who currently lives in the municipality, and the heritage, which includes history, costumes, events, and monuments that belong to the past. Those who perform and the ones who observe are involved in a cultural performance that implies meaning construction (Smith 2006). This representation ful-

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[7] Source http://www.labastida-bastida.org/

fils the emergence and connection between the subjects and objects of heritage.

Figure 3. Staged route in Labastida (Araba). Source: City Council of Labastida

In this way, in a territory-museum that revolves around the iron industry in Legazpia (province of Gipuzkoa), the head of the museum states that "the idea is to bring a person to the modern age of iron" (Arnaldo, head of museum). How is it possible, then, to come back in time, to an era that does not exist anymore, in which it is impossible to live and experience in the contemporaneity? Through heritage activations that simulate those social universes now extinct or in ruins:

> Then, what we have done is to recreate a housing of the 50s in one of the working class neighbourhoods, exactly as they were in the 50s (Arnaldo, head of museum).

Some of the most relevant social spaces of the 1950s have been reproduced based on research works that determine how they were at that time: a working class bedroom, a classroom, a chapel. Thus, some of most important referents of that time – labour, education, and religion – are invoked. All of it is staged where everything took place, recreating their social existence and including their buildings, aesthetics, languages, practices, and objects (see figure 4 on the next page):

> You open the desks where we put inside some texts and books... you open some of them and you hear the music, or how they learnt, the teacher saying, "one time one, plus three, plus five, let's see... wrong!" (Arnaldo, head of museum).

Figure 4. Recreation of a classroom in the 50s, Legazpia (Gipuzkoa).
Source: Lenbur Fundazioa

Not only do experts try to reproduce the spaces from an aesthetic and a formal point of view, but they also seek to get the visitor involved in what happened there. This social universe is unified through a route: "One day in the 50s. The route of the workers" (see figure 5), which offers the chance of travelling in time and experiencing the universe of working class families in the 50s[8].
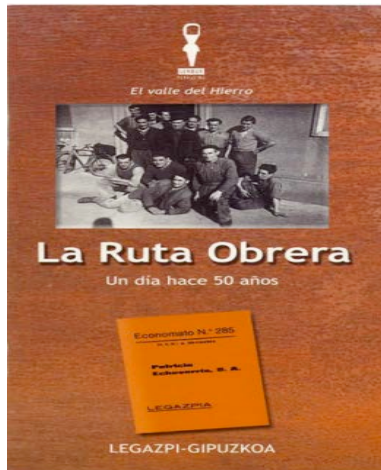
Figure 5. The Route of the Workers. Promotional diptych on the Route of the Workers.
Source: Lenbur Fundazioa

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[8] Source: http://lenbur.com/es/rutas/ruta-obrera/

In this manner, heritage, to be considered as such, must be experienced or, even beyond that, heritage is the experience in itself (Smith 2006). It is an experience that makes the partnership between heritage and the groups who experience it unbreakable. The re-enacted spaces during the activation vibrate like meeting points between experts and non-experts and, above all, between the population and heritage. Those are the places where it is possible to establish the relationship that produces both of them.

Standardising Heritage: The Activation of a Route

The standard is how heritage is enacted in this kind of activation. Exhibited following a closed pattern, it is part of a "factory-produced common heritage" (Bauman 1993, 161). The advantages of this kind of activation rest on the fact that it simplifies the recognition of its codes, which makes the task of socialising heritage elements simpler. Brands, typical signs and standard nomenclatures facilitate – by giving a framework of shared meanings between subjects and experts, humans and non-humans – the crystallisation of the heritage relationship. I will describe, in this case, part of the process through which an expert, that belongs to a hiking business, designs and executes an official route, between the Basque towns of Zaldibar and Elorrio, where different elements of heritage are highlighted.

The official approval of the route is a central process within this type of heritage activation. In this procedure, an alphanumeric code is assigned to the path designed, becoming, effectively and officially, a route:

> When I asked him what would happen in case the approval number did not arrive, he answered angrily: "No number, no route! That simple!" (Fieldwork note).

The expert expresses his sharp opinion in relation to the possibility that an already designed and signposted route was not officially approved: the staging would be ruined because of the absence of the number that certifies it is an officially approved route and, therefore, the possibility of individuals approaching heritage through the act of walking would vanish.

This particular staging of heritage gradually takes shape around a route, which that same representation helps to construct, through a series of articulated figures, colours, codes, and standardised forms (see figure 6 on the next page).

To that end, it is necessary to paint some spots along the path with the required colours and forms, a task assumed by the hiking technician. The entire route is, thus, signposted with the corresponding marks and colours, always trying to orientate the subjects who decide to visit it. Moreover, a set of boards and arrows are posted in the field in order to orientate

the subjects' trajectory while they are walking along the route. At all times, the aim is to maintain the visitor inside a *closed circuit,* which is determined by the official approval and the points of passage the visitor must pass and visit.

Figure 6. Codes for type of path (Great Path, Little Path, Local Path) and direction according to international regulations. Source: Spanish Federation of Mountain Sports and Climbing.

Once the route is appropriately delimited, the only step left is to sign-post the relevant points on the path with a particular piece of heritage. Interpretive panels (see figure 7) point out where to locate heritage elements inside the route, offering a brief interpretation of that heritage, which should be understood by the subjects who are walking through the route.

Figure 7. Interpretive panel and hiking technician placing the base for an interpretive panel. Source: Author.

This is, in the end, the activation of an officially approved route following a standard protocol. Experts face a representation of heritage that, in their opinion, will enhance its value, recognition, and, eventually, will facilitate that the subjects who walk its path will make that heritage their own. It is possible to walk across *what is ours.*

5. Conclusions

In this article, I focused on a network of experts that – in their majority – take into account other people as part of their main goal. Associated with other agents – not always human, this group of experts articulates themselves in a complex network that enables them to mediate between things, influence others, and produce relations.

Beyond the reflexivity of the individuals studied and rare cases of experts who were only focused on heritage as an object, most of the mediations they were involved in had as their final objective to influence other individuals. Despite the importance of the network of experts as regards heritage, they never impose their willing in a unidirectional and unequivocal way on those subjects they seek to affect. The interests and processes at stake are multiple: some pretend to construct a sense of belonging and community; others, socialise a knowledge about a reality that potentially defines us; there are those who wish they could seduce more people, attracting increasing numbers of visitors; it is even possible to find those with more material intentions, who want to sell cultural heritage more and better. In any case, subjects (experts) who take into account other subjects (the individuals who are represented by cultural heritage).

Even though there is a strategic orientation in this dominant heritage mentality (Smith 2006), not all the elements of the network explicitly consider this question, since everyone and everything seek different aims. According to Latour (1999), intentionality does not belong to objects nor to humans, but to these *dispositifs*, apparatus, institutions or, as in this text, networks:

> Purposeful action and intentionality may not be properties of objects, but they are not properties of humans either. They are properties of institutions, of apparatuses, of what Foucault called *dispositifs*. Only corporate bodies can absorb the proliferation of mediators, to regulate their expression, to redistribute skills, to force boxes to blacken and close (idem, 192).

Cultural heritage is, then, part of what we could call *politics of meaning* or *politics of identity*; and the network of experts, including human and non-human elements, play an essential role in it. In this case, the principal network studied has been the one that is configured by expert agents who traverse the field of cultural heritage in the Basque Country, observing the main relationship in which they mediate and help to produce: the relationship between an object – heritage – as the synthesis of images and experiences of what is ours, and a subject – the group, society, community or individual that identify with that heritage – who considers that object as a fundamental part of their own definition (or at least they recognise it as something that belongs to a group, even if it is not their own).

How do these experts succeed in – or attempt to succeed – influenc-

ing other people in the particular relationship that is established between them and heritage? The processes described here were four: register, conservation, interpretation, activation. They do not cease to be forms – ideal types – constructed from brush strokes of reality – impressions. In sum, the impressionist mapping that describes systematically the set of mediations that leads to the emergence of a heritage relationship.

Considering that the social is the articulation of dissimilar elements, an articulation that is produced through the comings and goings of associations and displacements, it is postulated that the attention of sociological description should be focused on those movements and transformations, which can be condensed in the notion of mediation. Mediations which involve the diverse agents and processes that fall under the sociological perspective, constituted as sociology's units of observation. This way of approaching social reality permits the study of both the most regular and stable aspects and situations (aligned and stabilized mediations), and those that by their nature are more fluid and changing (volatile and continually transforming mediations) as shown by the case studied.

Mapping applied as a sociological methodology avoids the observed processes, agents and mediations being enclosed in social forms that have already been studied or installed in sociological knowledge, thus, it permits us to carry out more accurate representations of the reality studied. In some cases these social forms may adequately describe the reality observed, but in many other cases they will limit the richness of movements, displacements, and actors being studied. This involves a research process that is detailed, costly and relatively slow, but the results of which provide more realist sociological descriptions.

However, as social reality is in continual change, an assemblage of displacements, transformations, and associations in permanent movement, it appears as an unpredictable tide or maelstrom (Law 2004), which is difficult to describe with meticulous mapping methods that, moreover, are inadequate for carrying out sociological descriptions on a certain scale. As a result, joining a mapping technique with an impressionist approach is a way of capturing these fluid and changing aspects of reality; in doing so, the impression of their movements remains, while the descriptions reveal regularities and typologies that partially transcend the specificities of the cases studied, facilitating the work of generalizing, which is the objective of all sociology. With its own limitations, the impressionist mapping seeks – within a particular regime of truth or mode of existence, a particular sociological ontology – to end "the restrictions imposed by the notion of symbolic representation of a material world" (Latour 2013b, 299).

I have to insist that this narrative is built from the point of view of experts, which leaves to others the task of researching about the role played by the rest of the social actors in the heritage relationship: how do they receive these expert representations? Do they contest them? Do they pledge to them? Do they transform them? Is it established an alliance be-

tween these groups and the network of experts? Or is it more like a con-
frontation? Do they add different things to the mediations of register,
conservation, interpretation and activation? Or do they add complete
new mediations? Do they, in short, create new definitions of heritage? If
we want to redefine agency and how reality is constructed from an Actor-
Network Theory point of view, we do need to acknowledge the distribut-
ed nature – the different entities involved – of the different "modes of do-
ing" (Abrahamsson et al. 2015).

As a general conclusion, it can be stated that behind the idea of herit-
age there is no fundamental *ethos* that constructs it. There is no element
or transcendental concept that explains it, neither identity nor tradition
nor history. Although those concepts are constantly invoked, they are nei-
ther the outcome of heritage nor its previous condition. That is the para-
dox of contemporary society; full of politics of identity, memory, and
meaning, only the succession of processes and mediations which are part
of heritage is what actually gives a value to that heritage, what makes it a
contemporary sense of belonging provider.

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Self–management and Type 1 Diabetes
How Technology Redefines Illness

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Abstract: In the last decades, health and illness have been redefined by the technological artefacts. This research explores users' opinions of the potentials and limits of apps related to the self-management of type 1 diabetes. Our research takes the "app" to be a socio-cultural artefact whose meanings and practices are mediated by situated practices and knowledges. The analysis has been conducted on two different kinds of texts: the description provided by the app itself (commercial description) and the reviews provided by app users (customer reviews). Our aim is thus to contribute to the study of how technological tools contribute to the processes of patients empowerment.

Keywords: Type 1 diabetes; apps; patient empowerment; commercial description; customer reviews.

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1. Introduction

As the digital revolution has emerged in the last decade, opportunities for patients to access and share healthcare information have expanded. Consequently, a new form of 'patient 2.0' (Danholt et al. 2013) emerged and should be analysed.

Technological tools are fundamental in guiding laypeople as they become more aware of, and informed about, their illnesses. Technological tools that redefine our culture of therapy and self-care have proliferated in the health market. These tools can be used in several manners. As suggested by the Green Paper on mobile Health – mHealth – (2014, 1) "mHealth solutions cover various technological solutions that among others, measure vital signs such as heart rate, blood glucose level, blood pressure, body temperature and brain activities. Prominent examples of apps

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are communications, information and motivation tools, such as medication reminders or tools offering fitness and dietary recommendations". Some claim that in the 2.0 era the patient becomes a sort of self-entrepreneur (Maturo 2015), who can control both the process and the result of the therapy or healthcare. Consequently, as Bruni and Rizzi (2013) point out, in the case of patient 2.0, the production of reliable data is dependent on the patient because s/he wields the technological tool necessary for collecting that data. In addition, as Maturo and Setiffi (2016, 478) observed: "as the sources of medical information shift from those controlled by doctors such as medical records and specialist journals to interactive websites and online communities, it is easier for individuals and patients to find information, get support and share their illness experiences with others with the same condition".

The number of people chronically ill is steadily increasing, which indicates the need for services that ensure continuity of patient care and assistance. About 117 million people suffer from chronic illnesses in the United States, while one out of four adults has two or more chronic health conditions (Center for disease control and prevention 2012). In Europe, those figures are even higher: around 150 million Europeans were chronically ill in 2005 (European Observatory on Health Systems and Policies 2005). Patient self–management is increasingly perceived as a viable alternative to the currently strained health care system (Busse et al. 2005). In this alternative scenario, new technological tools dealing with health would become part of patients daily lives.

2. Self-management of Type 1 Diabetes through Mobile Apps

Type 1 diabetes is a chronic disease that occurs when the pancreas does not produce enough insulin or when the body is not able to effectively use insulin. Insulin is the hormone that regulates blood sugar; hyperglycaemia is a common effect of uncontrolled diabetes that causes serious systemic damage, especially to nerves and blood vessels. Diabetes is an important public health problem; it is one of four non-communicable diseases (NCDs) that world leaders have deemed "priority," i.e. prioritized for preventative action (WHO 2016). Globally, an estimated 422 million adults were living with diabetes in 2014, compared to 108 million in 1980.

Type 1 diabetes is known as juvenile, childhood-onset, or insulin-dependent diabetes, as it requires daily administration of insulin in various doses and with varying frequency. The cause of type 1 diabetes is unknown, and the disease is not preventable at our current level of scientific knowledge. According to a 1999 report prepared by the World Health Organization, a healthy way of life, *i.e.* the maintenance of normal body weight accompanied by regular physical activity, can delay or prevent the

onset of type 2 diabetes and, at the same time, help to control type 1 diabetes.

The adoption of self-management practices is a foundational resource in the process of controlling and managing type 1 diabetes and its effects. Routine self-monitoring allows diabetes to exist in the background of the patient's social life by contributing positively to its normalization (Spencer et al. 2013). According to the WHO's latest global report on diabetes (2016), mobile technology can improve the management of diabetes in that it encourages users to adhere to treatment plans meant to manage their disease.

The advent of new technologies such as smart phones, Internet, tablets, as well as of increasingly sophisticated health monitoring devices (glucose meters, blood pressure monitors, oximeter), is accompanied by the miniaturization of those monitoring devices, as nanotechnology continues to develop.

This could result in increased efficiency of health services by adding value and efficiency to a continuum of self-care strategies (Lehocki et al. 2012). The use of mobile devices, which today more than ever affects every sphere of one's social and personal life, may change the face of health care by offering a new avenue for the management of one's disease. Health-related technologies take the place of a personal care assistant who supports a patient in the management and organization of the daily flow measurement and who assists in administration of care and personal data. Recent advances in ICT have enabled the design and development of new patient-centric models for these health-related technologies (Mougiakakou et al. 2009). Self-management of diabetes offers a representative example of intense patient engagement with health management practices and with the organization of health services.

The personal management of type-1 diabetes requires patients to have specific skills, which concern the measurement of their values in relation to the available technological tools. In order to better manage their disease, patients with type-1 diabetes have to develop medical skills. They must take steps to adapt to new habits and even a new lifestyle. Ideally, patients should also learn how to interact with the health technologies they use, thereby achieving a greater sense of responsibility and control in their experience of illness.

At the same time, the patient faces the burden of dealing with the emergence of new pressures and complexities in health management. The emergence of health technologies has completely restructured the form of clinical encounter between doctor and patient. Information about one's health is distributed in a fragmented way and shared over a wide healthcare network. In the centre of this network we find the patient, who is increasingly held responsible both for his or her self-care and for the accuracy of data that is useful for professional supervision of the disease, which he or she measures (Bruni and Rizzi 2013). Clinical encounters that address patients'

mismanagement of measurement technologies offer a clear example of the heavy responsibility assigned to patients.

Such appointments are characterized by two main activities: inspecting the patient's clinical documentation and verifying the relationship between patients and technological tools. The self-management services generally have the following characteristics:

– acquiring patient data communication;
– supporting compliance to treatment;
– visualizing of the state of health;
– educating the user.

Several studies show that the use of mobile technology has a direct impact on the management of chronic diseases (Free et al. 2013). With regard to diabetes in particular, these studies evidence that mobile phone intervention has led to statistically significant improvement in glycaemic control and self–management in diabetes care (Liang et al. 2011).

According to Research2Guidance's annual survey, 76% of mobile health app publishers see diabetes as the self-care area with the highest business potential for mobile health. Currently only 1.2% of people with diabetes who own a smartphone or tablet use apps to manage their condition. Research2Guidance predicts that this percentage will rise to 7.8%, or 24 million people, in 2018.

As mentioned above, digital technologies have expanded opportunities for people to access and share information related to their personal health. In addition, "mHealth solutions support the changing role of patients from a passive to a more participative role, while enhancing their responsibility over their own health through sensors that detect and report vital signs, and mobile apps that encourage them to adhere to diet and medication" (EU 2014, 5). Indeed, many apps have been designed for the health market. The functions and contents of these medical apps provide useful insight into discourses related to illness and chronic conditions. As shown by Lupton (2014), apps are new digital technology tools, but they are also sociocultural products located within pre-established circuits of discourse and meaning. Moreover, these tools are now playing a crucial symbolic role in our social lives; from this perspective, the integration of technological devices with longstanding cultural relationships reflects the dominant place held today by science and technology in our society (Magaudda 2015). Using these technological tools, it is possible to increase doctor-patient interaction (using an app as a medium) and to improve the relationship between the patient and his/her illness (using the app as a memo).

3. Methodology

Type 1 diabetes and the apps designed for its sufferers are particularly ripe for analysis for two reasons: first, adolescents' notorious propensity for

new technological tools; and second, the fact that self-management at a young age is even more difficult and challenging than it is for adults. Indeed, measuring blood sugar levels is not always easy, especially on occasions in which having a chronic illness may be stigmatized, as some patients mention in their reviews of health apps. In addition, several studies (Mol and Law 2004; Ho and O'Connor 2014) examine a wide range of psychological issues related to adolescent self-management of disease, including stress, burn-out, depression, peer relationships and diabetes-related family conflict.

This study in based on content analysis of the 5 most downloaded diabetes apps: mySugar Logbook, Diabetic Connect, Diabetes Pilot, Bant, and MyNetDiary. Commercial descriptions and customer reviews have been used to evaluate the strengths and weaknesses of these new technological tools in the managing of type 1 diabetes. Several studies have been conducted through content analysis (Lupton 2014; Lupton and Jutel 2015; Maturo and Setiffi 2016; Maturo, Mori and Moretti 2016). The ways in which apps verbally and visually represent the human body provide insight into contemporary notions of embodiment, health and disease. Examining the words used in the app titles, images and descriptions on the store, including the logo and screenshots employed to illustrate what the app offers potential users, is a way of identifying the tacit assumptions that underpin the apps and their truth and authority claims (Lupton 2014, 612).

These diabetes apps belong to different categories and they were searched in the App Store using the formula "most downloaded diabetes apps" during February 2016.

Specifically, we focused our analysis on the self-tracking possibilities offered by those apps. Four out of five apps offer a standardized method to calculate the level of glucose in blood and offer the possibility of creating a food database in which to check the calories of foods. Although we have considered apps from 3 different categories – Medical, Health & Fitness and Social Networking – all of the apps can be considered helpful in managing self-monitoring as this chronic illness requires. Further, all five apps make use of gamification in order "to increase influence and encourage engagement and activity" (Luminea 2013, 13). We can define gamification as the use of game features in non-game situations (Groh 2012; Maturo 2015). Often, such recreational elements are considered important as means to motivate employees to be more productive or to motivate patients to be more constant and precise with self-monitoring. However, gamification is also becoming widely used to foster consumption among individuals. As far as diabetes apps are concerned, the use of quantification helps people to be more diligent in their self-monitoring.

Commercial descriptions and customer reviews of these apps touch on themes that can be broken down into four main areas, each of which we have analysed: the language used by the app, the app's visual features (design), the services provided by the app, and the app's targeted users.

4. Findings

4.1 Commercial Descriptions

The first linguistic component of our research investigates the commercial descriptions of diabetes apps, and in particular, which of their characteristics their sellers choose to highlight. Commercial descriptions play a fundamental role in our content analysis because they help us to understand how "digital technologies have been developed within a wider ideological environment, one which has shaped their social evolution both materially and symbolically" (Magaudda 2015, 2). As aforementioned, our content analysis focuses on four main aspects of the apps: the language used by app developers, the app's visual features, the services of the app itself, and the app's target group of users.

Regarding the first aspect – the language used by the App Store – we found that diabetes apps are described in technical terms specifically associated with diabetes; at the same time, these descriptions are simple and clear because they are intended to make sense to customers. According to the commercial description of, e.g., the app MyNetDiary's Diabetes Tracker, it is possible to make a lifestyle change and acquire good habits through:
– checking remaining food calories;
– viewing BG average and next check reminder;
– reviewing daily foods;
– getting tips and recommendations about today's food;
– logging water and weight;
– logging foods-selecting from favourites or dictating searches.

These instructions, presented as a list, are straightforward. Focusing on guidelines for basic components of everyday life (weight, exercise, food and water), this list offers the customer small-scale steps to follow in order to better manage his or her diabetes: apparently, it is enough to follow these clear instructions and the advice listed in the app's description.

The connection between food and illness management ought not go unmentioned: as Mol (2008, 3) points out, "(nutritious) food and (curative) drugs may have similar effects on the body."

The visual features of an app – the second aspect of apps we analysed – prove to be particularly important, because they concern the app's visual impact, and may thereby influence a user's overall perception and use of the app. Indeed, pleasant visual features can encourage monitoring activity, transforming a boring task into a fun and recreational activity (gamification). For instance, the junior version of MySugar LOGBOOK (a version of the app intended particularly for young people) can – according to its commercial description – help one get motivated and involved in his/her diabetes therapy.

It is also worth noting that game design involving personal activity monitors may contribute to youth engagement with self-tracking, health, and identity. The Junior version, for example, makes easier the collection of data through a "monster" (Slimer, see fig. 1), a diabetes avatar.

Fig. 1 – App mySugar Logbook.

This app is particularly intended for children who suffer from type 1 diabetes, because the activity of self-management is turned into something interactive and amusing. Moreover, the app makes it is possible to share data with one (or both) of the child's parents. This app can be used through the registration of the child – name and phone number – and the parent, who must insert several details. The child/user has to manage his/her self-monitoring by selecting different icons that represent physical status – great, good, bad – at different moments throughout the day (before a meal, after a meal, before sports, after sports). In addition, the young user has the task of collecting data (blood glucose level) and of taking pictures of meals. Other important functions concern estimating amounts of carbohydrates and, in the case of injecting insulin, the units of basal and bolus injected; the child can write notes about his/her care management and send them to the parents. Every time the child monitors the relevant metrics of his/her body and sends his/her data successfully, he/she receives a reward (points) that forms a part of the process of his/her self–management. Through this app, it is possible to create graphs and histograms related to the level of blood glucose, using a timetable that involves days, weeks and months. It becomes possible to track and analyse personally relevant data with less effort.

Fig. 2 – App Bant.

The third area we analysed, the services provided by diabetes apps, can – according to their commercial descriptions – improve and facilitate the illness management. Using the app Diabetes Pilot, it is possible to find track trends in 14 categories, among which are blood sugar levels, medications and diet. First and foremost, the patient is tasked with selecting time, the day/hour in which he/she starts with the monitoring, category[1] and value in order to start with this tracking. Consequently, the app, on the basis of the precise records entered by the user, draws glucose and weight graphics. The app can also function as a memo/notebook because it allows patients to search past data, to scan barcodes on food packages in order to track food and carbohydrate intake, and to learn about the calories, fat proteins, sodium nutrients and cholesterol in foods. It is also possible to set reminder alerts on any record. Another important feature of the app is the possibility of its calculating the user's insulin-level. Through the app's Data Sharing function, it is possible for a user to save, print and email reports directly from the app. The transfer can be made using an email data file or WiFi Sync. The possibility of data transfer should be seen as a way to simplify medical appointments. These services undoubtedly foster quantification; let us now consider the Bant app (see fig. 2), in order to get a better idea of how these apps can simplify self-management among young patients.

Nowadays, getting medical information through the web seems to be a simple and predictable activity: "consumers are starting to do this individually, in collaboration with health peers, who also have greater prominence now, and in co-care with physicians and other medical professionals" (Swan 2009, 494). However, most of the services require a subscription

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[1] Unfiled, imported, breakfast, after breakfast, lunch, after lunch, dinner, after dinner, snack, feeling hypo, sick.

that allows the patient to get all food database updates, unlimited records and unlimited access to all services.

Finally, the reference group consists of all sufferers of type 1 diabetes. Many patients receive their diabetes diagnoses at a young age; interpersonal connection and the exchange of experiences by users are among the main services of these apps in their effort to promote a healthy lifestyle. For someone with the disease, sharing how diabetes affects his or her life can help alleviate the stress and anxiety it provokes. This psychological aspect of having diabetes, as we will see from user reviews of the apps, is particularly delicate. Apps like Diabetic Connect are designed primarily to promote healthy eating habits by way of connecting people so that they can share their feelings and personal experience of the disease. Especially among youth, peer support is considered fundamental to achieve happiness. Through this app, it is possible to get connected with the largest community of diabetes patients on the web (see fig. 3). The app principally offers users the possibility of following discussions while on the go, asking questions, and adding comments to a forum.

Discussions on the app/forum are ranked according their popularity: how many likes and comments they receive. A user can also choose different topics (insulin, stress, type 1 diabetes, oral medications, finances etc.) to read about. To join the community and post a comment or subscribe to a discussion, users create patient profiles.
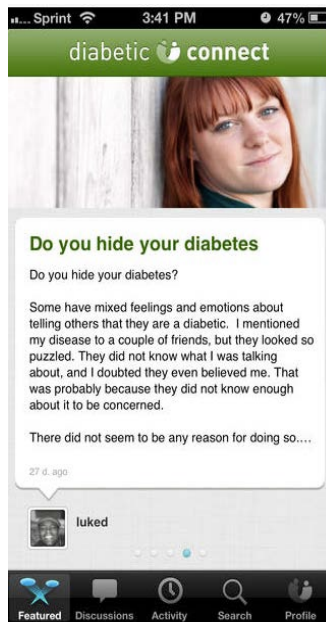
Fig. 3 – App Diabetic Connect.

4.2 Customer Reviews

The second linguistic component of our analysis concerns users' customer reviews, i.e. the comments and suggestions they make informed by their use of the diabetes apps. These comments[2] were collected from some of the online forums we identified as the most popular. Here are some examples of the numerous blogs and forums we analysed in the course of our research. First, we considered www.diabetes.co.uk, a digital community that supports people with diabetes in the U.K. and other countries. This is undoubtedly one of the most interesting such forums in terms of its users' access and ability to comment: whereas some blogs and forums require a user to have a special subscription, no such subscription is necessary on this site. Using this forum consists in a user interacting with other members of the forum by answering questions they have posed, or by a user submitting new questions of his/her own. A similarly important webpage is www.childrenwithdiabetes.com, an online space designed for use exclusively by parents of diabetic children. In Italy, the most popular forum is www.diabetando.it, a community which requires some registration but which offers a highly accessible, user-friendly comment section.

Customer reviews of apps give voice to the needs of individual users and bring to light their problems with and suggestions for the latest technological tools intended for diabetics. In addition to the commercial descriptions of the apps, four main components of users' feedback have also been analysed in our research. These four components are: 1) apps language; 2) apps visual features; 3) apps services; 4) apps users.

Regarding the first, the syntax of an app proves important to users. As noted by Berger and Luckmann (1966), language allows us to objectify human expression; understanding language means understanding the reality of everyday life.

> I had a lot of trouble controlling my blood sugar, and my last A1C was 8.5, up a bit from before. The issue was estimating proper insulin based on what I was eating. With the software here, in the last month my estimated A1C is hovering between 6.2 and 6.3.
> [Crossfire, diabetes–pilot.iapps4you.com, Diabetes Pilot app)]

Users describe the way diabetes demanded a complete reconstruction of their habits, and further, how apps have played a helpful role in that reconstruction:

> I just joined this forum and it helped answer a lot of questions I had. Especially how to cope emotionally with the diagnosis of a chronic disease. And

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[2] Every comment reported is quoted exactly and is publicly available at the websites listed. No registration to the cited forums or private pages was required to access these comments.

some of the more practical ways to live with changing your lifestyle. I travel a lot for business and will admit it's been a challenge in some ways. I really miss Sonic cherry limeades (LOL).

