TECNOSCIENZA
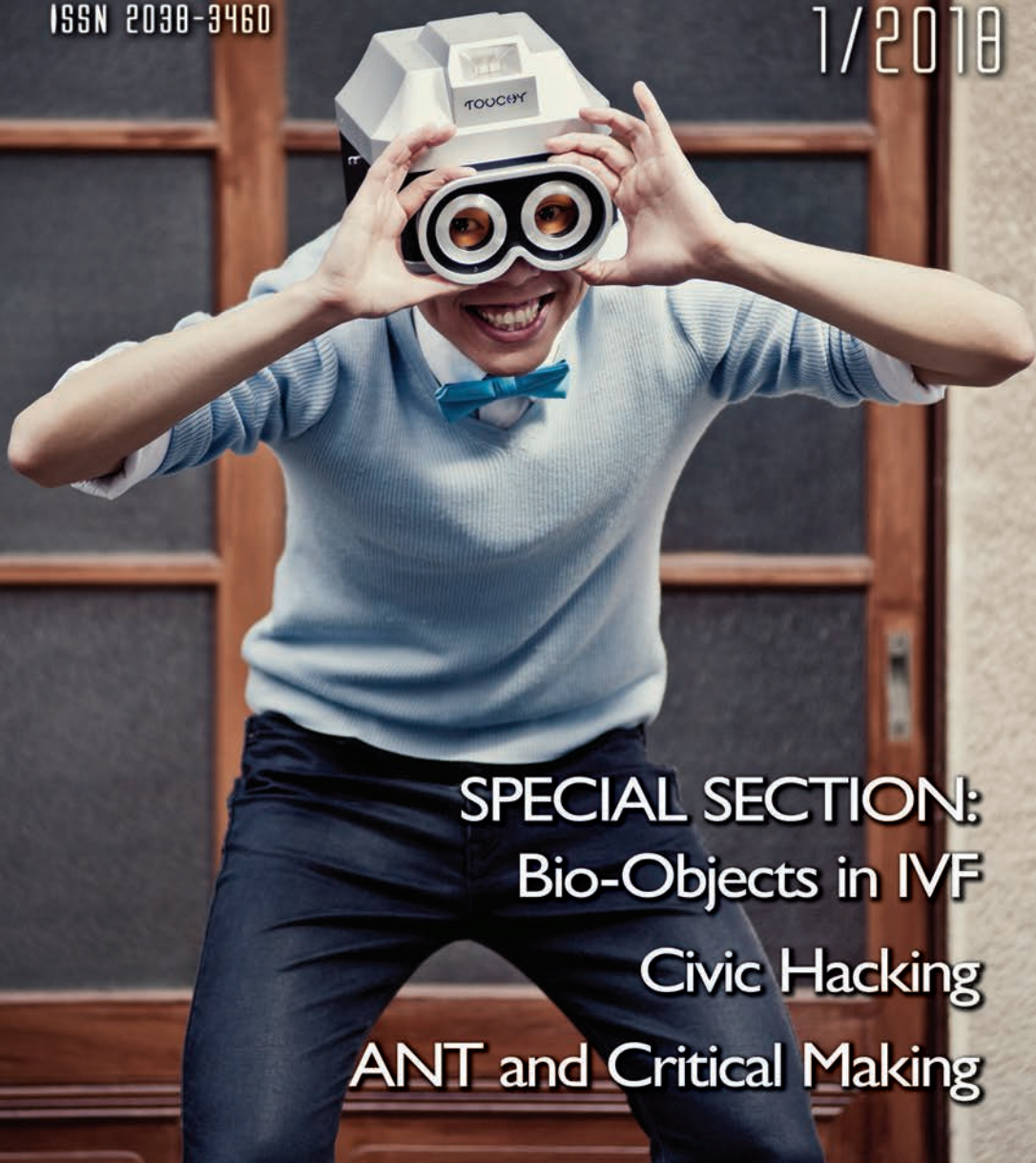## Italian Journal of Science & Technology Studies

SPECIAL SECTION:
Bio-Objects in IVF

Civic Hacking

ANT and Critical Making

Touchy (2012) by Eric Siu

Touchy is a human camera – a wearable device that literally transforms a human being into a functioning camera. The individual who is wearing the device is constantly "blinded" unless someone touches his/her skin. The touch causes the shutters in front of the eyepieces to open and restores the wearer's vision. When physical contact is maintained for 10 seconds, the camera takes a "Touch-Snap" (i.e., a photo that is taken by *Touchy*), which is displayed on the device's LCD.

Online social technology loosens our social boundaries, yet equally dehumanizes physical communication. Connecting with people can now solely occur through our fingertips as conveniently as pushing a Facebook "Like" button or posting a birthday wall post. Considering the urgency of such dehumanization, *Touchy* is devised to encourage offline communication through touch, eye contact and engaging activity of photography presupposing that a camera is historically known for sharing valuable life memories and emotions. The resulting touch-snaps remind us of the ephemeral richness of togetherness.

Touchy hybridizes the roles of humans and cameras by unifying their respective capabilities. The mechanical process of taking a photo is transformed into a physical touch and eye contact. With these capabilities, *Touchy* becomes a magnet for physical communication, potentially turn itself into a social healing device by establishing a reciprocal relationship – the wearer, who is caged in darkness, craves human touch, while "Toucha," the person who touches *Touchy*, offers assistance and receives a touch-snap through an effortless touch. The project then investigates the possibility of healing social problems, such as "Hikikomori" in Japan, isolated senior citizens, orphans, or those who experience social anxiety.

Touchy pursues to extend from being a performance device to an actual contribution to society. Since September 2012, the artist has put himself into experiment throughout numerous performances. He has experienced personal transformation after meeting vast amounts of people whom he otherwise would not have met, seeing a great deal of smiling faces, and experiencing countless friendly touches in thousands of touch-snaps.

http://touchy.camera/en/
http://ericsiu.net/

Cover photo by Keith Tsuji

T E C N O S C I E N Z A

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Cover *Touchy* by Eric Siu

*Special Section - **Sliding Cells***

Guest Editors' Introduction

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Sliding Cells
The Situated Making of Bio-Objects in IVF

Manuela Perrotta
*Queen Mary
University of London*

Kristin Spilker[*]
*Sør-Trøndelag
University College*

Stefano Crabu
Politecnico di Milano

Abstract: The introduction aims to introduce the topic under investigation in this thematic section and underline connections among the three essays. Taken as a whole, the thematic section explores "ontological shiftings" in life sciences, i.e. how reproductive cells can assume different meanings, roles and values according to the situated processes in which they are embedded. The section sheds light on the co-production of reproductive cells and "moral landscapes", showing how conventions concerning biological "properties" and "qualities" are intertwined with social norms and values about family, kinship, and gender relations. The term "sliding cells" is meant to evoke the unstable boundaries between "Nature" and "Culture" explored in this section.

Keywords: bio-objects; ontological shifting; gametes; assisted reproductive technologies.

Corresponding author: Manuela Perrotta, Department of People and Organisations, Queen Mary University of London, 327 Mile End Road, E1 4NS, London, UK – Email: m.perrotta@qmul.ac.uk

In memory of Kristin Spilker

1. Introduction

In June 2013, *Tecnoscienza* published a special issue on "Creating Human Life Itself. The Emerging Meanings of Reproductive Cells among Science, State and Religion". The special issue, edited by one of the guest editors of this thematic section (MP), explored the processes of bio-objectification of reproductive cells in the Italian context. The investigation of the case of Italy intended to be an interdisciplinary enrichment of

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[*] Work published posthumously.

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the STS literature on the study of the relationship between the contemporary politics of life and technoscience. Looking at material and regulatory dimensions of life-in-itself (Clarke et al. 2010), the contributions shed light on assemblages of substances and meanings unpacking the connections between bodily tissues, medical conceptualisations and biopolitical issues of regulation and governmentality. The special issues examined the Italian embryo as a prime example of how a bio-object (Vermeulen et al. 2012) is shaped and how such a conceptualization of embryos emerges from a network of heterogeneous elements and becomes relatively stable.

This thematic section aims to further investigate these connections, focusing closely on the 'ontological shiftings' in IVF, i.e. "how multiple translations generate a network able to crystallize biological substances into a specific shape with a specific array of meanings, producing bio-objects" (Perrotta 2013, 9). The three essays presented in this thematic section explore how these 'shiftings' are subject to different cultural-political, socio-economic and legal regimes. Drawing from different perspectives, the essays shed light on the co-production of reproductive cells and what Svendsen and Lock (2008) define "moral landscapes". In their work on the construction of "spare embryos" at the IVF–stem cell interface, they use the spatial metaphor of moral landscape to explore the how professionals negotiate the biological and moral meaning of spare embryos in their daily work "through practical organizational relations, regulatory frameworks, different notions of responsibility and techno-scientific objects" (Svendsen and Lock 2008, 95).

Taken as a whole, the thematic section contributes to deepen the current understanding of how local meanings of reproductive cells emerge in the daily work of IVF labs and beyond (Parry 2006; Ehrich et al. 2008; Almeling 2011), exploring how they emerge as stabilised bio-objects in different contexts as well as how the networks of relations – through which moral landscape are shaped – are co-produced. Based on research carried out in different countries (Denmark/Germany, China and Argentina), the three essays offer illuminating insights on how biological materials, such as human reproductive cells, are embedded in these processes of co-production.

Mohor's and Hoyer's analysis of quality assessments of semen in different contexts (male infertility, sperm donation, and in-vitro sperm) unpacks the entanglement of quality measurements with social values and reproductive visions, showing how both the evaluative processes and the emerging meanings of semen itself are situated in different practices and moral landscapes. Quality assessments of semen rely on approximations rather than objective standardised criteria and semen quality is far from being inherent to semen itself. The flexibility embedded in the quality assessments allows professionals to use them as socio-technical tools able to support their decision-making processes that are framed into situated social norms and assumptions about family, kinship, and gender relations.

Drawing from a different approach, Klein's investigation of the Chi-

nese debate on sperm donation and its evolution in recent years shed light on the multiple shifting relationships between cultural norms, quality criteria of assessment, family heritage, and deep-rooted sociocultural concerns. The essay shows how a variety of factors, such as the diffusion of social media platforms and social-networking practices, the implementation of the new 'two-child policy' and aggressive marketing strategies adopted by sperm banks played an important role in changing the public perception of sperm donation in China, thus contributing to reframing it as a mundane practice.

Ariza's analysis of gametes donation in Argentina offers a novel perspective to the field, looking at the interplay of potentiality and risks entangled in the biological substances. The essay illustrates how Argentine conceptualisations of kinship and IVF professionals' normative ideals participate in the co-production of gametes as objects of risk. Based on extensive ethnographic data, the essay explores how the fear of endogamy, the loss of biological variation and the risks for donors' health simultaneously emerge in medical discussions and statistical measures used in the clinics. Ariza's work highlights how not only gametes as bio-objects but IVF practices themselves are culturally embedded and entangled in local networks of political, economic and moral relations.

Overall, the three essays illustrate local trajectories of the multiple shifting relationships and their ongoing renegotiations, generating hybrid assemblages able to objectify biological entities as material and discursive arrangements that act at the interface among laboratories, clinics and society. The analyses of these emerging hybrid assemblages illustrate how conventions concerning biological "properties" and "qualities" are intertwined with social norms and values about family, kinship, and gender relations. Under this perspective, the possibility to be a "re-productive subject" is a matter of complex socio-technical processes of questioning the unstable boundaries between "Nature" and "Culture", as the term "sliding cells" strongly evokes.

Acknowledgements

accepted are part of this thematic section.

We are grateful to all the original contributors, the authors who eventually submitted their manuscripts, and the anonymous peer reviewers. We are indebted to Attila Bruni for suggesting "sliding cells" as the title of the collection. Finally, we thank the Editorial Board of Tecnoscienza for making this thematic section possible despite its unconventional path.

References

Almeling, R. (2011) *Sex Cells: The Medical Market for Eggs and Sperm*, Berkeley, University of California Press.

Clarke, A.E., Mamo, L., Fosket, J.R., Fishman, J.R. and Shim, J.K. (eds.) (2010) *Biomedicalization: A Theoretical and Substantive Introduction*, in A.E. Clarke, L. Mamo, J.R. Fosket, J.R. Fishman and J.K. Shim (eds.) *Biomedicalization: Technoscientific Transformation of Health, Illness in the U.S*, Durham, NC, Duke University Press, pp. 1–44.

Ehrich, K., Williams, C. and Farsides, B. (2008) *The Embryo as Moral Work Object: PGD/IVF Staff Views and Experiences*, in "Sociology of Health & Illness", 30 (5), pp. 772-787.

Parry, S. (2006) *(Re)constructing Embryos in Stem Cell Research: Exploring the Meaning of Embryos for People Involved in Fertility Treatments*, in "Social Science & Medicine", 62 (10), pp. 2349-2359.

Perrotta, M. (2013) *Creating Human Life Itself. The Emerging Meanings of Reproductive Cells among Science, State and Religion*, in "Tecnoscienza: Italian Journal of Science & Technology Studies, 4 (1), pp. 7-22.

Svendsen, M.N. and Koch L. (2008) *Unpacking the "Spare Embryo": Facilitating Stem Cell Research in a Moral Landscape,* in "Social Studies of Science" 38 (1), pp. 93-110.

Vermeulen, N., Tamminen, S. and Webster, A. (eds.) (2013) *Bio-Objects. Life in the 21st Century*, Farnham, Ashgate.

The Good Sperm Cell
Ethnographic Explorations of Semen Quality

Sebastian Mohr
Centre for Gender Studies,
Karlstad University

Klaus Hoeyer
Department of Public Health,
University of Copenhagen

Abstract: In this article, we compare the meaning and assessment of semen quality across three different contexts: male infertility, sperm donation, and in-vitro sperm. We ask how semen quality is determined in these three contexts and what kind of practices and normative choices these evaluative processes involve. While the notion of good semen quality is often reduced to biomedical evidence, our analysis shows that it also draws on beliefs about what is desirable and what is not, producing biomedical evidence in light of specifically desired outcomes. Unpacking semen quality, by looking at the specificities of how it is done across three different contexts, in this article we thus move beyond comprehending quality standards as purely technical matters and reposition biomedical assessments of male reproductive potential in their political and normative contexts.

Keywords: artificial sperm cells; gender; infertility; masculinity; reproductive biomedicine.

Corresponding author: Sebastian Mohr, Centre for Gender Studies, Karlstad University, 65188 Karlstad, Sweden – Email: sebastian.mohr@kau.se

1. Introduction

Julia and I are alone in the laboratory. It is Thursday afternoon, and even though it has not been a slow day at the sperm bank, it is a lot quieter now than it was before lunch, quiet enough for Julia to find the time to calibrate the counting chambers which are used to count sperm cells. She is telling me stories about some of the sperm bank's clients she has to deal with, when Aaliyah walks in. Aaliyah is the donor coordinator at the bank and responsible for scheduling donors for their interviews and check-ups. As she tells Julia and me, the donor candidate waiting at the front desk had shown up too late for his appointment: "Why do they do that", she says frustrated. It would be hard enough to schedule all the

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interviews in the first place. "But, he is very cute", she adds right away and Julia and I tilt our heads in order to get a glimpse of him through the laboratory window. Julia and I agree: he is very cute. Aaliyah doesn't know what to do with the donor though, since his first sperm count had turned out to be too low, "only 76". Normally, donor candidates need to have a count of 200 in order to be considered. "Well, you know, the quality of samples varies a lot", says Julia to Aaliyah. She had a donor once who just needed to wait longer in between ejaculations in order for his quality to improve. To start with, his samples were not good quality, even at an interval of 70 hours in between ejaculates: "But then I had him wait for 100 hours and what do you know, the quality was perfect." Maybe this candidate has a chance after all. Aaliyah agrees: "Okay, I will let him donate today and if it is good enough I reschedule him for an interview." (Excerpt from fieldnotes)

Quality assessments of semen are, in part, a technical matter. Semen samples are weighed, their pH-value measured, their viscosity categorized, and the number of sperm cells counted. As such, semen analysis has become a science. However, this scientific expertise is plagued by uncertainties: how many sperm cells need to be positively evaluated in order for a man to be classified as fertile? How much semen fluid needs to be tested in order to give a valid answer? How motile is motile enough for 'normal' reproduction? Does a crooked tail or a 'pretty' head say anything about a sperm cell's ability to merge with an egg cell? In principle, just one viable sperm and egg cell are enough to produce a child. Yet while technology can be used to assess a man's and his semen's reproductive potential, the determination of a threshold will always rely on an interpretation of that assessment. Furthermore, as the introductory fieldnote from fieldwork at an American subsidiary of a Danish sperm bank illustrates, quality assessments of semen include non-technical matters as well. Values such as attractiveness or the 'cuteness-factor' of donor candidates as well as their reliability to show up for appointments on time can become part of 'semen quality' and thus influence decisions about whether men's semen will be accepted by a sperm bank.

Evaluations of quality as part of reproductive medicine include normative claims and understanding these claims is important since they, as Ayo Wahlberg puts it, enable assessments of which life is worth living (Wahlberg 2008; 2010). This article explores the concept of "semen quality" in the context of reproductive biomedicine. In particular, we are concerned with how assessments of semen quality become imbued with certain values and how these assessments are used to make decisions about reproductive futures. Our analysis concerns three different contexts: assessments of semen quality at a male fertility clinic, the concept of good semen quality at sperm banks, and definitions of good quality at a research lab for artificial sperm cells, so called in-vitro sperm. The entanglement of quality measurements with social values and reproductive visions in these three distinct settings shows how semen quality is far from being inherent to semen itself. Rather, semen quality represents a particular techno-scientific configuration of semen depending on the context in

which semen is assessed. Comparing the assessment of semen quality across three contexts we thus show how biomedical judgements about good semen quality are highly normative decisions rather than simply matters of technical precision.

We begin with a short discussion of perspectives on semen from within the social sciences which provide the background for our own analytical approach. Thereafter we attend to how semen quality is construed as a political and medical problem in public debates in Denmark and in andrological literature. This provides a backdrop for the subsequent analysis and comparison of concrete practices of semen quality assessments at a male fertility clinic in Denmark where subreproductive semen is analyzed, the selection of sperm donors based on semen quality at Danish sperm banks, as well as quality assessments in experiments with in-vitro sperm cells in Germany. In conclusion, we will offer remarks on what good quality semen means in these different situations and how that relates to norms of reproduction.

The fieldwork that provides the empirical context of our analysis was carried out between 2011 and 2014 and is part of Sebastian Mohr's doctoral research on sperm donation and sperm donors in Denmark (Mohr 2014; 2015; 2016a; 2016b; 2018). Fieldwork included participant observation at a large clinical research and medical treatment centre for reproduction and fertility in Denmark as well as at Danish sperm banks and their American subsidiaries and semi-structured interviews with two researchers developing new modes of producing male germ cells in-vitro, that is, outside the male body, at a German institute for human genetics. What connects these different contexts, beyond their interest in semen quality, is their international orientation in regard to concrete working practices and ways of knowing and valuing under the umbrella term (male) reproductive biomedicine. Thus while each empirical site represents an individual organizational unit, they are nonetheless connected by a shared investment into what Marica Inhorn has termed "reproscape", that is, a global biomedical "meta-scape […] traversed by global flows of reproductive actors, technologies, body parts, money, and reproductive imaginaries." (Inhorn 2011, 90). Passages from interviews and field journals were translated to English from their original German or Danish. All informants appear under pseudonyms.

2. Studying Semen: From Discourse to Materiality

Semen has fascinated human kind for a quite a while. At least since Antonie van Leeuwenhoek examined sperm cells under a microscope in the middle of the 17th century, semen has been interrogated again and again. Preceding the relatively recent social science interest in semen as part of reproductive technologies (Martin 1991; Daniels 2006; Moore 2008; Adrian 2010; Almeling 2011; Émon 2012; Mohr 2016a), social sci-

entists though have primarily focused on semen's cultural role (Herdt 1987; Allen 1998). Inspired by a symbolic reading of the body (Douglas 2010), this research understands semen to be part of a symbolic system with which people orient themselves in the world pointing to the central role of ideas about semen in gender and kinship norms.

As Antje Kampf points out, the need to understand the physiological characteristics of semen grew tremendously after World War Two (Kampf 2013), with infertility gaining attention as a recognized pathology in need of therapy. The subsequent success of reproductive biomedicine after the introduction of IVF sparked an interest in the social sciences for the social dynamics of reproductive biomedicine (Franklin and McNeil 1988). This coincided with the so called *materialist turn* in the social sciences as a result of which social scientists turned their attention to the production of biological facts and materialities. In particular feminists such as Emily Martin (1991) or Donna Haraway (1991) for example engaged with so called biological facts, revealing ways in which these facts are embedded in the performative realm of gendered social life.

The assessment of cell's characteristics in particular can be understood as not only technologically and culturally mediated understandings of what 'cells' are and do, rather they also reflect the human quest to gain control over reproduction (Clarke 1998; Svendsen and Koch 2008). In their work on the selection and assessment of embryos at a Danish fertility clinic, Mette Nordahl Svendsen and Lene Koch show that work at the biomedical lab is embedded in moral landscapes understood as terrains of agency which are "continually recreated in relation to organizational relations, research protocols, techno-scientific objects, clinical classifications and notions of professional responsibility." (Svendsen and Koch 2008, 106). Likewise, when semen quality is assessed, scientists and lab technicians are not only "doing" cells. They are also re-enacting norms which revolve around what it means to be human and not least what relations certain gendered individuals should have with one another. Thus while the claim to scientific objectivity engrained into biomedical sciences certainly has a particular history (Daston and Galison 2007), the understanding of semen as a pure male liquid that gives new life its form so important for reproductive biomedicine, also has a longer genealogy as Murat Aydemir shows (Aydemir 2007). This understanding leads back to ancient Greece and Aristotle's conceptualization of the role of men in the creation of life which holds that men pass on certain social characteristics with their semen. This notion is still relevant today when for example sperm donors are selected not only according to their sperm count but also because of certain characteristics thought of as transferable to the child (Daniels and Golden 2004; Mohr 2016a). This potency of semen also plays into religious imaginaries of human-deity relationships as Amy DeRogatis (2009) shows (DeRogatis 2009). Here semen either becomes God's tool to punish sins with sexually transmitted diseases or takes on a

metaphorical meaning in the form of the word of God entering the body as healing sperm.

These examples from a larger body of scholarly work on the meanings of semen (Tober 2001; Blaagaard 2006; Kilshaw 2007; Shand 2007; Kroløkke 2009; Lie et al. 2011) draw attention to the ways in which the meaning and actions of semen are dependent on networks in which it circulates. Semen is never alone, even as a single cell under a microscope. However, most of this literature has focused on the ways in which semen is represented, and on the social implications of networks that enable the exchange of semen. The clinical tests and procedures themselves however, which determine whether a semen sample is used or discarded, and whether a man can become a sperm donor or is likely to become a father, have not received a lot of attention. This article addresses this gap, focusing on the production of quality in the assessment of semen.

Since in the clinical domain, the potentials ascribed to semen and the ways in which samples are used and patients treated are often determined via a measurement of semen quality, we use *quality* as our analytical object in order to understand the norms and values that are incorporated in clinical and laboratory practice. By understanding how quality is determined, one can better comprehend the characteristics of those norms which are entrenched in biomedical rationalities, yet which are rarely acknowledged as particular ethical, social, and political choices.

3. Semen Quality as a Sociopolitical and Medical Problem

Throughout the past decade, Danish men's semen quality has been monitored and debated regularly, with falling numbers of semen quality giving rise to a notion of a fertility crisis (Andersen et al. 2000; Jørgensen et al. 2006; Aggerholm et al. 2008; Jørgensen et al. 2011). In May 2011, the Danish Health Authority Sundhedsstyrelsen published a minute that concluded that Danish men's semen quality was actually not as low as previously believed (Bredsdorff 2011). The researchers responsible for the data behind this minute were not consulted prior to its release and, subsequently, Danish and international researchers reacted with much anger because they had interpreted the data differently than the Danish Health Authority. Whilst there is a shared understanding between these two parties that measurements of semen quality are necessary and important, there seems to be no agreement upon how to conduct and interpret such measurements. Some researchers are even convinced that the data used to determine whether semen quality has fallen or risen during the past 15 years is too heterogeneous (methodically, ethnically, and geographically) to conclude anything at all (Merzenich et al. 2010).

From a broader social science perspective, the interest in semen quality and attempts to measure and compare it on a national and even international level, seems to reflect a social fear that Danish men are losing

their fertility, threatening a bright reproductive future. As Lisa Jean Moore has argued echoing much of the work outlined above, any discussion about semen quality should be situated within a much wider discourse about the crisis of masculinity within western societies (Moore 2008). That is to say that the term 'semen quality' and the ways it is understood, measured, and mobilized are not only connected to specific material qualities of sperm cells, but also to our understanding of the role of men, both within reproduction and more generally as part of a heteronormative society. In this context having bad semen quality is potentially connected to being seen – and understanding oneself – as a man of lesser quality (Birenbaum-Carmeli and Inhorn 2009; Goldberg 2010).

Public discussions about semen quality are characterized by a very vague understanding of what semen quality actually is and what it refers to. Even in andrological textbooks the term's meaning is most of the time assumed rather than explicated. Semen quality can be understood as a measurement of the ability of sperm cells to fertilize an egg cell. Arising out of the andrological literature on semen quality, this definition reifies gender stereotypes by assigning the role of the passive and awaiting part to the egg cell (Martin 1991). Alternatively, semen quality could be defined as a measurement of the ability of sperm cells to merge/fuse with an egg cell. More importantly, however, both these definitions point to the end result of a process, rather than a measurable parameter inherent to sperm cells itself. Indeed, a clear definition of which semen parameters 'quality' actually refers to is almost always missing from chapters in andrological reference books. Instead, these books define semen quality implicitly through the evaluation of a set of characteristics acting as proxies for desired end results (Kvist and Björndahl 2002; Björndahl 2010; Cooper 2010)[1].

A number of different parameters have been identified as being important for a sperm cell's capacity to reach an egg cell and fuse with it into a zygote: semen's smell, texture, and volume; the number of sperm cells, their vitality, and tendency to stick to one another; the individual sperm cell's appearance and morphology; and the concentration of sperm cells within the ejaculate. Semen analysis is the process by which these parameters are identified, an established and relatively low-tech laboratory practice. Semen quality is used to argue for or against a certain medical intervention in men's bodies and lifestyles when they undergo so called fertility treatment[2], but also as a point of reference for public health guidelines with regard to national and international reproductive trends. Yet, as British andrologist Allen Pacey (2009) puts it, the assessment of semen quality is not an exact science. After the World Health Organization (WHO) had published a new manual for examining and processing semen in 2010, it was discussed very critically within andrological circles (Handelsman and Cooper 2010; Jequier 2010), especially in relation to the WHO's much-contested definition of normal fertility (Joffe 2010).

Adding to the difficulties with defining and conducting precise measurements of semen quality, most andrologists believe that quality is not stable over time, or across contexts. Sexual arousal (Pound et al. 2002), environmental pollution (Jurewicz et al. 2009), work environments and lifestyle (Collodel et al. 2008; Sharpe 2010), and situations of deep crisis such as war (Abu-Musa et al. 2011), all seem to affect semen quality. Yet even with the awareness that semen analysis has intrinsic limitations, the search for more accurate and objective ways of measuring semen quality continues. The introduction of computer based semen analysis (CASA) in the 1980s and its continued development (Vested et al. 2011) as well as the growing influence of DNA based methods of analysis (Lewis and Agbaje 2008) are examples of this. The attempt to find a more objective way of measuring semen quality can never fully do away with the fact that measurements embody norms, and that the semen samples which are measured are influenced by subjective circumstances such as sexual arousal. In other words, the longing for objectivity does not do away with subjectivity. The evaluation and assessment of semen is embedded in a dynamic field of scientific requirements and claims, cultural systems of meaning, and individual fate. This also means that quality is an ambiguous concept whose actual meaning is played out in practice, and it is to this practice that we now turn, beginning in a clinic for male infertility.

4. Male Infertility: Semen Quality as Minimum Goal

In the clinic, efforts revolve around a simple goal: conception. When men are treated for infertility as a consequence of subreproductive semen, semen thus does not need to be excellent in order to qualify as 'good enough'. Rather, good quality sperm cells are cells which have the potential to reach an egg cell despite particular deficiencies. This premise frames what standards for assessing semen quality in this context looks like: the goal is to find a basis from which to decide whether a man, and implicitly a couple, should receive treatment in order to become (a) parent(s). In other words, the quality assessments of subreproductive semen have a treatment objective. At the same time, measuring semen quality in this setting involves a number of different approximations and choices of what to measure as a proxy for that which one actually wants to look at but cannot examine directly: the capacity of sperm cells to move in a particular woman's body and fuse with that woman's egg cell.

The treatment centre for male infertility where fieldwork was undertaken is situated in a large hospital in Denmark and combines clinical treatment with a research centre. Analyzing semen samples of men with fertility problems is therefore only one of many different procedures carried out by the staff and researchers. Semen analysis takes place in a special laboratory separated from other parts of the treatment centre and combines many different tests and procedures: weighing semen samples;

evaluation of their texture and pH-value; measuring motility (capacity to move) and concentration of sperm cells in the samples; testing sperm cells' penetration strength and their reaction to anti-bodies and assessments of sperm cells' morphology (cells' physical appearance). A lab manual describes the procedures for conducting each test. These guidelines broadly follow the manual for semen analysis published by the WHO (Cooper 2010) but also differ in certain details. For example, the WHO manual recommends counting 200 spermatozoa twice when assessing a semen sample's motility, whereas the lab manual specifies counting only 100 sperm cells twice. Standards for semen analysis are not fixed but continuously adapt to local practices. Counting only 100 spermatozoa instead of 200 as recommended by WHO does not make the Danish lab's test results less reliable since counting 200 sperm cells is just as imprecise as counting 100. In both instances, only a tiny part of the semen sample is being tested (0,00003 %) with a single semen sample potentially having between 40 and 600 million sperm cells.

The laboratory staff is aware that their work encompasses these approximations. One of the bio-analysts talked about how, at the beginning of her professional training, she tried to count every single sperm cell every time she looked through the microscope. She thought counting every cell would be more correct than just counting 100. But that was, as she phrased it, "an illusion": certainty about a man's fertility cannot be reached even when all cells are counted. In line with the bio-analyst's reflection, manuals for semen analysis point out that semen analysis is not a definitive answer to the question of whether a man can father children or not. Rather, semen analysis is an approximation that supports a decision for or against a treatment plan. Or in other words, measurement practices develop performative effects: they not only describe a certain version of reality but create one in the sense of determining what treatment will look like and how people will perceive of themselves (*Am I man enough? Can we become parents?*).

One of the ways in which semen quality is assessed at the treatment centre is a so-called penetration test. This test's objective is to test sperm cells' capacity to move and penetrate. As part of this test, sperm cells are placed within egg whites to test their ability to move. Thus, in effect, egg whites stand in for the female body, chosen based on their similarity to vaginal mucus. Their ability to perform this role is tested by using sperm cells that have been declared to be motile in other egg whites. The test is thus based on a model as part of which two actors are used to validate each other's reproductive capacity. Whether sperm cells will perform well or not during this test, contributing to the kind of quality assessment a specific semen sample will receive, and thus what kind of treatment patients will be offered, is in other words due to the characteristics of egg whites and laboratory conditions as well as to sperm cell's own capacities.

In practice, the dynamic relationship between different actors (laboratory staff, egg whites, glass tubes, sperm cells) during the test looks as follows:

Maria is looking at the first sample under the microscope and after a few seconds she says: "One thing is for sure, these ones did not make it very far. And I also knew that beforehand." When analyzing the penetration test, Maria looks at how far sperm cells have moved within the tubes containing the egg white (which are called micro capillary tubes). In order to find out how far the sperm cells have advanced, she looks at the first tube and searches for sperm cells in its upper part (farthest away from where the sperm cells started). If she cannot find any sperm cells in that section she goes back to the lower part (closest to where the sperm cells started) and examines whether sperm cells have moved at all and if so, how far they have gotten. Maria explains that a normal sperm cell will be able to move about 40 to 60 millimeters. But that is not what happened in this case. To the contrary, the sperm cells have barely moved at all. And she would have to be very careful and precise when looking whether the sperm cells have "hidden somewhere", as she phrases it. Without looking up from the microscope, she says: "You can see that I am really concentrated. You have to look for every single cell." (Excerpt from fieldnotes)

So, what does good quality mean in this specific setting? All the work at the semen analysis lab is done in order to assure that a specific man will be able to father a child with a specific woman. A sperm cell is good enough if it is able to move through a woman's body in order to realize fertilization and thereby create a genetic relation between certain individuals. Here, the objective is to secure that certain people become parents by creating an environment that is as close as possible to fertilization due to heterosexual intercourse – the penetration test. Quality assessments are organized around this reproductive objective and based upon approximations and particular sets of measurements. A variety of important factors when assessing the quality of semen is not measured or accounted for, for example the state of sexual arousal at the time of ejaculation. Nevertheless, the outcome of the assessment is understood as a neutral and technical result, serving as the best possible and only available model to base medical treatment plans upon. And even if conception in principal takes only a single sperm and egg cell, and whilst it is unclear which sperm cells are most likely to fuse with egg cells after sexual intercourse, it is still tests for the number of sperm cells, their shape and their capacity to move that are used to assess semen's so-called quality. As we shall see when we now turn from the clinic for male fertility to the sperm bank, the indicators serving as 'measures' of good quality shift when the objective no longer is to find out what treatment plan a given couple should follow, but to select the right donor.

5. Sperm Donation: Semen Quality as Abundance

In contrast to the clinic where a minimum of vitality is good enough, the measurement of semen quality as part of sperm donation aims at max-

imum quality. Since sperm banks deal with semen samples that have an abundance of vitality (defined by most sperm banks as at least 200 million sperm cells per milliliter semen liquid), sperm banks need to establish standards in order to manage this abundance. As a consequence, the assessment of good quality at sperm banks includes additional measurements to those used in the context of male infertility. The objective of semen quality assessments at sperm banks is to screen for the best rather than treating the subfertile individual man or couple. Within the legal and state authorized frameworks set in place in Denmark (which, for example, exclude gay men from being sperm donors)[3], sperm banks thus undertake a detailed sorting of applicants guided by what staff at sperm banks deems to be indicators of 'good quality'. Sperm banks screen men as well as their semen: to identify good semen also means to find the good donor and vice versa. As previous research on sperm donors has shown, the performance of a particular kind of masculinity qualifies men – and therewith also their semen – as valuable within the biomedical context of sperm donation (Mohr 2010, 2014, 2016a, 2016b; Almeling 2011).

Once a man has made the decision to become a sperm donor, he will have to undergo a number of tests. While an initial assessment of men's semen based on similar tests for sperm count and motility as they are used in the clinic for male infertility verify that men pass the entry threshold of having an abundance of sperm cells, subsequent questionnaires relating to men's physical traits, their medical and genetic history, their family relations, their behavioural characteristics, and their personality are measures set into place to qualify that abundance. When sperm banks pose questions about illnesses and diseases, alcohol consumption, drug use, education and professional status, physical activity level, and sexual partners and promiscuity, the obvious goal is to rule out potential biogenetic factors that could pose a risk to a future child's health. But these assessments are also about more than just health. They contain ideas about who is suitable for reproduction and thus sort men according to specific personal characteristics that identify potential donors as socially acceptable. In order to do so, sperm banks rely on a negative list of characteristics including drug use, criminal behaviour, sexual promiscuity, and bi- and homosexuality, categories which – inside a biomedical logic – are all understood as indicators of risk behaviour and thus their absence as indicators of responsibility. When donors are asked to qualify themselves by answering different questionnaires, men are thus asked to identify themselves as belonging, or not, to certain *risk groups* with the effect that men are required to pass as 'responsible' when answering questions concerning health status, education, and sexual activity. In this way, the abstract ideal of responsibility becomes part of sperm banks' attempt to secure high quality semen, an extrapolation from the general to the particular that is both technically and normatively problematic (Mohr 2010).

Since responsibility is hard to measure on a scale from one to ten and therefore cannot only be captured in laboratory based assessments, do-

nors have to continuously *perform* responsibility as part of their interaction with sperm bank staff. One of the moments in which the performative dimension of responsibility is clearest is the screening interview potential sperm donors have to attend. These interviews are arranged after the applicant has delivered his first semen sample, and primarily serve the purpose of checking medical history. Verifying these so called 'facts' about their medical history in person is part of performing responsibility and takes place not just via verbal confirmation but also through the interaction between staff and donor:

Stine now turns to the medical history: "I am assuming that you are well and healthy' she wants to know". "There has never been anything wrong with me", the donor replies. He then adds that his sister is overweight. Stine wants to know by how much. He explains that his sister would not have any problems in her daily life; she would just weigh more than other people. Looking at a piece of paper that contains information about his relatives, he answers all of Stine's questions. He also mentions that his mother has an allergy: "But neither my sister nor I have had any symptoms", he reassures Stine. His uncle has had heart problems: "But he was a drug and alcohol addict, so this was clearly due to his lifestyle", he concludes. As the interview is over, Stine and I talk about the donor candidate. "This was a typical interview", she says, "He didn't ask a lot of questions." But, Stine points out to me, what made this candidate special was the fact that he could actually answer all the questions in regards to his medical history: "He was very well prepared", she says, "and that reassures me that I can actually trust what a candidate says, which is always an advantage." (Excerpt from fieldnotes)

Men who want to be sperm donors thus have to perform responsibility, if not in their daily life then at least in situations in which they meet sperm bank staff. As the fieldnote demonstrates, coming forward with information relevant to one's medical history is part of performing responsibility. Also, pointing out that problematic health conditions are a result of irresponsible lifestyle rather than genetics construes the donor candidates as the responsible men that are sought after. Whereas good semen quality at the male fertility clinic was about finding enough vitality in order to determine a treatment plan, good semen quality at the sperm bank always already encompasses an abundance of vitality. Vitality, as an element of quality, thus operates differently at sperm banks. Here, vitality needs to be upgraded, as it were, through a number of social characteristics that the donors have to exhibit. These characteristics are partly thought of as travelling with sperm cells and partly as lowering the risk of potential illnesses and diseases. To assess quality at the sperm bank therefore means not only to evaluate each semen sample's observable characteristics, as in the male fertility clinic, but also involves the donors' lifestyles, personality, and sexuality. Good quality in the sperm bank embodies not only measurements of vitality, but also assessments of the personality of donors. These measurements are strikingly absent when we now move to the labs working with artificial sperm cells.

6. Articifical/in-vitro Sperm: Semen Quality as Proof of Principle

In 2003, germ cells of male mice were produced for the first time in-vitro, meaning outside of the animal body, with the help of a laboratory setting (Toyooka et al. 2003). This was followed by experiments with human tissue (Clark et al. 2009). In 2006, a German research team was able to create living mice offspring using in-vitro germ cells (Nayernia et al. 2006). As part of a publicly financed research project entitled *Germ Cell Potential*, some researchers from this team are continuing their research with tissue from subfertile men (Gromoll 2011). Social characteristics such as responsibility are not part of the quality assessment of in-vitro sperm; on the contrary, such characteristics are deemed utterly irrelevant by researchers. The primary goal is instead, as one researcher phrased it in an interview, "to get basic research as far as possible in order to secure that it can be used to cure male infertility at some point." Researchers imagine the production of in-vitro sperm as a solution to the cases of male infertility which the male fertility clinic cannot treat. Thereby their research can be read as an attempt to reify a kinship system which is based on the ideal of the nuclear family – father, mother, child – in which no "donor daddy" or "biological mother" interferes. Good quality sperm cells here are sperm cells from the *properly related* person. The quest to establish an unquestionable certainty, that genetic and social fatherhood reside in one and the same person, can, in other words, also be understood as an attempt to avoid the challenges to patriarchal kinship that donor insemination introduces.

If procreative cells can be created out of stem cells, a type of cell that everyone possesses, potentially anybody can become a "father". Sperm cells made from stem cells, what scientist themselves call in-vitro sperm, would not be found in semen anymore and, as a result, one of the central points of reference of a heteronormative gender order – the male-female dichotomy – would disappear[4]. While the queer implications of such research are obvious, they nevertheless do not appear to be the main driver of this research's agenda.

In comparison to the context of the male fertility clinic where the laboratory was acting as a stand-in for the female body, here the laboratory serves as a stand-in for the male body. The objective is to produce sperm cells that resemble the 'natural original' as much as possible, with the work which the male body accomplishes in order to produce sperm cells being imitated by researchers in the laboratory. In this setting, good quality sperm cells are primarily tied to a concept of purity. Cells have to be recognizable as 'pure' cells since they otherwise will be sorted out, a sorting practice which also manages the purity of the cell culture as a whole.

The culture mediums in which cells are grown are of utmost importance for this process as a researcher explained in an interview:

The cells need to be cultivated within a certain time span in order to make sure that you have a pure culture. That means that I isolate the cells and place them in a medium and this medium needs to be changed, as far as I remember, after three days. Of course there will also be other cells in there, but they don't grow in the petri dish and that's why they can be washed out, so that just those stem cells which actually have the potential to grow further will stay in the dish. (Excerpt from interview)

Securing a pure culture of cells with the help of a specific medium and through particular working practices can be understood as an attempt to imitate the process in the male body through which sperm cells are produced as part of spermatogenesis. Stem cells in testicles turn into sperm cells via a chain of different developmental stages and splitting phases, imitated in the lab by successive changes of the medium and by washing out unwanted cells. The purity of the cells and culture – absence of bacteria, presence of specific proteins – is an important quality criterion. Semen quality is therewith tied to an idea of purity that is believed to be found in the healthy, that is, fertile man. But just as the definitive healthy man does not exist, neither does the ultimately pure culture. In the interviews, researchers described problems they have trying to cultivate a pure cell culture:

A big problem is of course the contamination of cell cultures. That happens all the time, either when bacteria come in during times when everybody has a cold, someone sneezes while the incubator is open, that kind of stuff. That is a typical problem. Or when the cells which are supposed to be used for spermatogenesis do not express the expected phenotype. (Excerpt from interview)

The ideal of natural purity is not so easy to reach, and even its approximation requires researchers to repeatedly intervene in the developmental processes that take place in the petri dish.

The culture mediums thus guarantee the growth of the desired cells which helps researchers to identify the right cells. After the cells have grown successfully, researchers rely on protein markers that signal which cells have reached a certain state. Most experiments use fluorescent markers, which attach to the specific proteins of interest, meaning that "good" cells will light up under fluorescent light. The sorting of "good" cells from "bad" cells is done by an automated device, echoing the ejaculation of whole, mature sperm cells by the male body.

The ultimate proof of success in creating good sperm cells is to show that they can produce offspring, as another researcher explained in an interview:

Mohr: "What does having a good cell mean for you?"
Researcher: "That is not so important for us. We are interested in how we get most of the cells successfully through meiosis, how we can raise the number of haploid cells. But proof of principle is of course that we should find out if the cells can fertilize or not, if we can get living animals out of them." (Excerpt from interview)

Surviving offspring in these experiments is a sign of *good enough* quality, in contrast to the quality assessments at sperm banks. But a different set of approximations is used for this assessment than when sub-reproductive sperm samples are assessed at the male fertility clinic.

Whereas the goal of sperm donation is to create children with desired traits (and absence of disease), it is the genetic relationship between certain animals that is of importance in the context of in-vitro sperm. The objective is to be able to say for sure who is father to whom instead of father to what. Sperm cells do not need to be of excellent quality in order to be good enough, just as it is the case at the male fertility clinic. The deciding criterion is that an unwanted intervention in heteronormative kinship can be avoided. Queer kinship relations remain only a future, unintended consequence should new users adopt the technology. Semen quality in in-vitro research shifts from being an intrinsic quality of cells into a constructed quality. In the course of this construction, the very word "sperm cell" seems to change its meaning: it is not so much an entity any longer, but rather a capacity, an action, namely to fertilize and reproduce. It changes its associations from a noun to verb, we might say, with the gender and 'fatherhood' attached to artificial germ cells becoming the result of a historic precedence rather than that of a social identity assigned to the body from which the cells originate. That which makes the cells good depends on the laboratory's ability to produce and identify certain markers which mark the cells as good cells. In the broadest sense, all this is set in place in order to be able to control *who* is related genetically to whom.

7. Conclusions

By definition, quality reflects values and thus will always depend on subjective assessments. By comparing three different contexts in which the quality of semen is assessed, we have shown that these assessments reflect norms and desires which some people have in common and others not and which those involved – medical professionals, patients, sperm banks staff, sperm donors, or researchers – only seldom consciously and autonomously choose or dismiss. In other words, whilst these norms and desires surrounding reproduction and genetic relatedness shape measurements with very concrete effects, they are seen as not worth discussing in the clinical or research context. In this way, semen quality is made to

appear as a purely "technical" matter used as background data when making the "real" normative decisions about who gets to reproduce and in which ways. We have shown, in contrast, that norms are not just added at some later point when treatment decisions are made but go to the core of the medical judgment.

We have presented three different ways in which sperm cells can be identified as being of good quality, reflecting different goals and implicitly associated values. A sperm cell can be good enough if it is able to move through a woman's body in order to realize fertilization and thereby create a genetic relation between certain individuals, as seen in the context of subreproductive semen. Here, the objective is to secure that certain people become parents by testing sperm cells in an environment that is as close as possible to heterosexual intercourse. A sperm cell can also be good, if it has an abundance of vitality, as is the case in sperm donation. Here, however, sperm donors are also assessed, and personal characteristics become a deciding factor when assessing if a man's semen is good enough. Last but not least, a sperm cell can be good, if it has the capacity to perform a certain function, namely to fertilize, as is the case with in-vitro sperm. Here the cell as an entity is no longer important. It is not heterosexual intercourse that needs to be recreated but rather the developmental processes within the male body, the objective being to control and minimize interventions in specific kin relations.

Though public debates use and refer to semen quality as an unquestionable technical fact, most bio-analysts, clinic staff, and researchers are aware that the standards they employ rely on approximations. Measurements are made in order to support decisions – be they treatment plans or interventions in petri dishes. When moving across the three different fields of subreproductive semen, sperm donation, and in-vitro sperm it becomes apparent that what 'good quality' means is very much dependent on context. In fact, the whole idea of a sperm cell being a phenomenon which is just out there with measurable qualities becomes increasingly unconvincing when one moves across the different contexts. When we look at semen and examine it, the way we look at it and from which perspective will be decisive for what we will define as a problem and what we will think is appropriate to solve it. Normative choices are part of this process, even when measurements are framed as "just" quality assessments. Determining semen quality means to decide and plan who gets to have children with whom, and exploring, changing, and negotiating what semen is, and what it can do, means also structuring future family, kinship, and gender relations.

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References

Abu-Musa, A., Kobeissi, L., Hannoun, A.B., and Inhorn, M.C. (2011) *Effect of War on Fertility: A Review of the Literature*, in "Reproductive BioMedicine Online", 17 (supp. 1), pp. 43-53.

Adrian, S. (2010) *Sperm stories: Policies and Practices of Sperm Banking in Denmark and Sweden,* in "European Journal of Women's Studies", 17 (4), pp. 393-411.

Aggerholm, A.S., Thulstrup, A.M., Toft, G., Ramlau-Hansen, C. and Bonde, J.P. (2008) *Is Overweight a Risk Factor for Reduced Semen Quality and Altered Serum Sex Hormone Profile?,* in "Fertility and Sterility", 90 (3), pp. 619-626.

Allen, M. (1998) *Male Cults Revisited: The Politics of Blood versus Semen*, in "Oceania", 68 (3) pp. 189-199.

Almeling, R. (2011) *Sex Cells: The Medical Market for Eggs and Sperm,* Berkeley, University of California Press.

Andersen, A.G., Jensen, T.K., Carlsen, E., Jørgensen, N., Andersson, A.M., Krarup, T., Keiding, N. and Skakkebæk, N.E. (2000) *Hig Frequency of Suboptimal Semen Quality in an Unselected Population of Young Men*, in "Human Reproduction", 15 (2), pp. 366-372.

Aydemir, M. (2007) *Images of Bliss. Ejaculation, Masculinity, Meaning,* Minneapolis, University of Minnesota Press.

Birenbaum-Carmeli, D. and Inhorn, M.C. (2009) *Masculinity and Marginality: Palestinian Men's Struggles with Infertility in Israel and Lebanon,* in "Journal of Middle East Women's Studies", 5 (2), pp. 23-52.

Björndahl, L. (2010) *A Practical Guide to Basic Laboratory Andrology,* Cambridge, Cambridge University.

Blaagaard, B.B. (2006) *Relocating Whiteness in Nordic Media Discourse. In Rethinking Nordic Colonialism: A Postcolonial Exhibition Project in Five Acts. Documentation,* Helsinki, NIFCA, Nordic Institute for Contemporary Art.

Bredsdorff, M. (2011) *Læger truer med at lægge Sundhedsstyrelsen på is*, in "Ingenøren", 18.

Clark, A.T., Park, T.S., Galic, Z., Conway, A.E., Lindgren, A., Handel, B.J.V., Magnusson, M., Richter, L., Teitell, M.A., Mikkola, H.K., Lowry, W.E. and Plath, K. (2009) *Derivation of Primordial Germ Cells from Human Embryonic and Induced Pluripotent Stem Cells Is Significantly Improved by Coculture with Human Fetal Gonadal Cells,* in "Stem Cells", 27 (4), pp. 783-795.

Clarke, A.E. (1998) *Disciplining Reproduction: Modernity, American Life Sciences, and "the problems of sex",* Berkeley, University of California Press.

Collodel, G., Moretti, E., Fontani, V., Rinaldi, S., Aravagli, L., Saragò, G., Capitani, S., and Anichini, C. (2008) *Effect of Emotional Stress on Sperm Quality*,

in "Indian Journal of Medical Research", 128 (3), pp. 128-135.

Cooper, T. G. (2010) *WHO Laboratory Manual for the Examination and Processing of Human Semen,* Geneva, WHO.

Daniels, C.R. (2006) *Exposing Men: The Science and Politics of Male Reproduction,* Oxford, Oxford University Press.

Daniels, C.R. and Golden, J. (2004) *Procreative Compounds: Popular Eugenics, Artificial Insemination and the Rise of the Americn Sperm Banking Industry,* in "Journal of Social History", 38 (1), pp. 5-27.

Daston, L. and Galison, P. (2007) *Objectivity*, Brooklyn, Zone Books.

DeRogatis, A. (2009) *"Born Again Is a Sexual Term": Demons, STDs, and God's Healing Sperm,* in "Journal of the American Academy of Religion", 77 (2), pp. 275-302.

Douglas, M. (2010) *Purity and Danger. An Analysis of Concept of Pollution and Taboo,* New York, Routledge.

Émon, A. (2012) *The Making of the Sperm Donor: Constructing Science, Managing Identity in five US Cryobanks*, PhD Dissertation, University of Wisconsin-Madison.

Franklin, S. (1997) *Embodied Progress: A Cultural Account of Assisted Reproduction*, London, Routledge.

Franklin, S. and McNeil, M. (1988) *Reproductive Futures: Recent Literature and Current Feminist Debates on Reproductive Technologies,* in "Feminist Studies", 14 (3), pp. 545-560.

Goldberg, H. (2010) *The Man in the Sperm: Kinship and Fatherhood in Light of Male Infertility in Israel,* In D. Birenbaum-Carmeli and Y.S. Carmeli (eds.), *Kin, Gene, Community. Reproductive Technologies Among Jewish Israelis*, New York, Berghahn, pp. 84-106.

Gromoll, J. (2011) *Germ Cell Potential*, http://www.germ-cell-potential.de/index.php/concept (retrivied March 23, 2017)

Handelsman, D.J. and Cooper, T.G. (2010) *Afterword to Semen Analysis in 21st Century Medicine special issue in Asian Journal of Andrology,* in "Asian Journal of Andrology", 12 (1), pp. 118-123.

Haraway, D. (1991) *Simians, Cyborgs, and Women. The Reinvention of Nature*, London, Free Association Books.

Herdt, G. (1987) *The Sambia. Ritual and Gender in New Guinea,* New York, CBS College Publishing.

Inhorn, M. (2011) *Globalization and Gametes: Reproductive 'tourism', Islamic Bioethics, and Middle Eastern Modernity*, in "Anthropology & Medicine", 18 (1), pp. 87-103.

Inhorn, M. (2012) *The New Arab Man: Emergent Masculinities, Technologies, and Islam in the Middle East*, Princeton, Princeton University Press.

Jequier, A.M. (2010) *Semen Analysis: A New Manual and its Application to the Understanding of Semen and its Pathology*, in "Asian Journal of Andrology", 12 (1), pp. 11-13.

Joffe, M. (2010) *Semen Quality Analysis and the Idea of Normal Fertility,* in "Asian Journal of Andrology", 12 (1), pp. 79-82.

Jørgensen, N., Asklund, C., Carlsen, E., and Skakkebæk, N.E. (2006) *Coordinated European Investigations of Semen Quality: Results from Studies of Scandinavian Young Men is a Matter of Concern,* in "International Journal of Andrology", 29, pp. 54-61.

Jørgensen, N., Vierula, M., Jacobsen, R., Pukkala, E., Perheentupa, A., Virtanen, H.E., Skakkebæk, N.E. and Toppari, J. (2011) *Recent Adverse Trends in Semen Quality and Testis Cancer Incidence among Finnish Men*, in "International Journal of Andrology", 34 (4pt2), pp. e37-e48.

Jurewicz, J., Hanke, W., Radwan, M., and Bonde, J.P. (2009) *Environmental Factors and Semen Quality,* in "International Journal of Occupational Medicine and Environmental Health", 22 (4), pp. 305-329.

Kampf, A. (2013) *Tales of Healthy Men: Male Reproductive Bodies in Biomedicine from 'Lebensborn' to Sperm Banks,* in "Health: An Interdisciplinary Journal for the Social Study of Health, Illness and Medicine", 17 (1), pp. 20-36.

Kilshaw, S. (2007) *Toxic Emissions: The Role of Semen in GWS Narratives,* in "Anthropology & Medicine", 14 (3), pp. 251-258.

Kroløkke, C. (2009) *Click a Donor. Viking Masculinity on the Line,* in "Journal of Consumer Culture", 9 (1), pp. 7-30.

Kvist, U. and Björndahl, L. (2002) *Manual on Basic Semen Analysis,* Oxford, Oxford University Press.

Lewis, S.E.M. and Agbaje, I. (2008) *Sperm DNA Tests as Useful Adjuncts to Semen Analysis,* in Systems Biology, in "Reproductive Medicine", 54 (3), pp. 111-125.

Lie, M., Ravn, M.N., and Spilker, K. (2011) *Reproductive Imaginations: Stories of Egg and Sperm,* in "NORA - Nordic Journal of Feminist and Gender Research", 19 (4), pp. 231-248

Martin, E. (1991), *The Egg and the Sperm: How Science has constructed a Romance based on stereotypical male-female Roles*, in "Signs: Journal of Women in Culture and Society", 16 (3), pp. 485-501.