[Dderm, tudiabetes.org, MySugar LOGBOOK app]

Regarding the second object of our analysis – app design – individuals prefer visually pleasant layouts and features, which can make less rote the process of collecting and recording one's medical or physical data. This gamification of a tedious burden is particularly interesting in that it casts electronic gaming in a new light. Gaming is often considered harmful[3] and is the leading causes of some common diseases among children.

The chart of my weight helps me see if I'm staying on track.

[Hopester4, iphone.informer.com, MyNetDiary app]

I'm truly enjoying the design and layout of your website. It's very easy on the eyes which makes it much more enjoyable for me to come here and visit more often. Did you hire out a designer to create your theme? Outstanding work!

[Anonymous, everydayupsanddowns.com.uk, MySugar LOGBOOK app]

The third object of our analysis, namely the services these apps offer their users, is important because the more distinct services an app offers, the more its users interact with one another. Further, the use of these health tracking tools in the management of disease is very important because "the logic of care for diabetes involves the broader process of diagnosing, in-forming, injecting, encouraging and so forth, a process in which the patient is not only acted upon by medical professionals, but is also a principal actor his or herself. In this sense, caring is "a collective effort of uncertain practices shared by doctors, nurses, patients, relatives and friends, and even technologies" (Turrini 2010, 75).

I lost over the past 10 months was with the other app, but if I had known about this I would have used it exclusively. It's accuracy with nutrition in relation to diet, exercise, weight, & calories is the best I have seen so far. As a result of this app I better able to manage my tendencies toward diabetes, completely eliminated any cholesterol issue, and better track BP, which as returned to normal […] This app does it all and allows to track your pro-gress in many levels.

[hawk_fam003, mynetdiary.com, MyNetDiary app]

An individual patient's use of an app services can prove indispensable not only for his or her disease management, but also for his or her entire

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[3] We refer to the abuse of video games by children that can lead to obesity. For further information, please refer to the study of Vandewater et al. (2004).

medical team. Self-monitoring can, in fact, be essential for successful diabetes management, in that "the relegation of data-collection to patients or caregivers is a part of a therapeutic alliance in which data is used by patients for self–management purposes but is also shared with healthcare providers" (Piras and Miele 2016, 3).

> I highly recommend this application for diabetics and their care givers, not only for the quality of the software but the diligent and quick response I had from the Company when I commented about a concern. The application is extremely useful, inputting of data is quick, far better than flipping through log and carb counting books. I have had a chance to utilize the desktop version and must say that it is a far beyond what I had hoped for when choosing this application. The data syncing is easy to set up and transfers seamlessly to and from each device. Reports are clear and easy to export, print and email to Doctors.
>   [E. Scarborough, diabetes-pilot.iapps4you.com, Diabetes Pilot app]

Finally, by way of studying user reviews, we analysed which people or populations make use of these apps. As aforementioned, having Type 1 diabetes is a very complicated experience, "particularly for young people for whom diabetes self-management evolves alongside adaptation to developmental changes in association with individual contextual factors and disease course" (Cooper et al. 2007, 474). The effective treatment of diabetes requires more from a patient than the mere acceptance of the problems the disease causes: it also requires the acquisition of particular skills (Bruni and Rizzi 2013). Essentially, a person diagnosed with diabetes must play a highly active role in the reshaping of his or her daily life, a reality interpreted by men and subjectively meaningful to them as a coherent world (Berger and Luckmann 1966). The changes to daily life which diabetes demands can cause patients' psychological stress or denial or cognitive dissonance about what managing their illness requires:

> Ok, so I was diagnosed about 2yrs ago and I hate: the daily testing (actually have not been testing), the 3 times a year A1C, and everything about diabetes. I am really struggling with what I know I should be doing and what I am not doing.
>   [Practice grandma, diabeticconnect.com Diabetic Connect app]

Another essential aspect of our analysis concerns the use of these forums by the relatives of people with diabetes. In many cases, parents are interested in using technological tools (e.g. apps and forums) in order to help their children in the management of their disease and, more than anything, in having satisfying social lives. In particular, the issue of peer acceptance – notoriously delicate and important during adolescence – is on many relatives' minds.

So, my little sis, age 17, is a super cool person. But she wants to be so normal that she doesn't take care of her diabetes when she is around friends. I have tried so hard to get her to explain to them how important it is or to try to find friends that will understand that she has to take care of it – but unfortunately she refuses. Any suggestions?
[Eggo sis, diabeticconnect.com Diabetic Connect app]

My son use to be like that with his friends, but I sat him down and told him that if he wanted to go place and hang out with his friends then he would have to tell them about his diabetes. At first I think he was scared, scared that they would think that he was weird, but after he told them, they understood and even wanted to know more about it. It is so hard on teenager, because they do not want to be different.
[Frustrated mom, diabeticconnect.com Diabetic Connect app]

Finally, in the same vein, we highlight use of forums by romantic partners of diabetics, and in particular, their curiosity about the disease and starting a relationship with a diabetic:

My boyfriend has type 1 diabetes. He doesn't like taking care of himself when it comes to giving himself insulin. I'm not for sure but most of the I know when he gives himself to much insulin. He gives himself too much a lot and his sugar gets low like 25–30 low and I have to feed him and he never remembers.
[amy12852, diabeticconnect.com Diabetic Connect app]

Hello, I am not sure if this is the right place to ask this type of question, but I really do not have anyone else that I can ask. Me and this girl have shown interest in each other, we haven't really gotten serious […]. Anyway, my concern is that she has type 1 diabetes, I do not really know too much about diabetes, but just what I've been reading over the past days and I am wondering how this will affect our relationship. Will she have tons and tons of health issues, and is it wrong or insensitive of me to think, maybe I do not want to even get started on it, and end it before things start?
[Anonymous diabeticconnect.com Diabetic Connect app]

It has become evident that patients can influence the outcome of their treatment[4] and health care service. Following a phenomenological approach, medicine, illness and health become real symbolic systems with specific functions, and consist of a set of meanings, values and behavioural norms. Patients' autonomy and self-determination in adhering to medical care and treatment plans have been issues much discussed in recent years – not only in pharmacological terms, but also in terms of instructions for

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[4] The concept of compliance becomes a key parameter in the clinical management and evaluation of experimental protocols of medical treatments. The critical factors that influence the level of compliance are the type of disease, the cultural structure of the patient, the physician's role, environmental interference.

the adoption of a lifestyle conducive to making more effective recommended treatment.

5. Interpretation

Through content analysis – of both commercial descriptions and customer reviews – it was possible to identify the potential of these applications, as well as the limits to what they can offer. Although further research is necessary, we outline below the strengths and weaknesses of diabetes apps according to our analyses.

5.1 Strengths

Self-care can surely benefit from the use of health apps. For instance, the continuous monitoring function of interstitial glucose (CGM5), which such technology encourages, can be highly beneficial: according to the Regional Observatory for Innovation in Emilia Romagna (2014, 3), those benefits include "improved glycaemic control, a reduction in hypoglycaemia, and improved measures of physical condition (e.g. weight loss) and quality of life. The improvement in intermediate outcomes should help reduce short and long-term complications". These apps offer a reminder service (alarms), which patients can use to keep track of the tasks they must carry out. Such services are being adopted around the world, especially in the most disadvantaged areas. The Senegalese government, for example, uses mobile technology during Ramadan to improve diabetes management by sending citizens text messages with health tips (e.g. that one should drink 1 litre of water each morning before beginning the day's fast, a list of foods to avoid when breaking a fast in the evening, and information for healthcare providers about medication management during fasts) (WHO 2016).

A second benefit of health apps – following the analysis of Rich and Miah (2014) – is their potential as public pedagogical tools. Indeed, patient education is a crucial component of diabetes management, especially in the case of type 1 diabetes, many of whose patients must learn to manage their disease at a very young age. We can define public pedagogy, in basic terms, as assistance in improving one's self-monitoring offered outside of a formal educational structure (Rich, Miah 2014). The use of health-focused apps may not only may serve a preventive function but may also allow the smoother management of diabetes in the earliest phases of the disease,

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[5] Device that allows to obtain frequent measurements of glycemic level and to rebuild the profile of a diabetic patient's blood sugar level with a time resolution of a few minutes. For further information please refer to the Regional Observatory for Innovation in Emilia Romagna (2014) *Innovative medical devices for the management of diabetes. Updating the short report number 6.*

providing new patients with information and therapeutic services. These technological offerings aid patients in adapting to the new lifestyle that diabetes management requires.

A third benefit of these mobile apps is the reduction of the cost of treatment. According to the National Diabetes Statistics Report (2014, United States), the total costs related to diabetes in 2012 were around 245 billion USD, of which 176 billion USD related to direct medical costs (outpatient and emergency care; inpatient hospital care; medications and medical supplies such as injection devices and self–monitoring consumables; and long–term care), while indirect costs (disability, job loss, premature death) accounted for around 69 billion USD. According to the 2016 report of the Italian Society of Diabetology, the International Diabetes Federation (IDF) has estimated global spending on the prevention and treatment of diabetes and its complications for the year 2015 to be 673 billion USD. Projections for the year 2040 estimate an expenditure of over 802 billion USD, an increase of 20%, in contrast to the substantial stability of the expected population in 2040. In Italy, the total expenditure estimated by the IDF for 2015 amounted to 12 million USD, with an expected growth for 2040 of 14.4% which is slightly smaller than that expected at the European level (18%). The use of these applications could alleviate some of these costs by decreasing visits to the doctor through patients' ability to send metrics about their health via email.

Another positive contribution of these apps is their gamification in gathering data, and the related levels of rewards they offer users.

In several contexts, such as health management, game design involving personal activity monitors is highly promising. Accumulating a large number of points, especially in the first app we analysed, shows a high level of adherence to a treatment plan on the part of the patient. However, incentivizing rewards cannot be considered the sole motivation for boosting intense control. Children's autonomy in managing their diabetes is wrapped up with (factors involved in) their acquisition of wider independence from the parents. This practice, in fact, requires much effort. A patient decides to make diligent use of technological tools in managing his or her disease only once he or she recognizes the centrality of his or her role in effective health management (Lehocki et al. 2012).

Finally, we highlight the power of patient-to-patient influence, considering foremost blood sugar-tracking habits. Interpersonal connections made through social networks or forums that involve the exchange of information may promote healthy practices. Our analysis of forums and customer reviews highlighted that most teenagers affected by diabetes can improve the tracking and management of their health metrics by sharing tips and comments with other patients online.

5.2 Weaknesses

Let us turn to apps' weaknesses. Although most of them include a warning that the information they offer should not be taken as medical advice, it is worth our considering more specifically the potential risks use of these apps may involve. Recorded glucose, food, medication and other data should be verified with healthcare professionals. This is because resultant insulin dose recommendations will be decided based on both contextual and behavioural factors: "the potential for new risks arising from the use of medication apps is suggested by the withdrawals of a small number of products, including an insulin dose calculator developed by a pharmaceutical company, because of clinically relevant errors" (Huckvale 2015, 2). The health market is growing rapidly and several medical apps are designed to make diagnoses; one of the most discussed debates is to what extent these diagnoses can or should be taken seriously by patients. If apps are becoming widely prescribed by doctors, could they replace traditional physical exams meant to diagnose patients? This seems unlikely: the process of diagnosis requires a more nuanced process of cooperation on many actors' parts in the name of achieving precise information about a patient's condition.

At the same time, technological objects and artefacts become constituent elements of the clinical encounter between doctor and patient 2.0 (Bruni and Rizzi 2013). The patient's load is simultaneously lightened (in that he or she can use technological tools to make self-management easier) and burdened (in that considerable pressure accompanies the responsibility of care being transferred from the doctor to the patient).

In fact, it is not easy to establish if these tools can effectively improve the quality of life of patients with chronic illness, or if they are only a shortcut to reducing the operating costs of care services. Innovation potential, however, is high. It is important to establish and keep in mind that these technological tools and telemedicine services can be useful only if patients are highly motivated to manage their disease in an autonomous and conscious way.

Indeed, "by shifting the load of responsibility from the way in which society organizes public life to the way in which individuals organize their own lives, the neoliberal ethos is carrying out a highly depoliticizing operation" (Maturo, Mori and Moretti 2016, 264).

The last drawback of these technologies that we must consider is their social implication. Self-management and quantification through health apps presupposes a social construction of the body as something that is an enterprise, or rather as an 'embodied enterprise', given that the symptoms of a chronic illness are evaluated and categorized digitally. In this sense "medical technologies provided health care providers with effective tools to coerce others into approved, healthy lifestyles" (Timmermans and Berg 2003, 97). Moreover, surveillance practices are often associated with both care and control (Brighenti 2011). This form of self-monitoring can be

shared on social networks, thus overturning the foucauldian panopticon idea: the subject does not want to watch over everyone; rather, he demands to be monitored and evaluated by everyone. Moreover, he wants not only his external behaviour to be monitored and evaluated, but also his mental states and physiological data. New technological tools increase the visibility of relationships between the individual body and the body of the population, and shed light on the way these two bodies form the two poles of the control itself (Brighenti 2011). Intimacy becomes extimacy; surveillance becomes inter-veillance; the panopticon becomes the endopticon (Maturo, Mori and Moretti 2016).

6. Conclusion: An App a Day Keeps the Doctor Away?

It has hard to deny that the growth of technological devices such as apps has created new opportunities for health care and disease management. Moreover, these medical applications increase the amount of low–cost or free information and publicly accessible data about diabetes, facilitating patients' self-management. Alongside these valuable functions, several issues with these tech tools must be noted.

First, in its focus on self-care and self-diagnosis, technology around diabetes plays a large role in the redefinition of the illness; apps and forums like those we have discussed locate the individual patient and his or her identity at the centre of treatment. By way of these apps, self-management of one's disease becomes a playing field of opportunities to reinvent the self: technological devices and services become an integral part of the diabetic lifestyle. In this way, these technology-borne tools seem to aid in satisfying the adoption and management of a new lifestyle required by disease; apps are designed not to force patients to alter their lifestyles (so to adapt to the disease), but rather to make disease-management more adaptable to the lifestyles patients already have.

These turnabout technologies play a crucial role in that they give the patient an additional resource with which to empower him or herself. Nevertheless, focusing on apps as empowering forces in patients' lives diverts attention from the real risks associated with a lack of professional medical care. The doctor, as a mediator between the individual and the disease, should have a central and irreplaceable role in a clinical counter, a role founded on the knowledge he or she possesses and the experience-based expertise that he or she can offer a patient. Still, it may be the case that these apps allow doctors to achieve greater familiarity with their patients; and perhaps the patient's increasing adeptness in self-tracking and new skills in self-management partially erode the boundaries imposed by the professional status of physicians.

Further, the self-management that apps and other technology engender appears to give laypeople more opportunity to monitor their bodies and

health in line with the discourses of healthism and control that pervade contemporary medicine (Lupton and Jutel, 2015). The potential of this innovation to improve self-care is profound. Still, it is important to establish that these technological tools and telemedicine services are useful only if patients are highly motivated to manage their disease in an autonomous and conscious way. The risks associated with simple self-care that is not integrated with other sources of healthcare must be taken into consideration, so to avoid assigning patients disproportionate responsibility for their health and wellness.

In conclusion, our analysis shows that these tools not only promote communication between users in the dimension of patienthood, but also open up a new dialogue between patient and doctor. For the most effective diabetes management, it is important to create a communicative triad of patients, physicians, and caregivers, in which technology facilitates communication, especially about management of the disease. The management of life with the disease affects more than the patient alone. In fact, there are many different actors who should not be overlooked in the creation of new technological tools. This is crucial in the process of ensuring that patient empowerment is more than a mere rhetorical tool for health policies. Health-management technologies must not become an isolated channel through which healthcare enters people's lives: rather, they ought to offer support to patients, so that diabetes (and the challenges it presents) can exist in the background of patients' daily lives.

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Theory within a Policy
Dissecting Capacity Development, Harvesting Knowledge Stances

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Abstract: This essay unpacks capacity development policies, discussing its core rationales and building theory out of its main conceptual assumptions. Capacity development focuses on addressing and improving the elusive terms, qualities and means of 'capacity' needed for lasting development.
The essay addresses the following questions: what are the core rationales of capacity development? What theoretical sources lay within capacity development? Is it possible to distil analytical synthesis from these theoretical sources? It draws upon the understanding of agency as described by capacity development. Its theoretical foundations are extracted and discussed, building a single corpus: the knowledge stance perspective is proposed to observe meso-level agency. It builds on institutional work and innovation intermediation scholarly streams.
The knowledge-stances perspective on agency shows a set of knowledge stances as analytical tools. Stances of boundary exploration, boundary setting and practice work are shown as forms of enacting, positioning and expanding a practice field. Stances of knowledge exploration, intermediation and supply are shown as strategies to enlarge its cognitive base. The theoretical value of this perspective accounts for a twofold purpose. First, addressing the realms of knowledge at stake in meso-level interaction, as a means to deepen conceptual reach on the myriad of discourses currently fostering change. Second, promoting a scope of practice and research that allows framing (capacity) development beyond the project level and the donor-focused scope.

Keywords: capacity development; knowledge stances; critical policy analysis; governance technologies; social change.

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Introduction

This essay discusses a possible STS approach to policy analysis. The argument is built on the Foucauldian assumption that technologies of power are knowable objects (Jessop 2006). Rather than taking the more common critical policy analysis approach developing criticisms of power, this essay builds on policy as a possible ontological state of knowledge (Jasanoff 2004), and experiments on extracting and building from theoretical sources likely rooting policy itself.

Following a backwards-analytical inquiry, the essay unpacks capacity development policies, discussing its core rationales and its main conceptual assumptions. Capacity development performs as an umbrella term in the context of development practice (cf. DAC-OECD 2009). An unstable concept, it focuses on addressing and improving the elusive terms, qualities and means of 'capacity' needed for lasting development. Interestingly, capacity development as a model brings together various aspects in a way not often seen in scholarly work. The expression identifies and describes capacity, mediating both analytical frames and practical experience in its attempt to guide change-oriented agency: agency oriented towards what has recently been labelled as transformative change (Grin et al. 2010).

On the assumption that "there is nothing more practical than a good theory" (Lewin 1951, 169), the essay addresses the following questions. What are the core rationales of capacity development? What theoretical sources lay within capacity development? Is it possible to distil analytical synthesis from these theoretical sources? As a possible answer, the analysis builds on institutional work and innovation intermediation literature to propose a knowledge-stances perspective on agency.

The essay draws specifically upon the understanding of agency as described by capacity development policies. Capacity development is therefore not used here as a source of contents, rather as a knowledge reference (Keller 2011). Relevance of these questions – and the proposed exercise – can be stated at several levels. As a STS scholar approach to policy, these questions pose an example of an inquiry into the ontological status of knowledge in policy. As such, the case has been rarely raised for the case of social sciences. Capacity development is seen in this essay as a performative form of knowledge (Van Egmond and Zeiss 2010) that can be addressed as an object and further analysed. Knowledge stances describe a set of repertoires, gestures that can be played by actors in the attempt of change (as inspired by capacity development).

But there is more to it in what relates to the theory-practice continuum. Because of its context and sectorial challenges, policies related to capacity development attempt to set comprehensive models as means for action. These models bring together knowledge sources and rationales that would be otherwise divided.

However, there is a fundamental shortcoming to it: capacity develop-

ment policies are concerned with development of other actors. Policies are functional to developmental aims, sight focusing only in the counterparts of aid, on those at the other end of the string. As policy development tools, capacity development policies aim at affecting agency of other actors, yet they do not acknowledge the full agency of those issuing the policy, their presence as counterparts. Actors themselves are not visible.

One main assumption of our discussion is that it might be worth exploring the hidden theoretical implications beyond this invisibility. By digging deeper into the theoretical foundations of these policy tools, it should be possible to see how is it that different actors gather around new practices. Moreover, it should be possible to illustrate how embedded institutions and rationales of these actors might affect other parties and the extent (and deeper challenges) that actors might have to face towards the goals of transformative change.

Therefore, this essay focuses on the understanding of agency in capacity development. Capacity development theoretical foundations are extracted and discussed, building a single corpus: knowledge stances are proposed as analytical units to observe meso-level agency. To this effect, we comparatively discuss institutional work and innovation intermediation scholarly streams, arguably the theoretical background of capacity development policies.

The essay is composed of three sections. The first section discusses the context, foundations and overarching rationales of capacity development policies, as enacted by international organizations, NGOs and governments playing in the sector. The second section discusses the scholarly streams that, more or less explicitly, nurture international capacity development thought and practice: institutional work and innovation intermediation. The section also builds on their theoretical overlaps and complementarities, revealing both the shortcomings and potential of practice-laden social scientific work. The third section proposes a comprehensive theoretical synthesis focused on features of meso-level agency.

1. What is Capacity Development?

This section discusses capacity development, following a twofold purpose. First, it aims to deepen our understanding of capacity development as a discursive *dispositif* (Foucault 1972; Keller 2011). Second, it aims to set some points of reference in order to ground theory (Charmaz 2014). Capacity development is discussed as a tool of international development policy. The section describes its background settings, discusses its epistemic status and delves into its (veiled) assumptions.

The various definitions of capacity development originate from the international development sector – and the scholar activity taking part in it. The most influential definitions are given by the United Nations (2008a, PAG???), who define capacity development as: "the process through

which individuals, organizations and societies obtain, strengthen and maintain the capabilities to set and achieve their own development objectives over time". In the World Bank context, Otoo et al. (2009, 3) define the term as: "locally driven process of learning by leaders, coalitions and other agents of change that brings about changes in socio-political, policy-related, and organizational factors to enhance local ownership for and the effectiveness and efficiency of efforts to achieve a development goal". The OECD (2006, 12) defines the concept as: "the ability of people, organisations and society as a whole to manage their affairs successfully". Following a systemic approach, Ubels et al. (2010, 4) define capacity development as: "change processes [in] the ability of a human system to perform, sustain itself and self-renew." Overall, capacity development refers to increasing people-based autonomy deployment.

The tenets behind these definitions can be traced to Sen's and Nussbaum's works on human capabilities. Sen (from economics) and Nussbaum (from ethics and law) proposed seminal insights for the human development framework (Gasper 2003). According to their approach, human beings and social, cultural and environmental sustainability are to be regarded as the priorities for development efforts, where capacities constitute both the means and ends of development. Acknowledging, creating and maintaining capacity is, in this sense, acknowledging, creating and maintaining development (UNDP 2010a). "When we talk about capacity" – says Sen – "what we are ultimately looking for is the capacity of human beings, what they are capable of doing, what they have the freedom to do" (UNDP 2010b). These principles are at the core of the concept's axiological references.

Beyond the realm of discourse, capacity development has brought about institutional change for international development practice. It was used to drive the transformation of technical assistance practices, which with time became also a battleship to bring about changes in international aid architecture, as seen in the various aid summits (Dabelstein 2012). The concept brought to the table alternative approaches, creating a path (e.g. Browne 2002) and scoping and embedding new practices into development agencies (e.g. DAC-OECD 2006; Otoo et al. 2009; UNDP 2008b). Many actors built the term, adding formal networks (e.g. OECD's GOVNET's reference DAC-OECD 2006), informal networks (e.g. LenCD.org 2013) as well as independent consultants (e.g. Morgan 1997).

In the following paragraphs, we will discuss several overarching aspects lying in the background thinking of capacity development. The first relates to the understanding of social learning as a means of social change. The second relates to the levels at which capacity is to be found and nurtured. The third relates to the analytical scope of capacity development, situated at the meso-level. We will finish reflecting on what these rationales entail to the understanding of change agency.

1.1 Theorizing Social Learning as Means of Social Change

Often capacity development texts aim at making sense of social learning as a vehicle for "development" or "social change," unveiling the necessary means to strive for it (e.g. Brinkerhoff and Morgan 2010; Taylor 2007). These texts try to assemble the various pieces of the puzzle, addressing this subject as broadly as possible.

Capacity development texts' understanding of social learning includes the distributed capabilities that would imply the change of individuals, organizations and societies (e.g. Alaerts 2009; Kaspersma 2013; Morgan 2005), but also the role played by more complex social processes, like power, local history and change drivers. DAC-OECD (2006) stresses how: "capacity is not only about skills and procedures; it is also about incentives and governance". Interestingly, this link between the account of distributed capabilities and governance suggests some practical understandings of the cognitive dimension of institutional work (see Lawrence et al. 2013).

Expectedly, capacity development often stresses the importance of the non-material dimension of change. Or, at least, it implies more importance should be given to this aspect as a determinant of change. To specify these realms, Ferreira (2012) introduces the concept of social technologies. Social technologies are: "methods and designs for organizing people in pursuit of a goal or goals" (Beinhocker 2006, 262). According to Beinhocker, social technologies include institutions – in North's sense (1990) – but also include other ingredients, such as structures, roles and cultural norms (Beinhocker 2006).

Examples of social technologies are facilitation methodologies, management practices, electoral systems and rural small market cultures. Changes in social technologies, says Ferreira, suppose dialogues between various local and general knowledges. The use of the plural form for knowledge is deliberate: it implies convergence of multiple sources, rationales and values behind knowledge. These sources would refer to social technologies' components, dimensions or processes. Dialogue between knowledges, it would be expected, creates new ways of understanding and constructing local realities.

Therefore, capacity development assumes that social change is a function of social learning, with change coming about as a result of transformations in individuals, organizations and societies, especially in the realm of social technologies. This is seen through transformations in the ways people organize themselves to go about their circumstances. Expectedly, models adding to capacity development as a reference framework delve into mechanisms of social learning – one could say absorption, learning, and innovation on social technologies – attempting to tackle these complex layers. These models are here means of theory, in the sense that they provide an abstract understanding of the social phenomenon at hand (Abend 2008).

1.2 Identifying and Linking Capacity Levels

Where is capacity to be found according to development practice? We have already mentioned capacity is seen as a feature of individuals and organizations. But capacity is also to be found at less concrete levels, such as in society, the system and/or the enabling environments. Capacity development texts often assume a close interrelation between these levels. Here are some details of this approach.

The notion of an enabling environment describes "the broader system within which individuals and organizations function and one that facilitates or hampers their existence and performance" (Land et al. 2009). In a sense, it describes an aggregation of social technologies, to use Beinhocker's concept. The enabling environment is the changing – trending and/or conflicting – space of encounter between organizations and the cultures it is drawn upon. But it also appears in the multiple forms of institutions: the less tangible "rules of the game" and the formal ones in the form of norms or policies (UNDP 2008b). All these elements constrain or foster change. In spite of the difficulties of effectively addressing this level, it is regarded as a core objective of capacity development efforts.

The organizational level is perceived as functional to the enabling environment level. Therefore, the capacity development framework stresses the organization's effectiveness at delivering on mandates as a core performance criterion (ECDPM 2008; Mentz 1997). From this starting point, various aspects referring to organizational capabilities extend the capacity development literature. The individual level, again, is subordinated to the organizational level. The capacity development approach supposes an evolution from a generic provision of disperse technical assistance and training initiatives to a more systematic understanding of social learning and decision-making, thus to a more strategic role of an individual's potential in organizational contexts (Browne 2003).

1.3 Analytical Scope

Expectedly, capacity development texts do not give an explicit account of their analytical scope. It is possible to infer it, however, by means of its role and settings as a concept. In other words, it answers the questions: what kind of practice does the concept inform and for whom?

As said, capacity development performs at the same time as an embedded tool and a goal of developing practice. It informs policy-making, project management and boundary relations of the many international aid stakeholders and operators. Its regular setting is that of the meso level, defined as the concrete sphere where encounters between diverse organizations take place, the sphere in which, in the interaction of actors in "fields, arenas or games […] social orders […] are constructed and reproduced" (Fligstein 2001, 107). The meso-level comprises the interac-

tions of diverse organizations, whatever their purpose and nature, and the forms of practice and institutional spheres they build in that process. These arrangements play roles at the local, regional, national and international levels.

Capacity development texts attempt to identify and address lasting features of the meso-level. Although its rationale is limited to the project level – in tune with development practice – it is concerned with the building of enabling environments (e.g. DAC-OECD 2006; Otoo et al. 2009; UNDP 2008b): understanding and intentional agency towards sustained governance and institutional depth (e.g. World Bank 2012), is expressed in the design of practical ways to tackle its multiple levels, multiple actors and multiple dimensions (Ubels 2010).

This form of agency, that is, pro-development through interaction at the meso level, is built and suggested by the collection of models informing the framework. These models are often presented as a result of learning processes (e.g. Browne 2003; DAC-OECD 2006; ECDPM 2008). They further inform, guide or frame practice by means of setting guidelines (e.g. UNDP 2008c), assessment of previous experiences (e.g. ECDPM 2008), evaluation criteria (e.g. Otoo et al. 2009), or facilitation references (e.g. JICA Research Institute 2008).

1.4 Change Agents as Means of Governance

Who brings about change? One can infer from capacity development texts that social change can be triggered and led by any actor within society. We have above introduced the World Bank's (2011) definition, coining change agents as: "leaders, groups, coalitions and others that can initiate and drive positive changes towards the achievement of a development goal". In this sense, neither the type of agent nor his or her impact scale is relevant, for developmental value is not exclusively a state matter (DAC-OECD 2011).