Merzenich, H., Zeeb, H., and Blettner, M. (2010) *Decreasing Sperm Quality: A Global Problem?,* in "BMC Public Health", 10 (24), pp. 24-28

Mohr, S. (2010) *What Does One Wear to a Sperm Bank? Negotiations of Sexuality in Sperm Donation,* in "Kuckuck Notizen zur Alltagskultur", 25 (2), pp. 36-42.

Mohr, S (2014) *Beyond Motivation: On What It Means To Be a Sperm Donor in Denmark,* in "Anthropology & Medicine", 21 (2), pp. 162-173.

Mohr, S. (2015) *Living Kinship Trouble: Danish Sperm Donors' Narratives of Relatedness*, in "Medical Anthropology", 34 (5), pp. 470-484.

Mohr, S. (2016a) *Containing Sperm - Managing Legitimacy: Lust, Disgust, and Hybridity at Danish Sperm Banks,* in "Journal of Contemporary Ethnography", 45 (3), pp. 319-342.

Mohr, S (2016b) *Donating Semen in Denmark,* in by L. Manderson, E. Cartwright and A. Hardon (eds.), *The Routledge Handbook of Medical Anthropology*, New York, Routledge, pp. 63-67.

Mohr, S. and Koch, L. (2016) *Transforming Social Contracts: The Social and Cultural History of IVF in Denmark*, in "Reproductive Biomedicine & Society Online", 2, pp. 88-96.

Mohr, S. (2018) *Being A Sperm Donor: Masculinity, Sexuality, and Biosociality in Denmark*, New York, Berghahn.

Moore, L.J. (2008) *Sperm Counts. Overcome by Man's Most Precious Fluid,* New York, New York University Press.

Nayernia, K., Nolte, J., Michelmann, H.W., Lee, J.H., Rathsack, K., Drusenhei-

mer, N., Dev, A., Wulf, G., Ehrmann, I., Elliot, D.J., Okpanyi, V., Zechner, U., Haaf, T., Meinhardt, A. and Engel, W. (2006) *In Vitro-Differentiated Embryonic Stem Cells Give Rise to Male Gametes that Can Generate Offspring Mice,* in "Developmental Cell", 11 (1), pp. 125-132.

Pacey, A. A. (2009) *Sperm, human fertility and society,* in T.R. Birkhead, D.J. Hosken, and S. Pitnick (eds.), *Sperm Biology: An Evolutionary Perspective*, Burlington, Oxford, Acedemic Press, pp. 565-597.

Pound, N., Javed, M.H., Ruberto, C., Shaikh, M.A., and Del Valle, A.P. (2002) *Duration of Sexual Arousal Predicts Semen Parameters for Masturbatory Ejaculates*, in "Physiology & Behavior", 76 (4-5), pp. 685-689.

Shand, A. (2007) *Semen Anxiety: Materiality, Agency and the Internet,* in "Anthropology & Medicine", 14 (3), pp. 241-250.

Sharpe, R.M. (2010) *Environmental/Lifestyle Effects on Spermatogenesis,* in "Philosophical Transactions of the Royal Society Biological Sciences", 365, pp. 1697-1712.

Svendsen, M.N. and Koch L. (2008) *Unpacking the "Spare Embryo": Facilitating Stem Cell Research in a Moral Landscape,* in "Social Studies of Science", 38 (1), pp. 93-110.

Tjørnhøj-Thomsen, T. (2009) *"It's a bit unmanly in a way": Men and Infertility in Denmark*, in M. C. Inhorn, T. Tjørnhøj-Thomsen, H. Goldberg, and M. la Cour Mosegaard (eds.), *Reconceiving the Second Sex: Men, Masculinity, and Reproduction,* New York, Oxford, Berghahn, pp. 226-252.

Tober, D. (2001) *Semen as Gift, Semen as Goods: Reproductive Workers and the Market in Altruism,* in "Body & Society", 7 (2-3), 137-160.

Toyooka, Y., Tsunekawa, N., Akasu, R. and Noce, T. (2003) *Embryonic Stem Cells Can Form Germ Cells in Vitro*, in "Proceedings of the National Academy of Sciences of the United States of America", 100 (20), pp. 11457-11462.

Vested, A., Ramlau-Hansen, C.H., Bonde, J.P., Thulstrup, A.M., Kristensen, S.L., and Toft, G. (2011) *A Comparison of Conventional and Computer-assisted Semen Analysis (CRISMAS software) Using Samples from 166 Young Danish Men*, in "Asian Journal of Andrology", 13 (3), pp. 453-458.

Wahlberg, A. (2008) *Reproductive Medicine and the Concept of 'Quality',* in "Clinical Ethics", 3 (4), pp. 189-193.

Wahlberg, A. (2010) *Assessing Vitality: Infertility and 'Good Life' in Urban China*, in J. Yorke (ed.), *The Right to Life and the Value of Life: Orientations in Law, Politics and Ethics*, Farnham, Ashgate, pp. 371-397.

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[1] It is important to note that the term "fertility" carries different meanings in different contexts. In popular discourse and debate, it is typically used to describe a man's ability to have children. In the andrological literature, fertility means that a man has actually had children. The potentiality embedded in the popular understanding of fertility is instead referred to as "fecundity" within andrology. For communication purposes, we follow the popular usage.

[2] Biomedical interventions like IVF or ICSI are often referred to as treatments within the clinical settings of reproductive biomedicine. While these treatments also represent a particular medicalization of reproduction in general and the female and male body in particular, the sense making of the use of reproductive technologies also involves the (de)stabilization of gender identities, that is, while

some women and men undergoing fertility treatment experience closure in the sense that they become women and men through the successful birth of a child, others come to realize the boundaries of their gendered selfhood and the pain that this might entail due to not being able to have children (Franklin 1997; Tjørnhøj-Thomsen 2009; Inhorn 2012). Our usage of the term treatment here tries to capture this dynamic, the potency of reproductive technologies "to constitute gender identities in which imaginations about, and norms pertaining to, what it means to be a woman or a man are linked with the idea of the good citizen as a reproductive citizen, someone who pursues having children as a collectively shared ideal." (Mohr and Koch 2016, 93).

[3] The legal document states that men who have had sex with men should be excluded, unlike in Spain and Great Britain – both countries of the European Union. The Danish authorities based the guidelines for sperm donation on those regulating blood donation, grounded in the assumption that men who have sex with men have a higher risk of HIV infection. This risk is thought of as being present no matter the actual behavior of an individual man. Sperm donors are thus selected based on their sexual preference rather than on their actual risk behavior.

[4] It should be noted that the production of offspring using only genetically female tissue and cells is more difficult. As researchers interviewed during fieldwork explained, cells with two X-chromosomes have difficulties getting further than meiosis, a critical developmental stage in the production of germ cells.

Transformations in the Public Perception of Sperm Donation in China
An Analysis of Media Debate in Chinese Newspapers in the 2010's

Kerstin Klein
Independent scholar

Abstract: Despite a long history of assisted reproductive technologies including the use of IVF and artificial insemination, sperm donation has always been a difficult topic in China due to a number of political and sociocultural factors. The article will look at the cultural biases against sperm donation, that in the past have led to a severe shortage of sperm donors across the country's provincial sperm banks. It will also look at the political and regulatory context of sperm donation, and it will explore new developments more recently that have transformed the perception of sperm donation and the attitudes among Chinese men to become sperm donors. In particular, it will look at the media controversy about sperm donation that followed the death of a sperm donor in Wuhan city in 2011, which served as an important catalyst to initiate wider public debate about sperm donation in the media. As the Chinese government is actively seeking to encourage more men to become sperm donors, and media organizations have taken a more active role in collecting, disseminating and transmitting information, this has changed the perception on sperm donation, at least to some degree. Today, there is a more knowledgeable and better informed (male) public, in particular among university students, who is more willing to become sperm donors than it was the case only five years ago. However, as much as this has changed, the end of China's one-child policy in 2016 has put new pressures on an already strained system of supply and demand of donor sperm in the context of assisted reproductive technologies, as today even more couples are seeking to fulfill their reproductive wishes to also have a second child.

Keywords: sperm donation; gametes; china; media analysis; assisted reproductive technologies.

Corresponding author: Kerstin Klein, Archer Tower, Berger Rd, London E96FG, UK – Email: kerstin.s.klein@gmail.com

1. Introduction

In February 2011, a 35-year-old doctoral student at Huazhong University of Science and Technology in Hubei Province fatally collapsed during the process of making a sperm donation at the local sperm bank. The case came to wider public attention when, in the following year, the media reported that the donor's father had taken the university to court, claiming that the sperm bank was responsible for his son's death. The case triggered a surge of media reports and changed the image of sperm donation from a somewhat taboo topic that people did not talk about even with close family and friends, to a new domain of public interest. The paper will look at how, whilst tragic, the incident served as a crucial breakthrough in China, to change the character of the media debate about sperm donation, and to transform the (male) public's perception of issues surrounding it. In fact, sperm donation has been one of the most controversial aspects of assisted reproductive technologies (ARTs) in China[1].

Artificial reproductive technologies have been a central object of research in science and technology studies for several decades now, and numerous studies have looked at the impact of ARTs in different national and political cultures (e.g., Inhorn and Van Balen 2002; Strathern 1992). As those undergoing ART treatments often rely on gametes (eggs and sperm) or embryo donors, social scientists have also looked at the motivations of donors in different countries and the impact of legislative contexts on the diversity of donor populations (e.g., Mohr 2014; Pennings et al. 2014). This study draws on two related bodies of literature in the Chinese context, one that has explored the social and political conditions of reproduction (e.g., Handwerker 2002; Greenhalgh and Winckler 2005), and another that has looked at human gamete and embryo donation (e.g., Klein 2010; Klein 2017; Liao, Dessein and Pennings 2010; Ping et al. 2011). China reported the birth of its first IVF baby only ten years after the world's first baby was conceived from IVF in England in 1978, and this marked the beginning of China's intensive involvement with ARTs. What is different in China than in most other countries is that the Chinese government does not permit the donation of spare embryos leftover in IVF clinics for use by other infertile couples (Klein 2010). From this follows that spare embryos can only be donated for research purposes (e.g., stem cell research), or alternatively they have to be discarded (MOH 2003), and only human gamete donation is lawful. Many of the concerns surrounding the application of ARTs are unique to China, where Confucian beliefs and values strongly influence the debate. Although IVF has been long established and 'routinized' in China over a period of more than three decades (Wahlberg 2016), and even though artificial insemination (by both husband and donor) has been practised for an even longer period of time (Liao, Dessein and Pennings 2010)[2], sperm donation, although encouraged by authorities, has always been one of the most controversial applications in the ART sector in China.

Sperm donation serves as a remedy for the lack of male gametes in infertile couples and satisfies the male partner's desire to have a child, but it also means that the couple will raise a child that is biologically unrelated to the father. The absence of this genetic link poses a direct conflict with Confucian norms and values, which many people still accept, especially in rural areas of China. A child conceived with the help of a sperm donor is difficult to accept, because Confucian filial duty strongly favours the biological link as it fits with a central Confucian value of 'continuing the patriline' (Qiu 2002). From this vantage point, the implications for the sperm donor are that he passes on his ancestral bloodline to strangers, which would be akin to an insult to his family and ancestors, because the biological father is not able to fulfil his filial duty for his unknown and unacknowledged offspring (Heng 2009). Consequently, sperm donation has been a highly controversial topic in China.

The paper uses a qualitative approach to look at the media debate about sperm donation. Chinese newspapers will be analysed with the help of textual analysis. Following Fairclough (2003), newspaper articles, as 'texts', are elements of social events which have 'causal effects' and can bring about change. For instance, texts can bring about changes in our knowledge, beliefs, attitudes, values and so on. However, this causality is not regular. According to Fairclough, it is not possible to say for instance that particular features of texts automatically bring about certain changes in people's knowledge or attitudes, or particular social effects. Analysing the causal effects of texts, what needs to be accounted for is that they are embedded in "processes of meaning-making" (Fairclough 2003), and that it is these 'meanings' that have social effects and can lead to change, rather than the texts as such. Such a methodological approach implies that meanings and interpretations associated with these texts (newspaper articles) and their messages about sperm donation will be more relevant than for instance the number of times they occur. The media analysis will primarily draw on Chinese English-language media[3], in particular but not only the dailies 'China Daily' and 'Global Times'[4]. The period of data collection concentrates on the time when sperm donation became a topic of wider public debate in China in 2011 until 2016, but the analysis will also include newspaper articles from earlier years, as well as regulatory guidelines and scientific reports.

In China's system of media control, the Publicity Department of the Communist Party of China (CPC) (sometimes still called by its old name 'Propaganda Department') coordinates with the General Administration of Press Freedom to enforce media censorship and control of politically sensitive and taboo topics (Stockmann 2013). Since President Xi Jinping took office, he has asked for 'absolute loyalty' from the state media (South China Morning Post 2016a), and censorship of all forms of media organizations and content has tightened. Despite heavy government censorship, however, mainland Chinese media production has also turned into an increasingly competitive market, offering diversified content and an

increase in investigative reporting. Many topics and political events are strictly monitored and either considered to be taboo or sensitive, but there are also some areas with less heavy state censorship, where journalists enjoy greater freedoms in their journalistic expression. Sperm donation is not considered to be a politically sensitive topic, and government authorities have in fact actively sought to overcome the deep-seated sociocultural prejudices against sperm donation prevalent among many Chinese, which in the past have led to severe shortages among the country's sperm banks. The paper will start with a discussion of the broader cultural and regulatory context surrounding sperm donation in China. The media analysis will then include an analysis of central topics, meaning and actors in the debate about sperm donation in Chinese newspapers. The conclusions will make some final observations about the effects of the media debate on the transformation of public perception.

2. Cultural and Regulatory Context of Sperm Donation in China

Confucianism is the main Chinese framework of norms and ethics by which the new ARTs have been taken up and interpreted. Confucian norms and values place a strong emphasis on the patrilineal tie between ancestors and their descendants, and procreation is by far the most significant aspect of Confucian filial duty. Childlessness has always been regarded as a failure in one's duty toward parents and ancestors (Heng 2009). Especially in rural areas, but not only, it is attached with social stigma, which may not only affect the infertile couple but also their entire family (Handwerker 1998; Ping et al. 2011). In the past, this has led to alternative techniques of reproduction to bypass infertility or to get hold of additional children, in particular if a couple was unable to bear a son, and such alternatives included for instance adoption of (extra) sons or taking concubines when a wife had not produced an heir (Klein 2017). Yet today, ARTs offer entirely new ways to deal with infertility and to alleviate the burden of childlessness. Since ARTs became available in China in the late 1980's, their development coincided with a unique biopolitical setting, namely that of a mandatory birth limitation policy, allowing only one child per couple (Greenhalgh and Winckler 2005). In her ethnographic studies of Beijing's emerging ART industry in the early 1990's, Lisa Handwerker has shown how in the context of government controlled reproduction, the availability of ARTs created new pressures for childless couples to do everything they can to overcome infertility, and how therefore, paradoxically, the one-child policy came to be experienced as a 'everyone must have one child policy' (Handwerker 2002). When Deng Xiaoping's economic reforms since the late 1970's culminated in the political reform project under Jiang Zemin at the turn of the millennium,

Greenhalgh and Winckler (2005) have shown, how the birth planning policy overall shifted from a mass surveillance intrusion into all aspects of people's lives to a more 'neoliberal' and indirect form of regulatory control through new social actors and intermediary organizations. This shift was characterized by two fundamental paradigm changes: firstly, a change from a focus on 'quantity' to that of 'quality of the population', and secondly, a change from direct state regulation to greater self-regulation through the market and by communities, families and individuals themselves. Under this 'neoliberal' influence, the one-child policy turned its focus away from curbing the size of the population onto improving its 'quality', and as Handwerker (2002) has pointed out, this meant a new focus on producing 'the quality singleton'. This trend has been particularly strong in urban areas and was exacerbated by the rise of new consumer markets for infertility and ART treatments and a new culture of self-regulating subjects obsessed with raising the quality of their single offspring.

It was in the midst of this shift, when medical experts and fertility providers in the late 1990's became increasingly unsatisfied with a vastly expanding but unregulated ART industry. They increased their pressure on the authorities to standardise and regulate the new medical sector, so that ART clinics require state licenses to provide their services. It took until 2001, when the former Ministry of Health (MOH), now the National Health and Family Planning Commission (NHFPC)[5], issued four new regulations: two methods, the 'Managerial Method for Human Assisted Reproduction' and 'Managerial Method for Human Sperm Banks', and two technical standards, the 'Technical Standard for Human Assisted Reproduction' and 'Technical Standards for Human Sperm Banks'. In 2003, these methods and standards were amended, and the amendments together with new ethical principles were incorporated into the currently applicable set of legal guidelines, called the 'Technical Standards and Ethical Principles for Human Assisted Reproduction and Sperm Banks' (henceforth referred to as MOH 2003). Under the new legal guidelines (MOH 2003), single women, unmarried and same-sex couples are not permitted to receive ART services, and those seeking to undergo fertility treatment need to show their marriage certificates. The guidelines also require confidentiality of all involved persons including the identity of donors, and sperm or gamete donors are guaranteed lifelong anonymity[6]. Due to Confucian cultural sensitivities in China, which have the potential to make a child conceived with the help of a donor difficult to accept, most couples respect this anonymity principle, as it goes hand in hand with a secrecy rule common among Chinese families: when the act of using a sperm donor is kept a secret, the rationale goes, the child will also never ask for his or her genetic father's name (Liao, Dessein and Pennings 2010)[7].

There are 30 provinces, autonomous regions and municipalities in mainland China. Under current guidelines, each province can only have one provincial sperm bank (MOH 2003)[8], but not all provinces have sperm banks yet. With more being planned, there are currently 23 li-

censed sperm banks. There are at least 178 licensed IVF clinics (Qiao and Feng 2014) and approximately 30 licensed clinics offer artificial insemination services (Ping et al. 2011). All of these clinics rely on the supply of sperm from sperm banks, hence there is a huge demand in donor sperm. It has been estimated that around 10% of infertile couples turn to a sperm bank for help (Shanghai Daily 2005). In large cities like Beijing, Shanghai, Nanjing and Guangzhou, this means that over 10,0000 couples hope to receive a sperm donation as soon as possible (Gong et al. 2009). Long waiting lists and waits of up to two years cause some of them to give up on their plans (Ping et al. 2011). For ethical reasons, China bans any form of commercial sperm banks, which means that sperm cannot be traded or acquired for a payment (MOH 2003). The ART regulations further define strict eligibility criteria for sperm donors. They must be between 22 and 45 years old, heterosexual, in good health, and they are required to undergo a series of physical and psychological evaluations (MOH 2003). Serologic and genetic testing aims to identify those at high risk for sexually transmitted infections and hereditary genetic diseases, such as for instance HIV, Hepatitis B and C, syphilis, gonorrhoea, mycoplasma, chlamydia, and numerous other conditions. This and a density threshold of at least 60 million spermatozoa per ml of semen means that many applicants fail at the first stage of the screening tests.

The rate has been found to be so high that a sperm crisis and declining sperm quality have become of increasing concern and a subject of scientific studies. For instance, a multicentre study of four major sperm banks found that out of 19,471 prospective sperm donors between 2003 and 2009 only 6,467 men (33.2%) qualified to become donors (Ping et al. 2011). The main reasons for non-recruitment were found to be semen parameters below the required threshold (55%) or a positive test for sexually transmitted diseases (7.9%). One recent study found that of sperm donor applicants in Hunan Province, 56% qualified in 2001 because their sperm met standards of healthiness, whereas by 2015 only 18% qualified (Huang et al. 2017, p. 88): "The semen quality in young men in China has been declining over the past 15 years", concluded the study, which involved more than 30,000 men. It is generally believed that the main reasons for the declining quality of sperm are changing lifestyles, which often are associated with China's economic transformation from Communism to a market society: such as long hours of sitting at the computer, stress, irregular sleep schedules, increasing substance abuse, and environmental pollution is also typically cited. However, an increased perception of declining sperm quality is not particular to China, as researchers around the globe have warned for years that the male sperm count is in a state of decline. It is difficult to know whether sperm quality is in a state of decline or whether there are biases in the study populations, but it is unlikely that the rate could have fallen that much[9].

When applicants pass the screening tests, they face a lengthy donation process from the initial tests to delivering the required amount of semen.

In addition to at least three visits for screening, a complete donation of usually 17-40 ml of semen (as required per individual sperm bank) requires approximately 10-15 visits at intervals of 5-7 days. All samples have to be frozen for a period of at least six months from the last donation, and donors are required to return to the sperm bank for final HIV testing. To truly qualify for fertilisation, post-thaw semen in addition needs to test for a frozen-thaw survival threshold of 60% or above (MOH 2003). Some eligible donors change their minds when they discover that it can take up to 10 months or longer to complete the entire process of having the semen samples declared eligible for donation. In China, each donor can only impregnate five women through AID or IVF (Gong et al. 2009). Sperm banks are required to follow-up with treatment results and to keep records in order to limit the number of pregnancies from the same donor. A computer management system is used to record this data.

3. The Media Debate about Sperm Donation in Chinese Newspapers

This section will look at how newspapers have reported about the controversial issue of sperm donation, and how this debate evolved during the 2010's. This analysis will focus on archive searches of the China Daily and Global Times. Both newspapers have news archives that are available online. Before the news of legal proceedings broke out in early 2012, following the death of a sperm donor in Hubei Province, there was only little news coverage of issues involving sperm banks and sperm donors. An archive search of the China Daily (CD) between 2001 (when ministerial bodies started to license and regulate human sperm banks and assisted reproduction) and 2011 (when a sperm donor died during the donation process) produces only sparse results. In some years, there were none, and in other years only up to two news articles per year. Reports during this period covered issues like the need of sperm banks for more sperm donors (CD 2004), the difficulties that infertile couples face to find a matching sperm donor (CD 2008), and the burdens and familial pressures that childless couples face when trying to conceive (CD 2010a). By 2009, the director of Shanghai's first sperm bank in an interview with the CD still considered sperm donation to be a social taboo in China (CD 2009), citing cultural prejudices and a lack of knowledge as the main reasons to keep potential donors away from enrolling with sperm banks. Medical experts and government officials have always attributed the shortage of donor applications to a 'lack of education' and insufficient knowledge about sperm donation among the general population (CD 2012a), yet at the same time the media also did little during these years to change public awareness and attitudes about the issue. Around 2010, this situation slowly started to change. The director of Guangdong Province's sperm bank for instance stated to the media that the numbers of prospec-

tive donors in 2010 had gone up by almost 100%, compared to the average in previous years, when over 900 applicants attended his sperm bank (CD 2011). According to him, the numbers started to improve, because "more people, especially college students, have developed an interest in donating sperm".

The majority of sperm donors have always been students in China. A 7-year multicentre retrospective study of sperm donation and its application in China examined four major sperm banks between 2003 and 2009 and concluded that college students constituted by far the largest occupational group (92.7%), and that only a small percentage of donors were office workers or trade and medical professionals (less than 8%) (Ping et al. 2011). The study further found that the majority of donors were also unmarried (95.2%) and childless (99.1%). There is no science behind it, but some like Jiangsu Province's sperm bank in East China in Nanjing city have altogether stopped accepting applications from working men, out of concerns about the lesser quality of their samples (GT 2012e). For the director of Jiangsu's sperm bank, this is a result of lifestyle, because "working males are usually under excessive pressure and many have bad habits, including drinking, which negatively affects their sperm" (GT 2012e).

While about 30% of the sperm donated in this sperm bank does not meet the required standard, the rate is said to be less than 20% in sperm samples from office or so-called white-collar workers (CD 2013c). In contrast, the rate of all donors (including students and all other groups) passing the examination at the Beijing Human Sperm Bank under the National Research Institute for Family Planning was said to be about 20% in the same year (GT 2013c).

The gradual change in the attitudes of Chinese men to consider sperm donation coincided with new efforts by sperm banks to increase the number of applicants. These early recruitment campaigns aimed particularly at university campuses, and news reporting began to pick this up too (Klein 2017). Recruitment on campuses usually involved students who were former sperm donors themselves, and their role was to distribute leaflets among classmates and in dormitories. Newspapers informed the public for instance that flyers were circulated on Beijing university campuses with the message: "if you are over 22 years old, male, healthy, full of love, courage and confidence, you are the right person for us" (GT 2010). It was also documented that these efforts caused a range of different reactions among students, many of whom were still lacking knowledge and awareness of the culturally sensitive topic. Most had never even talked or read about sperm donation before. A common reaction was therefore to question the purpose and methods of recruitment. One young student for instance said to a journalist: "I saw this in the restrooms on our campus and even our dormitory, it's embarrassing" (GT 2010). Hence, this form of recruitment was not always guaranteed to be successful. A student recruiter in Shanghai who was distributing leaflets in his dormitory for instance had not received any feedback from his fel-

low students, and he argued that this was due to their fear 'to lose face', in that by becoming a sperm donor they would have less chances of finding a girlfriend (GT 2012e). The attitudes and motivations of Chinese men for or against sperm donation also came into focus. Against sperm donation were voices such as: "I can't bear the thought that I might someday meet my offspring, whom I wouldn't even know" (CD 2012a).

There are also those for whom preserving biological kinship was not as much a personal value, as they worried it could affect 'others' like their family, friends or partners, and what would happen if they found out. A newspaper also reported about a graduate student in Beijing who had in fact decided to become a sperm donor, but who noted that he had kept the donation a secret out of worry that "my family might kill me for letting a stranger use the precious family seed" (CD 2010). Risk of incest through intermarriage of ART conceived descendants from the same donor has also been a recurring theme in media interviews with the public. A man from Hubei Province for instance, who over a decade ago when he was a student decided to become a sperm donor, told the media that "it feels weird to know that someone you meet on the street someday could be your child" (GT 2013b). He had decided to donate his sperm out of altruistic reasons, but is now married with his own child and full of remorse that he may have other kids.

While these cases demonstrate how sperm donation may be perceived as a risk factor for family and social relations, others like a senior student in Beijing also found that recruiting students to become sperm donors is a good thing, because it "reflects progress in society" and allows students "to make a contribution to the quality of the population in the future" (GT 2010). However, flyers and posters as methods of information dissemination to reach students have not always proven to be effective, and some sperm banks also turned to other strategies for recruitment on campuses including for instance collaborations with student unions. For the director of the Guangdong sperm bank, this turned out to work better, as "student union members normally talk to students one-on-one in private about sperm donation" (CD 2011). The director of Shanghai's sperm bank even appeared on local radio programs and gave lectures at the city's Fudan and Tongji Universities to encourage more students to become sperm donors (CD 2012a).

The comparison of sperm donation with blood donation was another common strategy to make the former more acceptable and to overcome deep-rooted sociocultural concerns. In this vein, sperm bank staff explain to potential sperm donors similar to the director in Hubei Province that "just like blood donation, giving sperm is a humanitarian and charitable deed" (GT 2013b). However, in as much as altruism is often presented as the main motivational factor, there is also a monetary dimension to the incentive to become a sperm donor. Although financial payments and the selling of sperm are strictly prohibited for ethical reasons, monetary compensation of donors for their time and expenses is permitted and ap-

proved by the provincial authorities (MOH 2003). This is also the case in other countries including the UK[10]. Compensation payments are often quite high in China compared to normal living costs and salaries, but medical staff insist that the cash payments are not the same as incentive payments. For instance, the director of Guangdong's sperm bank defended this system to the media, in that it "doesn't mean they are selling sperm", but that the sperm bank is "providing meals and transport fees and compensation for loss of working time" (CD 2011).

Donors are usually given compensation payments as the tests progress to make sure that they return and complete the full process which can be lengthy. Applicants usually first receive small payments to have their blood and semen tested, and they receive greater sums for every ml of sperm they give to the bank. When donors complete the process and return for the final HIV test six months after their last sample was frozen, they receive an additional bonus payment. The full compensation payment in 2011 was slightly above the average monthly income in Shanghai (CD 2011a).

In early 2012, the death of a sperm donor in the city of Wuhan took centre stage in the newspapers. The death of the 35-year old received great media exposure, when the case went to court and the father sued the sperm bank for four million Yuan (US$ 628,972) (GT 2012). However, the district court ruled in June that the donor, who studied towards a doctoral degree in medicine, was entirely capable of making his own decisions about his life, including whether he wanted to take part in the sperm bank program. He had signed up as a sperm donor in January 2011 and within ten days had made his fourth visit to donate sperm, when he collapsed in the collection room. In the aftermath of the tragic incident and the ensuing court case, news reporting about sperm donation increased significantly. For instance, a series of headlines in the Global Times (GT) in the month of September alone read: "Sperm Banks running empty" (GT 2012a), "Sperm bank calls for more donors" (GT 2012b), "Sperm bank offers donors a raise" (GT 2012c), and "Thank you for coming" (GT 2012d). In January 2013, the China Daily published a large editorial on "Banking on sperm – hope for childless couples" with a large collection of articles on related topics, such as an institutional overview of different sperm banks, what is involved in the process, a frequently asked questions section about sperm donation, and public attitudes about sperm donation (CD 2013).

State censorship of the media with respect to sperm donation has only been visible indirectly, when media reporting aligns with government policies. This is for instance the case when newspaper articles tend to showcase certain motivations and attitudes over others, as the selling of sperm is strictly forbidden in China, and donors are expected to have altruistic motivations (despite the fact that they receive significant financial compensations). Donors interviewed by the media are often quoted as being altruistic, and motivational statements such as "I'll just be glad if I can

help a childless couple" (CD 2010) are quite common in the media debate. However, although the media may showcase altruistic intentions over other motivations, donors also have personal motivations and individual experiences that make them inclined to, as Mohr (2014) puts it, "enact their moral selves". This is certainly the case when for instance a 34-year old civil servant in Shanxi Province described to a journalist that he became a sperm donor when his brother became infertile - in a car accident, and the condition eventually led to his divorce (CD 2013a). The donor firmly believed that the divorce could have been prevented, if his brother and sister-in-law would have known more about sperm donation, and he therefore hoped to help others in a similar situation. Yet, he also hid his donation from his wife, because he was not sure if she would have accepted it. In contrast, however, the newspaper also reported about a young student in Beijing who had openly discussed his wish to become a sperm donor with his girlfriend, who did not agree to it right away, but who eventually convinced her "that it was a worthy cause as it would help couples or single woman who are unable to reproduce get children" (CD 2016). Likewise, a 22-year old university student in Shanxi Province emphasized in an interview that it was important to him that people do not think that he sold his sperm, even though he was given a considerable amount of money for a student (CD 2013a). He did not want his actual intention to be misrepresented, which was to help infertile couples.

By 2013, public perception of sperm donation had shifted so much that it no longer fitted easily with the old system of Confucian values of filial duty and the patriline. There was now a more knowledgeable and better informed (male) public with a greater openness to sperm donation, and sperm banks significantly changed their tactics of interaction with the male public. Social media became the new favourite platforms of recruitment, and the setting up of blogs and accounts on popular Chinese websites and phone applications, such as Sina Weibo[11] and WeChat[12], became popular strategies of sperm banks to reach the young, male public. This way, sperm banks were now able to engage more directly with large numbers of internet users, and to provide those considering sperm donation with the opportunity to ask questions without the need to attend a sperm bank. Hand in hand with the use of social media to promote sperm donation, many provincial authorities also increased the level of monetary compensation to incentivize more men to become sperm donors. The higher compensation figures helped to draw more attention to sperm banks, and this in turn also was picked up frequently by the press. Henan Province's sperm bank early in this process posted a message on Sina Weibo, in which it offered cash payments of up to 5,000 Yuan (US$ 789) (GT 2013a). After the notice was issued, the sperm bank reported that it received around 50 donations per day and up to 100 during holiday periods, which was a significant increase to the number of applicants that had attended the sperm bank before. Monetary compensation in the range of 4,000 to 5,000 Yuan (US$ 631-789) was already quite high compared to

normal living standards, but Zheijiang's sperm bank in Hangzhou Province even topped all other sperm banks, when it posted on its Sina Weibo profile that it would offer a bonus of 6,000 Yuan (US$ 975) (CD 2013b). In the UK, in contrast, where living standards, costs and salaries are much higher, the amount is set at GBP£ 35 per visit (Human Fertilization and Embryology Authority). The principle behind it is that the amount offered is not a payment and a person should never feel compelled to donate for financial gain but rather because they want to help a family in need. The money a donor receives is to compensate for out of pocket expenses. This means that after 12 weekly visits over three months, a donor in the UK receives a total of GBP£ 420, which is far less than what a donor receives in China, where living standards and average living costs are much lower.

This quickly led to a race among sperm banks for bolder statements and catchier awards for donors. In 2015, Hubei Province's sperm bank lured new volunteers with a WeChat message beneath a photo of an iPhone 6s which read: "5,000 Yuan (US$ 785) will be paid for 40 ml sample of semen (the iPhone 6s is priced at 5,288 Yuan on the mainland)" (CD 2015). The China Daily also reported that the message received 85,000 page views within two weeks and that it was a much talked about topic among students and in online discussion forums. Trying to keep up, Shanghai also increased its compensation level to the maximum of 6,000 yuan and posted a controversial advertisement on WeChat stating to draw attention: "no need to sell a kidney... Shanghai sperm bank can make your iPhone 6s dream come true" (GT 2015). 'To sell a kidney' is a well-known metaphor in China that was coined when a 17- year old teenager made headlines in 2011 for selling his kidney on the black market to afford an iPhone and iPad. Within only a few days, the post had been viewed over 100,000 times. Although it drew heavy criticism for exploiting that case, the post was deemed a success, as the sperm bank was able to increase its rate of 20 phone calls on normal working days to 200-300 calls per day to those selected from registrations on the sperm bank's website. Online registrations of interest and calling up potentially eligible donors by phone have now also increasingly replaced the traditional walk-in service. In July 2015, online donor recruitment was taken to a new height, when seven sperm banks teamed up with the Chinese e-commerce company Alibaba in a three-day commercial campaign that was launched on the online shopping site 'Taobao'. Chinese men were promised that by signing up and completing a sperm donation they could receive a payment between 3,000 Yuan (US$ 483) and 5,000 Yuan (CD 2015a). Within the three days that the campaign lasted more than 22,000 signed up to register with a sperm bank. The registrations were passed on to the relevant sperm banks, some of which received equivalents to nearly a year of walk-in traffic.

At a time, when sperm donations just had started to pick up, the CPC in January 2016 implemented the new 'two-child policy' in order to curb

down on population aging and to expand the pool of working-age people. As a result of this policy change, sperm banks in Beijing, Shanghai, Shanxi and Hubei announced that their sperm storage was at an all-times low (GT 2016, South China Morning Post 2016). The end of the country's decades-old family planning policy has put new pressures on sperm banks, as the waiting times for donor sperm have gone up even further. Many families want to take advantage of the reforms to have a second child, including often also older couples who are more likely to have fertility problems. Even long before the two-child was introduced, some ART clinics already had to refuse new patients "who would just end up hopelessly waiting" (CD 2012), but the introduction of the two-child policy has made this situation even worse. Since the introduction of the new policy, the number of consultations in one IVF clinic in Beijing has risen by 20% (South China Morning Post 2016). However, it is also the case that not all families are seeking to have a second child. When the family planning policy started to relax in 2013 and allowed families to have a second child if both parents were a single child, only about 13% of eligible married couples (1.45 million) submitted applications to the National Health and Family Planning Commission (GT 2016). Yet, under the new nationwide policy, the government is actively trying to convince more families to have a second child, and in 2017 it announced to introduce new financial incentives, such as rewards or subsidies, for families who do not want a second child due to economic pressures (All-China Women's Federation).

4. Conclusions

The shortage of donor sperm has devastating consequences for infertile couples seeking to undergo fertility treatment. Sperm banks have tried in many ways to overcome the sociocultural prejudices against sperm donation that pre-existed in Chinese society, and the paper has argued how the situation has improved in recent years. Today, sperm donation is no longer a new concept or social taboo to Chinese people, even though recruitment of new donors is still not easy and requires a lot of effort and incentives. In interacting with a now less prejudiced (male) public, many sperm banks have found that the use of new platforms like the internet and social media help them to appeal to a larger number of men, in particular the younger generation of blog and social-networking site users that are the prime group for recruitment. However, this has also created the risk that recruitment of sperm donors in this latest phase has taken on a more commercial character than used to be the case. Whereas earlier on students used to receive leaflets or went to lectures to be informed about sperm donation, now the placement of promotional blog, social network or instant messaging posts incentivizes potential donors in ever more competitive and commercial ways, for instance by promising the latest models of iPhones but also through forming marketing collabo-

rations with commercial companies, such as in the case of the Alibaba campaign in 2015. As discussed earlier, the so-called compensation payments for sperm donors are significantly higher in China than the UK, despite the fact that the costs of living are comparably much lower. Unlike in the UK, where the compensation only covers out-of-pocket expenses, in China the compensation is at a level of incentivization, even though this is officially prohibited under the existing guidelines.

The recruitment of sperm donors has overall increased significantly in recent years. Evidence of this development is most visible from a retrospective study of China's largest sperm bank in Changsha in Hunan Province (Huang et al. 2017). Of a total pool of 30,653 donor applicants between 2001 to 2015, 3,114 were recruited in 2001-2005, 10,386 were recruited in 2006-2010, and a far greater number of 17,136 men were screened for eligibility in 2011-2015. It is important to note that sperm bank staff have never credited the shortage of sperm donors to cultural prejudices alone, but also to excessive government policies. For instance, although China has the world's largest population, it is also by far the most restrictive country in terms of limiting the number of women that can be impregnated by one donor to five only. In the USA, in contrast, there is no enforced national limit, but guidelines recommend 25 births per population of 850,000 from the same donor (The American Society for Reproductive Medicine 2004). For the director of China's largest sperm bank, the limitation of a single donor's sperm to five women only is a waste of resources and presumably the biggest hurdle for sperm banks to meet the demand of the ART sector (CD 2010). The chances of marriage between offspring from the same donor are already extremely slim when provided to five women in a population of only three million, whereas for a country of 1.3 billion people "one man's sperm could safely be provided to at least 10 women" (ibid.).

Additional policy restrictions are that donors cannot be younger than 22 or older than 45 years old, and that they cannot be gay or foreign nationals (MOH 2003). In the UK, in contrast, donors can be as young as 18 and sexuality does not matter (Human Fertilisation and Embryology Authority). The media frequently refer to the notion that sperm count requirement of 60 million spermatozoa per ml is often considered to be too high (CD 2013), because it is three times that of the "average healthy male", as defined by the World Health Organization (1999). However, normal sperm concentration ranges from 15 million to 200 million of spermatozoa per ml of semen, whereas a count of 40 to 60 million per ml is only average and necessary for fertilization. In fact, it has been suggested that values in the range of 50–60 million spermatozoa per ml should be used as a lower cut-off level for full reproductive competence, whereas the area between 15 and 40 million spermatozoa per ml delineates a grey subfertility zone (Skakkebaek 2010). Hence, the Chinese sperm density requirement is not too strict. It is important to note that sexually transmitted diseases are also a significant cause for screening failure, but Hep-

atitis B, for instance, is an endemic virus in China which affects approximately 120 million individuals. Numerous applicants fail, because they test positive for a recent or long-standing hepatitis B infection. Due to often unnecessary and counterproductive regulations, Chinese sperm banks have to recruit that many more sperm donors, compared to American or European sperm banks, to supply similar numbers of families.

As these are major reasons for the chronic shortage of sperm donors in China, medical experts hope for the government to ease some of the restrictions and they use interviews with the media as an occasion to create some pressure. This is an area where the government will have to make amendments in the future, in particular that now sperm banks also need to supply those who want to have more than one child.

The media initially did not take on much of a role as an 'educator' of the public with the aim to increase people's awareness and knowledge about sperm donation and what it involves. Yet, a fatal incident involving a sperm donor and ensuing legal proceedings in 2012 changed the news cycle. The little-known topic of sperm donation and the plight of sperm banks dealing with severe shortages of donors came more into the center of public attention, and changed the (male) public's awareness and knowledge about it. Sperm donation has become part of the public imaginary, and the debate in the media, as exemplified by two Chinese newspapers, has contributed to this in many ways. Medical experts and government officials have always attributed the shortage of sperm donors to a lack of education and knowledge about what it involves, and often told the media that engaging the public through education campaigns is a more effective way to ease the donor shortages (GT 2013b). The media have played an important role. They have filled the knowledge gap that medical experts and sperm bank staff always ascribed to be the main reason for the widespread cultural prejudices against sperm donation in the past. News reporting has also been balanced in regard to portraying the whole range of motivations and attitudes of Chinese men with respect to sperm donation. Thus, the news articles as 'texts' in the Chinese media debate about sperm donation that contain meaning and interpretations with the possibility of social change (Fairclough 2003) have played an important role in the dynamic relationship between sperm banks, social events, cultural interpretations and the (male) public's perception of the risks and benefits of being a sperm donor.

References

All-China Women's Federation, *Chinese government to mull incentives for second child*, in http://www.womenofchina.cn/womenofchina/html1/news/china/1-703/1871-1.htm (retrieved May 26, 2017).

Custer, B., Sullivan, S.D., Hazlet, T.K., da Iloeje, U., Veenstra, D.L. and Kowdley, K.V. (2004) *Global Epidemiology of Hepatitis B Virus,* in "Journal of Clinical Gastroenterology*",* 38 (10, Suppl. 3), pp. S158–68.

Fairclough, N. (2003) *Analyzing Discourse: Textual Analysis for Social Research,* London and New York, Routledge.

Gong, D., Liu, Y.L., Zheng, Z., Tian, Y.F. and Li, Z. (2009) *An Overview on Ethical Issues about Sperm Donation,* in "Asian Journal of Andrology", 11, pp. 645-52.

Greenhalgh, S. and Winckler, E.A. (2005) *Governing China's Population: From Leninist to Neoliberal Biopolitics,* Stanford, Stanford University Press.

Guo, K. (2006) *Roles of English-Language Media in Chinese Society*, in "China Media Research", 2 (4), pp. 90-96.

Handwerker, L. (1998) *The Consequences of Modernity for Childless Women in China: Medicalization and Resistance*, in Lock, M. and Kaufert, P. (eds.), *Pragmatic Women and Body Politics*, Cambridge, Cambridge University Press, pp. 178-206.

Handwerker, L. (2002) *The Politics of Making Modern Babies in China: Reproductive Technologies and the 'New' Eugenics,* in M.C. Inhorn, and F. Van Balen (eds.), *Infertility around the Globe: New Thinking on Childlessness, Gender and Reproductive Technologies,* Berkeley, University of California Press, pp. 178-205.

Heng, B.C. (2009) *Stringent Regulations of Oocyte Donation in China*, in "Human Reproduction", 24 (1), pp. 14-16.

Huang, C., Baishun, L., Kongrong, X., Liu, D., Hu, J., Jang, Y., Nie, H., Fan, L. and Zhu, W. (2017) *Decline in Semen Quality Among 30,636 Young Chinese Men from 2001 to 2015*, in "Fertility and Sterility", 107 (1), pp. 83-88.

Human Fertilisation and Embryology Authority, *Donors*, in: http://www.hfea.gov.uk/donation/donors (retrieved January 29, 2018).

Inhorn, M.C. and Van Balen, F. (eds.) (2002) *Infertility around the Globe: New Thinking on Childlessness, Gender and Reproductive Technologies,* Berkeley, University of California Press.

Klein, K. (2010) *Illiberal Biopolitics and 'Embryonic Life': The Governance of Human Embryonic Life Stem Cell Research in China,* in Yorke, J. (ed.), *The Right to Life and the Value of Life: Orientations in Law, Politics and Ethics*, Farnham, Ashgate Publishing, pp. 399-421.

Klein, K. (2017) *Assisted Reproductive Technologies, Sperm Donation and Biological Kinship: a Recent Chinese Media Debate*, in Santos, G. and Harrel, S. (eds.) *Transforming Patriarchy: Chinese Families in the 21st Century,* Seattle, Washington University Press, pp. 219-234.

Levine, H., Jørgensen, N., Andersen, M.-A., Mendiola, J., Weksler-Derri, D., Mindlis, I., Pinotti, R. and Swan, S.H. (2017) *Temporal Trends in Sperm Count: A Systematic Review and Meta-regression Analysis*, in "Human Reproduction Update", 23 (6), pp. 646-659.

Liao, J., Dessein, B. and Pennings, G. (2010) *The Ethical Debate on Donor Insemination in China*, in "Reproductive Biomedicine Online", 20 (7), pp. 895-902.

Ministry of Health (MOH) (2003) *Technical Standards and Ethical Principles for Human Assisted Reproduction and Sperm Banks*, Amendment issued on 30.09.2003, available at: http://www.nhfpc.gov.cn/qjjys/s3581/200-805/f69a925d55b44be2a9b4ada7fcdec835.shtml (retrieved May 29, 2017).

Mohr, S. (2014) *Beyond Motivation: on What it Means to be a Sperm Donor in Denmark,* in "Anthropology & Medicine", 21 (2), pp. 162-173.

Pennings, G., de Mouzon, J., Shenfield, F., Ferraretti, A.P., Mardesici, T., Ruiz, A. and Goossens, V. (2014) *Socio-Demographic and Fertility-Related Characteristics and Motivations of Oocyte Donors in Eleven European Countries,* in "Human Reproduction", 29 (5), pp. 1076-89.

Ping, P., Wen-Bing, Z., Xin-Zong, Z., Li, Y.S., Wang, Q.X., Cao, X.R., Liu, Y., Dai, H.L., Huang, Y.R. and Li, Z. (2011) *Sperm Donation and its Application in China: a 7-Year Multicenter Retrospective Study*, in "Asian Journal of Andrology", 13 (4), pp. 644-648.

Qiao, J. and Feng, H.L. (2014) *Assisted Reproductive Technology in China: Compliance and Non-Compliance,* in "Translational Paediatrics", 3 (2), pp. 91-97.

Qiu, R. (2002*) Sociocultural Dimensions of Infertility and Assisted Reproduction in the Far East,* in V. Effy, P.J. Rowe, and P.D. Griffin (eds.), *Current Practices and Controversies in Assisted Reproduction: Report of a WHO Meeting on 'Medical, Ethical and Social Aspects of Assisted Reproduction'*, Geneva, World Health Organization Publication, pp. 75-80.

Skakkebaek, N. (2010) *Normal Reference Ranges for Semen Quality and their Relations to Fecundity*, in "Asian Journal of Andrology", 12 (1), pp. 95-98.

Stockmann, D. (2013) *Media Commercialization and Authoritarian Rule in China*, New York, Cambridge University Press.

Strathern, M. (1992) *Reproducing the Future: Essays on Anthropology, Kinship and the New Reproductive Technologies,* Manchester, Manchester University Press.

The American Society for Reproductive Medicine (2004) *Guidelines for Sperm Donation*, in "Fertility and Sterility", 82, pp. S9-12.

Wahlberg, A. (2016) *The Birth and Routinization of IVF in China*, in "Reproductive Biomedicine and Society", 2 (Oct.), pp. 97-107.

Wolf, A.P. and Huang, C.-S. (1980) *Marriage and Adoption in China, 1845-1945,* Stanford, Stanford University Press.

World Health Organization (1999) *Laboratory Manual for the Examination and Processing of Human Semen*, 4th Edition, New York, Cambridge University Press.

Newspaper Article References

China Daily (CD):

CD (2004) *Guangdong's sperm bank in need of more donations*, 19.10.2004.

CD (2006) *Health ministry tightens control on sperm banks*, 10.04.2006.

CD (2006a) *There's something bigger to being a father figure*, 27.10.2006.

CD (2008) *Couples struggle to find usable sperm*, 23.04.2008.

CD (2009) *Male infertility on the rise in Shanghai*, 2.04.2009.

CD (2009a) *High-priced healthcare*, 07.12.2009.

CD (2010) *Sperm shortage breeds frustration*, 15.11.2010.

CD (2010a) *Heartache of Childless Couples*, 21.09.2010.

CD (2011) *College students ease lack of sperm donations*, 21.03.2011.

CD (2011a) *China's 2011 average salaries revealed*, 06.07.2011.

CD (2012) *Waiting for a baby*, 03.01.2012.

CD (2012a) *Sperm banks reach out for donors amid supply shortage*, 19.09.2012.

CD (2012b) *Sperm bank expands after relocation*, 10.09.2012.

CD (2013) *Banking on sperm – hope for childless couples*, 20.01.2013.

CD (2013a) *Sperm donors recount their experience*, 21.01.2013.

CD (2013b) *Sperm bank offers high bonuses for donors*, 07.05.2013.

CD (2013c) *Quality of donated sperm is low, sperm bank says*, 07.11.2013.

CD (2013d) *China's largest sperm bank produces 40,000 tube babies*, 21.01.2013.

CD (2015) *Donate sperm to get an iPhone 6s*, 17.09.2015.

CD (2015a) *Alibaba promotion helps sperm banks find donors*, 23.07.2015.

CD (2015b) *China's two-child policy puts pressure on sperm banks*, 15.11.2015.

CD (2016) *Finding the right sperm donor*, 01.01.2016.

CD (2018)

Global Times (GT):

GT (2010) *Students asked to make a small donation*, 26.03.2010.

GT (2012) *Sperm donor's death in court*, 20.06.2012.

GT (2012a) *Sperm banks running empty*, 06.09.2012.

GT (2012b) *Sperm bank calls for more deposits*, 07.09.2012.

GT (2012c) *Sperm bank offers donors a raise*, 09.09.2012.

GT (2012d) *Thank you for coming*, 17.09.2012.

GT (2012e) *Higher Standards from banks and growing infertility triggers donor sperm drought*, 28.05.2012.

GT (2013) *Banking on men*, 27.11.2013.

GT (2013a) *Sperm bank boosts donor payments*, 24.09.2013.

GT (2013b) *Sperm banks struggle to attract new donors*, 30.06.2013.

GT (2013c) *Sperm shortage*, 17.09.2013.

GT (2015) *Chinese sperm banks seduce donors with promise of iPhone 6s*, 18.09.2015.

GT (2016) *China's sperm banks facing dire shortage of quality donations*, 10.05.2016.

Other newspapers:

Shanghai Daily (2005) *Shanghai sperm bank seeking deposits*, 23.08.2005.

South China Morning Post (2016) *After China's one-child policy relaxed, fertility clinics see rush of older parents hoping to conceive*, 30.05.2016.

South China Morning Post (2016a) *China's top party mouthpieces pledge 'absolute loyalty' as president makes rare visits to newsrooms*, 20.02.2016.

Xinhua News (2012) *Increasing infertility concerns Chinese couples*, 19.12.2012.

Xinhua News (2013) *China targets reproductive technology abuse*, 05.02.2013.

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[1] ART's are methods to overcome infertility through a range of different methods, such as for instance in-vitro fertilization (IVF), fertility medication, donor conception or surrogacy, although the latter is not officially permitted in China.

[2] China's first human sperm bank, the Xiangya Reproduction and Genetics Hospital, was built in 1981 in central China's Hunan Province. It is also the first Chinese sperm bank, from where a baby was born in 1983, with the help of stored frozen spermatozoa.

[3] This strategy was chosen due to a lack of understanding of Mandarin. However, English-language media (ELM) are part of the news industry and Chinese social life, and they have a history that goes back to the early 19th century (Guo 2006). ELM exist at all levels (central, provincial, and local) and cover all types of media, such as TV, print media, radio and internet. They represent Chinese societal discourse, as they function as a window onto China for audiences abroad as well as within mainland China.

[4] China Daily was founded in 1981 and has the widest print circulation of any English-language newspaper in China. The digital edition of China Daily, established in 1995, has huge audiences around the world: daily pageviews now exceed 31 million, and nearly 50% of these views come from inside of China (China Daily, *About China Daily*, in http://www.chinadaily.com.cn/cd/introduction.html (retrieved April 16, 2018). Its editorial staff is mainly Chinese. It is often used as a guide to government policy, and its editorial policies are slightly more liberal than those of most other Chinese newspapers. The Global Times is a daily tabloid newspaper established under the ownership of the Chinese Communist Party's flagship paper, the People's Daily. Its nationally circulated Chinese version was founded in 1993, and since 2009 there has also been an English edition that shares editorial content with the Chinese flagship, but to some extent it also operates independently. It has earned attention and notoriety, in both China and abroad, as China's angriest newspaper, and has been labeled as "China's Fox News".

[5] In 2013, the Ministry of Health has been dissolved and its functions integrated into a new administration, called the National Health and Family Planning Commission.

[6] Across the world, countries have varying laws on whether to allow anonymous sperm donation. In contrast to China's position, in the UK sperm and egg donors no longer have the right to remain anonymous. Children born with the help of a donor are able to ask for the identity of their donor when they are 18 years old (Human Fertilisation and Embryology Authority).

[7] The rule of anonymity goes back to the feeling in the past that if one adopts a son from a non-agnate, it is best to adopt one from far away, because that way the child will have great difficulties finding his biological parents (Wolf and Huang 1980).

[8] The only exception are provinces with more than 100 million inhabitants which can have two sperm banks. For instance, Beijing has two sperm banks, one under the National Research Institute for Family Planning at China's Academy of Sciences, and another one at Beijing University Third Hospital.

[9] A large meta-analysis of 185 studies, covering nearly 43,000 men and their sperm counts between 1973 and 2011, concluded for instance that the concentration of sperm per ml of semen among men from North America, Europe, Australia and New Zealand fell by almost 60% (Levine et al. 2017).

[10] The commercialization of gamete donation is forbidden in many countries, but monetary compensation is often allowed. The same system also exists in the UK, where the Human Fertilisation and Embryology Authority requires that monetary compensation to donors is reasonable so as to avoid commercializing the procedure (Human Fertilisation and Embryology Authority).

[11] 'Sina Weibo' is a popular Chinese social networking site, similar to Facebook and Twitter.

[12] WeChat is a Chinese instant messaging application, which can be compared to WhatsApp and Facebook Messenger.

Risky Mixings: Unravelling Gametes' Bad Potential in Argentina

Lucía Ariza
University of Buenos Aires

Abstract: In both the expert and mass media cultures to which they simultaneously belong, ova and sperm have come to figure prominently as entities of potentiality, of expansion of the vital capabilities of bodies and of regeneration of their exhausted capacities. This article looks into the practices of gamete exchange in Argentina to argue, however, a different story. It contends that for all the good potentiality that gametes have come to represent, they are also entangled in webs of risk. They can be extracted too much or too often, decrease their provider's expectation of good health, or create wrongful (i.e. incestuous and/or endogamous) bodily links between individuals. Drawing on analyses of the actual use of statistical measures in the clinic; and of ways of understanding kinship that are particular to Argentina, the article suggests that the handling of gametes as risky substances may ultimately work to produce the risks that it only aims to prevent. The study brought together the literature on kinship and science studies in order to frame the problematic of kinship and risk management in technoscience.

Keywords: donor conception; gametes; numerical devices; risk; Argentina.