The assumption that "any actor can initiate and drive change" suggests a specific understanding of policy and governance. Here we are reminded of Ostrom's definition of an actor being: "a single individual or a group functioning as a corporate actor", and action being those "human behaviors to which the acting individual attaches a subjective and instrumental meaning" (Ostrom 2007, 30). This understanding implies power distribution at multiple levels, including that of the international and non-governmental agencies authoring the framework.

In effect, pursuing 'developmental' value (as any other value) supposes defying (with more or less degrees of antagonism) a certain state of affairs. It is not difficult assuming that such endeavour enacts a purpose, responds to (more or less legitimate and shared) motives, is expressed in a (more or less elaborated) discourse and is (more or less) contested by other actors. Policy, following this thread, is seen (and enacted) by the capacity development framework as the result of a multiple governance

grid (Hupe 2006).

Capacity development texts do not overlook the existence of political struggle in these processes. However, following the rationale of social learning as social change, they emphasize its contents. Or, as Li (1999) has argued, social change is rendered as a technical matter. Change agents, from this perspective, are vehicles of knowledge and institutional entrepreneurs (DiMaggio 1988). They are means for the building of competence, organizational accountability and institutions.

In summary, capacity development texts, scholarly and practice alike, reflect the means by which actors play a governing role at the meso-level. Capacity development is a collection of models, guides, recommendations and reports informing practice, in which models inspired in theoretical sources mix with accounts of experience. As such, capacity development illustrates the inner workings of a governance technology.

2. What is the Epistemic Status of Capacity Development?

What is the reach of capacity development as a reference, which is created in the realm of policy? A brief answer to this question allows understanding the particular approach of capacity development to its object, and therefore its theoretical limits. In the context of this essay, this answer accounts for the reason why digging deeper in capacity development's tenets is needed.

As loosely sketched in the introduction, we argue that capacity development was constructed as a developmental practice-based reference. Various threads come in line with this assumption. First, capacity development knowledgeable sources are practice-based sources. The work by Mosse about how development is cultivated allows interpreting capacity development as a practice-based reference model. Following Mosse, it is likely that capacity development emerged "through critical reflections on practice" providing "'second-order' rationalizations […] helping the way in which […] practice is represented and communicated" (2005, 154).

Capacity development reference documents from international organizations show semi-formal and informal networks playing a role as knowledge reservoirs (e.g. OECD 2006). These reservoirs include all kinds of reference sources. Websites linking to informal networks, such as LenCD.org and Capacity.org, display experiences (cases, editorials, and critical reflections), practice-oriented resources (handbooks, concept notes, toolboxes) or focused peer-to-peer assistance (topic communities). Sometimes they also edit bulletins or journals. These networks are specially focused on Capacity development as a topic. Others, such as km4dev – knowledge management for development – link to practice following practitioners' interest in addressing knowledge in development, focusing on knowledge-related functions, problems or tools, addressed by

and to any setting within the world of development.

Following this thread, the epistemic value of capacity development is shaped by international development cultures to the scope of a model-based, project-sized prescriptive approach. Except for one critical essay (Kühl 2009), scholarly work shares both the scope of practice and the prescriptive approach. Nurtured by the various development fields, scales and functions within development practice, Capacity development plays a role as an umbrella concept (Swierstra and Rip 2007). More a tentative than a mandatory or stable concept, it works as a transversal reference for the sector, set to affect its everyday routines and operative protocols: core documents of capacity development are meant to bring new rationales in-to project design (e.g. World Bank 2012; UNDP 2008c).

2.1 Conceptual Anchors

However, this does not mean the capacity development framework lacks conceptual anchoring. A knowledgeable reader will see that institutional thought is embedded in the approaches of the World Bank, OECD and United Nations. The systemic complex adaptive thinking shapes, more explicitly, the European Center for Development Policy Management – ECDPM approach.

The existence of institutional and systemic thought as theoretical references would allow seeing the capacity development framework as a performative form of knowledge or, as Van Egmond and Zeiss (2010) have suggested in a similar case, a boundary object informing policy. However, scholarly capacity development texts do not delve into these disciplinary fields. They do not give step-by-step accounts of its rationales and assumptions, nor do they discuss any disciplinary research (Alaerts 2009). These texts mostly draw on sources – and their experience – to sketch models that development actors could follow in order to develop the capacity of others.

Scholarly references nurturing these networks are scattered in types of content, purpose and approach. The references somehow resemble practice itself, in the sense of bringing in analytical frames to describe, justify or explain everyday uses. In order to do this, disciplinary sources are adapted or re-contextualized. The texts embed disciplinary explanations as model rationales, in the form of normative references (e.g. Otoo et al. 2009). Innovation studies or knowledge management languages appear often, although their 'natural' settings do not necessarily fit development rationales. Interestingly, the development sector is rapidly acquiring innovation jargon (e.g. Klerkx et al. 2011; Ngwenya and Hagmann 2011).

3. Building Blocks: A Conceptual Discussion

What does the previous account of capacity development unveil? In short, it describes practical means for governance, a detailed illustration of governance agency. As previously said, capacity development embeds a theoretically and practically informed understanding of: i) governance settings, set at the meso-level in interaction with actors; ii) governance layered accounts, specified by capacity levels; iii) governance means, focused on the realm of social learning; and iv) embedding of various disciplinary streams.

3.1 Constructive Means for Theory Grounded in Capacity Development

The overall approach builds on an interpretative reading of capacity development's disciplinary foundations. Arguably, this exercise will open capacity development's black box, informing scholarship from a practice-informed boundary-object model. As such, the exercise illustrates a constructivist effort, sets as an epistemological lens to read policy as well as to deepen the theoretical reflection. We propose this approach as a plausible way of unpacking knowledge within a policy: it means as a *dispositif* (Foucault 1972).

The discussion builds on linking capacity development policies to plausible scholar streams laying on its background. This approach builds on various assumptions. The first is that if capacity development is a performative form of knowledge, there might be some value in unveiling and intertwining core concepts of theoretical sources plausibly inspiring practice. For this, we use literature on institutional work, innovation and learning intermediation, and cognitive studies.

A second assumption sets the specific intersection linking capacity development practice and literature: the focus is set on agency. Capacity development will be understood as a performative form of institutional work and innovation and learning intermediation strategies. Capacity development agency is seen as embedding rationales and repertoires reminding those described by literature.

We will discuss the theoretical sources following two steps. First, we will discuss an overview of the bodies of literature. We will discuss also those layers detailing agency, pointing and nurturing at both complementary and overlapping sets of concepts of each stream relating to one another and possibly to capacity development. This will be the starting point in order to attempt a comprehensive analytical synthesis afterwards: a set of knowledge stances.

3.2 Institutional Work

The notion of institutional work is used to describe "the broad category of purposive action aimed at creating, maintaining and disrupting institutions" (Lawrence and Suddaby 2006, 215), where institutions are understood as "the rules of the game in a society or, more formally, are the humanly devised constraints that shape human interaction" (North 1990, vi).

As a field of study, institutional work interconnects various roots. The first root brings agency to the fore of institutional change. It describes agency as "dependent on cognitive (rather than affective) processes and structures [and] focuses on understanding how actors accomplish the social construction of rules, scripts, schemas and cultural accounts" (2006, 218). This foundation is based on contributions by DiMaggio (1988) and Oliver (1991) on institutional entrepreneurship and institutional processes, respectively. Therefore institutions – and change processes in institutions – are the result of deliberate agency.

A second root of institutional work comes from the so-called practice turn in sociology. Practice draws attention to how institutions are expressed in embodied, incarnated forms. It refers to "embodied, materially mediated arrays of human activity centrally organized around shared practical understanding" (Schatzki, Knorr-Cetina and von Savigny 2001), as quoted by Lawrence and Suddaby (2006, 218).

Practice builds on the assumption that all human action, speech and object embody knowledge (Berger 1991). Here knowledge is enacted (related to the world-at-hand in which knowledge has a domain), incarnated (received and shaped in a human body basis), and intersubjective (a product of human collective nature) (Maturana and Varela 1990). This assertion shares scholarly roots with cognitive science (Varela 2000), sociology of knowledge (Hornidge 2013; Hornidge et al. 2013; Keller 2011), and knowledge management (e.g., Goldkuhl and Röstlinger 2002).

Here the domain of experience is set as a first – given, spontaneous – feature of agency. The domain of experience provides a setting to acknowledge the features of specific actors in their specific contexts. This accounts for the multiple relations of non-tangible human features (e.g. culture, organizational culture, cognition, capabilities, social capital, etc.), as well as their location and multiple possible relations with a materially bounded space and time (Boisier 2006).

This local character is a source of boundaries: practice expresses the social technologies of a local culture at a given time. This token applies to international agencies and grassroots organizations alike: local situations bound practice itself. Inter-organizational exchange, encounter, clash, agreement or compromise at the meso-level can be understood as a feature of practice diversity. We argue that boundary effects of practice show a way towards the understanding of knowledge and governance interaction. Boundary effects of practice also point to the interplay of insti-

tutional settings as means and arenas of power positioning.

Practice is an object of concern of institutional work: practice work, as a form of institutional work, studies "how actors affect the practices that are legitimate within a domain… [focusing] on how practices are created, maintained or disrupted" (Zietsma and Lawrence, 2010, 242).

A third root of institutional work comes from boundary work literature. Boundaries separate practices, organizations, constituencies or stakeholders. Boundary work refers to various forms of agency oriented to "establishing, expanding, reinforcing, or undermining" these borders (Zietsma and Lawrence 2010; Gieryn 1999, 190). When conceptually set as a reference for agency, boundaries allow describing forms of positioning.

In a "within" position, an agent creates ways to "protect autonomy, prestige and control of resources" (Zietsma and Lawrence 2010 quoting Abbott 1988, 194). In a "between" or "outside" position, agency focuses on strategies to create connections. Creating connections is performing as a boundary spanning actor (Bartel 2001; Hargadon and Sutton, 1997) and, going some steps further, aiming at various possible effects at the boundaries. This role might account for managing cross-boundary connections, as Hoppe (2010a) discusses, for science/government interactions in the Netherlands. Or perform, in less collaborative contexts, strategies of boundary breaching, that is, framing and mobilizing resources as strategies to influence opportunity structures (Benford and Snow 2000; Zald and McCarthy, 1987).

A fourth root of institutional work brings to the fore the role of boundary objects. Boundary objects are different kinds of processes or artifacts establishing a shared context between boundaries (Bechky 2003; Carlile 2002; Kellogg et al. 2006; Star and Griesemer 1989). Boundary objects are relevant in the context of capacity development, for shared contexts create room for repertoires of institutional work and practice work. In global development, for example, projects, programs and policies have special interest. Hoppe (2010b), for example, discusses the extent to which such devices perform as the effective means of collaboration in Intergovernmental Panel on Climate Change (IPCC) efforts.

It is evident that capacity development describes forms of institutional work. As such, it is "intelligent, situated institutional action … [which is based on] the creative and knowledgeable work of actors which may or may not achieve its desired ends and which interacts with existing social and technological structures in unintended and unexpected ways" (Lawrence and Suddaby 2006, 219). Capacity development can be read as a (normative) attempt to push forward the cycle of creation, maintenance and disruption of institutional change (Zietsma and Lawrence 2010).

3.3 Learning and Innovation Intermediation

Arguably, in the realm of capacity development the notion of innovation is rather generic. It stands for the incorporation of alternative ways of

thinking, doing and organizing. Its relevance resides more in its change-oriented purpose than in the extent of its originality. We have given here this ampler sense by introducing a learning dimension, as developed by Marcus (1995). Learning and innovation intermediation is understood here as the support of innovation processes between various parties (Howells 2006) that aim to obtain and sustain knowledge-related assets such as skills, competences and/or new knowledges.

Naturally this understanding already bridges learning and innovation intermediation and institutional work literature, the former highlighting an intentional purpose to affect a cognitive dimension. It is evident here that local processes from the parties start in a given context at a given moment, and exchange – at the spatial, organizational, functional or field level – implies shifting, scaling, expanding, recreating or resignifying a field of practice and/or its bounding institutional settings.

'Innovation intermediary' is a key concept in this regard. It is defined as an organization or body that acts as an agent or broker in any aspect of the innovation process between two or more parties (Howells 2006). Such intermediary activities include helping to provide information about potential collaborators; brokering a transaction between two or more parties; acting as a mediator, or go-between, for bodies or organizations that are already collaborating; and helping find advice, funding and support for the innovation outcomes of such collaborations.

Any actor can play the role of an innovator intermediary. It has been noted how public, private or civil actors perform this role (Van Lente 2003). It has also been noted that this role can be performed as a specialized function or as one amongst other activities (Yang et al. 2014). Literature on innovation intermediaries has labelled some agents as systemic intermediaries. A systemic intermediary is an actor that "functions primarily in networks and systems […], primarily operate in the public, public-private, but not exclusively in the private domain and focus on support at a strategic level" (Van Lente 2003, 255).

Innovation intermediation encompasses a wide range of functions. The World Bank (2007) points out how various support activities are as important as knowledge access in innovation processes. Some of these activities relate forms of institutional work, in various aspects. A first aspect, related to norms and standards, includes fostering change in norms, regulations or other regulating practices. A second aspect, related to boundary work, includes activities to find and create connections between various actors and prompting policy changes. A third aspect relates to gatekeeping in networking activities, such as filtering and matchmaking (Kilelu et al. 2011). Some of these boundary activities exceed the realm of searching for innovation opportunity settings. Depending on the context, boundary work relates to strategic positioning of the intermediary. Therefore, boundary work at this level implies also leverage strategies in markets and political arenas. This aspect shows institutional work's manoeuvres played by intermediaries that innovation literature has not yet discussed at length.

Knowledge intermediation describes various forms of engagement within or between knowledge stakeholders. There are two distinguishable streams of literature. One refers to knowledge intermediation, while the other to knowledge brokering. Both describe similar phenomena, with a different emphasis: while literature on knowledge intermediation brings to the fore the theoretical discussion about mediation (Latour 1994) and intermediation (Doganova 2013; Meyer and Kearnes 2013; Schlierf and Meyer 2013), knowledge brokering brings about a descriptive approach on agency repertoires (Schut et al. 2013; Turnhout et al. 2013). This discussion will profit both streams.

A first form of knowledge intermediation repertoires is close to knowledge supply. It involves a clarifying role about the knowledge demand of the user (Turnhout et al. 2013). This role resembles the retrieval phase of knowledge management cycles, focused on "identifying knowledge that is likely to result in the satisfaction of a need or solution to a problem" (Carlile and Rebentisch 2003, 1189), or as Howells (2006) describes it, filtering. Knowledge supply refers an offer-demand relation in which knowledge solutions are provided to a knowledge user either directly (on the assumption the agent has the solution his or herself) or indirectly (appointing suitable sources with a solution) (Turnhout et al. 2013).

Supply should not be associated solely with technical or expert forms of knowledge. Literature also addresses context-related knowledges, such as foresights, forecasting, strategic intelligence and market research (Howells 2006; Kuhlmann 2002). Further, we argue that this knowledge base includes incarnated forms of knowledge: experiencing contact with specific contexts, such as markets, organizations, procedures or fora, is a form of expanding a practice base and prompting forms of boundary work. Which means, in other words, that knowledge supply refers practice itself as a source.

Supply is also performed at other moments, as with legal or technical advice, as means of a support function. In such cases, effects of knowledge supply might have a different impact: although this repertoire can be spontaneously assimilated as a repertoire close to practice, it has a place on boundary work strategies as well.

Another function of innovation intermediation refers to knowledge exploration. It refers generically to practices of knowledge production, accounting for different kinds of knowledge contents and sources nurturing knowledge supply and intermediation. In intermediation processes, it implies knowledge processing, generation and combination. Howells (2006) recognizes two forms of this repertoire: first, a combinatorial form, in which the intermediary helps to combine knowledge; second, a generation and recombination form, in which the in-house result is combined with partner knowledge. There are clear examples at the grassroots level: there are practices of "engaging and supporting actors (farmers, researchers) in participatory knowledge generation through facilitating demand led research or articulating experimental/local knowledge" (Yang et al.,

2014). In its more specialized forms, intermediation supposes forms of translation between domains and facilitation in pursuit of "doable problems" (Fujimura 1987; Latour 1994) within feasible inter-organizational frameworks.

There is also knowledge exploration in the pursuit of joint quests. A salient feature in these cases relates to its effect on boundaries: they tend to blur, or redefine. This phenomenon captures "how knowledge intermediators account for the unpredictability and uncertainty of their practices and activities and the fact that new knowledge and identities arise out of this" (Schlief and Meyer 2013, 435). In other words, knowledge exploration has possible effects both at the innovation and the boundary levels. Doganova describes a distinctive characteristic of exploration as the fact that "the socio-technical collective involved cannot be known ex ante: it is a result of the exploratory process, rather than its point of departure" (2013, 450). Hoppe (2010a) discusses a similar image in a different setting. He raises a case about scientific advice and policy-making in the Netherlands, describing how both advisors and policy-makers to some extent share knowledge production at a given time.

In this sense, a knowledge exploration repertoire could be described as a form of coproduction (Ostrom 1996), and as such, a form of boundary work with a twofold possible outcome. The first possible outcome relates to practice innovation in a specific niche (Geels 2002), affecting practice to some extent (local, sectorial or regime level) by collaborative means. The second outcome relates to describing mechanisms of boundary work as a form of change by engagement in collaborative/explorative settings (Cajaiba-Santana 2014).

Innovation intermediation literature gives texture to the cognitive dimension of capacity development. It adds conceptual richness to the understanding of forms of knowledge circulation, scaling out and scaling up. As a function, it can be attributed to a variety of agents and, most important from the point of view of agency, it describes the deployment of various possible repertoires. This understanding brings about the opportunity to attune the more abstract objects of institutional work with those more concrete objects of learning and innovation intermediation. To the goal of this essay, this adds to the aim of capturing the features of agency as an array of deployed repertoires involving knowledge.

4. A Knowledge Stances Perspective on Meso-level Agency

We discussed institutional work and innovation intermediation streams of literature in the last section. We also reflected deeper on their tenets, pointing at overlapping and complementary features to be found on its foundations. As a whole, the section shows a strong focus on meso-level agency, sketching on its relations to practice, boundaries and institu-

tions. As a result of this analysis we propose here an analytical synthesis, in an attempt to define a set of concepts likely capturing agency as it is illustrated by capacity development.

The synthesis discusses possible repertoires played by actors, labelled here as knowledge stances. Knowledge stances are agency gestures to be found in actors' relations to their contexts. Stances appear here as plausible heuristics allowing a comprehensive view of knowledge flows at the meso-level, pointing at the ways practice, boundaries and institutions might link to one another. By way of synthesis, knowledge stances reduce the complexity of the theoretical discussion to a comprehensive set of meaningful notions.

Agency is here seen as an act of positioning (Downey 1992), describing strategies as adaptive forms of practical coping (Chia and Holt 2006). Agency strategies are, in this sense, a function of agents' relative positions in their contexts. Therefore, knowledge contents feeding these repertoires are context specific and relate to a specific appreciation of institutional and cognitive settings that might be political (Mosse 2005) or calculative (Callon 1998).

The assumption is here that (meso-level-change-oriented) agency describes a variety of repertoires in the pursuit of creating, stabilizing and expanding specific fields of practice, and knowledge stances are useful to specify the agency situations in which these repertoires materialize.

As analytical tools, knowledge stances work as heuristics addressing moments, scopes, situations or performance of the various repertoires taking place in this kind of agency. Stances allow for making distinctions amongst various possible gestures of an actor, as well as pointing to the ways these gestures condition one another.

To add clarity, we will refer to a Colombian example, adding empirical detail to each of the stances. Built as a multi-sited case, the example refers strategies of cocoa producer organizations as change agents. Data was collected in various regions of Colombia (Balanzo 2016).

4.1 Boundary Exploration

Strategies under this category refer to coping strategies linking actors to their peers or to other partners. Simply, boundary exploration summarizes moments of "collaborating", "joining forces", "working together to achieve" or "finding solutions together."

Boundary exploration refers to meso-level collaborative quests, suggesting forms of shared agency where boundaries might blur. Implications of collaborative searches vary for involved agents. Boundary exploration is a form of institutional work aiming to create collaborative opportunities to generate or expand practice fields.

Boundary exploration supposes a form of rescaling the size or reach of the actors by means of collaborating. The scope and depth of rescaling depends on the means and ends of collaboration. Boundary blurring ap-

pears only in forms of shared performance. These grouped forms of agency overlap local, sub-regional, national or international scales and can have effects on any practice field as a whole. This stance is at the base of inter-actor collaboration, at any level, in the search of new institutional arrangements.

A good example appears in producer organizations, where boundary exploration appears in various possible degrees. The first set of strategies relates to partnering to share assets. Physical assets include logistical solutions, distribution channels and storage infrastructure. Some other intangible assets could also be included here, such as information about market conditions and support opportunities, linking to organizations' peer-to-peer technical and non-technical training, and advising. Because of its natural link to knowledge practices it will be detailed later. It is worth noting, however, that peer-to-peer knowledge supply is also a feature of boundary exploration.

Another group of strategies refers to forms of shared performance, namely, networking to access public investment, partnering with third parties and scaling public investment. Unlike the first set, where boundaries are kept except to take better advantage of specific assets, these types describe modes of shared operation, showing repertoires of boundary expansion. This is the case of some clusters of organizations at subregional levels. Shared operation, interestingly, takes place also in some collaborative projects involving enterprises, farmers' organizations and NGOs.

The last set of types relates to boundary exploring as a means to power shared positions, namely, to coordinate positions to negotiate prices (which might entail also partnering to collect cocoa grain), gain sector influence and demand local accountability. Boundary strategies here attempt to supersede disadvantageous boundary situations by means of showing the extent of re-scaled potential. While this might work at the business level to negotiate price, this allows organizations at the sector level to voice their interests in policy-making fora. At the local level this allows organizations to bring topics to the territorial agenda.

Strengthening the network is itself another type of boundary exploration. Which is telling about the place of this strategy in organizations' priorities. In effect, networking aims to be useful for organizations in terms of facilitating economies of scale, optimizing support access and striving to achieve a steering position in the sector.

4.2 Boundary Setting

Boundary setting describes the actor-related and normative contexts bounding an actor's agency, as well as the ongoing actions of an actor towards these contexts. Simply, boundary setting focuses on agency reacting to and coping with the given circumstances in which actors perform vis-à-vis other actors.

Boundary setting can refer to boundary situations, focused on the po-

sition of an actor in relation to other actors, or can refer to boundary conditions, focused on the effects on the actor of norms, rules or regulations. Boundary conditions and situations (are set to, and) bound the extent and means to which organizations can actually interact.

A good example is set in the case of producer organizations. Boundary setting shows differentiated patterns. Some strategies relate to positioning patterns while others relate to protecting patterns. When positioning, organizations are striving to be visible, to highlight their existence and determine the way to go about their business. This can take place in the realm of boundary situations (as in the case of demanding attention from authorities at the local level) or conditions (as in the case of creating a legal persona as a means of existence and representation at the national level).

Some other strategies attempt protecting a space. Drawing boundaries is understood here as a rather defensive move, shielding the organization or its practice base. It is the case with strategies such as assessing risk of partnerships and keeping gates, avoiding local disruption and adjusting terms and conditions of support schemes. The latter also include strategies such as blocking, negotiating and re-formulating.

Organizations deploy protecting strategies to safeguard their boundaries by filtering exogenous input, for example, when public initiatives seem unfit for organizations' priorities or when project terms have been set beforehand. Adjusting terms or blocking initiatives are forms of buffering, or shielding. The organizations take care of their boundaries by deploying means to take place before or after engaging in partnerships, both within and between contracts and projects.

Amongst these, shifting boundaries deserve some attention. This strategy appeared empirically in two situations. First, it appeared as a move to shield the organization from politics by rendering politics a matter of individuals. Afterwards it appeared to shield practice by engaging in projects with contested actors from the sector, despite bitter negotiations taking place at the negotiation table. The strategy speaks for itself on the complexity of social phenomena always at play, and somehow points to further scholar links yet to be made in order to tackle its full extent vis-à-vis, for example, literature on social movements.

It is worth mentioning that the deployment of some of these strategies takes place in markets. In these cases, the boundary strategy employs price as a means of calculative agency (as in the case of local price regulation and quality incentives) or expected return (as in the case of investment schemes).

4.3 Practice Work

Practice work describes those arrays of activity enacting, making possible, sustaining on time and shaping the rationale and values of a practice field. Put more simply, practice work refers to those activities describing how actors 'go about' creating and sustaining a practice field for a long

time. An integrating category, practice work adds texture to the understanding of various knowledge repertoires as means to create, consolidate or disrupt a practice field.

We will give an example to better demarcate this notion: soccer clubs 'go about' their field by means of being voluntary associations, its field expanding by internal and external selection of players and technical directors. Organizations for the promotion of Zen meditation 'go about' their field by means of master-to-disciple teaching and past learners' donations, and its field expands by means of voluntary shared practice and specialization of the apprentices.

We could say then that farmers' organizations go about cocoa business in a different way than other players. Not just in the more evident sense of having a specific place and heft in a value chain, but in the sense of striving to perform in such a way that will secure having a societal impact.

Practice work takes place through different means. The first way is through agency itself, by means of enactment. A set of practices (often starting with a promise) is incorporated in the actions of an organization to engage or develop with a practice field, as is the case when local champions take on breeding cocoa as an alternative and strive to convince others to follow.

Organizations are here a vehicle of exogenous practices entering the local realm. Knowledge is enacted by organizations' own means or by bringing third parties to the table in what constitutes a form of bringing about a role and positioning an identity. It is the case when leaders risk everything to start with a cocoa project out of the blue. Actors' presence comprises here a form of knowledge supply, embedding itself as a culture, a way of doing, and an example of practice. These acts embed or mark an initial or original stance. Arguably, this stance goes hand in hand with the boundary strategy of 'negotiate to exist' as its inner facet.

A second means of practice work refers to intermediation through practice. Here organizations devise ways of sourcing and financing practice itself. In effect, deepening existence of the practice field as an embedded social reality implies accessing, for example, financial resources, technologies and legal advice.

Strategies include creating funding and support opportunities and bypassing level restrictions. This latter strategy refers to organizations' attempts to solve gaps at the local level due to corruption or municipal weakness. It is worth remembering these strategies are played in different fields and therefore require deployment of different protocols. Some are business based, while others are development-project based or politically lobbied. The common feature between them relates to how meso-level endeavours are carried out in order to secure means allowing developing the field of practice.

Organizations look for partnerships or sponsorships making it possible to fund research, training or specialized staffing. Often the process describes some sort of triangulation: A partnership lacks a piece of a puz-

zle and then the organization strives to obtain it. For example, an organization can fund specialized internships in agreement with a university, the logistic costs of expert training or a cocoa quality lab. Organizations deploy these strategies to strengthen the endogenous realm with a long-term rationale, striving to breed the field of practice. Complementary strategies, namely, allocating resources incrementally, informing and including are telling about organizations' aims given a scarce or shifting context.

The last type of practice work refers to normalizing practices. Here, organizations set rules as means to guide and stabilize a field of practice. For example, they can set rules with quality contests, best organizational and developmental practices, or visions attempting to influence local policies.

Some of these strategies, such as setting a market access vision, productive standards or best practices, take place within the sphere of action of organizations. Here organizations aim at developing practice in a specific direction by utilizing these normative devices.

Some other attempts go beyond the immediate sphere of action of organizations, as with organizations' attempts to position a vision to influence policy. Policy is a way organizations stream their visions, values and interests at territorial and sectorial levels. By targeting policy, organizations strive to set a guiding compass in a broader scale, shaping mid-to-long-term planning sceneries of other actors.

4.4 Knowledge Supply

Knowledge supply refers to knowledge delivery complementing other stances. Contents of knowledge supply include local, contextual, technical, expert and/or scientific forms of knowledge. Along with these various forms of knowledge, there are also different knowledge containers, including up-to-date information (e.g. program calls), reports of various kinds (e.g. technical or legal), technologies (e.g. protocols, eventually linking to new objects) and persons. Knowledge supply is a crosscutting stance, performing in boundary exploration, boundary setting and practice work stances.

A good example is set in the case of producer organizations, where knowledge supply has shown to play strategies related to knowledge filtering, allocating and delivery. First, we will refer to knowledge filtering. Here organizations (or their scaled forms) cope with knowledge requirements or gaps and manoeuver to satisfy them. For example, organizations request legal advice to assess possible intermediary legal structures or develop a better understanding of their assets and decide on technological requirements to access specialized marketing niches. Knowledge filtering includes strategies such as clarifying knowledge demands and appointing providers.

The second group of strategies describes knowledge allocation. The term allocation stresses a conscious function of targeting or distributing knowledge means, in various ways. One way, knowledge scaling, focus on

training strategies, assigning at different scales (that is, at member, organizational, node or network levels). Another way, staffing, refers to appointing or shifting the appointment of people and knowledge provisions to other levels, as is the case, for example, with member-sourced provision schemes or the flexible scaling or re-design of organizations based on sub organizational emerging capabilities.

The last group of strategies clusters forms of knowledge delivery. Naturally, delivery stresses the knowledge providing function as such. Strategies such as training, gathering and circulating information, and peer advising are included in this group. Strategies take on specific contents and rationales in each field. In-field technical aspects of seedling breeding, for example, have different vehicles and containers than project management.

4.5 Knowledge Exploration

Knowledge exploration is the process of knowledge unveiling and production. Knowledge exploration includes research, as broadly understood, but also includes facilitating access to unknown contexts and scaling out of tacit knowledges.

The experience of organizations can give nuances to this broad understanding. In their case, some strategies describe repertoires of knowledge unveiling outside the immediate practice field of organizations, namely, performing in other links of the value chain and piloting complementary income sources. Not the original core of organizations' activities, these are understood as forms of expansion by means of relating to complementary fields, often linking to territorial or sectorial scaling strategies.

Other strategies refer to knowledge exploration within the field of practice, which, in other words, refers to its deepening as a field. For example, organizations' attempts to identify and try cocoa genetic materials are by all means their most important asset. Creating, actualizing and retrieving knowledge as strategies relate to a core aim: building a knowledge base for the field of practice, in other words, setting reference foundations to normalize their practice field as cocoa organizations.

4.6 Knowledge Intermediation

Knowledge intermediation refers to forms of knowledge work (that is, knowledge storage, manipulation and delivery) aiming to protect a practice field. Knowledge intermediation describes here creative forms of receiving, filtering and delivering knowledge in the attempt to adequately fit boundary crossroads.

The case of Colombian cocoa organizations adds detail to this broad understanding. Here knowledge intermediation consists of knowledge translation and mediation. The former illustrates attempts to better match

endogenous interests or capabilities with external input, manoeuvring to synchronize paces and priorities, adjusting internal and external languages and providing internal bases to match external standards. The latter strategy, mediation, stresses organizations' conscious design of educative means.

Translation and mediation strategies show organizations' interests in securing mid-to-long-term knowledge provisions, which we referred to before as a keen interest in knowledge sustainability. Evidence also indicates the interest to deliver education in both physical and social technologies, this includes technical productive aspects as well as managerial and personal development knowledge. To this end, organizations partner with actors both from the rural development sector as well as actors within the cocoa value chain.

5. Conclusions

This essay discusses a constructivist theoretical approach to work theoretically from the inner rationales of a policy tool: capacity development. Institutional work and innovation intermediation literature bring insights to understand this purpose. By intertwining them analytically, the article proposes a knowledge-stances perspective on agency as an overarching approach, with a set of knowledge stances as its analytical tools.

To sum up, figure 1 illustrates knowledge stances. Rather than matching one another linearly, stances complement one another. The figure sketches the rough, uneven, adaptive landscape in which developmental agency takes place. Stances of boundary exploration, boundary setting and practice work are shown as forms of enacting, positioning and expanding a practice field, tackling the institutional features of the field. Stances of knowledge exploration, intermediation and supply are shown as strategies to enlarge its cognitive base.

The theoretical value of this perspective accounts for a twofold purpose. First, it addresses the realms of knowledge at stake in meso-level interaction, as a means to prompt further research and inform emerging policy settings, development practice and the myriad of local discourses and initiatives currently fostering change.

Second, it promotes a scope of practice and research that allows framing (capacity) development beyond the project level and the donor-focused scope, which gives a natural reach to the concept as a policy tool. This feature suggests that the epistemic status of the capacity development framework (and therefore its conceptual scope) is but a result of the boundary setting in which it was created.

This theoretical approach is meant as a heuristic tool, and it accounts for phenomena with political and ethical implications. Li (1999) and Mosse (2005) accounts of development projects describe knowledge-intensive forms of disguising contradictory practice, as well as questiona-

ble forms of boundary work with project partners and beneficiaries. It is likely that capacity development in volatile or sensitive contexts prompt 'grey' arrangements as forms of strategic coping with exceptional circumstances. The focus on knowledge stances and a cognitive approach will help tackle explicit as well as implicit forms of institutional work, thus maximizing the impact of diverse agencies tackling the challenges of social change.
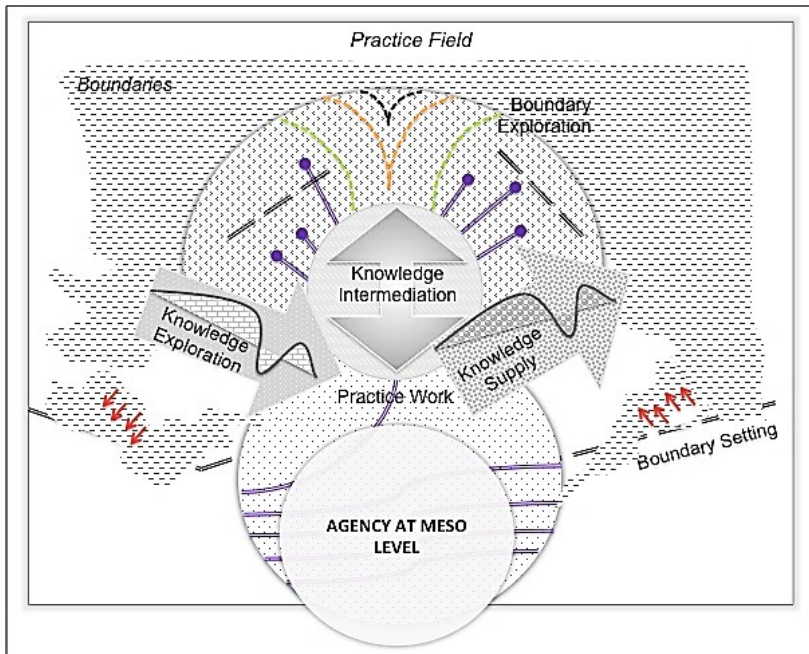

Fig. 1 – Meso-level agency featuring knowledge stances.

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Sociotechnical Environments
Actors, Technologies, Geographies and New Kinds of Action

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Abstract: This section draws from the opening plenary session of the 6th STS Italia Conference "Sociotechnical Environments" (Trento, 24-26 November 2016). The section was dedicated to the topic "Sociotechnical Environments: actors, technologies, geographies and new kinds of action". It is composed by three contributions which articulate different relationships among actors, technologies and sociotechnical environments. Felix Ekardt presents an analysis of the scope of technologies with reference to societal problems, analysing the case of climate change. The idea of sufficiency as leading human behaviour for a sustainable normality drives the author's analysis of the node technology-environments-action. The second contribution by Luigi Pellizzoni is an epistemological travel around possibilities and conditions of an alternative science. Drawing from philosophical and STS literature the author inquires the (not) surprising convergences between critical STS literature and neo-liberal approaches, pointing to the concepts of materiality and materialism, In the third piece of the section Christine Fassert focuses on the node of actors-technologies-geographies through the case of Fukushima contaminated territories. She presents technologies of zoning in their ambivalence towards residents' life and multifaceted consequences of scientific controversies in territorialised risks.

Keywords: Sociotechnical environments; climate change; alternative science; contaminated territories; STS Italia Conference.

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Sociotechnical Environmnents: New Challenges for STS

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This contribution analyzes some new challenges for STS which have increasingly been discussed lately – especially the scope of technological solutions for societal problems and the way we explain human behavior. In the following, the big issue of climate change will serve as an example.

Climate change is an existential problem for human kind, because anthropogenic global warming will threaten food and water supply. It will increase the risk of massive natural disasters potentially triggering huge migration movements and might lead to wars over scarce resources. Consequently, a new global climate agreement was passed by heads of states all over the world in December 2015. While details remain vague and are legally not binding, the overarching target however is clear and binding. The Paris agreement requires limiting global warming to well below 2 °C. According to the Intergovernmental Panel on Climate Change, a 2 °C limit implies for an industrialized country with high per capita emissions such as Germany to reduce their greenhouse gas emissions by 95 % by 2050 in comparison to the commonly used base year of 1990. Furthermore, the Paris agreement aims at pursuing efforts to limit the temperature increase to 1.5° C. A 1.5 °C limit (or a well below 2 °C limit) requires reduction goals to be met considerably faster; this creates the necessity for emerging countries to soon commit to reduction measures as well. Looking at current politics, those targets however are beyond reach in our hemisphere.

Despite the common notion of us being the role model of climate protection, if not of environmental protection as a whole (Moreno, Speich, Chassé and Fuhr 2015), neither Germany nor the EU in terms of either absolute numbers or development pathways correspond to that image. Being a role model is frequently falsely claimed officially and publically. Looking at the development trend since 1990, emissions in Germany have – weeding out calculation errors – by no means decreased by 25 %, as official statistics claim (see ibid.). It is e.g. neglected that many emissions have been transferred abroad – displacement effects since 1990 alone account for more than claimed emission reductions in the EU (concretely in a mainstream economic calculation even almost twice as much – Peters, Minx, Weber and Edenhofer 2011; Hoffmann 2015). In a globalized economy, emission intensive production stages occur in emerging economies, even if the produced wealth goods are used by German consumers. Sometimes, emissions during use are reduced at the cost of higher production emissions (abroad). The alleged success of German toxic substance policy since the 1970s can be deconstructed in a similar manner (neglected e.g. by Fatheuer, Fuhr and Unmüßig 2015; on the empirical evidence Peters, Minx, Weber and Edenhofer 2011; Hoffmann 2015).

Renewable energies and energy efficiency as technical perspectives might by themselves not be enough to meet the above-mentioned global temperature limit. To address various problems associated with the current energy supply system, sufficiency might become necessary. Sufficiency describes in short the idea of a simple life. It stands for a sustainability strategy and a vision for the future. A vision achieved through changing behavior (instead of only technology).

Even though purely technical solutions seem appealing to solve environmental problems such as climate change, they might just not go all the way. New technologies create new markets and employment, whereas behavioral change often means eliminating a good from the market and eventually question an economic model which is based on growth. Also, a purely technical transformation can be more convenient and therefore easier to implement than changing behavioral patterns. There are different aspects however, which speak against exclusive (!) technical problem-solving. This is true for climate change, but even more so regarding other environmental problems. Just to mention some of the relevant aspects:

Firstly, the scope of problems caused e.g. through climate change has to be considered. Taking into account the speed of innovation so far, it seems not very probable that a transformation to increased renewable energies and energy efficiency will globally reduce greenhouse gas emissions to zero by 2030 or 2040. It remains uncertain whether the potential of renewable energies is always estimated correctly by their proponents (see DLR 2006). New findings of resources will merely put off the problem; in case of climate change they even aggravate the situation.

Essential is also that some problems cannot be solved by technology, for example regarding food. The majority of produced emissions in the food sector can be allocated to animal produce. This is because the long chain from animal feed to animal calories leading to human nutrition requires a multitude of plant production (for animal feed) and therefore a multitude of fertilizer, land as well as other emission sources, such as the notorious methane flatulencies of cattle. This can be avoided by reducing consumption of meat and other animal products which does not however imply technical measures, but behavioral change.

This leads to the maybe most important point: in order to sustain living conditions (as well as the economy and to preserve world peace) other environmental problems besides climate change have to be tackled. However, for many of them, technical solutions are much less available than they are for climate change. Key examples are damaged eco-systems and loss of biodiversity, disturbed nitrogen cycles and soil degradation (for more see Ekardt 2016). Solutions will require mankind to retreat from land use and to restrain agricultural production. This implies putting a stop to ever growing personal living space and continuously growing consumption of animal products; likewise it will not be possible to compensate the elimination of mineral fertilizers by constantly expanding land use etc. It will also not be possible to replace all materials used for goods

in wealthy societies with renewable or quasi infinitely available resources (especially since most of them will compete with food production and cause further problems: Ekardt 2016).

Even if all of the points above prove to be wrong, and it would after all prove to be possible to solve climate and other environmental problems purely relying on technology (and ergo with continuous growth here and globally), there is the unsolvable problem that, with continuous growth, we would have to constantly (!) improve technical options. Because then, more than the current level of energy consumption has to be produced. At this point at the latest, the endless spiral is bound to collide with the physically finite nature of this planet – thus the question is less about "if", but rather about "when".

Against this background, it can be said that technical improvements are able to decouple growing prosperity from nature devastation. This however will not be nearly enough and will eventually be exhausted in the above explained manner (Hoffmann 2015; Becker and Richter 2015; missing the point Handrich et al. 2015). The dogma of decoupling, known among economists as Kuznets curve, was not even valid at the point of its invention in the early 20th century. A fact of which even Kuznets was well aware (closer calculated by Piketty 2013). Of course, not only the future in general, but also technical innovation cannot be predicted with certainty. Furthermore, the development of environmental problems, one of which being climate change, are also subject to high uncertainties. Also the scope for action needed is subject to normative discussion, while general objectives such as the far-reaching reduction of greenhouse gas emissions, stabilizing ecosystems, stopping soil degradation etc. have elsewhere been proven to be imperatively necessary (Ekardt 2016). It is therefore possible to determine a tendency that behavioral change has to play a central role. This is by no means exclusively an issue of distribution; it will not nearly suffice if only the rich restrict themselves as becomes evident looking at the figures above.

There is a tension between sufficiency as one (!) part of a sustainability transformation and the dominating political idea of infinite economic growth on a global and occidental level. If, as seen, sufficiency needs to play a crucial part in the sustainability transition, less goods and services will be sold (e.g. less holiday flights). This could, if taken to a considerable scope, lead to an unplanned transition towards a post-growth society, meaning to a society that has to cope without growth or even with degrowth in the long run (Schulz and Bailey 2014). The predicable finite nature of growth is a thus fundamental problem, considering that modern societies are in many ways dependent on economic growth.

After what has been said, sufficiency is probably necessary, but ambivalent in its consequences. At the same time, the finding at the beginning shows that the general enthusiasm for sufficiency is obviously limited (even more so than for new technical options and their comprehensive insertion in the short and middle term). On the other hand it seems that

citizens, politicians, enterprises etc. are quite enthusiastic about non-sustainable behavioral patterns – both individually and collectively – how can that be explained? This leads to the next challenge for STS (which is also relevant for subjects other than sufficiency). There are several competing methods to unravel human behavior and its motivations. Only some of them are promising. This lack of methodology presents – as can only be briefly touched on in this article – a basic problem of social sciences (Kivimaa et al. 2015; Ekardt 2016). It is sometimes forgotten here that not only sociologists, but also economists, cultural scientists, psychologists etc. do behavioral research.

Inquiring after behavior and motivations, i.e. in interviews is confronted with several problems. One obvious problem is that the respondents might not be honest. Other falsifying factors include social desirability, i.e. the wish to please the interviewer, or to remain within social conventions. Also, the way in which questions are asked and the context of a conversation will influence possible answers and might preclude some answers from the start. The latter problems can be minimized by the setting of the interview, even though it will be hardly possible to eliminate them entirely. Other issues are harder to avoid. Especially regarding motivations, but also talking of a variety of every-day behavior, which is relevant for sustainability, is limited by the complexity of its implications and subconsciousness. People are also prone to misconceptions on their behavior and motivations of e.g. denial, cognitive dissonances etc. By the mere act of actively raising a question, behavior and motivation is already potentially considerably reshaped.

These objections are in broad terms also applicable to experiments of game theory and modified formats such as focal groups or real-world laboratories, even if such experiments can in fact be quite informative (largely neglected by Schäpke et al. 2015). Additional problems are that the realization of experiments presents a significant alteration to reality and the translation of generally highly complex realities (regarding set positions and courses of action) that are almost impossible to reflect in a simple experiment, and are also subject to the desire to comply with socially acceptable behavior etc. It is also possible to repeat which is characteristic for experiments in human science. Furthermore, set situations and options for action are in reality tainted with many uncertainties and actors are neither fully aware nor entirely unaware of motivations of others. This cannot be adequately reflected in an experiment setting. The hypothetical character of an experimental situation is also problematic. Because behavior is hard to assess that way, the respective methods have to be complemented by other approaches such as personal observation, i.e. participant observation used primarily in anthropology and religious studies. Characteristic for this method is that no observation setting is specially created, but real-life situations are used to make observations. Self-observation, ethnological or historical material and interpretations which allow for conclusions from human tribal history can be useful as monitoring tool.

Based on these (pluralistic) methodological approaches, it was shown elsewhere that non-sustainable and non-sufficient behavior has various sources in different actors and that it should therefore be avoided to focus relevant aspects on behavioral science only. Pure knowledge of facts has proven to be only a small aspect of triggering behavior. More important is an understanding of how actors are interdependent. The behavior of citizens for example is influenced by politicians and vice versa, the same goes for the dependency between enterprises and consumers. It is part of a certain economic system to constantly acquire customers that buy more and new products without caring about the means of production and that are inclined to find products which are produced socially and ecologically exemplary too expensive. But it also requires enterprises which offer – or in fact do not offer – customers products to trigger needs in order to constantly increase their profits, ergo keeping up the spiral of growth and high resource intensity. It would be misled however to simply talk in Marxian tradition of exploitation and estrangement, particularly since many individual liberties have been achieved in modern societies at the same time (see Ekardt 2016). As suggestive offers to consume might be, production and consumption are not forced by just one side and many individual suppliers and demanders make their contributions[1]. The role of factors – determined by all above mentioned methods – such as self-interest, the dilemma of public goods, path dependencies and conceptions of normality as aspects of motivation in this interaction, especially looking from an economic point of view has been described by many. Two aspects crucial to comprehensively explaining the reluctance to act on sufficiency are however frequently neglected.

One aspect is the common conceptions of normality (see also Deutscher Bundestag 2013; Schützenmeister 2010). Despite all intellectual recognition, we continue living in a high-emission world. After having put aside this article, the next meat buffet, the next car drive to work or the next holiday flight will not be far. These things are just ordinary nowadays, as long as one can afford them financially. Dismissing flights as a whole might lead to social pressure and an image as "weirdo". Lifestyle is also relevant to social standing, if in a current situation the social surrounding requires a certain apartment, cars and travels in order to belong to a certain peer group. This is increasingly true for countries outside the Western hemisphere, which follow the role models in industrialized countries. Especially decision-makers in politics and enterprises are often used to entertaining a lifestyle that includes frequent flights, opulent buffets, global friendships, regular meat consumption, and now they are required to think of abolishing it (with foreseeable results?). Perceptions of normality vary significantly at the moment; however the fact that people

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[1] This is still true if supposed that people nowadays are determined by many very subtle mechanisms in jobs, leisure, romantic relationships, emotions, identities etc., even if this external determination utilizes the illusion of individual autonomy.

develop those perceptions (unconsciously) in order to simplify ordinary activities seems to be a biological invariable.

Human emotions are likewise relevant for all of us, including entrepreneurs, politicians, civil servants etc. (while the different aspects cannot be precisely differentiated; Klöckner 2015; Deutscher Bundestag 2013). Geographically and temporally distant, invisible, and highly complex causalities make it hard to imagine damages due to climate change yet caused by an ordinary activity. Those long-term or long-distant consequences are usually not emotionally accessible to people (citizens, politicians, entrepreneurs). On the other hand, a daily car drive to work and the next holiday flight are here and now allegedly very well visible. Time-space abstraction massively reduces empathy, which is also recognized in experimental psychology, e.g. in the notorious Milgram (1974) experiment and in holocaust research. Additionally, mankind has remarkable talent in emotionally preferring the comfortable, the dwelling in the accustomed, the denial of unpleasant interconnections etc. Another typical component of emissions is a justifying mechanism: others are even worse (SUV drivers, other political parties, other industries). The tendency to increase what is mine (in terms of votes, profits or personal belongings), sometimes even resulting in greediness, also seems to be equally imminent to mankind and can probably be traced back to evolution. The same might be said for the fundamental human pursuit of appreciation from other people, e.g. through "status goods", which also determine ones identity and place in social networks – by thriving for goods which display to myself and others that I am a well-off, nice, open-minded person. This is complemented by other, empirically well founded human inclinations (Stoll-Kleemann et al. 2001; Ekardt 2016) which also turn out to be rather fatal in the context of sustainability and climate change: inability to belief that future catastrophes will happen; notoriously underestimating moderate risks as well as the allegedly "only small" contribution to big, highly complex occurrences; tendency to solve problems with already known measures (which just might have caused the problem); tendency to judge big problems by way of personal experience as well as prominent or dramatic events (leading at times to major distortions); tendency to unrealistically positive perceptions of one's own efforts as well as shifted perception of some maybe less important risks compared to others. Such emotions well documented for the case of climate change; also in focus-group experiments (Stoll-Kleemann et al. 2001).

Whether the listed aspects should be categorized by "individual actions" and "collective structures" is a discourse in behavioral science disciplines and especially in sociology since Weber and Durkheim who thought the opposite. The controversy is however questionable since this would express concrete motivations of people, respectively interacting groups of people, or at least their side-effects and aggregated consequences. All aspects are to be encountered both in the individual and in structures – there of course in human – forms. "Self-interest", "concep-

tions of normality" or "emotions" are not only visible in individuals but are also shaping highly aggregated structures; so in the end, retention of power or accumulation of capital are collectivized variations of self-interest and path dependencies. Those who prefer to identify e.g. "capitalism" as a whole as driver for developments in society fail to clarify the aspect to which they refer. This leads to the here proposed position that it does not make sense to distinguish between "anthropology" and "social theory". At least, if assuming that not every social situation is deliberately broad about by someone. There are unexpected or unintended consequences to actions, and of course, individuals aggregate to structures. Individuals act, as already discussed, by no means always rationally and deliberately[2]. This speech will therefore neither advocate for methodological collectivism, nor for methodological individualism, but will rather assume that this confrontation is empirically inadequate.

Non-sufficient behavior is therefore easy to explain. At the same time, these findings hint at the fact that a fundamental turn towards sustainability and specifically sufficiency might be very hard to achieve, as there is reason to assume that especially emotions are part of a core biological configuration which cannot be eliminated. It will however be essential that different actors will move at once – and that aspects which can be changed are in fact changed, e.g. self-interest calculations or path dependencies, which can be influenced through new political frameworks such as levies or caps on fossil fuels. Pricing will also support a change in conceptions of normality (more in Ekardt 2016). However, because of the interdependencies of actors, it will hardly be possible to achieve change exclusively through political measures. It is of particular importance to have someone demanding new policies not only on the discourse level. The crucial point will be practicing new and more sustainable normalities.

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[2] Explicitly on this Greve (2015), who on p. 26 points out that individual actions cannot be allocated to "collective attributions" alone, because these attributions would again be actions, therefore leading to an infinite regress.

Is Another Science Possible? And Can STS Say Anything About It?

Luigi Pellizzoni

Is another science possible?

Naïve question, possibly. And yet, addressing the issue of sociotechnical environments, new kinds of action and key challenges for STS, I'll venture to say something on that.

Naïve question: science is what it is. If there is one thing that objectivist outlooks share with constructionist and co-productionist ones, it is the assumption that science has its own paths. Not that knowledge acquisition and technology development necessarily follow a predetermined trajectory. Rather, whether the chosen rationale is of ascertaining "givens" on which to intervene or eliciting a "response" from an agential materiality, the result of the process is just that one. As it takes place it rules out any other previous possibility, simultaneously opening a new space of possibilities which would have never been precisely the same if things went differently. Whatever the intricacies of the way research develops and technologies take shape – intricacies which STS has documented admirably – what happens, happens. This conveys a sense of necessity, no matter how much one tells oneself that inevitability appears only in retrospect.

There is another, more specific, reason why there is something compelling about the unfolding of science and technology, which SSK and co-productionist outlooks did not wash away but, if anything, strengthened by showing the embroilment of factors that characterize this unfolding. The reason is what Vicky Kirby depicts as "the extraordinary challenges and perceived success of so much scientific and technological research" (2008, 7). Aircrafts and rockets fly. Computers elaborate information with astonishing quickness. Drugs and surgery techniques become increasingly precise. The success of science and technology exerts an undeniable fascination. It expresses a solidity that overwhelms any fundamental "questioning". This constitutes a challenge for whoever aims to reflect on alternatives to the existent. Browsing STS literature, one realizes that technoscience's overall success, in spite of or even thanks to evidence of failures, is mostly taken as a starting point, very seldom as an object of inquiry.

What does it mean, then, "another" science? And, first of all, why should we think of, or search for, another science? Yes, we know that the case for the unquestionable benefits of innovation, a narrative that from the West has spread in the globalized world, can be and is contested. Yet, contestation usually addresses issues of research choices (such as the

10/90 problem)[3] or of distribution of burdens and advantages, losses and profits, costs and gains of science and technology. Complaints nowadays rarely address their fundamental rationale and attitude towards the world, as it happened with such thinkers as Weber, Adorno or the much maligned Heidegger, whose critical writings have often been regarded as expressions of anti-scientism and technophobia rather than calls for another science and another technology. Even Actor-network theory perspectives make no exception in this regard. Once we realize we have "never been modern" (Latour 1993) and that this mistake enabled an unbridled intermingling with materiality, the ensuing case for a greater intimacy with and concern for the nonhuman world does not necessarily entail any actual change in the basic attitude, opening rather the way to, or legitimizing, technological interventions ever more powerful and invasive precisely as they get more intimate and concerned with matter. The question, in other words, is not intimacy and concern as such, but the spirit of such intimacy and the ultimate goals of such concern. Admittedly, however, this question resonates in recent approaches to the government of science and technology, such as "responsible research and innovation" (or "anticipatory governance"), according to which social actors and innovators should be made "mutually responsive to each other with a view to the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products" (von Schomberg 2013, 63); according to which, in other words, technology has to be inclusively shaped before technological "lock-in" sets in, having regard to both "how" and "why" issues. At least on paper, this sounds as good news, no matter if the basic aim underlying this framework is not redirecting science and technology but addressing people's "resistance" to innovation.

So, the theme of a different science can be not only inappropriate but also untimely. And yet, we find ourselves increasingly immersed in pervasive sociotechnical environments on which we depend for any aspect of our life. We are hit almost daily by worrisome announcements about climate change or energy and water scarcity. We are struck by claims concerning forthcoming technoscientific revolutions capable of fulfilling any possible need (clean energy, healthy food for everyone, personalized answers to diseases or "enhancement" desires, and so on), while dazed by opposed evidence of a decline in the rate of return on investments that the blossoming of ICTs and biotech, a massive reduction in wages and social expenditures, and the spiralling expansion of finance and debt have to some extent been able to conceal but not to reverse. We are confronted with equally dazing calls for "downshifting", "voluntary simplicity"

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[3] The so-called "10/90 problem" concerns the fact that only 10% of health research worldwide is directed towards problems accounting for over 90% of the global burden of disease. In other words, the bulk of research is targeted to the health problems of affluent populations, instead of the more urgent ones of the poorest people in poor nations. On this issue see for example Woodhouse and Sarewitz (2007).

and "communal life", often proclaimed by people who travel around the world to diffuse the new gospel among admiring audiences that, in their turn, live in comfortably warm and well-equipped houses, at close distance from hospitals provided with high-tech facilities. We are confused by ag-biotech industry contentions that what they do is just what humans did for thousands of years, only more competently and precisely, or indeed what nature always did, additional confusion coming from champions of traditions who find nonetheless in genetic interventions a precious support for revamping forgotten plant varieties. We are disconcerted by expert claims of safety, reliability and trustworthiness when compared with (post-accident or side effects manifestation) statements from the same experts about how prediction is limited, scientific knowledge is progressive and hypothetical and the "costs of technology development" are worthy of shouldering – whoever has to shoulder them.

Fascinated and confused, attracted and worried or infuriated by this and much else, Walter Benjamin's image of modernity as an accelerating train on the verge of derailing comes to mind: "Marx said that revolutions are the locomotive of world history. But perhaps things are very different. It may be that revolutions are the act by which the human race travelling in the train applies the emergency brake" (2003, 402). It may even be that the image of a train running faster and faster is not the right one; that a more correct description of the technoscientific present is an engine running idle at growing speed and at constant risk of falling apart. Be that as it may, the question about the possibility of something else, a thoroughly different scientific and technical approach to the world, naïve or rhetoric that it may look, takes a sense of urgency which sounds also as a call to STS engagement.

To address such call, however, STS meets at least two difficulties. The first one has to do precisely with science's success. If science "works" (whatever the defects in its working), why not just trying to make it work "better" (addressing such defects)? And could another science work (better)? Coping with these questions raises a problem that Ian Hacking (2000) has effectively described. The notion of science's success, he notes, verges on tautology. Even the discovery of "fundamental constants of nature", like the velocity of light, is not immune from tautology. Any difference in observation, to count as a difference, is to be achieved within the same conceptual-experimental framework (same assumptions, equipment and tacit knowledge to use such equipment). Yet, if the framework is the same, no difference can emerge; or, if it emerges, it will likely be interpreted as a measurement error. Similarly, it makes little sense to say that an alternative science, to exist, should lead to as good results (for example in terms of yield of foodstuff) as the actual one. If this means that one has to pull off exactly the same specific material results of actual science, "then the alternative is not going to be an alternative" (Hacking 2000, S64).