Corresponding author: Lucía Ariza, Instituto de Investigaciones Gino Germani, University of Buenos Aires, Pte. José E. Uriburu 950, Piso 6, C1114AAD, Ciudad Autónoma de Buenos Aires, Argentina – Email: lucia.ariza@gmail.com

1. Introduction

In both the scientific and mass media cultures in which they are simultaneously implicated, ova and sperm have come to figure prominently as sites of positive potentiality, of expansion of the vital capabilities of bodies and of regeneration of their exhausted capacities. Figuring in the narrative of modern biology as the basic units through which all forms of sexual reproduction are possible on earth, human (and nonhuman) gametes are metonymically assimilated to the idea of 'reproduction' *per se.* They have for a long time condensed notions of procreation and propagation. In the West, many societies have become accustomed to regarding

them as the ending product of a process of maturation (Sutton et al. 2003) whose union with its opposite further enables life to develop.

Since the advent of assisted reproduction technologies (ARTs) forty years ago, ova and sperm's association with positive potential has increased. They have become the locus of a series of politico-scientific interventions that are favouring their understanding as entities of potentiality (Taussig, Hoeyer and Helmreich 2013). Particularly through the cultural significance of the use of donor gametes in ARTs, gametes have come to be regarded as capable of renewing a lost or absent ability of the human body (Simpson 2013). They are seen as aiding in the body's reproduction when this is not achievable by other means, returning or reigniting a force or capacity for procreation that the body might have lost or simply never had. Thus, eggs and sperm that can be scaled up and frozen in vitro multiply their uses. They supplement what is missing or defective in certain bodies, both fostering new life and bringing new capacities to the lives already existent. Further, insofar as they can be stored in vitro for a considerable amount of time, their potentiality can be deferred in time, actually allowing for its futurity.

In fact, as Taussig, Hoeyer and Helmreich (2013) point out, the capacity to envision, foster and promote particular human futures is part and parcel of potentiality's double bearing as a concept and object of study. In their Introduction to a Current Anthropology's issue devoted to the anthropology of potentiality, the authors highlight the concept's use in biomedicine as an idiom employed to "imagine the benefits of new medical interventions" (2013, S4) and thus a key element in giving shape to the impending. These hopeful visions commonly articulated in biomedicine serve to socialise images of prosperous futures less determined by contemporary evils like disease, hunger and pollution. However, they are also strongly resonant with current anxieties in relation to food safety, biosecurity, biological weapons, armed conflict and ill health (Taussig, Hoeyer and Helmreich 2013; Vora 2013) that may derive from the sheer actualisation of such futures. According to the authors, 'potentiality' is thus a notion devised to capture the emergent, process and oriented to future character of Western societies (cfr. Gammeltoft 2013), and it refers both to promising and dystopian scenarios. In this context, gametes and the technologies that make them detachable and manageable can be thought as partaking of such contemporary biomedical fostering of the positive potential of bodily fragments. Their capacity to survive freezing and thawing; their ability to 'live' in vitro for long periods and to actualise their generative capacities years after having been born to life, also makes them naturally resonant with the biomedical thinking of good potential.

Increments in the capabilities of bodies and gametes that are captured by the idea of potentiality, can also be thought as inherently linked to a

wider (Western) culture oriented towards the creation of economic and social value, and where persons and things need to be permanently 'enterprised up' and transformed from their natural state (Strathern 1992b). It is a logical consequence of this that gametes, and especially ova, are now central to strategies like stem cell research and somatic cell nuclear transfer, their good potentiality for curing and improving actually being ever more explored and exploited in the creation of what Sarah Franklin (2001) termed 'the new biologies'. It is in this sense that authors like Sunder Rajan (2006) and Franklin and Lock (2003) speak of the different forms of 'biocapital' that are now being created by developing the ever-expanding potentialities of gametes, embryos and other tissues. Yet again such advances, and the treatments they make possible, have also been rendered in the advanced industrial democracies as rife with risk and dangerousness. By now, a notoriously voluminous body of work in the sociology and anthropology of medicine and health has been dedicated to account for the many ways in which recent advances in biomolecular technologies have been thought as, or directly posing, new and specific risks for, and inequalities within, the bodies of persons and populations (Fisher 2016; Simpson 2013; Cooper and Waldby 2013). As Taussig, Hoeyer and Helmreich (2013) also indicate, such notions about dangerousness are intimately linked to ideas of, in this case, bad potentiality, entailing a necessary part of the anthropology that studies it.

This article focuses on this last set of associations of potentiality. It deploys the notion of 'potentiality' as a concept that helps to elucidate how gametes come to be handled, in the fertility clinic, as objects of risk. The piece draws on insights gained from a wider project that explored how nature and 'natural norms' work as normative ideals for fertility practitioners in Argentina. It intends to think through some of the ways in which ova and sperm are also implicated in a logic of risks, beyond partaking in the contemporary biomedical promotion of the good potential. To show this, I look at the medical discussion regarding how many times should a donor be allowed to donate her gametes. I explore notions of danger enacted in connection with that limit being overflown, like the fear of endogamy, the loss of biological variation and the risks for donors' health. As part of this discussion, I consider in particular who are those who are thought to be implicated in the risks that emerge with a potential diminishing of variation. A key element of my argument is that 'those' who are the focus of the risks is a resultant of the specificity of Argentine kinship. In fact, in this setting, kin relations are thought to pre-exist their knowledge and their social elaboration: kinship connections are thought to be eminently biological. The fact of sharing genes is already the fact of being kin: people who descend from the same biological progenitors are 'brothers' independently of them knowing the fact that they are siblings.

Further, I suggest that these understandings entail that gametes potential harmfulness is directly linked to notions of morally proper and improper kinship between persons.

By doing the above, I show that for all the promising capabilities (i.e. fostering life, promoting reproduction) that gametes are deemed to have, a different set of contrasting characterisations emerge. The latter are the paradoxical result of gametes clinical circulation as entities of good potential. Either by being extracted in amounts thought to be 'too much' or 'too often'; by decreasing their provider's expectation of good health; or by mixing in ways considered to be both biologically and morally wrong, gametes become known also as carriers of riskiness. Observing how this capacity to create risks adds up to their ability to promote generation and propagation, I show that ova and sperm epitomise ARTs' long double implication in both utopian and dystopian rhetoric, simultaneously connected with hope and moral wrong[1].

In this article, I first provide a theoretical framework followed by a contextualisation of ARTs and kinship in Argentina. I then go on to explain the methods used. The first analytic section introduces the two main types of risks that are regulated in the clinic ('endogamy' and 'health'), and explore what is understood by the 'endogamy risk'. I follow by discussing the ethnographic valence of the term 'siblings' in the context of fertility doctors' discussions of the risk of 'inbreeding'. I then examine ideas of biological variation among Argentine doctors, and how they are used to justify the potential harmful character of gametes. The fourth analytic section recaps the second type of risk ('health') regulated in the clinic, and considers how probabilities work in practice. I conclude by suggesting that promoting the control of the bad potential of gametes is one of the ways in which humanness is enacted.

2. Kinship and Technoscience

This section explores the work of selected feminist theorists on reproductive technologies, technoscience, and their interfaces with kinship. I aim to show how this body of work provides tools to acknowledge the different ways in which ideas about what kinship is can become normative, that is, part of projects to be enforced on particular groups and populations, mainly by the same participants.

A core concept in anthropology since the late 19th century (Carsten 2004), kinship re-emerged as a relevant category during the '90s and early to mid-2000s, amidst an interest in the 'new' reproductive technologies and what was perceived as their re-articulation of the 'natural facts'

thought to be a central feature of Western models of family (Viveiros de Castro 2009). The reasons for the decline of kinship as an analytic category during the '70s and '80s lies in the waning of the functionalist and structuralist schools in anthropology. Its revival was linked to the works of Marilyn Strathern, Jeanette Edwards, Sarah Franklin and Charis Thompson, among others. In the following, I discuss some of these contributions together with Donna Haraway's (1997) understanding of kinship as a technology.

2.1. Inherent and Extraneous Nature

Theorising about nature as a domain of mixture and recombination, Donna Haraway (1997) states that nature (together with race, sex and kinship) represents the paradigmatic domain of the impure, a realm of cross-fertilisation and hybridisation that has always evolved, even before the collapse of science and technology into each other two hundred years ago, on the basis of contamination and mixing between species, orders, genera, etc. Beings of different orders have always co-evolved on account of inter-species assimilation and recombination, exchanging genetic information unaware of and unregulated by taxonomic systems of organisation. This is (was) nature's natural order, one whose capacity for mixing orders makes industrial recombination pale beside it. In Haraway's words: "History is erased, for other organisms as well as for humans, in the doctrine of types and intrinsic purposes, and a kind of timeless stasis in nature is piously narrated. The ancient, cobbled-together, mixed-up history of living beings, whose long tradition of genetic exchange will be the envy of industry for a long time to come, gets short shrift" (1997, 61).

The above suggests that for Haraway pre-technoscientific nature had an inherent normativity, one characterised by the underlying kinship of all natural living beings, and one where the human lacked any precedence over the nonhuman. This inherent normativity might be called non-social or 'natural' in the sense that it opposed what for Haraway may be a characteristically 'moral' (and racist) normativity, one concerned with human affairs in the form of modern political projects of classification and depuration. Haraway refers to the latter as the 'arguments about purity of natural kinds', and they entail what Rosengarten (2001, 169) has termed the "suggestion that all creatures have their rightful place". These projects, Haraway maintains, predate modern biology in the form of classificatory regimes, and paradigmatic examples of it are Linnaeus's taxonomic system of kingdoms, orders, genera, etc., and Mendeleyev's periodic table.

In this sense, Haraway shares with Bruno Latour (1993) a characterisation of modernity as intolerant to impurity and infection, and sees it as consequently attempting to make distinctions where orders seem to be

confused or contaminated. This project entails a typically modern and moral form of normativity, one where the human is produced, detached and elevated as part of the categorisation of all 'natural' elements, as in Linnaeus's and Mendeleyev's attempts. It is a work of depuration that distils nature as its product while producing new normative forms of natural kinship and disambiguation. By ordering creatures and elements and according them a place in an orderly nature, (kin) relations are built between some elements and entities and a purity of lineage normatively enforced, while other 'impure' connections (for example, inter-species, inter-kingdoms, inter-races, intra-family, intra-sex), are discouraged. Significantly, Haraway calls 'kinship' these normative (and moral) modern devices whose material and semiotic effect is the production of 'natural kinds': "Kinship is a technology for producing the material and semiotic effect of natural relationship, of shared kind [...] The periodic table is a potent taxonomic device for what my people understand as nature" (1997, 53-54).

Yet it can also be said that there is at least one sense in which Haraway's work can also be thought as involving a certain form of (political) normativity. In effect, Haraway's politics can be described as one which opposes critical theory projects which feature prominently a critique of technoscience as a form of domination and instrumentation of nature. If pre-technoscientific nature was capable of ever novel combinations and hybridisations, technoscience's ability to mime nature's ways of reproduction by increasingly enhancing the mixing of orders and the production of contaminated kinship needs to be promoted rather than 'critiqued'. Haraway sees in this project the possibility of countering racist ideologies based on the classification and disambiguation of entities, and problematically opposed to the mixing of the wrong kinds.

Also conceptualising kinship as mixture, the account by Sarah Franklin (2000) has points in common with Haraway's. She explores how nature is being re-conceived in the context of thinking about the new forms of genealogy that are emerging as a result of the work of biotechnologies. She examines what she alternatively calls 'technologically assisted genealogy', 'artefactual genealogy' or 'respatialisation of genealogy' as a result of a series of reductions in the understanding of nature (from nature to biology, from biology to genetics, from gene to information). Sustained by the 'information analogy', new ways of producing genealogy have materialised the 'literal and metaphorical prospect of reprogramming biology' (2000, 190). In Franklin's view, once the gene begins to be understood as "information, message, code or sequence" (2000, 190), its flexibility is also enhanced, affecting directly its reproductive capabilities. A technologically assisted type of genealogy results from mastering knowledge about how to reprogram the information contained in the gene, so that it now

fuses laterally – and not only vertically – with information coming from other species. This information reproduces itself now as a new hybrid, a mixture of codes once statically duplicated only within a given species, but now recombined not only diachronically within the same species, but also synchronically and between species. The significance of this 'detonation', which has made possible mice that express human genes and plants which have genes from fish, is that it has transfigured "familiar models of kinship and descent, by demonstrating that patterns of filiation and succession once considered irrevocable because they are fixed by nature can be transcended by technology" (2000, 224). Worth noticing, this conception has points in common with Eduardo Viveiros de Castro's (2009) proposal of a 'post-complex kinship', one where both consanguinity (biology) and alliance (sociality) have come to be submitted to the logic of choice.

Thus, Franklin refers to a new genealogical time and space which are, respectively, faster than the conventional brachiations of familiar descent, and post-arboreal. This new 'artefactual' kinship shares with Haraway's an acknowledging of the blurring of boundaries between the well-differentiated and solid families and species through which modern biology traditionally organised its understanding of living beings. Yet what characterises Franklin's re-spatialised genealogy is the fact that it is specifically technoscientific (that is, it is different from the principle of cross-mixing and shared co-evolution of living beings that for Haraway is only *re*-produced – and not produced for the first time – in contemporary technoscience). Franklin's technologically assisted genealogy is specifically post-Darwinian in that it implies both a decrease in time and a re-spatialisation of genealogy, while Haraway's industrial recombination matches nature's own capacity for mixed evolution only with difficulty. Significantly, close to Rabinow's (1992) 'biosociality', Franklin's techno-scientific post-arboreal genealogy implies imprinting on nature extraneous purposes, predominantly guided by the search of commercial gain, while Haraway's principle of transgenic border-crossing is already inherently contained in pre-scientific nature itself. In Haraway's case then, it is the political, racist projects of modern biology which, by imposing external rules and re-categorising its elements, manufactured a new nature which allowed only certain forms of kinship. Such projects resemble what Rabinow (1992) has termed 'socio-biology', a set of (eugenic, philanthropist, liberal and moral) operations upon the social that constructs it using the language of biology. For Franklin, however, the projects to which pre-scientific, self-referential nature subsides are similar to those that Rabinow has identified under the rubric of 'biosociality', the reprogramming of nature's own intrinsic norms on the basis of an extrinsic normativity that enabled new, lateral and fast forms of kinship, mostly geared towards the making of economic profits.

2.2. Modern English Kinship and Lay Knowledge

Focusing closely on the increasing social significance of the new assisted reproduction technologies, Marilyn Strathern (1992a; 1992b) and Jeanette Edwards (1999; 2000), among others, investigated during the 1990s the impact that the latter may have for the lived experience of kinship. Their accounts also make sense, as do Haraway's and Franklin's, of the changing ideas and ontological status of nature in the face of growing intervention into the life processes. But their chief concern is to examine forms of lay knowledge about kinship, and what knowledge might in fact have to do with kinship in England, once ARTs became more common as a way to have children.

In her analysis of kinship in late modern England (19th and 20th centuries), Marilyn Strathern (1992a) suggests a way of theorising the normative workings of kinship. According to Strathern, central to English understandings of kin relationships are the concomitant tropes of diversity and individuality. During the 19th century, the diversity of the stock was thought to ensure the true unique character of the descendants, insofar as more plurality at the outset increased the potential for novel combinations in the progeny: "Kinship delineated a developmental process that guaranteed diversity, the individuality of persons and the generation of future possibilities" (Strathern 1992a, 39). In a version of this model, the uniqueness of the English character was thought to be a resultant of the slow amalgam of races that took place in the early formation of its population: "The greater the genetic diversity, the more rugged the offspring [...]. If England formed the basis of a hybrid nation, it was a vigorous hybrid, created centuries ago by waves of conquerors each of whom added their genes and skills to the stock" (Strathern 1992a, 36).

In these accounts of English kinship, a normative ideal emerges about what 'better nature', and thus 'better kinship', are. This ideal normatively enforced frequent genetic exchange, one which, if realised, had the potential to influence culture, the character of a nation or group of people. Thus, the more mixed nature was, the more diverse the genetic pool, the better the cultural prospects of a group. According to this, nature was graded with regard to its degrees of mixture and its potential to foster novel combinations. Genetic variety was also conceived as a foundation for personal individuality, and the latter ensured the reproduction of new diversity, achieved over time and as a result of procreation. This suggests that for English kinship the uniqueness of the person, enabled through genetic exchange and mixing, also performed as a normative core. Those not sufficiently 'mixed' were deemed not sufficiently 'unique'.

Writing at the beginning of the '90s, Strathern saw that the morally praised individuality that had so far been seen as the result of mixing natures was increasingly represented in the 'public mind' as disappearing. English and European publics evinced a progressive anxiety over new means of assisting nature, or of reproducing people, perceiving them as possibilities that hampered the potential for more differentiation in nature. Thus, Strathern identified a 'postplural' nostalgia (1992b) in the paradoxical fear that more choice for artificially assisting nature eventually entailed less diversity in nature. Directly connected with a sense of reduction in human genetic diversity, the paradigm of these fears was the use of gamete donors and surrogacy to create persons who would be genetically connected to a number of unknown others. The image of the clone, which in Strathern's view is colloquially associated with eugenics and the reduction in genetic diversity, fully expresses the apprehension attached to such increases in culture that imply ultimately a loss of nature and of the very nature of Western kinship: "The present anxiety concerns interference with natural relations. Civilisation is not so much under threat; Nature very much is" (1992a, 41). This social feeling of being in a world where there is less nature than before is powerfully associated, Strathern suggests, with the notion that less nature implies less diversity, or less individuality, or less of both.

Jeanette Edwards' ethnography of narratives of conception in an English town also focuses on the importance of knowledge of biological connections for modern English kinship. Her fieldwork leads her to affirm that "knowing is central to what constitutes a person in late twentieth-century English kinship" (Edwards 2000, 243). According to her interviewees, knowledge about one's roots implies that one is connected (and, in opposition, not knowing one's origins conveys a danger of being unconnected, as in offspring from donated gametes who are denied the chance to know the identity of the donor). This suggests that 'knowing' (what a person's roots are) becomes normative, a requirement to be completed as an individual and to be connected with others, insofar as to be connected one has to know. Those who do not know are considered to be less related; knowledge of roots becomes thus a (normative) way of establishing relationships per se.

Yet what 'things' are known in this knowledge about connection? Relying on an English idiomatic expression, Edwards (2000) talks of being 'born and bred' as a specifically English form of knowledge about kinship and connectedness. She refers thus to forms of creating connections among people that involve both 'shared substance' (idiomatically expressed in the term 'blood') and effort and care; they include simultaneously biological ties and social bonds. In *Born and Bred* (2000), Edwards explains that the roots that connect a person to others are never exclu-

sively circumscribed to the biological aspects of substances that get transmitted in the genetic recombination of the fertilised egg, through sexual intercourse and pregnancy. They also involve the knowledge of places where one's family has lived and where one grew up; the ties created through frequent visiting of relatives, and the bonds sustained through care and love.

Having revised key concepts in the debate on kinship, knowledge and technoscience, I provide in the following section a contextualization of the development of ARTs in the Argentine context.

3. ARTs in the Argentine Context

ARTs have been used in Argentina for more than thirty years. Their beginnings were linked to an early implementation of such technologies by a group of entrepreneurial doctors who envisaged the potential demand for them, and managed to replicate them successfully after a few months of trial and error. As in many countries around the world, the local adaptation of procedures developed elsewhere implied more than the capacity to reproduce technical know-how: it required also the design of a whole new set of moral justifications and medical accounts of the need to make ARTs available to the local population. This was particularly true in the context of a declared majority of Catholics[2], the Vatican's banning on ARTs for its congregation, and the vast adherence of the population to pro-life discourses and their promotion of the 'unborn life', especially during the first two decades of the local existence ARTs.

As a particular case of the Catholic countries, techniques for aiding conception were implemented in Argentina slowly but steadily, targeted (almost through exclusively private provision) for the middle and high income sectors that could afford to pay its high costs. Since 1986, when the first successful birth took place, ARTs have been satisfactorily challenging the impact of economic and political crises on their demand, increasing each year the number of cycles they perform[3]. Despite the Vatican's position and the standing of Argentina as a country of Catholics, even the most controversial types of ART treatment, like donor conception and Pre-Implantation Genetic Diagnosis, have now been widely accepted, and ARTs are certainly an important part of the local culture, as can be deduced, for example, from its recurrent featuring in the mainstream media (Ariza 2013). Moreover, Argentina's ART field has had a dynamic performance, actively and promptly incorporating technical innovations, sending tens of its members to train in the prestigious centres of the North (especially the US), fostering local research and the professionalization of the sector.

Due to this vocation of the ART field for increasing its reach over society, Argentina has consistently been the second country in Latin America, after Brazil and before Mexico, in relation to the annual number of cycles it performs, a position which is better apprehended bearing in mind that Argentina's population is about a third of Mexico's, and a fifth of Brazil's. In 2013, Argentina performed the 22.8% of all ART treatment carried out in Latin America and recorded by the RedLara Register[4], while Brazil contributed with the 44.1% and Mexico with the 12.9% (Zegers-Hochschild et al. 2016). This percentage, and the elevated ratio of annual cycles per individual (unique in the Latin American context), speak of the prevalence and high visibility of ARTs as the most sought-after solution in the event of infertility. Other factors, such as the relatively recent (July 2010) passing of the Egalitarian Marriage Act, which confers parental rights on same-sex couples, have also fostered local demand for ARTs.

The numbers mentioned above are even more poignant if only egg donation is considered. In effect, this type of treatment increased from 281 transferred cycles with fresh embryos in 2004 to 1136 in 2008[5], and from 26 transferred cycles with frozen embryos in 2004 to 323 in 2008 (Mackey 2011), a 400% rise and 1200% rise respectively.

Likewise, the pregnancy rate has had an increasing tendency from 2004 until 2010, during which it grew from 35.5% to 42.2% (Mackey 2014). These results, which show the rising importance of egg donation in Argentina, have had a distinct facilitating factor, and this is the large availability of donors, which distinguishes the country from the current situation in other parts of the world[6]. Women donate a lot in Argentina and, despite the investments arranged to 'altruistisize' them (Ariza 2016), for many practitioners the reasons for this are mainly economic. In this context, the analyses below discuss the emergent preoccupation of practitioners with the notable local increase of gamete (and particularly egg) donation treatment in Argentina; a concern that surfaces given the frequent practice of donating more than the stipulated amount of times to different centres, once that there is no centralised control of the number of donations by a single donor.

Finally, in spite of the relentless presence of ARTs in Argentina, they remained unregulated until June 2013. Once passed, the Human Reproduction Law failed to define a number of important issues, including the creation of a central donor register. Interestingly for the discussions that follow in this chapter, it has been the ongoing commitment of the medical corporation to supplement the lack of local regulation with self-imposed medical guidelines, many of which are adaptations of internationally accepted parameters.

3.1. Argentine Kinship

In order to understand how the development of ARTs both has an impact, and relies on, understandings of kinship that are particular to this setting, I explore in the following paragraphs two examples taken from popular culture. I use them to illustrate widespread forms of conceiving kinship that resonate with the ways in which Argentine ARTs' doctors make sense of the sharing of ancestors between people.

The boom hit *Celeste*, a 1991 Argentine soap opera whose successful performance entailed the extension of the original 154 chapters to 172[7], had as its central plot the story of two young persons who meet by chance and fall in love. After a lot of coming and going, 'Brother Sun' and 'Sister Moon', as they agree to call themselves secretly, conceive a child shortly before Sister Moon learns that she and Brother Sun are actually biological siblings. She spends the rest of the series avoiding a relationship with Brother Sun, foreclosing a romantic relation considered morally impossible due to the pre-existent biological connectedness. She is moreover confirmed in her thinking by being misleadingly told that the child born of her union with Brother Sun has died due to congenital malformations, which she attributes to the couple being siblings. By the last chapters, both 'brother' and 'sister' are finally told the truth (which had been kept from them in order to prevent them inheriting money): that they are not actually biologically linked, to which they respond giving free course to their love.

Celeste's story is one of a number of popular culture products (including novels, movies and other soap operas) that reflect on the tension between genetic relationships and their knowledge in Argentina. In fact, in *Celeste* the whole plot is arranged according to the idea that the relation between Brother Sun and Sister Moon is already there, independently of the protagonists being aware of it or not. The riskiness of the relation emanates precisely from this fact, and it manifests both biologically (the congenital malformations due to its supposedly endogamous origin), and socially (it is morally incorrect to marry your brother). Although this relationship may be socially elaborated throughout the series (in the fluctuations between having and not having a romantic relationship), a main theme is the biological link that the characters are thought to have[8], its potential riskiness in the face of an eventual relation, and the consequences of having or not knowledge about it: 'knowing where one comes from' allows people to act in morally proper ways (for example, rejecting a relationship), while not knowing is dangerous: it might lead people to act improperly, with dire consequences (congenital malformations).

Another relevant example can be found in the Argentine TV series *El Donante* (The Donor), broadcast during 2012. The story features a re-

cently divorced, depressed middle-aged man who has no children of his own. However, this successful engineer used to donate semen as a young student, something of which he has almost forgotten. The plot starts when one donor child, Violeta, locates him and reveals him that she is her 'daughter'. Together, the engineer Bruno and Violeta initiate the search for each of the remaining 143 persons that have been born out of Bruno's donations. In the last chapter of the series, when all the 144 children have been reunited and a 'club' formed, he is asked by his therapist (whom both know is a donor children procreated from Bruno's semen) if he is remorseful of having had donated. He answers that he is not, since 'where there was going to be nothing, there are now 144 offspring'. In this case, knowledge plays a key part in acknowledging the existence of the social link of 'paternity', insofar as were it not for such knowledge, Bruno would have ended with 'nothing'. However, it is again the fact of sharing genes which testifies to the pre-existence of paternal relationships, insofar as it is only because such biological links exist that the social paternal connection can be established. In a previous shot of the series, there is an exchange between the therapist and the donor, where the latter tells the therapist "Be calm, you will not make out with him without knowing, because I am your donor". Here, again, knowledge is put in service of acknowledging a previous link, while it serves to 'calm' the anxieties over a potential wrongful doing (as would be people making out with someone with whom they are related). Again, the question of riskiness appears as an inherent aspect of a relation thought to be already there, and knowledge allows characters to act dutifully.

I have examined these two examples as illustrations of the significance of genetic connections in Argentine culture, the way in which they are culturally rendered to be relatively autonomous from knowledge (culture), and how this autonomy is understood to be potentially dangerous. I have also stated that knowledge may be a gate to act properly. These examples allow me to highlight the extent to which kin relations based on biological substances appear to have, in this particular milieu, a sort of independent or self-evident existence, one that is already there even if it is not socially acknowledged. A person might not know that they are biologically related to someone, but the relationship is still there; the family connection has an actuality given in the sole and very fact of sharing genes. Knowledge is not, therefore, the key defining feature of kinship; rather, biology is. This, in turn, allows me to ask: how are these conceptions of kinship important for the enactment of gametes as risky substances in the Argentine clinic?

The fact that kin relations are thought to be independent from knowledge is a key element in enacting gametes' potential harmful character in the clinic, insofar as when people are procreated from gametes

from the same persons, the relation is thought to be already there, beyond the manners in which it is known. Moreover, relations that are there, but which remain unknown, are thought to be potentially harmful, because those who are already mixed should (in the opinion of doctors and fictional characters) not re-mix. My purpose in bringing in examples from popular culture has been, furthermore, to show how doctors' understandings of persons procreated from gametes from the same donors is rooted in, or at least has profound resonances with, how such links are thought about in the wider popular culture. This points to how expert and lay understandings of kinship appear not to be clearly distinguishable in Argentina.