The challenge, therefore, is to understand how an alternative science and technology can be first of all imagined. The problem bears similarity, but does not totally overlap, with an issue that Alfred Nordmann (2014) has raised in regard to the rationale of anticipation. There is an inherent contradiction, he remarks, in foresight exercises about technology. These seek to go beyond the depiction of "trivial" futures, that is, beyond a mere extrapolation from emergent trends, in order to grasp the possible shape of actual novelty: "black swans", "singularities" or at least "game changers" bound to make the world of tomorrow substantially different from the present. Yet, such "non-trivial" futures cannot be really anticipated, because a radically different world will be "inhabited not only by different technologies but inhabited by different people" (Nordmann 2014, 89). Here the problem is the gap between – borrowing from Niklas Luhmann (1976) – present-futures and future-presents, that is, between a future whose seeds can be discerned now and the future as it will actualize itself as a result of as yet indiscernible forces. The question of "non-triviality" of anticipation bears obvious relevance to the issue of an alternative science. The latter, however, has not just to do with the limits of discernibility and governability of change, but rather with whether and how a radically different path of, and approach to, change can be devised. Figuratively, we should conceive the gap as located not ahead of us but aside. The leap to be imagined is not forward but lateral.

The second difficulty in addressing the issue of alternative science concerns STS's conceptual equipment. Much research and technology development is still carried out according to a traditional objectivist framework, to analyse and criticise which STS has equipped itself, along the years, with increasingly effective instruments. The cutting-edge of STS outlooks can be considered the new materialist, or "ontological", approaches that, in different versions, have gained growing momentum in recent years (Woolgar and Lezaun 2013). Key to this strand is an account of materiality as agential and in constant flux and transformation, of subjectivity as "decentred" and equally "becoming", and of human agency as on a par with (or even lesser than) nonhuman one. This outlook is well synthesised by Annemarie Mol and John Law (2006, 19) when they claim that "knowing, the words of knowing, and texts do not describe a pre-existing world [but] are part of a practice of handling, intervening in, the world and thereby of enacting one of its versions – up to bringing it into being".

This standpoint works fine when the task is to challenge traditional approaches to science and technology, as grounded on binary thinking (nature/culture, mind/body, subject/object, organic/inorganic, animate/inanimate, reality/representation, matter/information, etc.). What happens, however, with cutting-edge research which, from physics to life sciences, from biomedicine to cybernetics, increasingly adopts non-binary

thinking? Should one buy into such science just because of this[4], neglecting in particular that an account of reality as disordered, emergent, constantly changing is key to post-Fordist capitalism and neoliberal governmental approaches? What happens if Friedrich Hayek's plea for market competition as the only efficient mechanism of value allocation, faced with the complexity of the socio-material world, meets Crawford Holling's ecology of disorder, with its celebration of instability and resilience as the only antidote to sclerosis and decline (Walker and Cooper 2011)? And if, whatever the researchers' intentions, science's increasing focus on the extremes rather than the norm meets capitalism's growing demand for flexibility and speed of change (Cooper 2008)? What happens if one finds that hardly distinguishable celebrations of technological transformations of an insubstantial humanity in the context of a dynamic, ever-changing, self-organizing materiality underpin both radical critiques of capitalism such as Rosi Braidotti's (2013) case for the post-human, and resolute restatements of the necessity of capitalism, as Roco and Bainbridge's (2002) case for technology convergence? What happens if the Anthropocene is increasingly taken, rather than a call to a profound change in our approach to the world, as a justification for "post-environmentalist" agendas aimed at an accelerated decoupling of social systems from biophysical systems (Asafu-Adjaye et al. 2015), the ultimate goal of which is "doing without nature", and if non-dualist ontologies underpin "post-natural" accounts of sustainability (Arias-Maldonado 2013) where human exceptionalism re-emerges in terms of agency over an indefinitely pliable materiality?

The convergence of cutting-edge STS with cutting-edge capitalist narratives and neoliberal regulations can be read in different ways. One, inspired to the idea of a "counter-revolutionary" use of notions and claims born with opposite intentions (Virno 1996; Boltanski and Chiapello 2005), maintains that theories of disequilibrium and adaptation have offered since the 1970s a framework for redirecting socio-ecological instability towards a new regime of accumulation (Walker and Cooper 2011; Nelson 2014). From this perspective, current ontologies of becoming are functional to legitimizing (even inspiring, perhaps) the most recent phase of capitalism, as this thrives ever more on unpredictability, turbulence and flux. Another reading, less unidirectional because drawing from Foucault's idea of "problematization"[5], acknowledges that a deep, broad so-

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[4] New materialisms, actually, often build on new technoscientific outlooks on matter and agency, while these often find inspiration in philosophical and social science accounts of reality and (post-)humanity, in a game of cross-influences on which I have elaborated elsewhere (Pellizzoni 2014).

[5] By "problematization" Foucault (e.g. 2001) means a way of conceiving and circumscribing the range of what can be regarded as a problem or a possible answer to such problem that characterizes a historical period, being shared by even opposite epistemic, ethic and political perspectives.

cio-cultural change has begun in the 1970s undergoing a crucial intensification in recent years, but that such process has involved in a tangle of reciprocal influences all social spheres: scientific and economic, political and technological, philosophical and artistic (Pellizzoni 2015).

Whatever the interpretation, the convergence between critical outlooks on, and dominant approaches to, the government of science and technology represents a problem for the endeavour we are discussing, to the extent that it leads cutting-edge STS to linger on criticizing technoscientific conceptions and practices of lessening relevance while adhering too much to emergent ones to be ready to acknowledge that what is assumed to (and could earlier) work as transformative in an emancipatory sense is now often made subservient to exploitative designs.

Does this leave STS helpless faced with the compelling "facticity" of current science and technology? I would not say so. STS has on its side at least three important features that can work as antidotes to the overwhelming power of such facticity: self-reflexivity, theoretical and methodological pluralism, and a capacity to build bridges between the natural sciences and the social sciences and humanities. Indeed, the point is not disavowing any of STS's conceptual equipment and research orientations, but taking care to avoid reproducing what Foucault calls the "analytics of truth", that is the aspiration, profoundly inbuilt in the Western tradition, to get closer and closer to the actual nature of things, to reality "as it is" (no matter, in this sense, if conceived as substantial and stable or differential and endlessly becoming). As I have argued elsewhere (Pellizzoni 2015), it is crucial that – borrowing from Adorno – the non-identity between things and concepts, reality and our apprehension of the world, is always acknowledged and respected.

This basic orientation, I think, is premised on addressing the question of an alternative science. Habermas (1983) once claimed, criticizing Adorno, that "for the sake of removing socially unnecessary repression we cannot do without the exploitation of external nature necessary for life. The concept of a categorically different science and technology is as empty as the idea of reconciliation [with nature] is groundless" (Habermas 1983, 108). In this perspective the exploitation of nature constitutes a universal, culturally invariant imperative for social reproduction. As hinted, the overcoming of dualist thinking does not rule out but rather discloses the possibility of an intensified exploitation. Opposed to this stands Adorno's case (but the same could be said for Heidegger and other supposed technophobes), which is not for a farewell to reason and enlightenment, but for the possibility of a different reason and a different enlightenment – hence, first of all, a different science. D. Bruce Martin, quoting Evelyn Fox Keller (1985), finds an example of this different science in the work of geneticist Barbara McClintock, as based on a respect for difference that impinges upon methodology, concepts and theory development, whereby "the unique or exceptional is not seen simply as an example that proves or disproves a general law, but as an opportunity to

make those exceptions or differences meaningful 'in and of themselves'" (Martin 2006, 148). However, we have to add, a different science entails not only different theories, concepts and methods, but also, and first of all, different goals and criteria of success – capable of avoiding that the usual rationale is reproduced in disguised forms[6].

How to conceive of these different goals and criteria, building on the available array of conceptual and methodological resources? This, to me, is a (perhaps the) core challenge for STS.

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Living in/with Contaminated Territories: an STS Perspective

Christine Fassert

Territorialisation of a *Risk Society*

The "Risk society" described by Ulrich Beck (1986) now 30 years ago has become, for a part of humanity, an enduring and daily experience, which invades all parts of our daily life. Beck referred mainly to the extension of risks that do not stop at national borders, but I refer here to a more territorialised aspect of risks, i.e. to the development and "management" of contaminated territories. The causes of contamination may vary. They may be the result of poor management of industrial waste, as it is the case, for example, in the Marseille region in France. They may also be the consequence of accidents. A series of industrial disasters has led to

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[6] This risk includes non-modern accounts of the embroilment of humans and materiality, if these are regarded as the solution to the problem. Think, for example, of indigenous American outlooks on the gathering together of the human and the non-human, the material and the spiritual. These are the addressees of many hopes as they are seen to underpin new "ontological struggles" against dams, oil drills, mining, deforestation, genetically modified crops – ontological in that they denaturalize Western binaries in favour of perspectives holding that "all beings exist always in relation and never as 'objects' or individuals" (Escobar 2010, 39). One should consider, however, that these "indigenous ontologies" are recent, indeed ongoing, elaborations of traditional cultures (Gudynas 2011), influenced by modern frameworks and understandings. Their "otherness" is therefore spurious: one might just find in them a distorted mirror of Western modernity.

the multiplication of contaminated territories worldwide. More and more people are now living in territories that are durably contaminated by a number of various toxic substances (petrochemicals, chemicals, pesticides, radionuclides). The extension of contaminated territories is part of the development of what Soraya Boudia and Nathalie Jas (2015) name a "toxic world", growing fast while current regulations fail to prevent the development of toxic substances in our modern society, making our world a more and more poisoned one.

Short-term and longer-term management of contaminated territories raise a number of questions: what is the basis for deciding that a territory is contaminated and what is the exact role of science and expertise in the "qualification" process? What are the actual choices of victims for staying or leaving these territories? What are the criteria defining "legitimate" victims? If staying, what may be the sanitary and psychological impact for the inhabitants? A number of research studies in social sciences, amongst which we can cite a few: Fortum, (2001), Centemeri (2015), Frickel (2007), and Kuchinskaya (2014) have explored how these questions are intertwined. The category of "contaminated territories" itself is a construct mixing scientific knowledge, State expertise, policy-making, and environmental activism. The New Political Sociology of Science proposed by Scott Frickel and his colleagues sheds a new light on the importance of power asymmetries, and institutional arrangements around those issues. In the post-Chernobyl situation, Kuchinskaya (2014, 9) uses the concept of "articulation": "the process of defining the scope and character of radiation danger and its actual effects, along with how to make them observable"; she argues that its very possibility often depends on "the existence of adequate infrastructural resources such as information systems and equipment", themselves embedded into institutional arrangements. She shows how some kind of invisibility of a number of health effects was produced after the Chernobyl accident. The resulting assessment of the consequences for health of the accident was indirectly supported by a number of international institutions, while local doctors and researchers grasped an entirely different reality concerning the consequences for the health of the population.

Zoning as a Political and Administrative Tool

Regarding the issue of "making visible/invisible" some risks, I will focus on the territorialisation of radiological contamination, and on its consequences for inhabitants after the Fukushima nuclear accident, drawing on research led these last years with Japanese colleagues[7].

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[7] Reiko Hasegawa (Sciences Po), Rina Kojima, (ENPC) and Masashi Shirabe (Tokyo Tech University). This research led by IRSN focuses of the social and political consequences of the Fukushima nuclear accident, and is based on an extensive field work led these last five years in the Prefecture of Fukushima.

The policy of "zoning" is framed here as a political and administrative tool. In fact, zoning establishes and "reifies" the territorialisation of a risk which is, however, intrinsically difficult to circumscribe spatially and temporally: there are still important uncertainties on a number of aspects of contamination, and amongst others, on the radioecological models that predict the evaluation of long-term contamination in rural areas. Zoning boundaries establish an obligation for people to evacuate but also rights for a financial compensation. In Japan, after the Fukushima accident, these compensations were set up by TEPCO, the operator who caused the accident, following the recommendations made by a special panel of experts under the Ministry of Science and Technology (MEXT). Zoning is, at the same time, a dispositive which excludes from these rights certain persons who can be in a very similar "radiological situation" as those defined as "victims" under the compensation scheme. Zoning traces limits, which simultaneously includes some people and excludes others. In "The Land of Hope", the film maker Sion Sono shows how two neighbouring families, formerly friends, are brutally separated after a nuclear accident, with a border drawn by the zoning between their homes, which defines the forbidden zone and the other where people are allowed to stay.

Zoning and Individualization of Risks

Zoning is a major issue for populations after an accident because it simultaneously defines orders and rights to evacuate through the definition of compensation schemes for the population. It has a strong authoritative and constraining aspect, but it is combined with an insistence on individual choice: inhabitants may choose to return or not in their home villages after the Lift of Evacuation Orders. Moreover, if zoning "reifies" and territorializes risks, some inhabitants, outside of the "risky zone", may feel in danger: 60 000 inhabitants have evacuated the area even though they were not living in the designated evacuated zones. They were voluntary, or "self-evacuees", who made the decision to leave their home village mainly because they felt worried about the radiological situation. Zoning as a policy, and the process of drawing a line between what is "safe" and what is not, are fascinating objects for STS.

Zoning also results in a series of specific situations, which makes the framework more complex than: "risk/evacuated versus no risk/not evacuated". For example, the Watari district of Fukushima city, was said to be, together with the Oonami district, the area most contaminated by radioactive fall-out within the city. The survey conducted by Professor Tomoya Yamauchi (specialist in radiation physics, radioactivity measurement and ion tracks) of Kobe University in September 2011 found that the level of radiation dose in the soil sample collected beside a temple exceeded 40,000Bq/kg and the air-born radiation level was recorded at over 20 μSv/hour at 1cm above the ground and 2.68 μSv/hour at 1m

above[8]. In October 2011, Fukushima city and the government's Nuclear Emergency Response Headquarters organized a meeting with Watari residents who were demanding that "radiation hot spots"[9] be designated within the district thereby assisting the families living in the elevated radiation environment to evacuate from the area. There was a discrepancy between the measures elaborated by the authorities and the measurements conducted by the residents. The government and municipal officials stressed that they would decontaminate the area. As a result, there was no case of evacuation assisted by the government from the Watari district nor Fukushima city as a whole.

What about the concerns of inhabitants in such a situation? Some inhabitants with young children evacuated their town, and others decided to stay. However, the consequences of radiological contamination on health have a slow outset, and cancers may develop after several decades. A father in the Watari district of Fukushima city confessed: "the difficult thing is that we have to wait for years to know whether we made the right decision for our children"[10].

The zones evacuated raise other concerns. After the Fukushima accident, a part of the inhabitants were evacuated and then could not return in their homes. The Mandatory Evacuation Zone established within the prefecture of Fukushima resulted in the evacuation of 110 000 inhabitants. The mayor of one of the evacuated villages, Kawauchi, explained:

"Some old people died before this (evacuation) order was lifted, and said how much they regretted dying without the possibility to come back to their home villages. This was one of the reasons that pushed me to hurry the lifting of the evacuation order"[11].

Indeed, the Japanese authorities took the decision to "recover" the contaminated territories through a programme combining intensive decontamination and revitalisation measures. They promoted a "return" policy, and their overall objective was to lift all the evacuation orders by March 2017, except in some very specific zones (the "difficult to return zone", and the villages of Futaba and Okuma). The mayors of the evacuated towns had the very difficult task of implementing this strong "re-

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[8] Tomoya Yamauchi (Kobe University), Report on the level of radioactive contamination – limit of decontamination in the Watari district, commissioned by Friends of the Earth (NGO), Fukuro-no-kai (NGO) and residents of the Watari district, 20 September 2011.

[9] The radiation hot spots are the spots detected with an air radiation dose of more than 20mSv per year situated outside of the official evacuation zone. Upon the validation of such spots by the local authority, the government designates them as 'specific spots recommended for evacuation' and provides financial assistance to the families living around the spots if they wish to.

[10] Interview R. Hasegawa and C. Fassert. October 2014.

[11] Interview October 2016, R. Hasegawa and C. Fassert, SHINRAI project.

turn" policy while facing the different wishes and specific interests of the inhabitants. For example, by "hurrying" to lift the evacuation order, the mayor of Kawauchi was confronted with another type of criticism, addressed by the inhabitants who were to some extent forced to return[12] to a place where some radiological contamination remained despite decontamination works. The promise, by the authorities, of the return to a radiologically "normal" situation (the 1 mSv/y recommendation of ICRP for so-called "existing situations") was not reached, mainly because in rural areas such as Kawauchi, covered by forests and mountains, contamination is difficult to remove, and even comes back. What does life look like when returning to "still contaminated" villages? With regards to children, the school director explained:

"Well, they live like before the accident, (…) well not exactly like before the accident. Pupils commute to school by bus and do not walk anymore. They are not authorized by their parents to go into the forests, or to swim in rivers like we, as children, used to do before. We were not allowed to do it, but still we did it (laughs). They do not climb trees"[13].

When the evacuation order was lifted, inhabitants were encouraged to return but some of them decided not to return. A majority of families with young children made this decision. Children are indeed more sensitive to ionizing radiation effects. The decision meant that parents had to weigh up the risks at stake, and it could lead to dramatic and engaging questions. A parent of two young children told in an interview[14]:

"On radiation risk, I heard from a friend who had consulted a doctor in Iwaki city, that the effect from radiation exposure could appear 10 years or even 30 years after the exposure. Therefore, even if there is no health problem today, it doesn't mean that there won't be in the future. When I understood this, I decided not to return to Naraha town. Because if one of my children gets sick in the future, I don't want to be in a situation where I wouldn't be able to answer their question: "Mother, why did you choose to return to Naraha when you knew the possible risk?".

The idea that you are accountable to your children for the decisions you made after the nuclear disaster carries a heavy responsibility and a feeling of enormous guilt for many parents. Such heart-breaking thoughts and decisions are also part of the life in contaminated territories. It shows also the ethical dilemma that inhabitants face: some families were separated because the parents did not agree on leaving or not, or on returning or not to their former village.

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[12] This is mainly because one year after the Lift of Evacuation Order, the compensations given to evacuated families will be suspended.

[13] Interview led by C. Fassert and R. Hasegawa. October 2016.

[14] Interview conducted by Rina Kojima. October 2015.

Attachment to Territory and its Limits

In Fukushima, people express very different forms of attachment to their hometowns. In Kawauchi, for example, some senior inhabitants have made the choice to return to their home. They present a common profile: people in their 60s, in good health, who possess a house that has sometimes been a "Family home" for several generations. These inhabitants, after the catastrophe, were evacuated, and most of them moved several times, sheltered by relatives, family or friends, or in dedicated temporary housing built in the aftermath of the accident. In this case, attachment is strongly linked to a set of desirable habits and rituals that form a way of life: a rural way of living (growing your own vegetables, sharing them with the neighbourhood, getting sensai (wild plants) in the forest…). It is also a way of living attached to community links and a strong sense of solidarity in this isolated part of the mountains: "I didn't want to come back if my neighbours didn't; in the mountains, you cannot live on your own" explained one of the senior people we met in an interview.

In her book, *Traverser Tchernobyl*, journalist and essayist Galia Ackerman shows the complexity and sadness of the post-Chernobyl situation, 30 years after the accident. She shows how some inhabitants of the so-called "exclusion zone" were forced to evacuate but they came back, illegally, in their former homes. They are called the "samossioly" and represent a form of resistance to the administrative scheme proposed by the government. Other inhabitants saw their houses destroyed by the authorities, in order to prevent them from returning (Ackerman 2016).

Attachment of people to their hometown is not an absolute rule, it is only a part of the picture. A number of reports and institutional recommendations that claim to "learn from the Fukushima accident" insist on the "dangers of evacuation" and on the need to foster "remediation strategies", supposedly helping people to recover after a nuclear accident. Attachment of inhabitants to their hometown is here essentialised, if not considered as a dogma. This is for example the case in Publication 111 of ICRP (2009) that states: "Worldwide experience following nuclear and non-nuclear accidents shows that neither nations nor individuals are very willing to leave affected areas". Also the reference to resilience spread out in a number of discourses linked to the Fukushima post accidental "management". However, these discourses are underlined by a number of strong assumptions that need to be examined in the light of concrete situations, in order to reveal a more complex reality than this straightforward and unconditional "attachment" notion. First, the case of "self-evacuees" shows that attachment is far from being unconditional. Besides, attachment comes with mixed and contradictory feelings in the nuclear accident victims: resentment against the nuclear operator, feeling of loss, anger, and fear for future and anxiety for health, claims for justice, willingness to "turn the page". No large scale inquiry that allows us to grasp the extent

and solidity of "people attachment" to their living area has been conducted yet. Such an inquiry would allow us to examine, for example, how much attachment to home town may, after a nuclear accident, resist negative effects such as durable radioactive pollution, the need to manage your contamination through a set of "appropriate behaviours", the loss of services, or of employment.

A "Safe" Threshold?

Zoning policies are based on the choice of a threshold which distinguishes the "safe" zones from "unsafe" ones; this threshold becomes an essential element which determines evacuation policies and their related consequences. It is difficult to trace back precisely the criteria which led to the choice of a "20 mSv" threshold in Japan. Authorities have justified their position by insisting on the harmlessness of ionizing radiations at "low doses". They have communicated, from the beginning, a very reassuring view on the dangers of ionizing radiations, advocating that there are almost no risks below the threshold of 100 mSv/year in spite of an enduring controversy on the "low-dose" radiation risk (Fassert 2016).

The Japanese authorities have also insisted on the fact that they have chosen the lowest limit of the values (20 – 100 mSv) established by the International Commission of Radiological Protection (in charge of setting recommendations for radiological protection in normal and accidental situations). In fact, when they set up this threshold, in April 2011, the situation was no more considered as "an emergency situation" in terms of radiological risks. According to the evacuation order issued at the time, the inhabitants could indeed evacuate their homes within the period of one month (e.g. Litate village). The situation could be thus qualified as an "existing situation", where values should be rather chosen between 1 and 20 mSv/y (and not 20-100 mSv/y) (Boilley 2016).

This shows that the selected threshold of 20 mSv/y was not purely drawn from scientific basis but also from other considerations. Simulation tools can indeed tell the scope of possible consequences for the population at any chosen threshold. The French Institute for Nuclear Safety and radioprotection (IRSN) calculated, using these simulation tools, that at the threshold of 10 mSv/year, half of the chosen dose, 70,000 more residents would have had to evacuate, which would have caused an additional financial burden to TEPCO and an economic impact on the region. Furthermore, this would have produced a strong symbolic message of a grave nuclear accident. Yamauchi[15], for example, estimates that such a threshold was precisely chosen in order to avoid evacuating important key cities of the Fukushima prefecture: "Fukushima city is the capital. It was symbolic, you could not evacuate the capital city without recognizing the significance of the consequences of a nuclear catastrophe".

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[15] Interview conducted by R. Hasegawa and C. Fassert, Kobe, May 2016.

The threshold was decided, without addressing the intrinsic uncertainties and controversies on the dangers of low doses with representatives of the affected population[16]. It was decided by the authorities who took into account political, symbolic and economic interests in addition to (controversial) scientific evidence. These aspects have been given little public scrutiny. Moreover, the global strategy based on intensive decontamination and recovery of territories is also a general framework which was not discussed with the population.

Accidents are an opportunity to "deconfine" controversies, and may offer opportunities for "citizen science" to be more visible in the public space, opening debates on radiological measurements and health issues (Kimura 2015). The 20 mSv/year threshold played an important role on this scene and sparked vivid debates and protests. They came mainly from within Japan, but also from the international scene. In Japan, the most spectacular protest was the resignation of a government advisor for radiological protection, Professor Toshiso Kosako, who declared that he could not scientifically nor morally accept the 20mSv/year as the threshold applied also to children. A number of scientists, such as Kodama and Shimazono (University of Tokyo), Koide (University of Kyoto), and Sakiyama, a member of the parliamentary accident investigation commission (NAIIC), also criticized publicly against this threshold. Protests also came from a number of NPO (Greenpeace Japan, Citizens' Commission on Nuclear Energy, in Japan, and, for example, ACRO in France). The Special Rapporteur of United Nations, Anand Grover, also addressed in his report a number of criticisms to the Japanese government for its post accidental policies. His criticism goes beyond the "threshold" controversy. Indeed, Anand Grover discusses the very basis of radioprotection for post accidental situations. He argued: "The ICRP recommendations are based on the principle of optimization and justification, according to which all actions of the Government should be based on maximizing good over harm. Such a risk-benefit analysis is not in consonance with the right to health framework, as it gives precedence to collective interests over individual rights. Under the right to health, the right of every individual has to be protected." (Grover 2012, p. 16). This criticism may result on a reconfiguration of the controversy on "low doses", and on a more fundamental questioning of radioprotection policies in the future.

Conclusion

I will terminate this set of reflections with a methodological plea: contaminated territories and their residents, staying or leaving, demand specific types of research settings which require extensive field work over a long period of time, not restricted to the immediate aftermath of the acci-

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[16] Masashi Shirabe, Tokyo Tech, internal deliverable of SHINRAI project. August 2016.

dent that led to the contamination. Research agendas are more and more guided today by short-term results and concerns. However, the consequences of accidents, and the life in contaminated territories demand long-term involvements of researchers in STS but also in transdisciplinary settings. Ulrich Beck (1986) had predicted "accidents without an end": this calls for a type of involvement that lasts even when the accident is declared "over" in the political discourse.

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A Fragile Field
The Development and Transformation of Science and Technology Studies in Switzerland

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Abstract: This contribution reconstructs the history of Science and Technology Studies in Switzerland. With a focus on the institutional aspects of the field's emergence, it traces early initiatives to foster social research on science and technology, then considers, in more detail, the network building that led to the foundation of the Swiss Association for the Studies of Science, Technology, and Society (STS-CH). It also identifies important sites of STS research in the Swiss academic landscape. This reconstruction reveals characteristics of the field as it emerges such as the late uptake of STS research in Switzerland compared to other European countries, the importance of young researchers and bottom-up initiatives for the building of a relevant academic network, and processes of fragile institutionalization and of de-institutionalization. To conclude, the contribution reflects on the field's (inter)national and (inter)disciplinary configuration.

Keywords: STS; Institutionalization; History; Academic association; Interdisciplinarity; Switzerland.

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Science and Technology Studies (STS) scholars are interested in the ways local settings, cultural contexts, and transnational configurations shape the production and use of science and technology and, at the same time, ask how these contexts and configurations are themselves co-produced and reconfigured by scientific knowledge and technological applications. In perspective of STS, it may thus seem inadequate to focus on the history of an academic field within a *national* context. Nevertheless, national funding institutions and local (actor) networks did play an

important role for the emergence of STS, be it in Switzerland or else-where. In this contribution, we reconstruct the developments of STS within the Swiss context. In doing so, we follow the suggestion "to tell parallel stories of the emergence of STS from other national and regional vantage points" (Jasanoff 2010, 192).

Such an enterprise could inquire into the epistemic culture (Knorr Cetina 1999) or the conceptual approaches of STS researchers, or provide an overview on the topics and debates in STS scholarship – laboratory studies, investigations of the control and environmental or social impact of science, and studies that explore the manifold challenges of biomedicine or nanotechnologies, to name just a few. It could then examine how these topics have been investigated and discussed in the Swiss context. In other words, it could explore the epistemic dimension of the emerging field. While Swiss STS researchers indeed address a heterogeneous set of research topics, our contribution, however, does not trace the thematic orientations but rather focuses on the institutional and inter-disciplinary framings and network developments which have been shaping the field in Switzerland. Building on the claim that STS should inquire into the "local configuration" of new research fields, which would allow "to recover the situated practices and distinctive policies in terms of which new research fields happen to be constituted" (Merz and Sormani 2016, 2), our interest in this contribution is to reconstruct some of these local practices and policies that have been shaping the formation of STS in Switzerland.

The contribution is organized around specific characteristics identified when reconstructing the history of STS as it emerged. We first trace early initiatives from the late 1980s and 1990s before considering, in more detail, how a Swiss-wide network of STS scholars formed and a dedicated STS association came into being. The contribution then proceeds with a sketch of the institutional development and situation of STS at a number of Swiss universities. Finally, we conclude the contribution by reflecting on the field's (inter)national and (inter)disciplinary configuration. Having been actively involved in the long process of building STS in this country (while pursuing our careers outside Switzerland today), this article allows us also to revisit the sites and initiatives of science policy 'from below'[1].

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[1] Both authors have been active in the Swiss STS community. Regula Valérie Burri was the co-president of the Swiss Association for the Studies of Science, Technology, and Society (STS-CH) from 2003 to 2011, and the co-president of the STS research committee of the Swiss Sociological Society from 2001 to 2013. Martina Merz was the co-president of the Swiss Association for the Studies of Science, Technology, and Society (STS-CH) from 2001 to 2012.

1. A Late Beginning

Science and Technology Studies (STS) has been established in several Western countries since the 1970s. In many European countries, academic departments devoted to the study of the social implications of science were founded with the expectation that they provide knowledge and advice to policy makers. However, in Switzerland STS was almost unknown at the time. Two decades later, the engagement with science and technology as a subject of scrutiny in the social sciences and humanities remained scarce. In the mid-1990s, a report on the academic situation of Science Studies commissioned by the Swiss Science Council called the status of the sociology of science in Switzerland "precarious". With the exception of a few researchers at the universities of Lausanne and Bern, the study found no institutional anchoring of research, and concluded that the sociology of science in Switzerland was equipped "extraordinarily poorly" compared to other countries (Heintz and Kiener 1995, 37).