4. Methodology

The analyses are based on 34 interviews with (and observation of the practices of) experts of the Argentine ART medical community. These included gynaecologists, biologists and biochemists, embryologists and geneticists, mental health professionals and researchers in basic science in the field of fertility. The interviews were carried out throughout two fieldwork trips to Argentina that took place in 2008 and 2009. They consisted in conversations with practitioners on their daily work, where aspects of how gamete donation treatment is provided and/or researched into in Argentina were discussed. Interviews were taped in all cases where permission was granted to do so, and a transcription of relevant extracts followed the identification of themes key for the research objectives. All interviewed practitioners signed an informed consent agreeing to be so. The research also included analysis of other types of empirical material (clinics' brochures, pieces of legislation, informed consent forms, medical and psychological guidelines, research papers, etc.) as well as of fieldwork notes from observation.

The research adopted a STS approach, and sought to acknowledge the role of practicalities (Mol 2002) in the empirical realities of the fertility clinic. In paying attention to some of the forms in which human practitioners interact with their nonhuman counterparts, the study assumed the sociotechnical quality of the fertility practices it studied. The project borrowed from Callon (1997; 2007) the idea of 'investment' and of 'performation' to describe the sociomaterial configuration of an entity. Description and analysis of the ethnographic material benefited also from related terms like Annemarie Mol's enactment (see also Law 2004) which, together with the concepts above, can be thought of as ultimately inspired by Latour and Woolgar's (1986) use of the notion of 'construction'. Such terms are of high currency among the STS literature. They are designed

to pay attention to how scientific, medical, expert practices produce objects of intervention rather than merely intervening or describing them as pre-constituted objects. They are terms that point to the way in which "reality is not independent from the actions of scientists" (Law 2004, 140), or to how both the natural and the social sciences also enact the realities that they describe (Callon 2007; Law and Urry 2004). Such an insight is crucial insofar as it allows to problematize the 'pre-arranged-ness' of objects, like the 'obvious' risk of 'inbreeding', showing how such 'givens' are never so; they are always at least partially the result of the performative capacity of science and technology. Finally, the research adhered overall to a pragmatist vision of practice whereby discursive and material deeds need to be thought alongside their success or failure (Butler 2010; Callon 2010), more specifically in addressing the efficacy of enactments in actually constituting, or not, what they purport to do.

Having provided an explanation of the methods deployed during the study, I now turn to the analyses of kinship, risk and technoscience in the Argentine fertility clinic.

5. Enacting Risky Gametes

When asked about how many times a given donor is allowed to donate their gametes, Argentine doctors are usually fast in providing a number. They might say, for example, that they or their clinics allow twenty-five pregnancies per donor, one donor per million inhabitants or six donations per donor. That is, there is always a limiting number, yet this number is different between centres and between practitioners working in the same clinic. This variation through which the limiting rule is given and reinstated is telling in itself: it speaks of the coexistence in practice of two different types of measures that aim, in fact, to regulate two different types of risks. One of these measures attains, in effect, the aim of avoiding the risk of 'inbreeding'[9] or endogamy (if a donor donates 'a lot' then it is thought that there might be less biological variation). Yet the other number that is used is oriented to prevent a wholly different risk: the potential risks caused to the egg donor's health. In the following paragraphs I look, first, at the endogamy risk, its relation to local conceptions of kinship and the significance of the 'variation' narrative for Argentine doctors. Towards the end of the article, I examine the other type of risk regulated by limiting measures (the 'health' risk), and consider how this number is actually combined in practice with the first.

5.1. The Endogamy Risk

To prevent the 'risk of endogamy', Argentine doctors have been implementing measures that limit the number of times that donors should be allowed to donate. The joint ASRM/SART "2008 Guidelines for Gamete and Embryo Donation"[10] provide (for the case of sperm donation)[11] a measure aimed at regulating the 'risk of endogamy'[12]. This is a population-based measure. It belongs with the sort of probabilistic calculation and the logic of the wager. It works by stipulating a number of allowed donations in relation to a certain amount of population. Such a measure readily exemplifies a concern with the risk of consanguinity, as it gives a number of pregnancies or births calculated as an amount which is contrasted with a number of inhabitants in the general population. The latter are imagined by practitioners, as I suggested in the introductory paragraphs above, as producing separation between those whose mixing or re-mixing is considered harmful. I argue that the formula in which they are invoked works not only to control but also to produce the risk it aims (only) to regulate.

Examples of the ways in which measures aimed to avoid endogamy are formulated are the statements:

When you increase above one child born from the same donor per million [inhabitants], the chances that they meet and marry are increased. (Gynaecologist 4)

You have to remember that the limit is twenty-five pregnancies per donor per 700.000 people. (Endocrinologist 1)[13]

If I use twenty pregnancies for a population of a million, this means that [...] tomorrow the probability of encounter between two half-siblings[14] is one in 50.000 by one in 50.000. This means… [calculates] five by five [is] twenty-five and then here you have four zeros, and here another four zeros. What is the result of that? [Surprised] Look at that, [it's] 2.500.000.000. One in two thousand five hundred million. This means that if I impose myself this figure, the probability is very very low. So far as I increase, this will decrease and it may be that they meet, two half-siblings. (Geneticist 1)

The extracts above are part of the answers I received when enquiring about 'phenotype matching'. This refers to the coordination of the physical appearance of gamete donors with gamete recipients, in order to increase the probabilities that donor children and their parents physically resemble each other. The clinic appears thus as a communicating space between two opposite practices: coordinating donor and recipients (through appearances) and dis-coordinating donor children from each

other (by reducing the probabilities that they 'meet'). This connection between coordination and dis-coordination attains in fact to the double-sided character of gametes that I recounted in the Introduction: their potential as entities that generate and relate (for example through physical resemblance) people; and their ability to reverse such 'good' potential, that is, the possibility that gametes generate harm. In fact, I argue that the answers of the practitioners quoted above are exemplary of a form of clinical thinking that, cast in the language of probabilities, is imagined as producing a necessary (both, as I will show, moral and biological) separation between hypothetical individuals.

To understand how this separation is attempted, it is useful to consider a theoretical subpopulation of 'donor children' procreated through gametes coming from the same ancestors, and imagine how their 'mixing' might be avoided once ideas about the healthiness of biological diversity suggest this. So, if one needed to ensure diversity between such donor children, one way of doing this would be to interpose 'other' persons (that is, persons not procreated from the same individuals) in between 'donor children'. This is, arguably, how the measures above are imagined by the practitioners who use it. In this form of representing the action of probabilities, the 'million people' or 'inhabitants' that come to be introduced in that hypothetical subpopulation of donor children, are imagined as producing diversity by actually separating donor children from each other, thus avoiding their possible mixing (or re-mixing, insofar as they come from the same donors).

Further, I suggest that these formulas need to be understood not only as mechanisms that control endogamy, but also as devices that stabilise the very terms ('one child born', 'twenty-five pregnancies') that they purportedly only represent. They actually identify those born or conceived in relation to a certain population as individuals that should not mix (or remix, given that they descend from the same ancestor). Thus, by helping to circulate, and thus configure, the very terms that they aim only to represent, the formulas make possible the fact that babies born as consequence of their use are identified as being siblings, and thus in risk of future remixing.

5.2. 'Blood Brothers'

As explained above, the use of statistical formulas is a mechanism to produce separation between individuals. Yet why are separation (with its expected result) and the existence of diverse persons important at all for the Argentine doctors that I interviewed? Where do such requirements come from? Who necessitates them, and why? An answer to these questions lies in what people procreated from gametes from the same persons

are thought to be in Argentine medical practice, and in the concomitant preoccupation with a potential diminishing of diversity. On the basis of conversations about numbers, endogamy and the future of the species held with practitioners in the field, I look in the following paragraphs into how donor children are conceived by fertility doctors. I further argue that such 'conceptions' have strong resonances with the ways in which donor children are represented in popular culture presented above, with effects for ideas of relatedness and family connection. The analysis of these scientific and lay notions of kinship allow me to show why gametes are handled in Argentine clinical practice as if they were carriers of potential harm.

In the previous sections I have quoted the words of a geneticist. In explaining to me how he calculates the probabilistic numbers he uses in his practice, he gave away some characteristic forms of qualifying those procreated from similarly originated gametes. In effect, in linking the number of donations to the capacity of his probabilities, the geneticist argued that:

So far as [he] increase[s] [the number of children born from the same gamete donor], [...] [the probability that donor children from the same donor do not meet] will decrease and it may be that they meet, two half-siblings. (Geneticist 1)

This is, he explicitly links the fact of having a shared ancestor to that of being immersed in a relation, in this case a relation of siblinghood.

Such ways of referring to those procreated from gametes from the same ancestor are characteristic of how donor children are talked about in the Argentine clinic. For example, a gynaecologist said that:

When you increase above one child born per million from the same donor, the chances that [children from the same donor] meet and marry are increased. It might even be that... it wouldn't occur to you to date your brother[15]. But you may do it without knowing that he is your brother. (Gynaecologist 4)

Another one tried to convey the risks involved in endogamy by exemplifying that:

[The risk] is that in the future people [born] from the same ova start to interbreed [...]. *It would be like having a child with your brother.* (Gynaecologist 1, my emphasis)

I take these quotations as telling interview data that show how Argentine doctors think of people procreated from the same donors as holding a relationship, that is, as being already entangled in terms of kin connectedness, independently of people being aware of so or not. In the case of

the geneticist, he gauges the strength of his probabilities against their power to avoid the encounter of two 'half-siblings'. In the case of both gynaecologists, and by referring more explicitly to the domains of both sexuality ('meet and marry') and procreation ('having a child'), they refer to the concomitant difficulties when such domains might be implicated with the fact of people being 'brothers'. I want to propose that understanding that people are related (through 'siblinghood' and 'brotherhood') in the absence of knowledge of such a relationship ('without knowing that he is your brother') is in itself a model of kinship, one that highlights the significance of the biological link, or at least makes it sufficiently important to be able to establish a relationship in its own right, independently of a social rendering of such connections between those who are implicated. Furthermore, the sheer artificial (i.e. culturally specific) character of such a model is evident, insofar as (natural 'evidences' like 'genes' and 'blood' notwithstanding) it could clearly be otherwise. That is, it could clearly be the fact that, for Argentine doctors, people who share ancestors, but who do not hold a social relationship (i.e. are mutually anonymous, are in lack of knowledge of such a relation), were not considered to be kin.

If, as has been already very well established, Western kinship models are characterised by the presupposition that biology is crucial to the definition of what kinship is (Edwards 2000; Schneider 1984; Strathern 1992a), the Argentine model might actually bring a nuance to this: biology might already be enough to establish kinship. In fact, according to the interviewees above, relations have already been established biologically, independently of them being known, with knowledge figuring here as a representative of culture. This is a model which is less merographic[16] than that narrated by David Schneider, Marilyn Strathern or Jeanette Edwards in their ethnographies of the Global North. For them, biogenetic ties are being submitted to the logic of choice (Schneider 1984); "kinship systems and family structures are imagined as social arrangements […] based on […] processes of biological reproduction" (Strathern 1992b, 3); and whereas "kinship embraces connections people trace to each other through notions of shared substance […] at the same time it places […] emphasis on the creation and maintenance of social relationships through intimacies of care and effort" (Edwards 2000, 27). In these models, kinship partakes both of nature and nurture, without being in fact subsumed totally in either system (that is, it maintains with both the natural and the cultural realm a partial or merographic connection). Yet in the Argentine medical milieu, kinship appears as being less composed of nature and culture; less characterised by both the fact of being born as well as of being bred. In this regard, nurture/culture would seem to have a secondary character to the bio-

logical aspect; an almost superfluous standing in relation to the true defining character of kinship, that is, the biological link. Rather than merographically or partially, the nature system captures the totality of kinship.

5.3. 'Lest They Meet and Marry'

As established, above, central to the handling of reproductive donations in Argentine fertility clinics is also a concern with the physical internal variation of the species, with instating both the biological and cultural goodness of diversity, and hence with ensuring proper degrees of separation between those who are already mixed (like children from the same donor), so that they do not re-mix. The latter are shown explicitly in ideas of the badness of inter-breeding, and of potential endogamy due to procreation between descendants from the same ancestors, that flourish recurrently in the practitioners' talk regarding gamete donation in Argentina. For example, discussing the work of numbers and the need to limit how many times a donor donates, a practitioner explained in the following way what in the field is known as the 'endogamy risk' or the 'genetic risk':

G: [with more children procreated from the same donors] endogamy begins to increase, and endogamy is not good for the species. It is detrimental to the species. Endogamy perpetuates many of the traits but also those which are useless [...].
I: But [...] would you say that there are [emphatic] biological arguments against endogamy?
G: Yes, of course. The improvement of the species is achieved by bringing in new races. Not by the mixing of all those who are the same
I: Which are the worst evils? What could happen?
G: [...] The more races are interbred, the higher the possibilities that they inherit beneficial genes. Also because those specimens that begin to have detrimental traits begin to be infertile, because they stop reproducing
I: But has that happened in humans?
G: In humans as well, in humans there are endogamous groups that tend to disappear, precisely because of endogamy [...]. That's why the improvement of species implies bringing in new specimens, from other species. (Gynaecologist 4)

The extract quoted above exemplifies the high stakes placed on variation, and on variation as a prerequisite for improvement, by Argentine doctors (and modern biology more broadly). Such high stakes, I want to argue, are a key element of the enactment of reproductive donations through a logic of risks and bad potential. In this narrative, insofar as the evolution of species by means of natural selection is the result of changes

in species' make-up that enable some individuals to adapt better to their environments, biological diversity is regarded as a fundamental prerequisite to ensuring evolution (or 'improvement'), providing a constant source of potential recombination and thus of the possibility of novel adaptations. When a population is varied, individuals inherit genes from different ancestors, and this mixing is considered to be the basis on which evolution takes place in the long run, as part of the appearance of individuals with genes that enhance their adaptation. Darwin ([1859] 2008) famously coined the expression 'evolution by natural selection' to name this process.

Moreover, not only is variation enthroned as the basis for evolution in this biological narrative, but also the lack of variation is made responsible for reducing the potentialities of genetic recombination and thus for the potential sickness and extinction of a population. In this account, endogamous practices thought to derive from 'the mixing of all those who are the same' lead to the production of less variation ('Endogamy perpetuates many of the traits'), an outcome that is regarded as having detrimental effects on a population ('many of the traits but also those which are useless'), and potentially conducting to its extinction ('in humans there are endogamous groups that tend to disappear'). In such explanations, the health of a population appears as depending on ensuring disconnection between certain (already connected) individuals, thus making some forms of kinship a ground for population wellbeing, and other the reason for a population's sickness.

Explanations such as the one above were part of those provided by doctors when asked about the use of probabilistic calculation and the recurrently stated need to limit the amount of donations allowed from a single donor. What is also significant in these accounts of the need for variation is how such a need is seen as originating in the 'sameness' of those procreated through gametes coming from the same ancestor (as evidenced in the talk by Gynaecologist 4 quoted above: 'the improvement of the species is achieved [...] not by the mixing of all those who are the same'), a sameness that further qualifies, as shown in the previous section, their being regarded as siblings.

These arguments are in noticeable contrast with prevalent ideas of Argentina as a 'white nation' comprised mainly by descendants from Europeans who alighted 'from the ships' (Perelman 2016); a mythical and racist account of the nation's formation whose ideological valence lies in excluding indigenous and the non-European migration from the myth of origins[17]. Although I do not have the space to dwell on this issue here, it is clear that the practitioners' emphasis on 'sameness' as problematic and variation as desirable described above clashes with an account of Argentina as a country composed mainly of White people. Numerous studies

have recently started to look at racist discourses and to incorporate the conceptual framework of race into understandings of contemporary Argentine society (e.g. Adamovsky 2012; Frigerio 2010; Grimson 2006). The previous relative underdevelopment of this academic area is a clear proof of the ubiquity of ideas about the prevalence of Whiteness in Argentina. My point in bringing this up is merely to observe that narratives of sameness as carrying bad potential exist side-by-side with those that take for granted, and that to a great extent rely upon reproducing (Ariza 2015), also a certain kind of White sameness. The relatively easy coexistence of these two narratives may be attributed to them being regarded as referring to different scales of the social (the family in the first case, race and/or ethnic background in the second), therefore to a certain degree independent from each other. Thus, if biological heterogeneity appears as valuable insofar as it ensures the prosperity and 'improvement' of the lot, that heterogeneity seems to be conceived as taking place exclusively between those whom, in other way, are thought to be 'the same' (the Argentine-Europeans).

6. The Health Risk

As said above, Argentine doctors also use another measure to regulate how many times does a (female) donor donate. In effect, in the case of egg donation there is the concern to limit how much a woman donates. This limit number is not directly addressed in the ASRM/SART guidelines[18], but it does appear in the talk of some practitioners. This is the risk that may be posed on the donor's health if she donates frequently, a preoccupation specific to Argentina given the large number of times that donors tend to donate[19]. One practitioner said:

It is generally said that there is no relation between [taking ovulation induction drugs and] an alteration in fertility, and no relation to cancer. (Gynaecologist 2)

Yet it is clear that for some practitioners the evidence for this lack of association is either not satisfactory or not sufficient[20]. For the gynaecologist above, for example:

Six is like a limit number, because you have to imagine that it is a polyovulation what they are doing every three months, and that is a lot for the ovary, and a lot for the body. (Gynaecologist 2)

Another practitioner also pointed out that:

All the studies carried out, they are done on the basis of donors of twenty years

ago, ten years ago. What happens tomorrow to girls donating now, it's not known. Today's donors don't donate like before. They donate more, everything is much more widespread. (Gynaecologist 1)

As these extracts show, some practitioners and the institutions they work for are indeed concerned about egg donors' health. This concern stems from the specificity of Argentina as a country where lack of state control and high monetary compensation foster repeated donation by the same donor. Moreover, this preoccupation is in line with some of the observations posed by ASRM (2006, S216), who has indicated that "[…] It is presently not known whether repetitive follicular aspirations could affect the donor's future fertility". Doubts persist to the extent that limitations on the grounds of individual health are also taken into account, and besides the need to ensure variation. Enforcing 'good practice' implies taking institutional account of the eventuality and locality of these risks, even if, as I show below, such taking this into account needs to be practically combined with the need to control endogamy.

Protecting donors' health is then another reason to limit the number of donations taken from the same egg donor. Measures of this type are usually formulated in relation to the donor rather than the population where the donor donates. They are given as a number of pregnancies or donations per donor (for example, six donations per donor, eight pregnancies per donor[21]). As in the case above, I propose to think of the use of a preventive formula not only as a way of avoiding a purported risk, but also as an uncanny form in which the risks inherent to donation are actually stabilised as a matter of concern, in fact enacting the use of donor gametes as a matter of risk and bad potential. Explanations about which measures are being used need to be thought, therefore, as part of the arrangements that perform gametes as eventual agents of bad potential, while also contributing to produce the doctors as those who are concerned about donors' health.

6.1. Which Numbers?

The 'health' risk posed to female donors shows that there are two types of measure that regulate the number of donations per donor, and hence two ways of enacting the bad potentiality of gametes. Yet how do these two types of measure/risks relate? And how are the different demands they represent coalesced in the actual limitations to donate? In fact, because for practitioners it is impossible to use the two measures separately, the measures are used together[22].

In effect, the difficulty of disentangling what each measure does by itself that stems from applying two ultimately incompatible measures as al-

ternative answers to one single demand (i.e. 'how many times should a donor donate?'), has effects in the very production of the risks at stake. And insofar as the investment in which such measures conjointly act needs to be understood as an investment that aims to performate, simultaneously, variation and health, the risks produced by risk-avoiding measures attain, precisely, the diversity of the species as composed of healthy individuals.

In effect, on the one hand the application of the norm that prevents risks to donors needs to be understood as a false number (Lampland 2010); that is, as a number whose use is inaccurate yet at the same time productive[23]. This means that even if the measure that prevents risks to donors is not strictly appropriate for the use to which it is put (i.e. is not a measure devised to control endogamy), it is still productive insofar as it helps to materialise the norm of variation in a simple(r) sort of way. By stipulating that donors are to donate, for example, only six times, it helps to perform medical practices as concerned with variation, that is, with the health of the collective, without having to enter into the more complex calculations entailed in applying the proper endogamy measure (i.e. twenty-five in 800.000). Practically applied to produce variation and avoid endogamy, the health formula stabilises those procreated through it as siblings, commanding their disentangling (only six). This productivity of the prevention-of-risks-to-donors measure working as a false number does two things. First, it performs those who are regarded as siblings ('six') as pertaining to the same kind, and therefore in need of avoidance of a potential re-mixing. Second, the measure also produces the donor and the offspring as individual bodies whose re-union needs to be avoided[24].

On one hand, to use the health measure as a way of controlling endogamy is, thus, to use the measure as a false number, deploy it inaccurately yet focus instead on the other result that it can bring (i.e. helping to easily materialise the norm of variation). The prevention-of-risks-to-donors measure is, however, a false number. It is ultimately inaccurate and as such the investment in which it acts is also bound to fail in some way. In effect, as much as the six-per-donor measure helps to practically materialise the norm of variation, its inaccuracy is responsible for the production of a biological relatedness between individuals that ultimately complicates the achievement of disentangling. This means that while the measure creates the circumstance that those born from the same donors are identified as siblings and therefore as kinds who should not re-mix, it also generates biological relatedness between individuals in ways that do not come to be acknowledged, in the investment in which they happen, as forms of 'siblinghood'. Thus, the investment is unsuccessful (or fails) in its own terms, insofar as it produces relatedness between those who

are thought to be, and performed by the very formula, as in need of disentangling.

Yet on the other hand, given that the measure that prevails in the clinic (or 'happens first') is that which prevents the risk of endogamy, it might be worth enquiring about the success of the investment that seeks to prevent damage to donors' health. This investment is not unrelated to the one that aims to perform variation, insofar as sometimes the endogamy measure is used to produce health. Then, if the measure according to which a donor is allowed to keep on donating is that of, for example, twenty-five pregnancies per 800.000, how does this investment adequately monitor the potential risks to the health of donors? The answer is that it monitors them poorly, since the application of the rule of three gives an allowed number of ten pregnancies per donor for the City of Buenos Aires[25]. Ten pregnancies per donor is a considerably higher number than the six (or eight) pregnancies per donor allowed according to the risks to donors' measure, an increase which, in the terms of the investment, considerably rises the risks to donors' health.

The above analyses show, then, that the concrete arrangements by which numeric calculations are normatively deployed in Argentina as part of the enactment of what are taken to be the natural norms of variation and health has consequences for how bodies, individuals and populations are intervened in and constituted as a result. Specifically, it allows to see how the combined use of measures devised to do different things is paradoxically productive of the risks that the investment aims explicitly to avoid (an increase in the 'sameness' of those who constitute the species; a decrease in egg donors' health). In the examples shown above, this means that genetic variation between people is not produced according to a measure of twenty-five per 800.000 or its variants, but according to measures such as six donations per donor, eight donations per donor, etc. The failure of the investment produces relatedness in ways that are not acknowledged within the investment, thus failing to biologically disconnect those whom it otherwise constitutes as in need of disconnection. For similar reasons, the failure of these arrangements results equally in the fact that it is not healthy bodies that are produced through them, but rather bodies whose exposure to the risks deriving from repetitive ova donation has been increased (as is the case when ten donations per donor are allowed, a limit which results from applying the twenty-five in 800.000 rule for the city of Buenos Aires).

7. Conclusions: How to Become Human

The analyses above have shown the surfacing of a growing biopolitical

concern with the species and its health that is currently emerging from the use of donor gametes in Argentina. This preoccupation, which is partly the result of the frequency and repetitiveness with which donors (particularly egg donors) donate here, is also notably characteristic of the kind of alertness, 'moral panic' and dystopian imaginaries brought by ARTs elsewhere (see for example Franklin 1993; Simpson 2013). Such concerns can be understood as evincing what Marilyn Strathern (1992a) already pointed out long ago, that technology may strip life of individuality; that a culture made of sameness may in fact make do without (its) people.

Yet the anxiety over a disappearance of (different) persons, culturally understood in the West as a reduction of diversity, and hence, of kinship as we know it, is important also because it speaks not only of the ways in which ARTs are still denaturalising kinship, but also of how much kinship is still shaping the practices of ARTs. In effect, far from allowing an unlimited number of donations from each donor, the Argentine fertility community strives, copying or adapting legislation from around the world, to perform gamete donation according to that which is expected from proper kinship, thus enacting itself as guarantor of appropriate (detached, differentiated) kinship links. Furthermore, anxieties over 'too much connection', or too much kinship, are signs of the limits of a post-plural world in Marilyn Strathern's terms: in the end, it appears that the overflow of 'choice' brought in by ARTs needs to be countered by a choice that limits, epitomised by the use of regulative numbers; that is, by the reduction of choice.

Apart from illuminating forms of doing ARTs in other parts of the world that have been less examined than those in the North, the analyses above illustrate as well a particular way in which kinship thinking (denoted in terms like 'endogamy', 'brother', 'sibling', or 'genetic risk') evokes nature and culture, the given and the made. Thus, on one side, practitioners' idioms are those of biological language ('endogamy', 'inbreeding', 'improvement'), and this is consonant with shown ideas about kinship being thought in strongly biological terms. Yet at the same time, 'knowledge' plays a key role in turning those biological concerns into moral ones and, ultimately, into human ones. In fact, it is clear from these set of discourses and practices that what distinguishes humans qua humans is not so much their capacity to identify moral horrors like incest, but rather their ability to worry about, and try to prevent, the possible biological risks entailed in further remixes of those who are thought to be too similar. This is a set of risks posed by technoscience. They are not inherent to nature, since the latter is conceived by Argentine doctors in line with Haraway's understanding of nature as a domain of pure mixing, contamination and cross-fertilisation. What makes humans (doctors, patients) human is therefore their preoccupation with where to cut the network (Strathern 1996) of relatedness, where to stop connecting. In the views of

the actors of this special milieu, the inherent risk of gametes lies in their inherent capacity to incessantly re-mix; ordering and limiting the potential profusion of connection (and risk) is also about enacting what is uniquely human; that is, to bring an artificial limit to biological connection.

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References

Adamovsky, E. (2012) *El color de la nación argentina. Conflictos y negociaciones por la definición de un ethnos nacional, de la crisis al Bicentenario*, in "Jahrbuch für Geschichte Lateinamerikas", 49, pp. 343-364.

Ariza, L. (2012) *Gestión poblacional del parentesco y normatividad: la producción de variabilidad biológica en el intercambio de gametas de la reproducción asistida*, in D. Jones, C. Figari and S. Barrón López (eds.), *La producción de la sexualidad: políticas y regulaciones sexuales en Argentina*, Buenos Aires, Biblos, pp. 127-146.

Ariza, L. (2013) *The normativity of nature: morality, variability and kinship in the gamete exchange.* PhD Thesis, Department of Sociology, Goldsmiths, University of London (UK).

Ariza, L. (2015) *Keeping up Appearances in the Argentine Fertility Clinic: Making Kinship Visible through Race in Donor Conception*, in "Tecnoscienza: Italian Journal of Science and Technology Studies", 6 (1), pp. 5-31.

Ariza, L. (2016) *"No pagarás": el Consentimiento Informado como productor de solidaridad en la medicina reproductiva*, in "Ciencia, docencia y tecnología", 27 (52), pp. 240-268.

ASRM (2006) *Repetitive Oocyte Donation*, in "Fertility & Sterility", 86 (Suppl. 4), pp. S216-S217.

ASRM/SART (2008) *2008 Guidelines for Gamete and Embryo Donation: a Practice Committee Report*, in "Fertility & Sterility", 90 (3), pp. 30-44.

Butler, J. (2010) *Performative Agency*, in "Journal of Cultural Economy", 3 (2), pp. 147-161.