In 1995, the Swiss Federal Institute of Technology (ETH Zurich) established a chair in philosophy of science and science studies. It constituted the first chair in an STS-related area of scholarship in Switzerland[2]. In Lausanne, Bern and Geneva a small number of researchers engaged in research associated with this field, predominantly relying on external funding. Considering these rare institutional initiatives, it does not come as a surprise that the social studies of science and technology did not advance significantly in the years that followed. Helga Nowotny, one of the prominent actors in the development of the field both internationally and nationally, recalls that STS had been adopted only hesitantly in Switzerland (Nowotny 1998).

2. Disciplinary Roots: The Role of Swiss Sociology in the Development of Swiss STS

The slow uptake of STS in the Swiss context was related to the local situation of the sociology of science and the history of science. Both of these important traditions within STS were institutionally weak in Switzerland until the mid-1990s. Nevertheless, within the Swiss Sociological Society, a few researchers took the initiative to create institutional frameworks for conducting studies on the social implications of science and technology. In 1987, a "research committee" (a section of the society) on work and technology was founded in Neuchâtel with the aim to foster research on the role of technology in the structuring of work ("Comité de recherche sur le travail et les techniques", SVPW/SGS 1987, 4). This re-

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[2] Available at http://www.ethistory.ethz.ch/materialien/professoren/resultat.php (retrieved February 14, 2017).

search committee survived just a few years.

In the early 1990s, the *Bulletin* of the sociological association published a call for the foundation of a research committee on information technology and society. The author, Blaise Galland, who was at the time a researcher at EPF Lausanne, pointed to the social importance of information technologies. Comparable to a "macro-social super structure" ("superstructure macro-sociale"), emerging information technologies would create new worlds and shape society: its history, politics, and social interactions (SVPW/SGS 1992, 44). Such impacts, he concluded, should be explored and analysed in sociological research.

Soon after this call, the mentioned research committee was established. In 1993, it organized a European conference on *Computer Science, Communication and Society: A Technical and Cultural Challenge* in Neuchâtel in cooperation with the "Swiss Informaticians Society". This seems to have been one of the first international events on this issue in Switzerland (SVPW/SGS 1993). Nevertheless, the committee was dissolved a few years later.

In April 1995, a third attempt was made to create an institutional setting for research on the social implications of science and technology. Two postgraduate researchers from the universities of Lausanne and Bern, Francesco Panese und Bettina Heintz, initiated a research committee on science, technology, and knowledge ("Sciences, techniques et connaissances – Wissenschafts- und Techniksoziologie"). The two researchers emphasized the central role of science and technology in modern societies and called for the development of analytical tools to understand and handle the societal transformations resultant from science and technology. Such research, they wrote, should inquire into the complex and diversified processes of the production and deployment of science and technology and should examine the involved actors and places (SVPW/SGS 1995).

This committee, finally, turned out to be a booster for the further development of STS in Switzerland. It initiated a variety of activities and cooperated with the science and technology sections of the German and Austrian Sociological Associations at a common congress of the three associations (SVPW/SGS 1999). Members of the committee also published an interdisciplinary collection of articles on STS issues in Switzerland, including policy concerns (Heintz and Nievergelt 1998).

At the same time, researchers of the committee were involved in the large social science research program "Switzerland: Towards the Future". Funded by the Swiss National Science Foundation, the program included a module on "Knowledge Production and Value Change" and provided grants to young researchers (SVPW/SGS 1994; 2000). With funds from this program, two committee members, Bettina Heintz and Bernhard Nievergelt, organized a Spring School with the title *Science and Technology Studies in Switzerland* in 1999. The spring school marked a milestone in the history of the development of Swiss STS.

3. Bottom-Up Initiatives and Young Scholars: The Spring School and its Aftermath

The Spring School took place in Zurich from March 1 to 5, 1999. It brought together a broad range of younger scholars with internationally renowned STS researchers like Susan Leigh Star, Karin Knorr Cetina, Helga Nowotny, Brian Wynne, and Timothy Lenoir. Paul Hoyningen-Huene and Werner Rammert acted as moderators. David Gugerli and Jakob Tanner complemented the Swiss speakers. The Spring School was fundamental for Swiss STS: it assembled the scattered researchers interested in social and historical studies of science and technology into an interdisciplinary community, and inspired many researchers to focus on science and technology issues for the first time.

Young scholars played an important role in this event. Most of the 80 participants were working on either PhD projects or early phase postdoc projects. Shortly prior to the Spring School, Helga Nowotny had remarked that, despite of the lacking institutionalization of STS in Switzerland, there existed young scholars acquainted with the international developments in STS who had shown to be "willing and capable" of participating in these developments "in consideration of the Swiss circumstances" (Nowotny 1998, 10-11, translation by the authors).

Two discussion events dedicated to the further development of STS in Switzerland took place during the Spring School. It had been the explicit objective of the organizers to develop a research agenda for Swiss STS and to create a network of Swiss STS researchers (SPP Zukunft Schweiz 1998). The participants of the discussion events agreed that a network fostering exchange among STS researchers was missing in Switzerland. An informal group formed spontaneously with the aim to explore the option of establishing a Swiss STS association and organize further meetings (see STS-CH Annual Report 2001-2002 and SVPW/SGS 2000). To foster communication among interested researchers Christoph Müller, a member of the organizing sociological research committee, set up a mailing list.

Convened by the aforementioned informal group a first meeting on *New Projects for the Establishment of STS in Switzerland* took place in Bern on January 19, 2000. Young scholars had organized this meeting, and most of the approximately two dozens of attendees were early career researchers in history, sociology, or geography. Only one of the participants was a professor (Lengwiler 2000). During the meeting it was decided to pursue the project of a Swiss STS association, to establish a website and to plan another spring or summer school. For each of these three tasks, a working group was set up[3].

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[3] The working groups' members were as follows: Swiss STS association: Regula Valérie Burri, Christoph Müller, Andrea Scheller, Beate Wilhelm; Website: Bruno Strasser; next Spring/Summer School: Marc Audétat, Alain Kaufmann.

The dynamics and enthusiasm that had characterized the Spring School carried over into 2000, giving rise to further activities. Two workshops organized in Lausanne and Geneva served as a platform for additional networking as well as the discussion of ongoing research. These events were accompanied by a visit to a museum and to the European laboratory for particle physics CERN[4].

Structural issues were an important and ongoing topic of discussion in these meetings. Participants agreed that the sociological research committee, which had organized the Spring School and provided the organizational structure for the later meetings, should serve only as temporary organizational platform for the Swiss STS community. This agreement was based on the variety of disciplinary backgrounds, besides sociology, of the emerging community. An additional reason for reorganization was noted in a review of the Spring School, in which the sociological research committee claimed that the organizational frame of the research committee had been overburdened and that "a discussion on the structure was urgently needed" (SVPW/SGS 2000, 54, translation by the authors). The review suggested that, if the committee would further serve as an organizational structure for the Swiss STS community, it should change its name. When the working group "Swiss STS association" presented a first outline of bylaws during the workshops in Lausanne and Geneva, the attendees agreed that the newly established association should have its own organizational structure.

At the same time, the members of the sociological research committee were "carefully positive" with regards to the further existence of the committee: despite their engagement in the foundation of the new STS association, the committee members advocated the continuation of its activities (SVPW/SGS 2001). The committee received regular funding by the Swiss Sociological Association, which allowed the flexible and easy organization of small-scale events. In 2001, when the long-term president Bettina Heintz resigned, the committee decided to reconstitute itself, and Alain Kaufmann, Bernhard Nievergelt and Regula Valérie Burri were elected as new co-presidents. During the following twelve years, the committee organized a variety of events and activities. These included two visits to the exhibitions *iconoclash* and *Making Things Public* at ZKM in Karlsruhe in 2002 and 2005 as well as two international work-

[4] The workshop in Lausanne took place at EPF Lausanne on April 27, 2000. It was organized by Marc Audétat, Alain Kaufmann and Bernhard Nievergelt and included a presentation of several local initiatives: the recently founded Observatoire Science, Politique et Société, the study program European Studies of Society, Science, and Technology, the Laboratoire d´études sociales des sciences, and IMédia, a local initiative at the University of Lausanne dedicated to the communication between science and society. The workshop at the University of Geneva on October 19-20, 2000 was organized by Martina Merz and Bruno Strasser (see also SVPW/SGS 2001).

shops at the congress of the Swiss Sociological Association in 2003, which discussed the relationships between science, technology, and neoliberalism. Members of the committee also co-organized conferences with the Swiss Academy of Humanities and Social Sciences on topics like "technology research" (2003) and "biomedicine" (2004), and they cooperated selectively with TA-Swiss (Centre for Technology Assessment). Further activities were mostly organized in cooperation with the then founded STS association – many times by identical staff. In 2013, the members of the sociological research committee agreed that it would not make sense to keep up the committee and decided to dissolve it.

The Spring School and the activities following it had all been bottom-up initiatives. They were not initiated by departments or larger institutions but instead were organized by younger academics with little institutional power. The engagement of these researchers finally led to the foundation of the Swiss STS association.

4. Interregionality, Interdisciplinarity, and Internationality: The Foundation and Development of STS-CH

In fall 2000 and early 2001, the preparations for the foundation of the Swiss STS Association advanced. At the mentioned workshop in Geneva, the participants voted on the name of the new association, and opted for "Swiss Association for the Studies of Science, Technology, and Society (STS-CH)". After a further preparatory meeting in Bern in early 2001, the inaugural meeting of the association was convoked. On April 20, 2001, seventeen researchers from Zurich, Lausanne, Bern, Geneva, and St. Gall met in Bern to celebrate the foundation of STS-CH. The bylaws adopted at this meeting listed two main objectives of the association: "information exchange and the building of networks" and "the external representation of interests" by fostering STS activities and research[5].

During this event, the executive council and the presidency were elected. The first council of STS-CH (Marc Audétat, Monika Dommann, Martin Lengwiler, Martina Merz, Christoph Müller, Bruno Strasser, Beate E. Wilhelm) consisted of three postdocs and four doctoral students. The constitution of the council conformed to the members' quest to have all regions and disciplines represented. They considered it very important to have a balance of representatives from the French speaking part (EPF Lausanne, University of Geneva) and the German speaking part (the universities of Bern and Zurich, and ETH Zurich), as well as having both the

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[5] See http://www.sagw.ch/de/sts-ch/Association/mainColumnParagraphs/0/ text_de_files/file0/STS-CH-stat-2001-d.pdf (retrieved February 14, 2017, sections translated by the authors). The following sections rely on the annual reports of STS-CH and on documents in the private archives of the authors.

social science branch and the history branch of STS represented in the council. To guarantee a fair balance, the meeting's attendees also decided to establish a co-presidency, constituted by the historian Martin Lengwiler and the sociologist Martina Merz. The care for such a regionally and disciplinarily distributed council would be characteristic for STS-CH in its later years and remained one important criteria for the organization of activities and the self-understanding of the association until today.

Disciplinary heterogeneity was not only an issue in terms of the organizational structure of STS-CH. More importantly for the members of the association was the genuinely interdisciplinary character of the field of science and technology studies. The association's bylaws thus explicitly mentioned that "STS is not disciplinarily restricted"[6]. Interdisciplinarity was also an issue in the welcoming addresses that had been prepared for the occasion of the inaugural meeting by prominent international STS researchers (such as Geoffrey C. Bowker, Steve Epstein, Bernward Joerges, Karin Knorr Cetina, Ted Porter, Susan Leigh Star, and Steven Shapin). Karin Knorr Cetina, a former president and founding member of the Society for Social Studies of Science (4S), advocated fostering discussion between the disciplines:

> "May the new association stimulate as many intellectual controversies and bloodsheds among its philosophical, historical, sociological and other factions as 4S has done in the past! (...) and may it always insist that its members are simultaneously inside and outside the science, technology and society they study".
> (Welcoming address by Karin Knorr Cetina, April 19, 2001)

This quote underlines that interdisciplinarity was no guarantee for successful communication and cooperation between disciplines. Rather, the STS community would have to continuously struggle for a mutual understanding. In the context of an academic world that was (and still is) predominantly organized in disciplinary structures, as is the case for Swiss universities, it was more difficult to integrate and institutionalize enterprises of that kind.

Another important issue, internationality – i.e. the ways a national STS association should relate to the international community – was addressed by Jakob Tanner, a Zurich based and internationally renowned historian:

> "My advice? STS-CH should write STS in capitals and CH in lower case. Academic research heads toward an open future without any national number plates. Instead, academic curiosity, the ability to amaze, and irritability are needed. Big, sedated explana-

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6 See http://www.sagw.ch/de/sts-ch/Association/mainColumnParagraphs/0/ text_de_files/file0/STS-CH-stat-2001-d.pdf (retrieved February 14, 2017, sections translated by the authors).

tory models should for now be parked. This is how experimental expeditions to new scientific territories come about, and thus emerges the space for the needed search movements and unexpected encounters".
(Welcoming address by Jakob Tanner, April 19, 2001, translation by the authors)

The founding members of STS-CH shared this view. The association's "national number plate" was never meant to foster specifically Swiss research topics but rather pointed to the context in which most activities of STS-CH would take place. From the very beginnings, researchers advocated an international orientation of the association that was in accordance with the international character of science in general, and STS in particular. This orientation was supported by the communication practices of the academics involved in the foundation of the association. Starting with the Spring School in 1999, academics had communicated in English rather than German and French, as it had been mostly the case before. The use of English was meant to prevent researchers from the distinct linguistic regions in Switzerland from teaming-up and excluding persons from the respective other region. Equally important, the establishment of English as the association's official and unofficial communication language allowed researchers from abroad to participate in the activities of STS-CH without language barriers.

In the academic landscape of the Swiss humanities and social sciences the language policy that was adopted had an innovative element. While, for example, the sociological research committees engaged in research on science and technology had been using English mainly in their workshops and conferences, STS-CH was one of the first academic associations that would use English in their official communication as well as in the daily exchanges of members from different language regions.

Since the foundation of STS-CH, its council and its members have initiated and carried out a large number of national and international activities and events. Often these were conceived and organized in cooperation with local teams with the aim of pooling organizational resources, as well as furthering contact across locations. Besides more confined workshops, there were also discussion sessions on topics of both scientific and societal importance and STS-informed guided tours through exhibitions. STS-CH has co-organized four larger international meetings to this day. These so-called Swiss STS Meetings covered a range of topics and took place at the then central locations of STS in Switzerland: *Knowledge in Plural Context* (Lausanne, 2001); *Sites of Knowledge Production* (Basel, 2004); *Science Futures* (Zurich, 2008); *Collecting, Organizing, Trading Big Data* (Lausanne, 2014).

That STS-CH had acquired a good reputation abroad was apparent with the invitation issued by the European Association for the Study of Science and Technology (EASST) to jointly organize one of their biennial

meetings in 2006. The EASST-Meeting 2006 took place in Lausanne, in August, under the title *Reviewing Humanness: Bodies, Technologies and Spaces.* This event marked the moment from which on, without doubt, the Swiss STS community – not only individual researchers or teams – had arrived on the field's international map. In the same year, STS-CH gained further respectability also nationally when the association was accepted as a member of the Swiss Academy of Humanities and Social Sciences. The approval procedure required the association's co-presidents (at the time, Regula Valérie Burri and Martina Merz) to argue convincingly that (a) STS-CH could not be represented by one of the existing, discipline-oriented member societies and that (b) the field, and its association, had a future lying ahead.

In the next section we will move back in time to take a closer look at the debates about and the processes of institutionalizing STS in Switzerland, especially as organizations of higher education are concerned.

5. Institutionalization (and De-institutionalization): STS Centers and Chairs

How STS could be institutionalized has been an important topic of discussion since the beginning of the field's broader introduction in Switzerland in the late 1990s. The question of potential forms of institutionalization would be difficult to answer, according to Helga Nowotny (1998), due to the extant profound structural crisis of universities that seemed to offer little opportunity for experimentation. Nowotny suggested that such instances of crisis lend themselves to transdisciplinary approaches and models "that consciously build on a 'light' and networked form of organization affording the exploitation of all extant personnel and institutional resources" (Nowotny 1998, 10-11, translation by the authors). Such networks should cross the existing disciplinary and institutional boundaries and, in addition, they should not be constrained by boundaries between the academic and extra-academic realms (idem). In these early years, another visionary account proposed the construction of an interdisciplinary centre for Science and Technology Studies in Switzerland (Nievergelt 1998).

Interestingly, science policy actors actively initiated and furthered this debate. To provide an example: the Parliament had commissioned the Swiss Science Council (SSC) to address science studies within its funding period 1992-1995. In this context, the SSC held a closed meeting with the title *Science Studies – Problems and Perspectives* in 1994 and launched a comprehensive review of the field (SWR 1995; Heintz and Kiener 1995). The conclusions note "a consensus that Science Studies is worthy of support, concerning the level of fundamental research as well as teaching" (SWR 1995, 61, translation by the authors). At that time, the office for

technology assessment ("Stelle für Technikfolgenabschätzung", the later TA-SWISS) was in a trial phase under the umbrella of the SSC. Foreign experts, in their evaluation of the TA office, also asserted that Switzerland lacked researchers qualified in conducting social studies of science and technology (Heintz and Nievergelt 1998). Such statements may well have contributed to the positive attitude that science policy actors in Switzerland held towards STS.

The Swiss National Science Foundation (SNSF) also showed a general openness for and interest in science studies, e.g. in the context of the aforementioned Priority Program "Switzerland: Towards the Future". The SNSF supported the field through project funding and by awarding research professorships (SNSF professorships) to scholars with projects in or closely associated with STS (Marcel Weber, Basel; Martina Merz, Lucerne; Valérie November, Lausanne; Monika Dommann, Basel; Marianne Sommer, Zurich and Lucerne). While the SNSF's continuing support played an important role to initiate and sustain research efforts in STS, it nonetheless could not contribute directly to institutionalizing the field at the university level. A first reason was the limited duration of each of the funding initiatives, a second that universities were wary of the SNSF's potential intervention in their strategic decisions, in particular where interventions would impact upon disciplinary configuration (Merz 2009).

At the same time, a number of Swiss universities pursued initiatives with the view to implement STS more strongly, albeit without coordinating their respective projects. As we will show below, the initiatives were adopted at different organizational levels of the universities, combining bottom-up approaches with the top-down implementation of new chairs. Two locations, Zurich and Lausanne, stood out with their long-term engagement in STS and associated areas of scholarship. Each location will be examined in more detail, followed by brief sections on other selected locations' involvement in STS.

5.1 Zurich

At ETH Zurich, philosophers of science Ferdinand Gonseth (chair in mathematics 1929-1960, also dedicated to philosophy of science since 1947) and Paul Feyerabend (chair in philosophy of science 1979-1991) had been active many years before a combined chair for "Philosophy of Science and Science Studies" was established in 1995. First held jointly by Yehuda Elkana (until 1999) and Helga Nowotny (until 2002), this chair, now a chair for Science Studies, has since become an attractive and lively center of considerable standing, of importance especially for the German-language academic community[7]. Together with other chairs at ETH Zur-

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[7] Available at http://www.ethistory.ethz.ch/materialien/professoren/ (retrieved March 1, 2017).

ich, the chair for Science Studies offers an interdisciplinary Masters program in the history and philosophy of science.

In 1997, ETH Zurich established the Collegium Helveticum. Inspired by the interdisciplinary Wissenschaftskolleg in Berlin, this new unit pursued the objective of fostering discussion and cooperation between the natural and technical sciences, on the one hand, and the social sciences and humanities, on the other. Besides ETH professors Adolf Muschg and Iso Camartin, the aforementioned Yehuda Elkana and Helga Nowotny established the Collegium Helveticum as a centre that offered an interdisciplinary fellowship program for doctoral students of different disciplinary origin and a guest program for artists, writers, and scientists. Numerous symposia, workshops, literary readings, and exhibitions brought together scholars from abroad with the local team and engaged the sciences in dialogue with the public[8]. Right from the beginning, central approaches and themes of STS constituted important topics of debate and enriched inter- and transdisciplinary exchange. In the years following 1998 – the year Helga Nowotny took over as head –, the Collegium Helveticum developed into the central location for STS in Switzerland. It continues to be a centre for reflection and debate about science and its relation with society also under its new bi-institutional roof of both ETH Zurich and University of Zurich since 2004.

In 2005, the University of Zurich and ETH Zurich founded the Center History of Knowledge as a joint centre of competence with the objective of fostering and coordinating research and teaching in historical, philosophical and cultural studies perspective on modern knowledge systems and knowledge societies. The centre has become the largest institution in Switzerland that addresses topics associated with Science and Technology Studies within perspectives of the humanities, such as, in particular, history. It also hosts a doctoral program on the history of knowledge, which is supported by the Swiss University Conference[9].

In 2014, the new Center for Higher Education and Science Studies took up work at the University of Zurich with the objective of conducting research and performing advisory functions.

Next to these centres, the professorship of history of technology at ETH Zurich, a chair in the history department of the University of Zurich, and, more recently, the chair of popular culture at the University of Zurich have become important locations in which STS research is being carried out.

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[8] See also Nievergelt (1998).

[9] Available at http://www.zgw.ethz.ch/de/doktoratsprogramm.html (retrieved March 6, 2017).

5.2 Lausanne

Lausanne is the other Swiss location in which activities in STS go back to the early 1990s. First initiatives in research and teaching were primarily undertaken by younger scholars. For example, an organizational unit at EPF Lausanne was involved in setting up the international Master's program European Studies of Society, Science, and Technology and participated in the program when the first cohort started in 1993[10]. This international study program connected (and still connects) students and teaching staff at selected universities in a number of European countries. Through the continuing engagement of scholars at EPF Lausanne and the University of Lausanne, first steps toward institutionalizing STS were undertaken. A success in this respect was the establishment of an assistant professorship in sociology of science and technology at the University of Lausanne in the year 2000.

The year 1999 saw the founding of the Observatoire Science, Politique et Société at EPF Lausanne which, in its activities, focused primarily on higher education research and its boundary areas with STS. In 2005, the Observatoire was transferred to the University of Lausanne where it became integrated into its Faculty of Social and Political Sciences. In this Faculty a chair for social studies of science and technology was established in 2011. Since 2016, the Faculty's STS scholars meet regularly in the context of the newly created STSLab: a research unit that gathers almost a hundred regular members, doctoral students and associates[11].

With its two universities, Lausanne is today amongst the most dynamic sites in Switzerland for STS research, especially in its social scientific orientation. The local community of STS scholars is well connected internally and is also closely associated with other fields of research and activity. These connections have afforded new profiles for positions. For example, the aforementioned assistant professorship established in the year 2000 was transformed, in 2008, into a full professorship held jointly by the Faculty of Biology and Medicine and the Faculty of Social and Political Sciences. In Lausanne, a social science and humanities perspective on medical research is well established, encompassing the history of medicine and public health. To mention another example, it was again those scholars who had engaged in fostering STS early on who took the initiative to found the Interface Sciences – Société. This is a platform promoting and organizing dialogue between science and the public that offers an institutional home for science mediators and researchers alike for more than fifteen years.

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[10] https://prezi.com/xhdhvcb0rbx7/esst-timeline/ (retrieved March 6, 2017).
[11] https://www.unil.ch/stslab/en/home.html (retrieved March 6, 2017).

5.3 Further Locations

A number of other locations developed activities in STS that were more closely aligned with particular research fields. For more than a decade, for example, *Basel* had been an important location for STS, especially for the sociology of science and knowledge. A professorship for Science Studies was established in 2001. However, after the professor left the university to take up a position abroad in 2013, the Rectorate closed down this unique centre for the social studies of science and technology at a university in German-speaking Switzerland. Since then, research and teaching associated with STS, in particular history of science, have been located primarily at the university's Department of History.

At the *University of Geneva*, since the early 2000s, it was a small number of scholars associated with the history of medicine that undertook activities in the field of STS. While STS has not become strongly institutionalized at this university so far, considerable research activity exists with a focus on biology and medicine. Two professorships have been of importance in this context: a chair of philosophy of science and a chair of science education and history of science.

At the *University of Lucerne*, founded as a modern higher education institution in the year 2000, research and teaching associated with science studies first took place in the Department of Sociology. A promising perspective for the future emerged only with the establishment of a chair for Science Studies in 2010. A year later, the chair holder together with the newly appointed professor for cultural studies (who happened to be a science studies scholar) founded the Department of Cultural and Science Studies. As of late, STS activities in Lucerne have taken up momentum; similar to the situation in Zurich, however, social science scholarship that addresses science and technology is still limited.

In addition to these locations, the chair of social and cultural geography at the University of Neuchâtel and some dispersed researchers at other Swiss universities, including universities of applied sciences, have engaged in STS research.

In summary, the current situation of STS in Switzerland is one of ambivalence (see also below). While the Zurich and the Lausanne contexts have succeeded in institutionalizing STS by way of dedicated professorships and the bundling of activities in centres, the situation looks quite different in other locations. In particular, the closing of the STS chair in Basel points to a de-institutionalization of the field, which had taken up considerable momentum locally to the benefit of STS in Switzerland more generally.

6. Conclusion

Our reconstruction of the history of STS in Switzerland has revealed several characteristics of the emergence of the field: a late uptake of STS research in both academic and institutional terms; the importance of one discipline, sociology, as a driver for the building of an STS network in its early stage; the engagement of young academics in organizing events and fostering the dialog bottom-up; the involvement of different language regions and academic disciplines in such activities; the orientation towards the international STS community; and, finally, processes of fragile institutionalization (and de-institutionalization).

In our concluding reflections, we will revisit two related themes. *First*, from the literature on the development of new research fields or disciplines it is known that institutionalization involves different levels and processes: in particular, the establishment of journals, associations, chairs, and degree programs (e.g. Heilbron 2004). The fact that STS was no longer a novel research field internationally when its development finally took off in Switzerland left its mark on how it evolved in this country. Initiatives at the *national* level, such as STS-CH, were geared toward the international state of the field and its international scientific community right from the beginning. "CH" indeed remained written in lower case (as a welcoming address had suggested, see above). No serious attempt was undertaken to create a separate epistemic space for "Swiss" STS in the form of, e.g., a journal. While also selected initiatives at Swiss universities closely cooperated or aligned with developments abroad (e.g. the early participation of EPF Lausanne in constructing a European Master's program in STS), the establishment of dedicated university positions and centres, however, depended more strongly on *local* particularities. Academic positions in STS have remained a scarce resource until today. In many cases, STS activities are undertaken either 'undercover' (i.e. under the denomination of another field) or in the context of positions that associate STS with other areas of scholarship. This scarcity of dedicated positions may be one of the reasons why the two Swiss locations in which STS is best institutionalized today are those in which two universities (a cantonal university and a Federal Institute of Technology) coexist: Zurich and Lausanne. The richer institutional milieus of such co-habitation may offer more opportunities for bottom-up initiatives to create chairs, centres, or degree programs and provide more options to reassemble local networks and resources to the benefit of a still fragile field like STS.

A *second* issue of interest pertains to the disciplinary configurations of STS in Switzerland. We again observe two separate trends when comparing the national level of the Swiss-wide association and the local, departmental level. STS-CH was founded deliberately to engage with STS in its broadest sense: involving scholarship from the full spectrum of disciplines as well as transdisciplinary activity. In contrast, individual centres and departments in many cases reproduce the organizational separation that

has also gained traction internationally: that between STS in a narrow sense (associated with the social sciences only) and its counterpart in the humanities, in particular the history of science, technology, and knowledge. When we take into consideration this distinction, the Swiss landscape of Science and Technology Studies shows a more nuanced picture than presented in our brief summary above. In Zurich, the cultural studies and humanist orientation of STS is particularly well established. With the Center History of Knowledge, and its broad spectrum of scholarship in the humanities, Zurich has become the most visible and important location for the history and philosophy of science in Switzerland. In contrast, as far as the social science orientation of STS is concerned, only the Lausanne context has succeeded in institutionalizing the field by way of professorships and the bundling of activities within the STSLab. The situation of STS in other locations keeps evolving, in varying directions. The fragility of STS in Switzerland is thus not only a feature of limited resources (personnel and other) but also of the unpredictability and contingent nature of its development.

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Bioinsecurities: Disease Interventions, Empire, and the Government of
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The book cover of *Bioinsecurities* arouses the curiosity of the reader with an exceptional black and white picture of a lonely rhesus macaque, in an introspective emotional state, in the midst of an undulating sea. It was one of the 409 monkeys that the US brought from India to Puerto Rico in the 1930s to start the first colony of free-ranging rhesus macaques in US-occupied territories for biomedical research on poliomyelitis. The image is troubling, perplexing and surprising. It condenses the kind of evidence and interspecies relations Neel Ahuja is interested in – visual and literary materials showing the entanglement of human, animal, bacterial and viral bodies in the US project of imperial expansion over the course of the long twentieth century (1870 – present). Ahuja's interdisciplinary work combines methodological approaches that are, for the most part, rooted in historiography and cultural studies, paying as much attention to archival materials as to photographs, films and literary works.

Through historical accounts of state intervention episodes involving interspecies contact, disease, and medical technologies, *Bioinsecurities* provides a genealogical understanding of the ways in which the US, as an

imperialistic machine, has sought to expand its dominance and control not only over territories and economies but also over varied domains of life. Based on this distinctive interspecies – bodily and material – approach to the history of US empire history, Neel Ahuja argues that disease interventions over interspecies relations have been crucial for the imperial project of US economic, territorial and military expansion, and also for the production of inequality in the distribution of life and death across the planet.

Two concepts are transversal to Ahuja's book and his overall argument. The *government of species* is the term he uses to refer to the ways in which "empire takes on life as a field of potential intervention" (p. 11). It is a double-way concept that comprises not only the modernizing – and more conventional – perspective that sees science and medicine as technologies used by states to control and dominate disease and human and non-human lives. This concept also encompasses the multiple ways in which species "govern the normatively anthropomorphized space of politics" (p. 11) and successfully challenge human-made dreams of species extermination and disease eradication. *Dread life* is the second concept Ahuja has crafted in order to capture the racialization of disease and contagion and the fears and anxieties towards foreign black and brown bodies as a means to channel optimism towards life-enabling medical technologies and state interventions.

Each of the five chapters of the book tackles one disease intervention, at a certain moment of US twentieth-century history, dictated by a specific racialization process of contagion, infectious risk and deviant behaviours through their association to foreign – constructed as alien, feared and even monstrous – populations and environments. The first two chapters provide examples of state interventions in US-occupied territories that employed spatial technologies, such as quarantine and incarceration, to disrupt interspecies contacts between settler bodies and viral and bacterial contagions. The first one explores the segregation of Hawaiians affected by Hansen's disease (leprosy) at a time when Hawaii's annexation to the US was at the centre of a polemic debate. The second chapter delves into the high incidence of venereal diseases among US soldiers deployed at the Panamá Canal Zone during the two world wars. It discusses the offensive strategy against Panamanian women who came to embody the threat of gonorrhoea and syphilis to the vulnerable bodies of white servicemen, with innate and uncontainable sexual desires, making women targets of criminalization, incarceration, forced medicalization and surveillance.

The third chapter moves away from the classic spatial battles of public health to one against infectious diseases by means of pharmaceuticals. Here, what matters is the management of time rather than space through the introduction of technologies used before (vaccines) or during the infection (antibiotics) to tackle the risk of bacterial and viral contact. This

strategy is explored through the importation of rhesus macaques from India to Puerto Rico and the use of these and other primates' bodies as "almost-but-not-quite-human models for testing drug safety and efficacy" (p. 20). This is, in my view, the chapter where the concept of *dread life* is at its most graspable state in Ahuja's work. Thinking along these conceptual lines, the author shows how primate trade and subsequent domestication in US-based institutionalized settings raised fears and concerns about human/animal and first/third-world contacts that were gradually appeased by fashioning primates into national subjects, "almost, but not quite, humans" (p. 117). The extraction of primates from (neo)colonialized regions and their exploitation as strategic resources for biomedical research made primates into *dread life*, provoking – ambiguously and simultaneously – anxiety towards their foreign bodies and optimism about their nationalization process and their use in the development of biomedical technologies. Ahuja argues that this episode in the history of the government of species was key in achieving public embracement and acceptance of biomedical interventions.

The fourth chapter of *Bioinsecurities* draws on the establishment of the international health movement during the Cold War and the efforts of scaling up public health interventions throughout the planet. Smallpox, the first disease to be worldwide eradicated in 1977, is the focus of this chapter. It explores the Smallpox Vaccination Program during the Iraq war and the fictitious idea of smallpox reemergence and weaponisation by Saddam Hussein as a pervasive incitement to war at the end of the twentieth century. In the fifth and last chapter of the book, time, space and scale strategies to manage an infectious threat converge in the case of HIV-positive Haitian refugees who were incarcerated in Guantánamo Bay, Cuba, in early 1991. Ahuja explores how the deployment of sovereign power – the right to kill – over the bodies of Haitian refugees was articulated through imperialist discourses that combine the threat of emerging diseases with biosecurity demands.

Neel Ahuja's work is a great example of the kind of ground-breaking interpretations of the political and historical consequences of imperialism and governance when seen through the prism of interspecies and decolonial epistemologies. They reveal the shortcomings of dominant anthropomorphic, white narratives of imperialism, science, health and diseases. They open up a wide field of inquiry to rewrite and re-account the myths behind these processes, as witnessed by Ahuja's study of episodes that question linear considerations of scientific progress or reductionist economic interpretations of imperialism and capitalism. Sometimes these efforts in departing from already explored angles come at a price: they demand very intricate arguments and interpretations, at times challenging for the reader for the number of aspects and consideration they involve in each case. Yet, the reader will be satisfied with the final outcome after reading *Bioinsecurities*.

Davide Bennato

Il computer come macroscopio. Big data e approccio computazionale per comprendere i cambiamenti sociali e culturali. [*The computer as a macroscope. Big data and computational approaches to understand social and cultural changes*], Milano, Angeli, 2015, pp. 148

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The Computer as a Macroscope is interesting book with a well-defined angle. Rather than delivering the umpteenth prophecy on how digital technologies will affect social life, the book describes how they already started to affect social research. Such angle (discussed in the first chapter of the book) allows Davide Bennato to steer clear of the vast and often shallow debate about the "digital age" and focus instead on the specific approaches and techniques of computational social sciences.

In its second chapter, the books focuses in particular on seven among the main approaches of computational social sciences: 1. analytical sociology (i.e. the effort to explain how global and long lasting structures are produced by local and ephemeral interactions); 2. network sciences and social network analysis (i.e. the investigation of the associations connecting individual in complex collective patterns); 3. social simulation (i.e. the struggle to understand social mechanisms by modelling them through agent-based models); 4. mimetics (i.e. the study of the 'viral' spreading of cultural items through media and especially social media); 5. cliometrics (i.e. the quantitative study of long-term historical trends); 6. behavioural economics (i.e. the use of experimental games, sometime in a digital form, to investigate or predict dynamics of cooperation or competition); 7. culturonomics and distant reading (i.e. the study of cultural and artistic phenomena through the analysis of large corpora).

The third chapter introduces four examples, allowing the readers to gain a deeper understanding of this emerging approach. The cases discussed include several influential studies. It is a pity, however, that all the examples concern traces extracted from social media (Facebook and Twitter in particular) and analysed through network models. While this type of studies does represent an important part of computational social sciences, it is far from covering the variety of such field. The richness and diversity of digital research, which is described in chapter 2, is here reduced to its most visible examples. This choice is unfortunate as much of the interest of digital methods comes precisely from their capacity to diversify and open the imagination of social sciences. Against "big data" prophecies, it is not the size of digital datasets that renews our understanding of the collective world, but their richness and variety. While the jungle of digital inscription meets the eye for its extension, its most amaz-

ing feature remains the stunning diversity of the species that it shelters.

The book of Davide Bennato does a good job in portraying the changing field of computational social sciences in a way that is both accurate and palatable. Instead of playing on the hype of big data and on the exoticism of computational research, it describes with plain words and vivid examples the practices of this new discipline. *The Computer as a Macroscope* is not a book for experts, it does not discuss the latest developments of digital techniques or their theoretical consequences. To borrow an expression from computer science, Bennato's book is "breadth first" (rather than "depth first"). Pushing the vanguard of digital sociology or perfecting this or that method is not the purpose of this volume, which strive instead to paint a wide portrait of the landscape of computational social sciences. In this, Bennato achieves the goal: readers searching a quick but exhaustive overview of this emerging research field will not be disappointed. The book touches upon the most important strains of digital scholarship in a way that is sometime rapid, but never inaccurate.

The main critique that could be addressed to *The Computer as a Macroscope*, however, concern its rather positivist view of social sciences. While Bennato introduces his work by observing that, in early modernity, the development of quantification techniques has played key role in the construction of our societies, he does not push his reflection to describe how the new computational research is currently affecting our collective life. He thoroughly describes the way in which digital technologies offers new investigation tools, but does not discusses the societal impacts of these research innovations. He introduced some of the most popular approaches of computational social sciences, but does not clarify which social visions are associated with them.

This is why the metaphor contained in the title of this book is misleading. The concept of "macroscope" risks to convey an idea of digital technologies as mere "observation devices" – instruments allowing researchers to see phenomena invisible to the naked eye. This is true, but also reductive. Besides being scientific instruments, digital technologies are also powerful social actors and mediating infrastructures. They certainly make the social more traceable, but they also do shape it in a variety of intended and unintended ways.

Even when considered specifically under the angle of social sciences (as in Bennato's book), digital technologies are not just observation devices, but also tools through which certain forms of collective coordination are promoted, while other are opposed. This type of is observation is presented in an 8th strand of digital research, absent from Bennato's book. Developing a sort of meta-reflection on computational social sciences, a number of researchers coming from the Science and Technology tradition have extensively showed how, far from being neutral, digital methods are associated with specific forms of visibility (cfr. among others, Bowker et al. 2009; Law, Ruppert and Savage 2011; Rogers 2013; Marres 2017).

More than to microscope or telescope observation, computational research resembles to cartography in the 16th century (cfr. Turnbull 2000) or demography in the 19th century (cfr. Desrosières 1993). As geography and statistics supported the rise of the national state in its modern form (cfr. Porter 1995), so the new computational research influences the way in which we live, buy and vote – and such influence will no doubt grow in the next years.

This is why books like *The Computer as a Macroscope* are deeply needed. Describing the emergence of new computational paradigms, they help us reflecting on the many ways in which digital technologies affect scientific research. This a very important contribution, but one that leaves open the most important question of contemporary sociology: do we understand what forms of social organization are we promoting through our computational research? And are we ready to stand by them?

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Stefania Consigliere (ed.)

Mondi Multipli, vol. I - Oltre la grande partizione [*Multiple Worlds - vol. I - Beyond the great divide*], Napoli, Kajak, 2014, pp. 220
Mondi Multipli, vol. II - Lo splendore dei mondi [*Multiple Worlds - vol. II - The splendour of the worlds*], Napoli, Kajak, 2014, pp. 255

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This collection of works is one of the first attempts to provide Italian readers with a panoramic overview of the so-called "ontological turn" (OT) in social and cultural anthropology.

The two volumes of *Mondi multipli*—fifteen articles in total, of which thirteen in translation—present a wide range of authors and topics, dealing with the methodological, philosophical, and political implications of the use of ethnographic concepts in order to dismantle the modern idea of a unified nature of the world. While the first volume, *Oltre la grande partizione*, focuses on general theoretical issues concerning the OT, the second volume *Lo splendore dei mondi* is more ethnographically oriented and approaches the problems raised in the first volume by offering examples and case studies from specific field sites.

Moved by the question "What happens when one takes indigenous thought seriously […] verifying the effects it can produce in our own thought?" (De Castro 2014, 194), the authors try to trace a different cartography of human and nonhuman collectives, following not only the proliferation of different cultures, but also of different ontological realities emerging with them. While the idea of variable "ontologies" has circulated in STS for more than two decades (Latour 1993; Mol 2002), and might be considered – along with the concept of "nonhuman agency" (Latour 2005) – as the specific contribution of STS to anthropology (de la Cadena et al. 2015), the OT in anthropology characterises itself through four specific features: multinaturalism, antirepresentationism, induction, and self-determination.

The first one, multinaturalism, is based on the idea of multiplying the natural reality, often presented in Western societies as a singular material entity. This theoretical move, which introduces an inversion of the one nature/many cultures approach that has characterised social and natural sciences, is heavily indebted to ethnographic research conducted in Amerindian societies over the last three decades, notably within the work of Eduardo Viveiros de Castro and Philippe Descola (two of the authors translated in the collection).

They both show that for Amerindians what distinguishes humans from nonhumans is not a different interiority – a soul –, as animals and supernatural entities may also have the same kind of soul according to na-

tive animistic conceptions, but their exteriority – the physical body itself.

In the seminal article "Cosmological pronouns and Amerindian perspectivism"— translated in the vol. II of this collection — Viveiros de Castro delves into this interiority/exteriority issue. He then underlines that if animals and spirits, like humans, have the same interiority or soul, they do also have similar *cultural* institutions, customs, ceremonies and their own kinship relations, akin to humans ones. However, he also brings attention to the fact that each group (humans, jaguars, peccaries, spirits, etc.) perceives the other as non-human, because they present a different natural exteriority. What we see as blood, to the jaguar is maize beer, what we perceive as a waterhole in the ground, is ceremonial house to peccaries; jaguars see themselves as humans and perceive us as game animals to hunt, while peccaries, who see themselves as persons, consider both humans and predators as spirits who chase them. Amerindian therefore only have one animistic model of humanity and culture, distributed across different species, and several natural worlds, one for each point of view. Wherever the perspective changes, "culture" will always be marked by the pronoun *us*, while "nature" will be marked by *them*.

The second feature, emerged in association with multinaturalism, is the antirepresentationism, which is also shared by STS (Woolgar and Lezaun 2013). This feature marks a strong shift from epistemology to ontology, i.e. from an idea of multiple worldviews as cultural representations of a single natural world, to the emergence of different native ontologies that people inhabit. This goes against a divide or partition — extensively discussed by both Bruno Latour and Isabelle Stengers in their articles in vol. I — set by Western modern societies between a supposedly inert material reality, only grasped by Western science, and the transient mental representations through which non-Western people imagine such a reality. The rejection of the concept of representation is thus linked to the refusal to reduce non-Western people's real worlds to mental artefacts subordinated to Western knowledge.

A third feature characterising the anthropological trend presented in this collection is instead the concept of recursivity – which seems to us more adequate to call "induction"[1]. One of the major proponents of this concept, together with Viveiros De Castro, is undoubtedly Martin Holbraad, whose article is included in vol. II. According to Holbraad (2012, 276), the term "recursivity" refers to "operations whose formal properties are modified by the contents on which they operate". In other words, anthropological theory and methods may be affected by the concepts expressed by the people ethnographers are working with. This idea led exponents of the OT to formulate an inductive methodology, consist-

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[1] The term "recursivity" in fact, in mathematics, linguistics and semiotics, refers to the indefinite application of the same rule to products of preceding operations.

ing in the adoption of ethnographic concepts emerging from the field, into the theoretical apparatus of the anthropologists themselves. Concepts like the animistic perspectivism outlined above, would thus become part of our theoretical framework, with the precise effect of shaking common Eurocentric conventions and assumptions.

A last and fourth feature is what I termed self-determination. Although not shared by all the proponents of the OT (see Holbraad and De Castro 2016), it is incisively presented in the last article of vol. I by Viveiros De Castro, and concerns a more "engaged" side of this trend (also discussed in Latour's article in the same volume). This element has been particularly emphasised by the editor Consigliere in her article (vol. I), and can be considered as a political implication of the theoretical move suggested by the other three elements. It refers to a possible reconception (Nelson Goodman) of anthropology as "the science of the ontological self-determination of the world's people" (De Castro in vol. I, 203). The "new mission" of anthropology should in fact consist in giving voice to local ontologies through a "theory/practice of the permanent decolonization of thought" (De Castro 2014, 40). Such position, which may slightly sound as a manifesto for indigenous rights, is actually part of a wider theoretical trend, partly shared by STS, which tries to decentre the modern Western idea of human subject by opening the range of ontological possibilities to also include nonhuman actors. The idea of self-determination implies both the denial of the intellectual superiority of the modern West, and the destabilisation of its political authority over the right of indigenous cosmologies to exist as real ontologies.

The four features I listed may be useful to provide an overview of the OT in anthropology as it also emerges from the two *Mondi Multipli* volumes. These features, however, are far from covering the complexity of each position and author, as well as the various issues addressed by this collection. Some of these authors are already well known within STS (Ingold, Latour, Stengers, and Strathern), other are more specifically related to social anthropology (Descola, De Castro, Santos-Granero, McCallum, and Holbraad), having worked on topics not directly connected to STS. This collection also includes scholars who would hardly be associated with the OT in international debates like Jean and John Comaroff, advocates of "historical anthropology", or like Piero Coppo and Mike Singleton. The inclusion of these last two authors in the collection resulted from collaborations with the editor in the field of ethnopsychiatry, a discipline which already has deep connections with STS *via* the work of Nathan with Stengers, reconsidered by Latour in term of factishes. Coppo and Singleton seek to further explore ethnopsychiatry by presenting their respective ethnographic experiences in Africa.

While the collection is valuable for the range of scholars and ideas presented, the way the different authors are portrayed might not reflect current anthropological discussion at the international level. Indeed, in

her article and prefaces to the two volumes, the editor never tries to clarify and problematize the great diversity of opinions and positions found within the OT, between, e.g. Latour, Descola, De Castro, and Ingold, and thus hardly engages with the current debate.

Also, the way the editor connects the OT to a possible Italian antecedent is quite questionable. Consigliere finds in the figure of Ernesto de Martino a possible forerunner for this trend (vol. I, p. 19). She seems to be implicitly driven by De Martino's idea of *crisis of presence*, thinking about it as possible explanatory model for the emergence of the Turn. While such application of an explanatory model of "crisis" related to a "social context" in Consigliere's article may sound highly suspicious to STS readers (cfr. Latour 2005), we should also keep in mind that de Martino's historicism stems from a Hegelian idealistic tradition diametrically opposed to the structuralist and post-structuralist movement from which the OT emerged (de Castro 2014). De Martino (1982) on the contrary sees history as active and pure human presence, where individuals affirm themselves against a backdrop of nature from which they forcefully emerge. This strong idea of subjectivity, where history is only defined in terms of "human society," or "a mode of collective organisation for the technical domination of nature" (De Martino 2012, 442), considerably diverges from STS concerns for the social role of nonhumans, as well as from the Amerindian reversal of the nature/culture relationship. In Amerindian myths the original condition of both humans and animals is in fact humanity and not animality (De Castro in vol. II), so that nature progressively emerged from culture and not vice versa.

This underlying identification of themes from the OT and the Italian historicism seems rather puzzling, all the more when the editor contrasts a supposedly Western "ontological monism" stemming from Greek and Christian thought, with the plurality of non-Western metaphysics. This position actually runs against Latour's idea of ontological monism as related, conversely, to the network-like complex interconnection between humans and nonhumans in non-Western cosmologies, whereas Western cosmology would instead be characterised by a dualism between nature and society, which radically spread with modernity (Latour 1993).

Despite such shortcomings, the two volumes can result relevant for the Italian STS community at least in two ways. On the one hand, they make available interesting ethnographic results coming from fieldwork in non-Euro-American societies, analysing radically different ways of thinking and living the relation with the environment. On the other hand, some of the translated articles make visible how some threads in the anthropological OT are at odds with STS's approaches and findings. For instance, in certain cases, anthropological OT is not able to go beyond the same modern dichotomies they are trying to question (e.g. Holbraad in vol. II) or it tends to project back onto "the West" old assumptions which STS scholars have been busy dismantling for at least the two last decades.

One example is Descola's quadripartite division of world ontologies into animism, naturalism, totemism and analogism (vol. I). In the same way as STS have demonstrated that one specific ontology does not refer to a whole collective of people, but people within the same collective emerge from different and often contrasting ontologies, general ontologies postulated by our informants in either Americas or Europe "in theory," are often subverted by local ontologies produced by the same informants "in practice" (Woolgar and Lezaun 2013). It remains thus highly questionable whether a general theory, either perspectivism or mononaturalism, would be heuristically useful to describe what "Amerindians" or "Europeans" do in practice in their lives.

To conclude, apart from the shortcomings of the Italian editorial operation, and a few questionable assumptions made by some of the authors about a monolithic "West" and the applicability of general ontologies, I would recommend this collection for the breadth of its themes, the quality of the articles translated, and the specific ethnographic contribution, which should appeal to STS scholars.

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Anna Lowenhaupt Tsing

The Mushroom at the End of the World. On the Possibility of Life in Capitalist Ruins, Princeton, Princeton University Press, 2015, pp. 331

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Can a mushroom become our guide to explore the "dark wood" of the current global capitalism, the "savage, dense and harsh" wood in which, paraphrasing Dante, we seem to have lost "the straightway"? This is the journey that anthropologist Anna Tsing invites us to engage in: the journey of the matsutake mushroom (*Tricholoma matsutake*), from gift to commodity and back. This journey brings us from "disturbed" forestry landscapes that, in such disparate places as the US state of Oregon, the Chinese province of Yunnan, Finland and Japan, result from "the overlapping world-making activities of many agents, human and not human" to the realm of disembedded market commodities in which the mushroom shortly, but decisively, dwells before its transformation into what is considered in Japan as a highly appreciated gift.

With this book Tsing pursues the programme of ethnography of "global connections" she began in the 1990s, with her work on predatory business and local struggles around Indonesian tropical rainforests. That work already focused on the study of "frictions", meaning the potentially empowering but also compromising effects of "encounters across differences". Now Tsing observes these frictions in the encounters of value regimes across the Matsutake mushroom global supply chain. Along the way, Tsing develops an original analysis of the value regime of our current capitalist economy that rests on three key-concepts: *scalability* (and its contrary, *nonscalability*), *salvage accumulation* and *global supply chain*. According to the author, scalability means "the ability of a project to change scales smoothly without any change in project frames. A scalable business, for example, does not change its organization as it expands. This is possible only if business relations are not transformative, changing the business as new relations are added" (38). Modernity and capitalism, according to Tsing, are filled up with dreams (and nightmares) of scalability that shape progress in the form of expansion. Scalable projects (be them social, economic or political) are oblivious to the diversity of contexts and the indeterminacies that originate from the encounter with this diversity. Nonscalability, on the contrary, refers to everything that is without that feature, "whether good or bad". In fact "nonscalability is by no means better than scalability (…). Feudal service was a nonscalable form of labor but not commendable because of it. (…) At the same time, ecological complexity is nonscalable, and so is love; and we value these things". According to Tsing we need a theory of the nonscalable, intend-

ed as an analytical frame designed so to notice nonscalable phenomena, because only through noticing the nonscalable it is possible to recognize "salvage accumulation". Salvage accumulation is the feature of capitalism consisting in "taking advantage of value produced without capitalist control" (63) or, more precisely, the ability to create capitalist value from nonscalable value regimes. Salvage accumulation operates through global supply chains that have become the dominant form of organization of commodity production in today world capitalism: "Supply chains are commodity chains that translate value to the benefit of dominant firms; translation between noncapitalist and capitalist value systems is what they do" (63). Wal-Mart is a good example of how a supply chain works. Retail expansion does not require that production be scalable: "Production is left to the riotous diversity of nonscalability, with its relationally particular dreams and schemes. We know this best in 'the race to the bottom': the role of global supply chains in promoting coerced labour, dangerous sweatshops, poisonous substitute ingredients, and irresponsible environmental gouging and dumping" (64). As explained by Tsing: "in this 'salvage' capitalism, supply chains organize the translation process in which wildly diverse forms of work and nature are made commensurate –for capital" (43).

In this respect, Tsing's analysis should be of interest to the community of sociologists and other social scientists working on issues of value and valuation. Shifting the analytical focus from the variety of technical devices of "qualculation" to the irreducibly contextual value regimes that emerge in livelihood processes, Tsing stresses the importance of paying attention to the nonscalable modes of valuation that innervate livelihood practices.

"Noncapitalist value systems" are defined by Tsing as "gift economies": not much more is said in the book about the specific modes of valuation that organize these evaluative spaces, beyond the fact that they are nonscalable, i.e. they cannot be scaled without changing the framework of knowledge or action. Still, Tsing's contribution to the debate on valuation and evaluation is important in that it points to the relevance, both in research and in politics, of *noticing* the nonscalable value regimes embedded in life processes.

Somehow, Tsing's idea of "salvage accumulation" echoes the analysis of the feminist thinker Silvia Federici (2012) and her denunciation of the systematic devaluation of "reproductive work", the largely unnoticed work that is needed for the maintaining of life processes. For Federici too, the sphere of reproduction (extended to include the reproduction of life in the environment) is a sphere of nonscalable modes of valuation that can be shared through practices of "commoning". Tsing, for her part, introduces the idea of "latent commons" to point to "entanglements" of human and non-human beings "that might be mobilized in common cause" (135). They are not "exclusive human enclaves" and the opening

of the commons to other beings shifts everything: "Once we include pests and diseases, we can't hope for harmony" (255).

Tsing's tone is in fact much less optimistic than Federici's call for a revolutionary resistance against capitalism, led by women and built on the "commoning" of reproductive work. In line with recent developments in feminist new materialism, Tsing embraces the perspective of a fluid state of reality, of an "earthwide condition of precarity" seen as an opportunity for new possibilities of multispecies coexistence, shaping a "third nature", that is, "what manages to live despite capitalism" (viii). Her enthusiasm for the perspective of the adventurous "life without the promise of stability", however, is quite moderate. In fact, "a precarious world is a world without teleology" (20), which means that "progress stopped making sense", for better or worse. The "end of the world" evoked in the book's title is the end of the modern world, with its progressive destinies and its oppression, both related to projects of scalability. On the one hand, the author argues, "dreams of progress" have blinded us to the diversity of the many world-making projects, human and non-human, that surround us. Without progress, capitalism has no teleology either, which means that "we need to see what comes together – not just by prefabrication, but also by juxtaposition" (23). According to Tsing, descriptions of capitalism as an all-encompassing global political economy (as, for example, in David Harvey's or Michael Hardt and Antonio Negri's analysis) may be accurate when pointing to the capitalist ambition of generalizable commensuration of all forms of value, but they can also underestimate the interweaving of historical contingencies and the fact that unexpected social forms can still emerge within capitalism.

On the other hand, Tsing acknowledges that "progress gave us the 'progressive' political causes with which I grew up. I hardly know how to think about justice without progress" (24). Scalability is a two-faced Janus and Tsing's book does not provide a solution to its enigma.

The author points to the possibility of "collaborative survival" within environmental disturbance; here it should be stressed that "survival" is not the same as flourishing. There is no optimism in Tsing's account of the adventures of the matsutake mushroom. But neither is there total despair. Even if she believes speaking of "postcapitalist politics" and economies is premature, she argues that out there are "pericapitalist economic forms" that "can be sites for rethinking the unquestioned authority of capitalism in our lives. At the very least, diversity offers a chance for multiple ways forward – not just one" (65). Still "since no patch is 'representative', no group's struggle taken alone will overturn capitalism. Yet this is not the end of politics" (134). However, the question of how to build equivalence between nonscalable "social demands", in Ernesto Laclau's sense (Lacau 2005), remains open.

Should we then really give up on all ideas of progress? As Peter Wagner (2015) suggested, we should at least not renounce the idea of progress

towards "a more adequate interpretation of the world we live in", by identifying new forms of domination while combatting "the hubristic inclination of considering human beings as actually capable of mastering all aspects of their existence on this earth" (Wagner 2015). In this respect, there is something that, according to Tsing, we, as social scientists, can do for a start: practice the art of noticing in our research. This means "to look around rather than ahead", to cultivate the vulnerability to unexpected encounters (with entities, objects, disciplines); to pay attention to the margins, with no rush to adhere to a pre-formatted narrative.

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Luigi Pellizzoni
Ontological Politics in a Disposable World: The New Mastery of Nature, Farnham, Ashgate, 2015, pp. 259

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Since roughly the 1990s, the "ontological turn" has been one of the most thrilling "turns" within social sciences. It has been a breath of fresh air beyond the limits and impasses of either constructionism and positivism. However, its thrill stems also from the controversies it raised, as STS scholars know (see, for instance, the debate in a recent issue of *Social Studies of Science*, 3/45 of 2015, spurred by a previous issue of *SSS*, 3/43 of 2013, dedicated to the issue).

Luigi Pellizzoni, in his book, brings such turn under deep scrutiny. Is it really the case, he asks, that the ontological turn has emancipatory implications? Can the conflation of the epistemological under the ontological liberate humans and non-humans from a dominative, hierarchical and exploitative logic which is based on dichotomies (of nature/culture, thing/thought etc.)? His answer is substantially negative. Pellizzoni, indeed, argues that the ontological turn is paradoxically nourishing neolib-

eral values and very consistent with them by celebrating flexibility, contingency and precariousness together with the "ever-green" capitalistic value of endless growth.

His critique is illuminating and, even if not always totally convincing, it is an engaging contribution, which encourage critical thinking. Through an unprecedented broad and very analytical examination, this book is also an impressive work of erudition, an exciting journey that connects ancient Greeks to most recent approaches in philosophy, social sciences and anthropology. For this reason, it can be read as a good – even if not short – introduction to the ontological turn, as well as a critical in-depth analysis of it. By drawing together the apparently unconnected threads of the ontological turn, it allows to grasp a broad intellectual landscape. The book starts with four cases, which have gained salience since the '90s and which exemplify the commodification of fields of material reality previously unaffected by market dynamics: 1) Carbon markets: each company has the right to pollute up to a certain amount, but can always buy quota from companies that pollute less; connected to this exchange of pollution permits there are "weather derivatives", i.e. financial instruments transforming environmental risks into investment opportunities; 2) Geoengineering: it consists in the manipulation of the planetary environment to counteract climate change, through, for example, carbon dioxide removal or solar radiation management; 3) Biosciences and biotechnology patenting; 4) Human enhancement: i.e. techniques applied to the human body to enhance indefinitely its potentiality and efficiency.

The blurring of the distinction between matter and information, living and non-living, identity and difference is what these four cases have in common. In this way they legitimize an ecological politics based on the value of unlimited growth and ideas of mitigation of risks and adaptation, instead of one based on limits and equilibrium, thus weakening precaution as policy framework.