Callon, M. (1997) *Introduction: the Embeddedness of Economic Markets in Economics*, in M. Callon (ed.), *The Laws of the Markets*, Oxford, Blackwell, pp. 1-57.

Callon, M. (2007) *What Does it Mean to Say that Economics is Performative?*, in

D.A. MacKenzie, F. Muniesa and L. Siu (eds.), *Do Economists Make Markets? On the Performativity of Economics*, Princeton and Woodstock, Princeton University Press, pp. 311-357.

Callon, M. (2010) *Performativity, Misfires and Politics*, in "Journal of Cultural Economy", 3 (2), pp. 163-169.

Carsten, J. (2004) *After Kinship*, Cambridge, Cambridge University Press.

Cooper, M. and Waldby, C. (2013) *Clinical Labor: Tissue Donors and Research Subjects in the Global Bioeconomy*, Durham, Duke University Press.

Darwin, C. [1859](2008) *On the Origin of Species*, Oxford, Oxford University Press.

Edwards, J. (1999) *Why Dolly Matters: Kinship, Culture and Cloning*, in "Ethnos", 64 (3), pp. 301-324.

Edwards, J. (2000) *Born and Bred: Idioms of Kinship and New Reproductive Technologies in England*, Oxford, Oxford University Press.

Fisher, J.A. (2016) *Stem Cell Initiatives as a New Window into Health Disparities*, in "Contemporary Sociology: a Journal of Reviews", 45 (3), pp. 276-278.

Franklin, S. (1993) *Making Representations: the Parliamentary Debate on the Human Fertilisation and Embryology Act*, in J. Edwards, S. Franklin, E. Hirsch, F. Price and M. Strathern (eds.), *Technologies of Procreation: Kinship in the Age of Assisted Conception*, Manchester, Manchester University Press, pp. 96-131.

Franklin, S. (2000) *Life Itself. Global Nature and the Genetic Imaginary*, in S. Franklin, C. Lury and J. Stacey (eds.), *Global Nature, Global Culture*, London, Sage, pp. 188-227.

Franklin, S. (2001) *Biologization Revisited: Kinship Theory in the Context of the New Biologies*, in S. Franklin and S. McKinnon (eds.), *Relative Values. Reconfiguring Kinship Studies*, Durham, Duke University Press, pp. 302-325.

Franklin, S. and Lock, M. (2003) *Remaking Life and Death: toward an Anthropology of the Biosciences*, Santa Fe, School of American Research Press.

Frigerio, A. (2010) *Luis D'Elia y los negros: identificaciones raciales y de clase en sectores populares*, in "Claroscuro. Revista del Centro de Estudios sobre Diversidad Cultural", 8 (8), pp. 13-43.

Gammeltoft, T.M. (2013) *Potentiality and Human Temporality Haunting Futures in Vietnamese Pregnancy Care*, in "Current Anthropology", 54 (57), pp. S159-S171.

Grimson, A (2006) *Nuevas xenofobias, nuevas políticas étnicas en la Argentina*, in A. Grimson and E. Jelin (eds.), *Migraciones regionales hacia la Argentina. Diferencia, desigualdad y derechos*, Buenos Aires, Prometeo, pp 69-97.

Haraway, D.J. (1997) *Modest-Witness@Second-Millennium.FemaleMan-Meets-OncoMouse: Feminism and Technoscience*, New York and London,

Routledge.

Lampland, M. (2010) *False Numbers as Formalizing Practices*, in "Social Studies of Science", 40 (3), pp. 377-404.

Latour, B. (1993) *We Have Never Been Modern*, New York, London, Harvester Wheatsheaf.

Latour, B. and Woolgar, S. (1986) *Laboratory Life: The Construction of Scientific Facts* (2nd ed.), Princeton, Princeton University Press.

Law, J. (2004) *After Method: Mess in Social Science Research*, London, Routledge.

Law, J. and Urry, J. (2004) *Enacting the Social*, in "Economy and Society", 33 (2), pp. 390-410.

Mackey, M.E. (2011) *Registro Argentino de Medicina Reproductiva 2004-2008* (SAMER), in http://www.samer.org.ar/docs/SAMER_presentacion_RA-FA.pdf (retrieved February 13, 2012).

Mackey, M.E. (2014) *Registro Argentino de Medicina Reproductiva 2004-2014* (SAMER), in http://www.samer.org.ar/pdf/ULTIMA-RESENTACION-DEFINITIVA.pdf (retrieved May 8, 2014).

Mallimacci, F. (2013) *Atlas de las creencias religiosas en la Argentina*, Buenos Aires, Biblos.

Mol, A. (2002) *The Body Multiple. Ontology in Medical Practice*, Durham and London, Duke University Press.

NICE (2004) *Fertility Assessment and Treatment for People with Fertility Problems*, available at http://www.nice.org.uk/nicemedia/pdf/CG011full-guideline.pdf (retrieved December 6, 2012).

Rabinow, P. (1992) *Artificiality and Enlightenment: From Sociobiology to Biosociality*, in J. Crary and S. Kwinter (eds.), *Incorporations*, New York, Zone Books, pp. 234-252.

Rosengarten, M. (2001) *A Pig's Tale: Porcine Viruses and Species Boundaries*, in A. Bashford and C. Hooker (eds.), *Contagion: Historical and Cultural Studies*, London, Routledge, pp. 168-182.

Schneider, D.M. (1984) *A Critique of the Study of Kinship*, Ann Arbor, University of Michigan Press.

Simpson, B. (2013) *Managing Potential in Assisted Reproductive Technologies Reflections on Gifts, Kinship, and the Process of Vernacularization*, in "Current Anthropology", 54 (57), pp. S87-S96.

Strathern, M. (1992a) *After Nature: English Kinship in the Late Twentieth Century*, Cambridge, Cambridge University Press.

Strathern, M. (1992b) *Reproducing the Future: Essays on Anthropology, Kinship and the New Reproductive Technologies*, Manchester, Manchester University Press.

Strathern, M. (1996) *Cutting the Network*, in "The Journal of the Royal Anthropological Institute", 2 (3) pp. 517-535.

Sunder Rajan, K. (2006) *Biocapital. The Constitution of Postgenomic Life*, Durham, Duke University Press.

Sutton, M.L., Gilchrist, R.B. and Thompson, J.G. (2003) *Effects of In-Vivo and In-Vitro Environments on the Metabolism of the Cumulus-Oocyte Complex and Its Influence on Oocyte Developmental Capacity*, in "Human Reproduction Update", 9 (1), pp. 35-48.

Taussig, K.S., Hoeyer, K. and Helmreich, S. (2013) *The Anthropology of Potentiality in Biomedicine. An Introduction to Supplement 7*, in "Current Anthropology", 54 (57), pp. S3-S14.

Viveiros de Castro, E. (2009) *The Gift and the Given. Three Nano-Essays on Kinship and Magic*, in S. Bamford and J. Leach (eds.), *Kinship and Beyond: the Genealogical Model Re-Considered*, London, Berghahn, pp. 237-268.

Vora, K. (2013) *Potential, Risk, and Return in Transnational Indian Gestational Surrogacy*, in "Current Anthropology", 54 (57), pp. S97-S106.

Zegers-Hochschild, F., Schwarze, J.E., Crosby, J.A, Musri, C. and Urbina, M.T. (2016) *Assisted reproductive techniques in Latin America: The Latin American Registry, 2013*, in "Jornal Brasileiro de Reprodução Assistida", 20 (2), pp. 49-58.

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[1] I thank one of the anonymous referees for pointing this out.

[2] According to data from 2013, 76.5% of the population identifies as Catholic, 11% as atheist or agnostic, and 9% as evangelical (Mallimacci 2013).

[3] Demand for ART treatment is still and likely to keep on growing in Argentina. Between 2000 and 2014 (the last year for which data is available in the RedLara Register), the number of initiated ART cycles (a cycle being each initiated treatment) increased steadily, with the exception of 2000, 2001 and 2006, when annual numbers remained the same or decreased by about 100 cycles per year. The 2000-1 stagnation was likely linked to the 2000-2001 financial and political crisis, which affected a great number of people.

[4] The Latin American Assisted Reproduction Register records data on ART treatment in the Latin American region since 1990. Centre participation in the Register is voluntary.

[5] 2008 is the last year for which separated data for egg donation is available in the Argentine Register of Assisted Reproduction (RAFA).

[6] See for example the warning tone of an article appeared in the NRGT news portal Bionews (London Bridge Fertility, Gynaecology and Genetics Centre): "Gamete Donation in the UK: Time to Think Again", *Bionews*, April 12, 2010. Retrieved October 10, 2012 from Bionews website: http://www.bionews.org.uk/page_58241.asp?hlight=shortage+of+gametes.

[7] *Celeste* was sold to all countries of Latin America. It was also broadcast in the US by the channel Univision, and in Spain and Italy among other European countries ("El fenómeno Celeste", *Way Back Machine Internet Archive*, available

at https://web.archive.org/web/20090823042752/http://www.quovadis.com.a-r/–telenovelas/celeste/fenomoceleste.html, accessed online 10 October 2017).

⁸ In fact, the names under which both protagonists agree to call themselves, 'Brother' and 'Sister', perfectly captures what they are also thought to be for much of the extent of the soap.

⁹ I examine the meanings associated with inbreeding and a potential diminishing of biological diversity further below.

¹⁰ These are the instructions most closely followed in Argentina on this regard.

¹¹ The fact that the ASRM/SART guidelines only regulate the potentiality of endogamy for the case of sperm donation further sustains my point below that the concern with egg donors' health is an emergent preoccupation specific to Argentina in view of the high frequency with which donors donate in this particular context.

¹² In Argentina, the ASRM/SART measure for sperm donation is also used for egg donation.

¹³ Measures of this type were not always reported with the same values. In fact, the endogamy measure was reported by different practitioners as being twenty-five in 800.000, twenty-five in 700.000, one in a million and twenty in a million. I do not have the space here to reflect on the significance of this fact for the overall question of how statistical, risk-avoidance measures are actually complied with in the Argentine clinic, yet I have done this elsewhere (Ariza 2012).

¹⁴ The term used in Spanish is the masculine form: 'medio-hermanos'.

¹⁵ I translate here more literally as 'brothers' (as it is said using the universal masculine form in Spanish) and not by 'siblings' since the interviewees are obviously talking to me, the interviewer, a woman, of whom they assume her heterosexuality.

¹⁶ Marilyn Strathern (1992a) defined a connection as 'merographic' when the parts that come together partake simultaneously of other 'wholes'; this is, a merographic connection is one which only engages parts partially.

¹⁷ I have reflected on the importance of fertility doctor's ideas of racial sameness for Argentine ARTs in Ariza (2015).

¹⁸ The 2008 ASRM/SART guidelines refer in point VI. H to 'Multiple oocyte donations', yet they do not tackle the issue directly, re-directing instead to the ASRM Practice Committee Opinion entitled 'Repetitive Oocyte Donation' (ASRM 2006). This latter document was, however, never mentioned by the interviewees, and it is unknown the degree to which it is actually used.

¹⁹ Egg donation has been known for a long time to imply some risks for the donors, insofar as it entails use of anaesthesia, surgical methods and the potential of multiple pregnancy and of hyperstimulation syndrome due to hormone intake. These risks are related to the donation as a single event, and they do not accrue over time (i.e. the risk of having a surgery-related complication is the same for each donation). They are different, in this regard, to risks to donors' health that derive from repeated egg donation (each time a donor donates, her risk of acquiring some sort of hormone-related cancer or having her fertility reduced may be increased).

[20] An absence of association with cancer is in principle supported by research done in the field, although studies looking into this have given mixed results and are ongoing. Cancer Research UK enumerates a number of Danish, Dutch, Australian and British studies that have shown there is no association between ovarian, breast and womb cancer and the intake of fertility drugs (*Does test tube baby treatment increase cancer risk?*, from Cancer Research UK website: http://cancerhelp.cancerresearchuk.org/about-cancer/cancer-questions/does-test-tube-baby-treatment-increase-cancer-risk, retrieved August 27, 2012). Similarly, a 2006 revision of the oocyte donation guidelines by the ASRM states that "Recently published data have not demonstrated an association between the use of ovulation-inducing agents and ovarian cancer, although definitive conclusion await further follow-up" (ASRM 2006, S216, emphasis added). A 2004 report by the NHS's National Institute for Clinical Excellence indicates however that "Women who are offered ovulation induction should be informed that a possible association between ovulation induction therapy and ovarian cancer remains uncertain" (NICE 2004, 34). The potential reduction of the donor's fertility is, however, a different matter, as shown in the observation by ASRM (2006).

[21] As in the case of the endogamy measure, measures of this type characteristically differed in value from practitioner to practitioner. Examples include eight donations per donor, six donations per donor, eight pregnancies per donor.

[22] According to Gynaecologist 1, they do "whatever happens first: that there are more than twenty-five born alive every 800.000, or that she donates more than six times".

[23] For Lampland (2010) 'false numbers' are temporary devices that enable rationalisation, stability and fixity. For her, this means understanding false numbers as formalising practices. I follow Lampland in her overarching claim, namely that the use of a false number can have productive effects, can help to performate things.

[24] By enacting variation, the health measure performs 'siblings' (six) as those who should not mix, therefore enacting those who share genes (the donor and the offspring) as figures who (so as to ensure variation) need to be disentangled.

[25] According to Gynaecologist 1, this figure comes out of applying the rule of three to the City of Buenos Aires: "If in Buenos Aires there are 3.000.000 people, then the application of the rule of three implies that there can be ten [children] born alive [per donor]".

Civic Hacking
Redefining Hackers and Civic Participation

Ksenia Ermoshina

Citizen Lab, University of Toronto

Abstract: Civic hacking movement, born at the times of Obama campaign, promotes trust in programming code as a new tool able to solve a large variety of public problems usually delegated to public services or dedicated private institutions. Based on a four-year STS-inspired ethnography of "civic hackathons" in France and Russia, the paper aims to draw a profile of a "civic hacker" and grasp the transformations of civic participation brought by this phenomenon. Beyond technoscepticism and solutionism, the author suggests to follow the actors in their work of "putting problems into code" and proposes a pragmatist approach to civic hacking. While recent studies have been critical of civic hacking as part of the broader neoliberal transformations of labor, the author argues that, in the context of distrust towards traditional political institutions and repertoires of contention, civic hacking can assist construction of public problems, and can also mean "hacking the civics".

Keywords: civic hacking; hackathons; civic tech; public problems; civic participation

Corresponding author: Ksenia Ermoshina, Citizen Lab, 315 Bloor Street West, Bloor St W, Toronto, ON M5S 0A7, Canada – E-mail: ksenia@citizenlab.ca

1. Introduction

The past decade saw a rise of a new hacker figure, the "civic hacker", the one who codes for "social good". An unprecedented wave of events around the world has been launched, promoting code as a ubiquitous means to address and potentially solve a large variety of public problems that were usually the responsibility of public services or dedicated private institutions. These events, called "civic hackathons", are short competitions that put together heterogeneous groups of actors, from developers and designers to political activists and NGO workers, who prototype technical solutions in response to different challenges of contemporary societies.

Civic hackathons do not have a lot in common with the Chaos Communication Congress, SHA or other gatherings well described by ethnographers of hacker culture. "Code 4 America", "Hack for Refugees", "Code for Humanity", "Code for Climate Change", "Hack against corruption", "Hack for Good" - these civic hackathons are often co-organized with the help of governments and private actors. They aim at building bridges between a certain form of civic participation and the art of coding.

The controversial phenomenon of civic hacking demands a (re)definition. Who are these new "hackers" and how does the figure of "civic hacker" challenge existing conceptual and methodological approaches to "hacker cultures"? On the other hand, what's the "civic"? Is there a new form of "citizenship" coined by coders? And how does it redefine social good, commons and political participation?

While technoscepticism (Morozov 2013) and the recent wave of critical hackathon studies, (Gregg, Lodato and Di Salvo 2014; Gregg 2015), suspect civic hacking to be a neoliberal appropriation of hacker cultures, other researchers (Irani 2015; Baraniuk 2013) praise civic hackathons as forging an "entrepreneurial citizenship" and helping countries in crisis: "they manufacture urgency and an optimism that bursts of doing and making can change the world. Participants in hackathons imagine themselves as agents of social progress through software…" (Irani 2015, 2). However, much less attention has been paid to the technical and infrastructural specificities of the software developed at civic hackathons, as well as to documenting the specifics of coding practices as they happen at civic hackathons.

This article, driven by a 4-year STS-inspired ethnographic study of Russian and French civic hacking groups, wants to engage in a dialogue with both "technosceptical" and "solutionist" approaches. It aims to draw a profile of the "civic hacker" and grasp the transformations of both civic participation and hacking practices brought by this phenomenon. I argue that, beyond technoscepticism and solutionism, we must follow the actors in their work of "putting problems into code". Civic hackathons help observe these encounters between activists (or "problem owners") and hackers, as they translate public problems into codeable tasks.

The article suggests, first, to analyze civic hacking by studying various organizational formats and instruments used by civic hacking communities. Analyzing the networks in which civic hackers are inscribing themselves, I suggest to focus on mediators that try to hold "civic" and "hackers" together and replicate the format of civic hackathons around the world. I argue that, even if this international circulation of a format can be interpreted as a form of "imported democracy", civic hackathons can also become an opportunity for countries in crisis where running code could replace broken public institutions. Secondly, I focus on the definitions of the "civic" as they are coined by actors and translated into technical tools – mobile and web applications. Beyond big political narratives,

hackers' "civic" manifests itself in a variety of very precise challenges and local solutions. I argue that, by looking at examples of civic tech, we can grasp some of the novel ideas brought forward by civic hacking, that strongly refer to a more general crisis of trust in political representation and traditional political institutions.

My research shows that, in the context of hybrid regimes, such as the Russian case, with its particularly vibrant IT-community and, at the same time, its centralized style of Internet governance, civic hacking is used as an emergency response to the crisis of democratic institutions. In France as well, when state institutions do not provide a viable solution to a problem, grassroots collectives turn to technology in order to equip their work and find a "workaround". Civic hacking methods are used when public institutions are not capable to properly respond to existing challenges, or when these public institutions are, themselves, the challenge that needs to be addressed. In this sense, civic hacking can also mean "hacking the civics" (Gregg, Lodato and Di Salvo 2014).

2. Grasping Civic Hacking: a Literature Review

The expression "civic hacking" goes back to Barack Obama's presidential campaign. Early enough, the format of civic hackathons has been vividly discussed by the actors themselves through a number of guides, textbooks and "howtos" circulating on the web and in printed form, such as "Civic apps competition hands book" (Eyler-Werve and Carlson 2012). The notion of civic hacking has been progressively institutionalized, with the official National Day of Civic Hacking held by Code for America and a network of governmental partners in 2013. This event, firstly US-only, went world-wide on its second edition in 2014. Code for America played an important role in framing civic hacking from its early days. Under the influence of this organization fostering civic hacking in the US "from the top", the early press interest to civic hacking focuses first of all on the state-driven civic hacking efforts around elections, reforms, public services efficiency, public budget and so on (Sterling 2013; Williams 2013; Lachance Shandrow 2013). In this sense, civic hacking was first seen as a movement of technologists who help improve the government.

However, early academic research on civic hacking demarcates itself from the body of work on "government 2.0" and "e-government" as it considers that "technology is integral to government, while [...] solutions to public sector challenges are not technological alone" (Hebert 2013). While first research on civic hacking was centered on the usage of open data provided by the government ("data-oriented hackathons"), the second wave of civic hacking studies is dedicated to what we can call "issue-oriented hackathons", where groups of "problem owners" can bring their challenges to the tech community and work together on prototyping

solutions (Lodato and Di Salvo 2015; Ermoshina 2016). Several ethno-graphic studies of civic hacking were conducted with a focus on India (Irani 2015), US (Lodato and Di Salvo 2015 and 2016), France and Russia (Ermoshina 2016). This research questions the belief in political and social potential of programming code. It pays more attention to the work of "problem owners", or publics, and the process of "translation" of issues (or challenges) into codeable tasks.

The organizers of the first civic hacking event define "civic hackers" as "technicians, engineers, designers, entrepreneurs, citizens, civil servants… everyone who wishes to collaborate with others in order to create, build, innovate and address challenges that concern our neighborhoods, cities, states and countries. For us a hacker is someone who uses the minimum of their resources and maximum of their brainpower and ingenuity, in order to create, repair or improve something" (Code for America 2013).

These actors' definition of civic hacking can find its academic echo in the branch of STS research interested in user-driven innovation and practices of "bricolage" (or tinkering). Within this interpretation, "hacking" is understood as an epistemological position, a method to solve problems using instruments that are "at hand", as George Dafermos and Johan Soderberg frame it: "In our use of the term hacking, we mean the act of taking a preexisting system and bending it to serve a different end from that for which it was originally intended » (Dafermos and Soderberg 2009, 55). In this sense hackers can be also perceived as "users" / "re-users" of certain instruments, standards, programs, who take part in innovation by *detournement* and *bricolage* (Akrich 1998).

This understanding of hackers also implies questioning institutional borders and the notion of expertise, as "bricolage" describes a specific way of sociotechnical and creative work that can be accessible not only to tech experts but embraces amateur and non-technical actors. Civic hacking thus can be interpreted as part of a broader process of "democratization of technology". Indeed, one of the important characteristics of civic hackathons, as compared to technical hackathons, is the heterogeneous expertise of the participants involved. The hackathons I have observed included representatives of groups of neighbors, nursing mothers, patients with rare diseases or handicaps, environmental or feminist activists, teachers' trade unions, NGO activists and so on. These populations were referred to by the organizers as "problem owners", as they were the ones proposing a social or political issue to be translated into codable set of tasks, for which a software could be then produced. Problem owners are defined as "political entrepreneurs who play central role in construction of public problems, inscribing them in the agenda and fostering social mobilization […] sometimes at the cost of operations of "translation" and "transcoding" within hybrid forums" (Boussaguet et al. 2014). In this sense, Harry Collins' and Robert Evans' research on "experience-based expertise", as well as Peter Galison's concept of "trading zones" (Galison 1997), are interesting to grasp the processes of translation happening at

civic hackathons, where heterogeneous communities meet.

Civic hackathons bring together "non-technical" and "technical" communities to propose solutions for a range of problems of public concern, and in this sense they can be analyzed alongside other forms of participatory and technical democracy, such as "hybrid forum" or "citizen conference" studied by Michel Callon et al. (2001) and Loïc Blondiaux (2008). However, while the literature studying various formats of events that foster participatory democracy can indeed help us to conceptualize organizational formats of hackathons, the enrolment of participants and the specifics of "translation" occurring at these events, it is important to understand the specifics of civic hackathons that are not part of a defined democratic process of decision-making or political representation, unlike citizen conferences.

While some civic hackathons are co-organized with the help of state actors or public institutions, the relations of hackathons with institutionalized politics are yet to be studied. There have been a vivid debate in the literature as for the democratic or political potential of civic hacking. The very idea to use programming code for social good was criticized by Auray and Ouardi (2014) as having a double narrative. One one hand, it can be interpreted as part of a liberal program - "provide a better service to the user" - but it can also be part of an emancipatory narrative as a means to help emerging or marginalized communities.

As Nicolas Auray describes it, the world of FLOSS is marked by a "brutal and massive rejection of the marketization of social relations, as the movement against proprietary software shows it. For these hackers the organizational principle in life is not money, nor work, but passion and desire to create together something socially meaningful" (Auray 2002). However, the values of "sharing", "open innovation", "collaboration" and "solidarity" are also vindicated by the newborn sharing economy culture, where civic hackathons are institutionally inscribed.

The recent wave of critical research on civic hackathons argues that they must be analyzed as a form of speculative labor, as a form of unpaid work, and thus, as part of the neoliberal restructuring of the high-tech market. Gregg argues that hackathons "reflect the difficulties, opportunities and compromises young workers face in the wake of the Global Financial Crisis. They are a symptom of a broader transformation affecting career preparation and training as stable paths for recruitment give way to the velocity of dynamic networks" (Gregg 2015). The study conducted by Cardullo et al. (2018) on Irish civic hacking events also describes civic hacking within the "living labs" as a form of "civic paternalism" disconnected from communities: "While presented as horizontal, open, and participative, LL [*living labs*] and civic hacking are rooted often in pragmatic and paternalistic discourses and practices related to the production of a creative economy and a technocratic version of SC [*smart cities*]".

This controversial character of civic hacking can relate to the critique of the formats for participatory democracy in general, as described by Lo-

ïc Blondiaux (2008). In his foundational work on the models of participatory democracy, he argues that these formats can lead to a "descendant", or "managerial" model where citizens become "users of public services", and participation becomes "an instrument of depoliticization in service of a neoliberal project" (Blondiaux 2008, 19), or, on the contrary, of an "ascendant" autonomous model that aims at a process of empowerment. While the autonomous model aspires to technically equip the process of civic empowerment and use technology to "hack the civics", the "managerial" model can use code to optimize and improve existing bureaucratic and administrative processes without questioning the status quo. By solving hyperlocal and material problems, it redefines citizens as "users of public services" (or "citizens without qualities"), and civic participation risks to be depoliticized.

The relations between civic hacking and political participation are peculiar. Civic hackathons are often framed as "not political" but rather suggesting "concrete solutions". The events I've observed were framed as focused on "improving the everyday life of citizens" or "solving concrete problems", often on a hyperlocal scale. My interviews have shown that civic hackers were seeing problems that they were treating as "very practical" and "small-scale" as opposed to "political" or "radical". The belief in the capacity of code to be a ubiquitous problem-solving tool producing tangible results is coupled here with a certain mistrust in public institutions. In this sense, the study of civic hackathons can shed light on "depoliticization" processes and on the relations between the tech community and traditional political representation and participation.

The tendency towards "avoiding politics" was analyzed by sociologist Nina Eliasoph in her book on the apathy in the American public sphere. Some of the insights of this work may be relevant to understanding the peculiar relation between hackathons and political participation. Observing volunteer social workers, Eliasoph found that they managed to avoid political problems and concomitant long debates by focusing on limited and concrete tasks, at the same time thinking that they can "really change the things" and that everyone can make a difference (Eliasoph 1998, 37). While sharing a common idea of civic participation, they had to paradoxically cut short all political discussions in order to keep "faith and hope" (Eliasoph 1998, 38).

Confronted to questions such as gender inequality, poverty, education, ethnic discrimination, these groups tended to define their action as being non-political. Their meetings were focused on pragmatic activities, technical and organizational questions. In the interviews, as Eliasoph describes it, these respondents stated they were solving issues that were close to them, that concerned their children and relatives, and that is "practically possible and not political". These activists shared a common "apolitical" culture: they focused on a limited, almost private, sphere in order to feel themselves capable to "influence the state of the things". They wanted to feel their influence on the society and their activism of

"small deeds" made it possible for them to reconstruct a "democracy" in the spheres of life where citizens were usually alienated of political decisions.

Another research group working on this "distrust" towards politics studied 7 groups of American volunteers (Bennett et al. 2013), and argues that local activism in US has been inspired precisely by this feeling of "disavowing politics". Researchers found that volunteers refused to describe their activities as being "political" while being engaged in struggles against environmental pollution, against corruption in municipal administrations, protection of architectural heritage and so on. The disavowing of politics is related to the connotation of politics in American society as being associated with "dirty" and "corrupted" activities. Politics is thus stigmatized while local activism, centered on precise issues to be solved, becomes a new ideal of collective action capable to produce a public sphere free from "dirty" politicians (Aronowitz 2006). This opposition between local activism and institutionalized politics is, according to Bennett and colleagues, a strategy that aims at legitimizing political activism as such: "a civic action can become a "good", when it's opposed to a political action perceived as "bad" (Bennett et al. 2013).