In the second chapter, Pellizzoni grounds these cases in the "ontology of the present", marked by the imbrication of humans things, nature, environment. Neoliberalism is seen as an intensification of liberalism, which, differently from the latter is not concerned by limits. Chapter 3 is the core of the book, the one in which Pellizzoni confronts himself with scholars linked to the ontological turn – the "post-constructionists", as he calls them. The main hypothesis of the book is the existence of a "subterranean complicity of social theory with neoliberalism" (69), defined by him not as simple subservience to capitalist interests, but "the sharing of a framing and sense-making which constitute the condition of possibility for certain problems to emerge and certain answers to these problems to become conceivable" (70). In the first part of the chapter he discusses the main features of the ontological turn: an exacerbation of constructionism, as an attempt to reconcile constructivism and realism. As everything is constructed, it is also real. This brings to 1)

the rejection of dualisms, hierarchies and identities, these replaced by fluid, emergent and contingent ontologies; 2) taking techno-scientific advancements as inspiration for innovation in social sciences; 3) connection of the "real" and the "political". In the second part of the chapter Pellizzoni analyses selected strands in the ontological turn: Marx and post structural-marxism; Actor-Network Theory; feminist new materialism; Paolo Virno; multinaturalism; speculative realist philosophers. There is no space to account for the detailed ways in which Pellizzoni examines these approaches. In general, he observes that indeterminacy is not a means for emancipation but a perspective of the world in contiguity with Neoliberalism, thus not a real alternative to it. Pellizzoni defines post-constructionism as just another analytics of truth (as positivism, for example), which defines what is right and true (contingency, fluidity, etc.) against what is not (stability, identities, etc.) (see also Laidlaw and Heywood 2013) and, as such, it is intolerant of other perspectives (see also Scott 2013).

In the fourth chapter, Pellizzoni analyses the limits of both post-constructionist theories and neoliberalism. He illustrates the metaphysical underpinning of modern science and technology, which, through Darwinism, conceive life as a general force, exceeding the life of singular living beings and thus establishing an ontological symmetry and continuity between humans and non-humans, where difference and variation are the base for contingent ontological outcomes. By assuming the Darwinian continuity between humans and animals, modern technology conflates nature into culture making ontology and epistemology overlap, thus justifying an unlimited exploitation of nature. Against this backdrop which characterizes both the *a-priori* of neoliberalism and of post-constructionism, Pellizzoni proposes Heideggerian theories: for Heidegger, technology is positive as long as it is used to dis-conceal nature through "bestowing", which is "listening to and respecting the poiesis of nature, its self-giving" (154). According to Pellizzoni's reading of Heidegger, humans and non-humans can never fully overlap and the acknowledgment of this gap, this "remainder" is key to respect nature's mystery. Thus, Pellizzoni, building on Heidegger, proposes a critical humanism which is critical because builds on the conditions specific to humans without drawing any hierarchical implication from it. I consider this call to a re-evaluation of a certain kind of humanism, as a solution to an increasing trend of exploitations, the most innovative contribution of this book.

In the final chapter, Pellizzoni, on one hand questions the way politics is addressed by these ontological approaches, transfiguring politics into ethics, on the other hand he introduces other possible approaches. By reconsidering biopolitics, Pellizzoni not only states the impossibility to deactivate biopower through desubjectivation, but also brings attention to how, through desubjectivation, biopower is enhanced: "the more deper-

sonalized one is, we could say, the more one can personalize itself in whatever direction" (183). Pellizzoni identifies a link between this process and current forms of self-capitalization, political consumerism, and – referring to the digital revolution – the coexistence of new monopolies thanks to "open" and ideological communities of commons. According to Pellizzoni, the current focus on ethics results in apolitical consequences because it prompts an ideal of fulfilment, expression and expansion of oneself, a move toward internalizing the world within oneself and, therefore, moulding and exploiting it in line with the capitalistic values of optimization, growth and expansion.

As alternatives, Pellizzoni considers Theodore Adorno and Giorgio Agamben. The German philosopher emphasizes the always present remainder out of the encounter between epistemology and ontology, the necessary violence (contrasted by Pellizzoni with the pacification of assemblages) necessary for change and critique. For Pellizzoni, the subtle but crucial difference between Adorno and post-constructionists is that for the former things are neither cultural nor natural, while for the latter things are both cultural and natural. The most recent work on Franciscanism of Agamben inspires, on the other hand, Pellizzoni's proposal for an alternative to both post-constructionism and realism or constructionism. It is to encourage a form of life based on our impotentialities, defined as "our possibility of not willing = doing = being" (215), against neoliberal understanding of "being" as consequence of the capacity to act, based on ideas of duty and will. Choose to not choose is, for Agamben-Pellizzoni, the crucial feature making us truly "human", as the capacity to deactivate the paradigm of operativity. This can be obtained granting primacy to acting over being (as according to the monastic rule) and establishing "use" as an alternative to property or right. This conclusion is somehow evocative and intriguing but it is not very clear how this alternative can be applied in real life and also intruding the doubt that the acting which should ground this new form of life is, at the end, very similar to "practice".

In general, Pellizzoni's critique of the ontological turn being not political is not a totally new observation but while similar critiques are mostly based on ideological and weak underpinnings easily deconstructed (Candea 2011; 2014; Holbraad and Pedersen 2014; Holbraad, Pedersen and De Castro 2013), Pellizzoni's argument is theoretically very solid and he deals with an in-depth and careful analysis of what he criticizes. Therefore, Pellizzoni's work cannot simply be dismissed as trivial "non-common-sense" (Pedersen 2012) but it provides food for thought for the critical assessment of the limits and threats of the ontological turn.

Still, I have two main remarks: I do not totally agree that post-constructionists draw a complete overlap between the epistemological and the ontological: in the work of Barad (2007) "what is left" is often reminded and in the work of other scholars (see for example Abra-

hamsson, Bertoni, Mol and Ibáñez Martín 2015; Greco 2004) is the main topic. Secondly, and related, I am not sure that Pellizzoni's theoretical alternative is not in the order of an analytics of truth. Pellizzoni advances a privative ethics, a negative modality of knowledge based on what is not accessible because out of human limits, while post-constructionists propose an ethics of excess (see for example, de la Cadena 2015), this resulting, similarly, in the incapability to access a final truth, because there are too many truths and only one is realizable at a time. Both define truth as something beyond the human – and this is a statement of reality. Thus, I would find more appropriate to define both as analytics of truth: Pellizzoni's negative modality is a step in the dialectical construction of identity, therefore within a logic of identity. The difference is that one has affirmative connotations, while the other has critical tones. Probably, it is impossible for humans to escape an analytics of truth exactly because the constitutive gap between ontology and epistemology condemns us to stick to the epistemic side, these being critical or affirmative. Thought, these two options are fairly different, and with potential for supporting or criticizing very different applications, as they define the ethical and political posture in accessing and relating to reality.

To conclude, Pellizzoni seems guilty of the same sin he accuses post-constructionists: to exaggerate the differences among them. But after all, I do not see this as sin but as a skill, necessary for developing critique, which is to make visible some hidden or potential risky trends allowing us to reflect always deeper about who we are and what we are doing in this world.

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David Pontille
Signer ensemble. Contribution et évaluation en sciences [*Signing Together. Contribution and Evaluation in Sciences*], Paris, Economica, 2016, pp. 206

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Since the 1980s we have seen the rise – if not the obsession – of evaluation policies of the academic production through the proliferation of performance indicators and devices to judge and measure contribution in sciences (bibliometric indicators, journal classification, and peer review). The translation of new public management theories into the academic field with the aim of tracing and measuring the individual contribution becomes problematic since every scientific activity – as *Laboratory Studies* had proved – implies the participation of human teams and the use of many instruments, artefacts and techniques. So the question is: how to distinguish the contribution of each one? How to decide who is legitimated to acquire the status of *author* signing the publication of research results? How to establish, without any doubt, what a scientific contribution is? The book *Signer Ensemble. Contribution et évaluation en sciences,* by David Pontille, analyses scientific contribution by simultaneously taking into account the issues linked to the knowledge production, the work organization and the evaluation policies for different historical peri-

ods and in three research fields: Life sciences, Medicine and Physics of particles. What makes this book original is that it combines some concepts and approaches coming from *Laboratory Studies* and *Actor-Network Theory* – i.e. the scientific work as a result of alignment of heterogeneous elements – with those belonging to the sociology of work. Pontille asserts that, with the exception of the book *Epistemic cultures* by Knorr Cetina (1999), *Science and Technologies Studies* tended to focus on the production of scientific authority by neglecting the fine grained analysis of processes that circumscribe contribution in sciences. Therefore, Pontille investigates the vocabulary of scientific contributions and practices of signature by inscribing them into what he calls "agencements" of scientific work, involving human, economic and technical resources, and analyses differences in work division, hierarchy of tasks and *technologies of attribution* according to specific organizational forms and epistemic cultures. As the author stressed in a previous publication – *La signature scientifique: une sociologie pragmatique de l'attribution* – researchers' names in scientific papers have been massively considered in a quantitative way by transforming signatures into bibliometric measurement units instead of documents to be opened. Seeing that name ordering is characterized by ambiguity (Zuckerman 1968) that researchers try to reduce through specific practices (alphabetic or decreasing order with the relevance of the last position), these names are not neutral recipients for the allocation of credit but allow the evaluation of the *agency* supporting scientific statements. Instead of considering researchers as the unquestionable origin of scientific production, Pontille grasps how human actors and instruments that inhabit laboratories are considered in the evaluation and how technologies of attribution come up by establishing some shared conventions. Another interesting aspect of the book is that these conventions are not fixed once and for all, but unstable: they change and are questioned along historical periods and according to specific forms of work organization and knowledge production, imply controversies among actors of the scientific scene (researchers, scientific journals, editors, professional associations) and represent a temporary resolution of conflicts for defining what a scientific author and a scientific contribution are. Pontille takes into account the epistemic and organizational transformations of scientific work by showing how new forms of knowledge change not only the way to conceive and circumscribe the pertinent phenomena to be studied, but also the modes of work organization and the way to evaluate and identify scientific contribution. Chapter by chapter, the book traces the stabilisation of three regimes of contribution with their own drifts, conflicts and changes: *Authorship*, *Contributorship* and *Membership*. As in the literary world, where the agency of an author (heir of the romantic figure of *genius*) is considered as an instantaneous and creative action instead of a long distributed activity involving other participants to the production chain (ty-

pographer, printer, editor), *Authorship* in science proclaims and recognizes only some genius in spite of a crowd of assistants and technicians, who remain invisible (Star and Strauss 1999) even they contributed to the scientific discoveries. The organization of work is based on vertical division of specialized tasks and on administrative hierarchy of positions (professors, researchers, post-doc, PhD students, engineers, technicians). The owner of a production unit – who synthesizes in his name the combination of epistemic, geographic, social and material elements – acquires the administrative management and the scientific responsibility. This conception, coming from the 17th century experimental science (Shapiro 1994), determines also the signature assigning the major part of work to the responsible of the team (the last name), who cumulates scientific prestige and institutional authority. However, the *Authorship* becomes progressively not adapted to the epistemic and organisational changes of medical research, and an alternative one emerges: the *Contributorship*, proposed as a solution to the excessive growth of signatures in scientific papers. In the 1950s researchers and chief editors argued that the writing of many impedes the identification of individual contributions. In the 1980s the increase of fraud revealed unacceptable practices in signing papers presenting false results and the multiplication of honorary signatories proved the loss of credibility of authorship. Moreover, when research projects become more multidisciplinary and require the association of several teams and geographical sites, it becomes more difficult to establish a hierarchy of contributions or disciplines. In this more horizontal division of work, the primacy of a only one leader tends to fade away by undermining the regime of authorship (Wray 2006). The crusade of chief editors of scientific journals for establishing an alternative option more adjusted to the new conditions of biomedical research lead to the systematic description of the contribution of each signatory to trace the scientific work in a more transparent way. *Contributorship* no longer recognizes the team as an epistemic, instrumental and geographical unit around the leader who hold the bigger part of credit and responsibility. The attribution shifts towards the project federating several teams for a period of time. These new distributed organisational forms give less relevance to the planning of tasks or to the hierarchy of positions and more importance to the fluidity of activity, the temporary combination of competencies and the flexibility of operators involved in ephemeral teams. The third regime of contribution – the *Membership* – is practiced in the Physics of particles where a project consists in fabrication, adjustment and maintenance of a giant instrument (accelerator and detector of particles) requiring a federation of teams coming from diverse research institutes over a ten years period. The minuscule, furtive and ephemeral entities emerging from the collision between particles demand innumerable tests, regulations and controls to identify their effective presence among the ground sound. Since the 1990s several laboratories from over the world

participate in the same project associating a detector to an assembly of researchers. As the project lies upon a large and durable collaboration and a decentralized supervision of experiments, the technology of attribution does not glorify some researchers with exceptional qualities. Actors contributing to the fabrication, assemblage, regulation and maintenance of technical infrastructure are all legitimated to sign scientific publications, without any distinction between technical or intellectual work. The collective name of the project talks with one voice for multiple research groups and institutions by privileging the common biography of a massive instrument and of a large work team.

The book shows that scientific signatures act differently and gain different value according to their graphical arrangement. In *Authorship* only some names acquire relevance while others remain insignificant, the more the list of names grows the more it is difficult to distinguish the principal author, each name is in competition with the others and any additional one undermines the value of others because of the risk of fragmentation. In *Contributorship* the names don't have the same value, the perimeter of each action is well delineated, the credit is distributed but the responsibility is individual and the evaluation considers the personal contribution. In *Membership* the collective name prevails over the list of signatories, signing means to be collectively an author (Galison 2003) and the more we add signatures the more positive it is. Three metaphors for these types of regimes are as follow: the *authorship* is like the literary author of an oeuvre, the *contributorship* is like the list of professionals appearing in film credits and *the membership* is like a group of people signing a petition.

Signer Ensemble also suggests an opportunity to reflect within our sociological discipline, also characterised by evaluation policies aiming to distinguish individual performance within scientific work and by tensions caused by the consecration of some researchers according to their hierarchical positions. Does the signature in sociology tend to favour and award those who are already well known? Are we faced with a field in which rivals fight each other to obtain scientific prestige by making (in)visible some of the heterogeneous elements participating to the scientific activity as, for example, the work of research assistants or the agency of technologies? Does this obsession with bibliometric indicators and individual evaluation discourage collaborative work and collective publications? Does it cause a fragmentation of knowledge in a multitude of brief articles on very well-known scientific journals to the detriment of a richer theoretical reflection?

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Simone Tosoni with Trevor Pinch
Entanglements: Traces of Science, Technology, and Sound, Cambridge, MA, MIT Press, 2017, pp. 200

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Science and Technology Studies (STS) are a compelling and heterogeneous interdisciplinary body of knowledge that has come a long way and continues to attract new generations of researchers. Despite in some geographical areas, such as Southern Europe, they are still relatively new, the maturity acquired after decades of intellectual debate and research efforts in the field are spurring moments of reflection and reflexivity among STS leading scholars, who do not dodge providing their own stories and viewpoints on the development of the field through conversations and interviews. In reading them, we come to know that, for example, Donna Haraway started reading St. Thomas when she was about twelve years old because of the advice of a Jesuite priest (Lykke et al.

2000), that a young PhD candidate Michael Lynch, like most of Ph.D candidates, mastered "the dubious arts of writing" that combined "defensiveness and intellectual pretense" (Lynch 2016), and that, in her encouragement to be "wild, innovative, inventive, sharp" as STS scholars, Anne Marie Mol thinks that guerrilla tactics are far more effective models than "old fashioned battles over regionally demarcated pieces" when it comes to sex-struggle (Bauchspies and de la Bellacasa 2009). It is precisely this blend of personal anecdotes, daring claims, and intellectual commitment that characterizes "Entanglements. Conversations on the Human Traces of Science, Technology, and Sound" between Simone Tosoni and Trevor Pinch.

The two voices of this extended dialogue belong to an Italian media scholar – Tosoni – with a large knowledge of STS, and to one of the leading figures in STS – Pinch – also known in neighbouring fields for being the co-founder of Social Construction of Technology (SCOT), and for his substantial contribution to the development of the field of Sound Studies.

The book is the outcome of four rounds of conversations that took place physically in Ithaca (USA), Paris, and Milan between 2012 and 2014, and that were subsequently transcribed, edited, and enriched with supplemental material from epistolary exchanges. The content is divided into four sections that cover Pinch's career, intellectual and personal path, from his early steps in the Sociology of Scientific Knowledge (SSK) as Ph.D and postgraduate scholar to the funding of SCOT and the dispute with other schools of thought in STS, to his more recent interests in sound studies.

The volume takes the reader in a rich and lively "guided tour" of SCOT, as well as of the past and present history of STS as experienced and recounted by Pinch through the wise and often challenging inquiries of Tosoni. The editorial work undertaken by the latter is very accurate, so that each reference mentioned in the conversation (books, papers, authors, approaches) is associated to clarifications and quotations in the footnotes which, therefore, take up a remarkable amount of space. For being of great interest, I would have preferred a bigger font-size for the quotations, which might become hard to read after the first pages.

The first round of exchanges between Tosoni and Pinch begins with the dawn of STS within the Sociology of Scientific Knowledge (SSK) and the Strong Programme developed by the Edinburgh School, which coincides with Pinch's early work within the Bath School and the Empirical Programme of Relativism (EPOR) in collaboration with Harry Collins. These were the days in which the metaphor of the "black box" came out written by Richard Whithley, who probably did not foresee the huge success that the "opening of the black box" would have achieved within and beyond the STS community.

Pinch's memories of his encounter, relationship, and work with Harry Collins are rich of intellectual inquiries and personal tales. One of the

most unexpected passages of the book is, in fact, the strong link between the intellectual adventure taken up by a group of then unseasoned European scholars and the meaningful connections among them. This appears clear in the first place by looking at the mentorship relationship between Collins and Pinch, or "a discipulus-magister relationship" as Tosoni eruditely defines it. Like many of the things happened in those years, their collaboration starts by chance on the one hand, and because of their common work on the study of scientific controversies in physics and paranormal on the other. As Pinch recalls: "Turns out I was very lucky because Collins had this projects on Uri Geller and the paranormal […] I was the only guy in the world who could possibly do this! Unbelievable! He was interviewing all these postdocs with degrees and books, and suddenly this naive guy, Trevor Pinch, steps in saying '[…] I am working on this wild idea of scientific controversies from the sociology of science perspective. I don't know what it all means, but this is what I am interested in', and I was just perfect" (p. 24). Then Collins decided to hire him and teach him everything as Pinch gratefully claims: that included how to properly interview scientists, how to set up field work trips, how to write scientific articles. And Collins' intention to instruct Pinch did not stop at the methodological training, but it went on with some advices about how to build a reliable academic appearance, which, in that case, meant for Pinch to dismiss his hippie clothes, get rid of science fantasy readings, and start to approach "some decent stuff" such as Flann O'Brien and William Faulkner. The relationship between research work and personal bonds goes beyond the University of Bath where Collins and Pinch were based, and involves a wider academic community starting from the Edinburgh School with Barry Barnes, Donald MacKenzie, Steve Shapin, Andrew Pickering, and David Bloor, and people working in the area of laboratory studies such as Karin Knorr-Cetina, Steve Woolgar, and Bruno Latour. Personal relationships were crucial in order to reinforce the network and the newborn field of study, and defend it from the hostility of philosophers of science. As Pinch explains, it is easy for people who are in a new field surrounded by scepticism and hostility to develop a strong new feeling like "Hey, we're on something important, a whole new view of science" (p. 26). It is striking to learn that the people who are now deemed as some of the preeminent scholars in STS have been regarded as "a wild, weird French guy", "an incomprehensible German", "undergrads with physics envy", and "old hippies" back in the day. On second thought, the rejection of "the new" is a common trait of all avant-guard movements that challenges what has been considered "the canon".

The approach developed by Collins and Pinch for the study of scientific controversies in the 1980s, and then exposed in the Golem Trilogy in the 1990s, was also applied to the study of technology in the seminal article "The Social Construction of Facts and Artefacts" that Pinch authored with Wiebe Bijker in 1984. This paper set out a new approach for the so-

cial studies of technology with the formulation of three fundamental concepts: relevant social groups, interpretative flexibility, and closure. The account of the development of SCOT covers the third and longest section (over 50 pages) of the book, with Pinch clarifying the terms whereby SCOT should be taken, that is not as a list of fixed concepts to be applied mechanically to the study of technological phenomena, but rather as a methodological approach that aims to tell people how to think about technology, rather than what to think about it. This is a crucial point as it marks out the discussion around SCOT's most recent developments and its dialectic relationship with Actor-network theory (ANT). In explaining his position about the understanding of the role of materiality and the nonhumans, Pinch claims that while Callon and Latour agree with SCOT in many respects, their treatment of humans and nonhumans as equivalent is "too radical". Perhaps this is anything but new for STS scholars, but it becomes important because such discussion is interestingly framed in political terms. Thanks to Tosoni's shrewd observations that articulate the idea of morality and social responsibility delegated to nonhumans by picking up the famous example on the speed bump by Latour, the two conversationalists agree that such delegation is problematic because social responsibility and morality are not plans that can be granted by an artefact and because the detachment of functions, meanings and values is not a methodological move as it is in Latour's treatment, but it pertains to the political domain. As Tosoni points out, one may slow down with her/his car because she/he is forced by an artefact, but then this course of actions does not account for the contextual decision of, for example, avoiding honking or throwing the cigarette butt on someone else's yard: we need more than the engineering repertoire to explain this set of actions, that is a view that takes into account the set of cultural values, motivations, and social goals that coexist with technical scripts. Therefore, the entanglement of all these elements represents a pivotal point of reference in order to think about technology in political terms as it calls into question the practice of drawing boundaries between something/someone that is in, and something/someone that is left out.

"Entanglement" is not only an analytic category whereby to interpret the epistemological inquiries and disputes that characterize the development of STS as experienced by one of its key proponents. "Entanglement" is also a lens whereby to read the important role that colleagues, friends, mentors, chance encounters, students, intellectual contenders, and significant others play within Pinch's professional and personal journey, which, accordingly, appears to be full of unexpected consequences, inspiring, and funny.

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Teun Zuiderent-Jerak

Situated Intervention: Sociological Experiments in Health Care, Cambridge, MA, MIT Press, 2015, pp. 248

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Situated Intervention: Sociological Experiments in Health Care is certainly a book that the community of S&TS scholars interested in studying health care as sociomaterial knowledgeable doing could use to get a new promising outlook. In this book, Teun Zuiderent-Jerak, undermining the rigid opposition between basic and applied sociological knowledge, develops an interesting new methodological perspective for researchers engaged in studying and changing medical practices. Even from the opening pages, *Situated Intervention* outlines a fascinating challenge addressed to contemporary social scientists to advance the current understanding of medical work by actively being immersed in the health care organizations.

From the first moment I began to read the book, it brought to mind the seminal article, "The Human Sciences in a Biological Age", in which Nikolas Rose (2013) offered a deep discussion about some crucial implications to the social and human sciences stemming from the most relevant technoscientific transformations occurring in the field of contemporary life sciences. In his work, Rose was interested in discussing (and, in a certain sense, eroding) the epistemological boundaries traditionally erected between social sciences and life sciences to highlight how these two domains may have profitably contaminated each other. Conceptually speaking, Teun Zuiderent-Jerak's book can be considered a further and inno-

vative articulation of the intellectual project inaugurated by Rose by exploring the conditions of possibility of the social sciences' regimes of truth about life, medicine and health care.

On the whole, the book is grounded in empirical data collected from different qualitative research methods – such as ethnographic observations, interviews, focus groups and documentary analysis – within four different projects on quality improvement and cost efficiency in Dutch hospitals, in which the author has been engaged as "change agent" and "evaluator" for over ten years. Within the five main chapters of *Situated Intervention*, the author "considers the question of how the direct involvement of social scientists in the practices they study can lead to the production of interesting sociological knowledge" (3). In this sense, the fundamental issue addressed in the book relates to the modalities through which sociologically informed knowledge can be generated via the direct transformative intervention of the researcher in the management and doing of health care in situated context. This issue, in its complex ambivalence, is addressed by Zuiderent-Jerak in how it relates, on the one hand, to the situated processes of knowledge production in social sciences, and on the other hand, to the reconfiguration of the researchers' subjectivity involved in doing intervention in health care context by cooperating with practitioners and patients.

The main theoretical insights on these two points are developed in the introductory section, where Zuiderent-Jerak proposes a comprehensive review of the broad debate concerning the engagement and involvement of social researchers in doing fieldwork. Particularly, this section discusses one of the main dilemmas circulating for a long time in social sciences: How to find and evaluate a sensible balance between the (political) engagement with and epistemological distance from the process researchers are studying? Zuiderent-Jerak innovatively faced this cognitive dualism by deconstructing many dualities embedded in it (such as objectivism and activism; experimenting and intervening; efficiency and quality – just to mention the most relevant), and therefore taken for granted by sociological knowledge makers. In deconstructing these solid (but not necessarily virtuous) traditions and customs performed by some "settled populations" in the world of the social sciences, the author conceptualises a new methodological posture labelled situated intervention. According to the author, this posture – emerging from the mutual entanglement between knowing and acting (or representation of and intervention in) – enacts an open-ended process able to generate new S&TS knowledge. Within this framework, Zuiderent-Jerak developed a situated interventionist approach that can promote not only positive actions for organizational changes in health care settings, but also enable the production of relevant sociological knowledge of medical work and related practices.

Starting with ten years' worth of data collected by ethnographic investigations within the framework of the situated intervention, the five main

chapters of Zuiderent-Jerak's book address, in radically innovative ways, some of the major concerns that have characterized the STS debate on medical practices in the last fifteen years, such as standardization, compliance, safety and commitment of the patients and marketization of health care assistance. In relation to these crucially relevant issues, both for scholars and stakeholders interested in health care, a "thick" ethnographic description brings the reader inside haemophilia, haematology and oncology departments to highlight how situated intervention is performed in practice.

The first chapter investigates the possibilities and emerging outcomes of a transformative interventionist approach in the context of home haemophilia treatment implemented under the supervision of a haemophilia care centre. Here the author makes visible the ordinary invisible work that is aimed at attaining the compliance of the patient. Under the lens of situated intervention, Zuiderent-Jerak conceptualizes compliance not as a mere cognitive problem, but rather as a sociomaterial process composed of situated negotiations between the patient and the technologically dense environments which are encountered daily.

In the second chapter, the issue of compliance is explored in relation to the physicians' role and the readjustment of their daily work to clinical standards. The standardization of the medical work is often seen by health scientists as a problem to be addressed through top-down rationalization programs of the clinical action, so as to limit the ambiguity and incertitude of the clinical decision making process. In this way, they remain entangled within a dichotomy between universal clinical knowledge and patients' idiosyncratic characteristics, namely what Lampland and Star have labelled "the tyranny of structureless" and the "fallacy of one size fits all" (p. 92). In order to dismantle this dichotomy which does not help to explain the problems of clinical practice, the author proposes the notion of situated standardization, with the aim to "focus on actual changes in medical practices brought about by standardization and on the perceivable renegotiations of orders and autonomies that come with the standards" (p. 92). In this way, standards are not interpreted as regulatory/normative devices to be constructed and implemented, but rather as a collective competence and a practical accomplishment to help face peculiar organizational problems.

In a similar vein, the third chapter highlights the heuristic potential of situated standardization in relation to "patient-centre care", by showing how patient-centredness may be the emerging result of the sociological intervention in the organization of the care delivery. In the fourth chapter, situated intervention is framed as an experimental strategy in the regulatory infrastructure of health care markets. In so doing, the author highlights how sociological knowledge can get involved in configuring market practices and "health care markets as driven by value rather than by cost-saving" (p. 37).

Finally, Zuiderent-Jerak returns to the potential of sociological intervention within national improvement programs in chapter five, where the main topic relates to patients' safety. In this context, the author adopts Annemarie Mol's notion of "multiple ontologies" (Mol 2002) as an analytical strategy to explore ways in which effective care is "enacted through different approaches to dealing with patient safety and what their consequences are for the care practices under study" (38). The exploration of multiple ontologies of safety allows the author to develop an alternative conceptualisation of "useful research" in respect to the utilitarian paradigm. In this way, Zuiderent-Jerak situates the sociologist not only as an external consultant who "discovers" latent factors that may impede the assessment of and improvements in safety, but rather as an active actor who reconfigures the problem space of patient safety in itself.

Even if it is not an easy read, Zuiderent-Jerak's book is a challenging experience as it proposes a new style of practicing social research in the context of health care, which stimulates researchers to actively intervene in the study settings. According to Zuiderent-Jerak, situated intervention can allows to take the responsibility for undermining the certainties established by the hegemonic medical discourse, or the organizational equilibriums within the health care contexts in which they are acting. At the same time, this powerful stimulus leaves a significant problem in the hands of the reader: What are the constraints and the risks in performing situated intervention in practice, especially when the organization in which the researcher is intervening is also the funding agency of the project? Answers to this question can most likely be found by experimenting with situated intervention as a new style of social research that seems to have the potential to redefine the role of S&TS in public issues.

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