I argue that, in case of civic hacking, the activism of "small deeds" finds another meaning, as hackathon also implies "small codes". The format of civic hackathons, with its urgency (48 hours!) and competitive elements, imposes a very particular way of coding: sometimes no or very little code is produced from scratch. Instead, it is about reusing and tinkering with other people's code, APIs, existing tools and software development kits. This actually results in producing small pieces of software that address precise challenges and promise rapid or "immediate" result. However, these very precise challenges, sometimes as local as a pothole on the road, can have political or critical framing when they are brought up by "problem owners" coming from a grassroots organization, such as trade-union, an NGO or a local activist group.

In this sense, I argue that the sociology of public problems and the pragmatist approach (Cefai and Terzi 2012; Cefai 2013; Emerson and Messinger 1977) can be relevant to analyze community-based hacking as opposed to, or complimentary to, the state-driven hacking events. When civic hacking engages the public united around a precise experience of a "trouble" (Emerson and Messinger 1977), hackathons can be observed as a collaborative process of "translating a number of notions and principles into matter" (Simondon 2016). In this sense, the tools built at the hackathons can also be interpreted in a pragmatist sense "not merely as means to reach a goal with given resources, but a creative form of mediation between problematic situations and solutions, where the two sides are transformed" (Dorstewitz and Kremer 2016, 6). Indeed, I argue that hackathons transform both the definition of a particular problem and the coding practices.

In the case of community-driven hackathons with pre-constituted publics that are able to "bring" the resulted tools back to the community and actually inscribe the tools in an existing agenda, these pieces of software can actually be used within a bigger political perspective. This was the case, for instance, for the civic app "Opensalary"[1]: the challenge brought by a teachers' trade union – corruption in schools in Russia and unequal salary rates across the country – was actually turned into a working webapp and used after the hackathon by the teachers movement as part of a broader repertoire of action. On the contrary, when the issues are imposed by organizers and inscribed within a broader "civic paternalist" discourse (Cardullo et al. 2017), civic hacking efforts would rather be focused on optimizing existing systems, especially if organizers include representatives of authorities or public services. The software produced at these state-driven hackathons is less likely to survive after the event, as no existing user publics are ready to implement that.

Different hackathon formats have been developed since the rise of civic hacking. The galaxy of institutionalized mediators has appeared that inscribes civic hacking in an interesting transnational network, that lies in the intersection of start-up, grassroots hacking groups, activists, entrepreneurs. In what follows I will first sketch out the geopolitics of civic hacking and its circulation around the world, and also explain the role of mediators in standardizing this format and coining a particular vision of what is considered as "civic". I will then try to define the "civic" as it manifests itself in civic hacking, and the critics of representative democracy brought up by the civic hackers.

3. Civic Hacking: Transnational Movement or "Imported Democracy"?

The analysis of a "movement" was never a starting point for my research. Instead, my curiosity for civic hacking was driven by very concrete and material products of their activity, precisely, pieces of software named "civic apps". Civic apps are applications for web and mobile that tend to respond to, and sometimes solve, a wide scale of political, social, civic challenges – from corruption, police violence and electoral fraud, to optimization of urban infrastructures and improvement of life quality in big cities.

However, during years of fieldwork I analyzed 11 hackathons in Russia and France and unveiled the motivations of organizers of civic hackathons and developers to inscribe their events and activities in an international, almost global, framework. Analyzing funding and organizational resources behind these events, one can identify an international network of institutions and communities, that participates in a transnational circulation of the format of hackathon. The hackathon itself, just like "hybrid

forums", "citizen conferences", or other forms of participatory democracy, can be deployed anywhere, as a festival camp or a fair, reaching a balance, in a peculiar fashion, between hyperlocal problems and globalized grammars of programming languages and related tools.

Observations of different events related to civic hacking – hackathons, barcamps, conferences on social innovation - have shown a common referential or even a mythology behind the movement. Thus, French and Russians refer to this movement as being born in the United States. Just like in the field of participatory democracy where France was inspired by Danish experiments, French actors of the social innovation scene refer to international techniques. The event such as "Code 4 Paris", for example, was directly inspired by "Code 4 America"[2], as organizers say. According to them, France is "far behind" the US in terms of digital economy and collaboration between coders and the government:

In the United States it is easier to articulate connections between governments, citizens and innovation while in France we are still in search for a way to make possible fructuous collaborations between coders and civil society, to give coders a voice. I think we need to take formats that already function, and inspire from Code4America. The beauty of the digital and opensource is precisely its ability to be reproduced and bootstrapped. (Field recording, workshop *Au code, citoyens*, 13.06.2013, Le 104, Paris)

Just like in free software where the code is openly available on the repositories, so the recipes for organizing these events are available online. They have been progressively standardized and circulated in form of guides and handbooks like the *Civic apps competition handbook* (Eyler-Werve and Carlsson 2012) and the Open Government Guide.[3]

Russian organizers of civic hackathons also refer to the American experience. Alexey Sidorenko, CEO of the most important Russian NGO specialized in social innovations, "Greenhouse for Social Technologies"[4], notes it:

We have initially based ourselves on an existent experience. Hackathons have begun in early 2000s, isn't it? And I think when the Greenhouse was created, in 2012, there have already been years of international experience in the area. (Interview with Alexey Sidorenko, CEO, Greenhouse for Social Technologies)

The first civic hackathon in Russia was a bi-national one, co-organized by the State Department of United States of America and Russian tech giant Yandex in 2012, under the name "Code for Country". As one of the organizers, Emily Parker, says in the interview, this hackathon was "part of the digital diplomacy initiative". In this sense, civic hackathons can be seen as yet another tool for the "export of democracy", and thus, an interesting tool of technical and social governance. However, civic hackathons can also become places where coders and activists question the status quo, discuss on most urgent social and political challenges, and proto-

type not only apps but also "possible worlds", by sketching out possible ways to translate public problems into code, find novel approaches to address issues that are not solved by existing political actors. The outputs of these events depend on their organizers, but also on participants, context and country where they take place. In Russia for instance, with public institutions in crisis, civic hackathons can forge real solutions for local challenges and even become "public spaces" that foster empowerment and build connections between technical actors and civil society.

Civic hacking is therefore happening somewhere between the realm of start-up, and the Free Libre Open Source Software movement, between modern coworking spaces equipped with "hype" high-tech objects, and underground hackerspaces where meetings of coders and activists take place off the record. This ambiguity was already well captured by Nicolas Auray and Samira Ouardi (2014) who underline the "double effect" of this new belief in "revolutionary potential of the code". On the one hand, the apology of code as instrument of social change has given birth to the start-up culture that promotes social innovation while searching for ways to monetize the "social good". On the other hand, a galaxy of libertarian, anarchist, grassroots projects pops up and seeks to mobilize digital technologies as tools for social critique.

The operation of translation of public problems into code, in the case of civic hackathons, demands mediation, an "entrepreneurial" activity. A galaxy of mediators, not strictly coders neither activists, try to regulate the vibrant civic hackers communities in-the-making and foster collaboration between the technical world and the world of social work or civic participation. They are developing a form of expertise that I would call, using Harry Collins' notion, "interactional expertise", the main function of which is to facilitate "translation" between two languages (Collins and Evans 2002). These organizations help organize events such as hackathons or barcamps, workshops and seminars, but also engage in longer-term projects. In my fieldwork I have come across two organizations of that kind, that can serve as case-studies or illustrations of the governance of civic hacking ecosystems.

The Greenhouse of Social Technologies (*Teplitsa Socialnih Tehnologiy*) is a non-governmental organization that was financed, until 31 May 2013 by the US AID program. However, after the adoption of "Law on foreign agents"[5], Teplitsa's source of funding has changed to "private western institutions". Teplitsa organizes both online and offline events – webinars, online courses, tutorials, hackathons, meetups) with a mission to "create innovative applications and solutions for civic participation, improve technical competences of NGO workers, improve quality and efficiency of services, facilitate creation of community of tech specialists sensitive to civic problems".

Teplitsa proposes to help developing new tools where no technical solution exists. One of the formats that serve this purpose is the civic hackathon. Daria, ex-manager at Teplitsa, describes the idea of hackathons in this way:

Sometimes NGOs or activists have fresh and exciting projects but no existing technical means. For that we organize hackathons, or "test camps", it is sort of a laboratory I would say where people meet and develop ideas together, it means that in two days we have prototypes of the apps, and after it Teplitsa finances selected projects to have a finalized working product. (Interview, Daria)

Teplitsa not only finances and frames hackathons but also helps find interested developers. However, organizers speak of a certain "reluctance" of the coding community, of the lack of engagement of developers in civic projects, and of a "mutual misunderstanding". Alexey Sidorenko, CEO, describes problematic relationship between the two communities as a problem of language that needs framing and translation:

We do a lot of work in this direction because these two groups are so far one from another that, in order for them to understand each other, there needs to be a long-term engagement because they speak different languages. It is a complex question, as it's about different languages and visions of the world. (Interview, Sidorenko)

Teplitsa, in this sense, can be perceived as a social entrepreneur, defined by Madeleine Akrich, Bruno Latour and Michel Callon as a "mediator, a translator in its pure sense, the one who puts two worlds in relation, worlds with different logics and horizons, two separate worlds who could not live without one another". (Akrich, Callon and Latour 2002). This "bridge-building" between developers and activists is happening with the help of several instruments, including the website of Teplitsa[6]. Their website is also a tool for enrolment, as it publishes calls for participation for different events organized by Teplitsa. On the other side, their website acts as a media that publishes articles on various civic apps cases around the world. With the help of this website and offline events, Teplitsa aims at "creating a community of civic coders":

People who build things in their free time and are not afraid to do that… these people, we need to look for them. And as soon as we find them, we try to contact them, to invite them at our hackathons or ask them to consult NGOs […] Because there's a problem – a lot of hackers are introverts, they can not come by themselves at an event… That's why it is important for us to reach out to them and show them – guys, you're great, we should do things together. (Interview, Sidorenko)

Teplitsa is involved with the international civic hacking organization Random Hack of Kindness[7], that operates in more than 30 countries and counts 5500 developers and 300 partners, from small start-ups to Net giants such as Google, Microsoft or Yahoo. They've organized 7 international hackathons under the "Hack for Humanity" label and supported hackathons organized by Transparency International and World Bank,

concerning a wide spectrum of social challenges, from water crisis in Africa to equal access to politics for women in Asia. With the help of RhoK and Transparency International, Teplitsa co-organized an international hackathon "Hack Against Corruption", that took place in 2012 in 6 countries around the world including Russia.

The "scene" of civic hackers, therefore, does not function by itself. Mediators, facilitators, are engaged in the process of "interessement" (Callon 1986) to create more stabilized networks and a more stabilized definition of a civic hacker. They also introduce new parameters of evaluation of coders by including the "social importance" of a software as a factor that determines success or failure of a project. These actors have enough resources and influence to coin and maintain a certain vision of "civic" that impacts both civic hackers and activists.

4. The Superheroes of Code: Hackers and Civic Duty

In 2013, Teplitsa launched a project aimed at facilitating the "encounter" between developers and activists under the code name "IT-volunteer"[8]. IT volunteer is a quasi-institutionalized response to the growing demand for technical help from Russian NGOs in crisis. In the context of openly authoritarian tendencies within Russian inner politics after 2012, existing institutions could not provide necessary support for non-governmental organizations seeking for assistance with websites, mobile applications, hosting and other technical tasks. IT-volunteer has become a platform that matches the needs of NGOs with the skills of developers:

It is a marketplace of social ideas… Say, a person asks help to build a website for an NGO that cares for deaf children, they can open up a ticket on this platform and describe their project. The goal is to help them find a developer who can realize this project, and then they work directly with each other. (Interview with A., developer of IT-volunteer, CEO Progress engine)

This form of civic hacking should be understood not as a promise of "disintermediation", but as an attempt of re-intermediation, where "failing" public institutions are partly or fully replaced by digital platforms that help to match or "translate" needs of the civil society in a set of microtasks. This echoes with the technical optimism behind early blockchain-based social projects that share the idea of "crisis of traditional institutions" and propose to redistribute responsibilities and resources by the means of code.

In order to engage coders in this form of collaboration, Teplitsa introduces elements of gamification such as rating of IT-volunteers, with the most active members being "starred" in a dedicated article praising their work and contributions. Teplitsa promotes a specific vision of a civic hacker as a "superhero". The following images were produced by Teplitsa for promotion of IT-volunteers:

Fig. 1 – "Discover which great deed can you commit today?" Source:
https://te-st.ru/2015/04/24/it-volunteer-results-of-week-24/

Fig. 2 – "Superhero, we need a superhero!" Source: https://te-
st.ru/2014/12/12/it-volunteer-results-of-week-9/
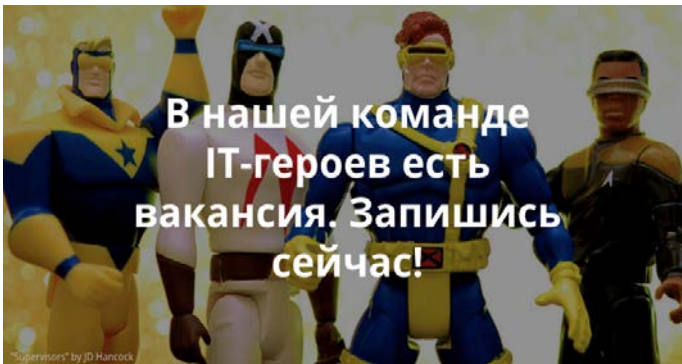
Fig. 3 – "Our team of IT-heroes has a task to do: volunteer right now!" Source:
https://te-st.ru/2015/03/06/it-volunteer-results-of-week-18/

The reference to the "geek culture" helps build the image of a coder as an "ordinary hero". Usually invisible behind their computers, coders get a chance to "do social good" and become known for their social contributions. Civic hacking therefore introduces new parameters for the evaluation of coding work that go beyond peer recognition (usual in technical communities) and strictly technical "beauty" or efficiency of code. Coding obtains a "social" meaning, or "usefulness".

A similar operation of "enrolment" has been deployed by a French organization, MakeSense, created to promote "encounters and collaboration between social entrepreneurs and developers, designers, all these people who have superpowers necessary to build great projects", as Christian, the founder of MakeSense, explains it. According to him the technical "superpowers" of developers, applied to a social or political cause, can help "make sense" and create value, both social and economic. These "superpowerful" tech workers are called "gangsters" - this terms helps build and maintain an international community, different from both traditional social entrepreneurship and the tech world:

We want to engage with people who are proactive, who do not ask permission to do something and that's why we need to create a universe different from a traditional social entrepreneur world. That's why we call them gangsters, gangsters of social innovation. It is also a provocation: in the social innovation world everything is nice and beautiful, but social innovation gangsters are intriguing. (Interview, Christian)

Just like the word "hackers", the word "gangsters" is inserted in a new context and associated with "social good". The enrolment of new "gangsters" happens at a particular event called "hold-up". These events are brainstorms, proto-hackathons, where ideas are suggested but nothing is really coded. "We have mobilized 10 000 people in 44 cities around the world around 200 projects in 2013, just with this community of gangsters, and this feeling of "belonging" (*appartenance*) that they have for the community" [Christian]. MakeSense co-organized and participated in a number of civic hackathons such as Hack The Future Now, Code4Paris, Hackathon Futures en Seine and others.

For the organizers of Hack4Good, one of the civic hackathons that I observed, it is important to change the connotations of the word "hacker", and "redirect" public opinion towards another definition of it:

Another reason why we wanted to call it Hack4Good is because so many people see the concept of a hacker as such a negative thing, there are so many groups causing harm using their skills. But it does not mean that anyone who does it causes harm. So I think that we want to redefine the vision of hacker. And for me to hack things means to rapidly put something together any way you can. Hack 4Good and the idea of a hacker for us is that they try to solve a problem any way they can do it... hacking is more about utilizing whatever resources you have to make things work and solve the problems. And in our case the problems are so-

cial problems. (Interview with Reuben Katz, CEO of GeekList[9], organizer of Hack4Good hackathon)

Hack4Good and GeekList launched, in 2013, a project that aims at institutionalizing and maintaining the ephemeral community of civic hackers involved in building social technologies. The project called "GeekList Corps of Developers" is a database of coders who can be mobilized in case of a humanitarian or political emergency where their skills could be needed. The word "corps" refers to "army corps", "marine corps" or administrative "corps" of highly ranked civil servants, with an idea being a member of an elitist community of peers. This membership implies not only privilege, but also a duty.

While the National Day of Civic Hacking takes its inspiration from American patriotism, international networks, such as Geeklist Corps of Developers, are mobilizing the "citizen of the world" cosmopolitan and global vision. In his introductory speech at the Hack4Good opening ceremony, Reuben Katz, the CEO of GeekList, presented the Geeklist Corps of Developers as an important tool to maintain the global civic hacking community:

The goal of GeekList is to develop a social network to keep together social-minded developers. We are a distributed team and we've formed the Geeklist Corps of Developers, to promote technology-focused civic action organization. You are not hacking for a prize or presenting your start-up, you wanna spend this time of your week-end doing something good for the world and that's awesome. So, we know that when you do that you become part of the Corps of Developers... a group of people that we can call at any time when there's an emergency, a humanitarian need, other events that occur around the world that need some sort of a relief, we can count on you to help […] If there's another catastrophe like in Japan... you need help and people to get around very quickly, from all over the world. (Field recording, Hack4Good, October 4, 2013)

Apart from the announced humanitarian and social mission, Hack4Good hackathons become an efficient and quite innovative instrument to promote GeekList and its services, as all the Hack4Good events rely on GeekList infrastructure (code repository and event management platform that coders have to use in order to participate). By its organizational design, Hack4Good means hundreds of new users for the GeekList platform.

The link between "civic hackers" and "civic duty" or "civil service" was drafted already at the first "National Day of Civic Hackers": "The 'Rosie the Riveter' image advertising the National Day of Civic Hacking in 2013 is a clear instance of recruitment strategies drawing on ideals of civic service, patriotism and duty. The title's red, white and blue etching positions hackers as inheritors of a tradition of patriotic service required in times of war" (Gregg 2015).

5. Civic Beyond Political: a Specific Vision of "Social Good"

At civic hackathons, civics are too-often seen as untapped markets for opportunistic entrepreneurs. These projects sate the neoliberal status quo, and push ever-more toward private, profit-driven public life.
(http://thomaslodato.info/writing/three-positions-on-civic-hacking/)

What is the sense of "civic" in "civic hacking"? What do the actors themselves understand by "civic duty", "social good" or "common good" in the name of which they code? Is there a definition of this "good" common for all civic hackers? Based on my ethnographic observations of hackathons, and on interviews with organizers and participants, I will try to sketch the main lines that define the contours of this "good":

All the interviews show that civic hackers tend to separate themselves from a traditional "repertoire of contention" (McAdam et al. 2001) such as street actions strikes or demonstrations. They criticize the very idea of a rally as being inefficient compared to what they call "concrete solutions". It's an extension of a popular critique that opposes politicians as "people of speech" and declarations, to the "people of action" that are focused on meticulous work. Political representation and associated forms of action, such as demonstrations, strikes, elections, are questioned, and substituted by an idea of "direct participation", production of meaning and objects that could help create a better world, or improve life conditions of people in the nearest future. Many interviewed developers oppose the apps that they build to the traditional repertoire of contention.

This opposition phrased by actors themselves is important because it gives us crucial elements of a possible definition of this "citizenship" forged by coding. Applications, and even prototypes, are valued as something "concrete" capable of producing "tangible" or "visible" results. A. P., developer of several civic applications, explains:

I do not believe in demonstrations and rallies that much. I go there rarely, however I try to support the movement by doing concrete actions. For example when we started having first massive rallies [winter 2011 – K. E.], we made this project, "HelpWall"… I made a webpage with a widget, a hotline number and a hashtag on twitter. So when you send an SMS to this number or you post on Twitter saying "Help me, I am arrested" and you use this hashtag… we can monitor everything, and we had 80 people with us – lawyers, people with cars, doctors, nurses and so on… (Interview A. P.)

In the case of Russia, civic hacking projects heavily rely on law that becomes somewhat a continuation of programming code. Russian civic hacking scene has produced several popular apps that use legal documents as part of the apps initial design. They are developed based on Administrative, Technical and Penal code, and all exploit a vulnerability of Russian administration itself, namely, its extreme hierarchical, vertical structure and the coercive functions of specific institutions. Among these

civic applications that count hundreds of thousands of users: RosYama[10], the app that helps document and map potholes on the roads and send complaints to the main Road Inspection of the region; RosZKH[11], the app that helps generate complaints on a wide range of problems related to the utilities, the house and the closest neighborhood; WebNabludatel, the app that helps document cases of electoral falsifications and facilitates the work of electoral observers; Zalivaet,[12] the app that helps victims of inundations caused by leaking roofs to write a complaint to the City Hall; Krasiviy Peterburg,[13] the app that helps document cases of urban infrastructure degradation and file complaints to the City Hall.

In Russian context the civic hacking movement is not a "revolution": civic apps are acting within the legal field and do not aim at challenging l'*état de droit.* On the contrary, civic apps are technical means to optimize and facilitate the application of the rule of law for everyone in the context where, because of corruption and deep structural crisis, the legitimacy of existing public institutions is undermined. In a technical metaphor, the "engineering mindset" (*inzhenerniy um*) becomes the last hope to "fix" the broken mechanism of legitimacy, by introducing technical – and thus, "objective" - elements in a corrupted administrative machine:

First of all, we can not call it a "revolution". I would rather call it an attempt to bring all forces in balance. Programmers try to fix the whole system, to repair it, to restore or even to clean, because now administrative resources… actually, all resources… are not distributed in a legitimate way. (A. P., CEO Progress Engine, developer of the civic app "WebNabludatel" for observation of elections)

Restraining from radical or revolutionary vision of "civic participation", civic hackers focus on building solutions for very precise, and sometimes tiny, problems related to ordinary life, such as potholes or leaking roofs. In the context of distrust, civic engagement is shifted (or refocused) towards "little things", material objects from the immediate urban or natural environment. The "crack", the failure, the breakdown of urban infrastructure, even as tiny as a pothole, can solicit citizens' attention (Bidet et al. 2015) and create a "public" (Dewey 1927) – even if somewhat ephemeral or elusive – better than any ideology or a political party.

The Russian case is particularly valid here, as recent studies show that civic participation in Russia is shifting towards local and urban groups organized around challenges of particular neighborhoods, districts, towns, and are related to urban planning (Alyukov et al. 2014; Zhuravlev et al. 2014). Thus, in the context of authoritarian or hybrid regimes where civil society and public institutions fail to respond to basic civic needs, civic hacking is not merely a neoliberal trend, but has a potential to become a tool of social critique or counter-democracy (Rosanvallon 2006).

The "social good" that hackers work for is rather vague: while it is certainly not situated in the scope of contentious activism, it is neither a mere improvement of the quality of everyday life.

Good means social good... but I think people understand what means "4 good"…
It means helping humanity in the ways to make people's and animals' lives better.
Solving first world problems for first world people is less interesting for me... I
think the correct problems to be solved are those that really make a change for
people's lives. Not necessarily how do I get to the bus faster or is it going to rain
today? People can argue, no if I know if it is going to rain than I will not get wet
and it will make my life better because I will not get wet ; but... ah... that's not re-
ally the idea. It's not making lives of people that have what they need more con-
fortable, it's about making lives of people that don't have what they need, better.
And animals that don't have resources, people who might be defenseless, situa-
tions with famine, food, refugees, disabilities... (Reuben Katz, CEO GeekList, or-
ganizer of Hack4Good)

The "good" seems to be clear, even if in a tacit way, for hackathon or-
ganizers ("people understand what means 'for good'") and they put it
aside from radical politics on the one hand and from "first world prob-
lems" on the other. Target groups as defined by Reuben are "humans in
need" who can not respond to their problems by themselves, or animals
and nature, also incapable, according to him, to solve their problems.
Civic hackers intervene to invent solutions where no institutional actors
are efficient, or to improve the work of existing institutions (as in case of
apps that should assist the work of emergency brigades during natural
disasters).

In the manifesto of the IT volunteer project we find another definition
of "social good" that is constructed somewhere in the junction between
code and social work: "We believe that citizens have a big potential to
create the collective good (*kollektivnoye blago*). We know that, equipped
with proper tools, citizens can realize their potential and benefit from it
mutually". This definition of "collective good" places the "proper tools"
at the center: it is based on a technocentric idea that it is possible to
"translate" human will to "do good" into an adequate technological solu-
tion. The "good" of civic hackers is a "good" that is properly equipped.

It seems that, one of the conditions of success of the civic hacking
movement is to have no common definition for what the "good" is, but
rather illustrate it by defining precise challenges. The idea of the collec-
tive good becomes much more concrete if we look at the list of the 41
topics that are accepted by the project "IT-benevole"[14]. The projects that
can be supported by the platform must focus on one or more following
topics:
  – help to the citizens without social care or people in difficult situa-
    tion;
  – improvement of life quality of people with disabilities, or suffering
    from rare, severe or incurable diseases, or elderly people;
  – improvement of the urban space, protection of nature and animals;
  – adoption, education and socialization of orphans;
  – promotion and development of charity and volunteer social work;
The social good as framed by IT-volunteer is a "good" that can be re-

duced to specific issues. Analyzing projects proposed by IT-volunteer one can see very precise tasks that already contain a certain technical task in order to be "translatable" in code: "develop a chat and a mobile app for psychological consultation for teenagers and children", "help to implement a Wordpress plug-in for an NGO specialized in child adoption in Moscow", "help automatize geolocation for an ecological project to promote recycling in Novosibirsk", and so on.

Even working on challenges related to global political problems (inequality, corruption, unemployment, crisis of representative democracy, natural disasters, ecological controversies…), civic hackers tend to take their distance from the institutionalized politics (Lodato and Di Salvo 2016). The manifesto of "IT-volunteer" clearly states that no project proposed by a political organization or a political party is accepted.[15]

Civic hackers, while they tend to distinguish their activities from politics, are not hostile but rather complementary to the work of NGOs or public institutions. They insist they do not want to assimilate their activities with political sphere but they are however collaborating with actors embedded in institutionalized politics, by developing civic applications. Moreover, as we see it on Russian example, they are relying a lot on the inner functioning of pre-existent administrative institutions and are actually reusing their weak points or flaws, as they would exploit a vulnerability in a computer network.

Civic applications are located in this grey area beyond traditional political activism, and related to this "ordinary citizenship", to the life of a community, but cannot be simply resumed to an activity of "making everyday activities simpler". As Emily Shaw (2014) says, the "social good" that is produced by the civic tech does not respond to "civic wants" but rather to "civic needs".

6. Conclusions

Civic hacking has nothing of a "natural" phenomenon: the meeting between the world of NGOs and the world of coders demands number of adjustments and compromises, difficult and not always efficient, that are realized by mediators, facilitator, entrepreneurs who create spaces and tools to facilitate collaboration between these two universes. Online and offline instruments, such as the web platform for Geeklist Corps of Developers, or meet-ups, hackathons, hold-ups, are used to try to create long-term connections between developers and activists. These mediators define and maintain criteria for evaluation of civic hackers' work, that go beyond merely technical efficiency but include a new dimension – the "civic" usefulness of a piece of software, its capacity to solve a problem of a public concern.

This "social good" is multiple and is defined *ad hoc* via precise pro-

jects and tools that are used to realize them. However, the question stays whether the "civic hacking" can actually have a counter-democratic potential? While civic hackers tend to apply novel technical solutions within a political status quo, could there be a form of civic hacking that would question the power relations within the field of technology, and largely, in politics, and challenge the ways our institutions are organized? As Lodato puts it: "These hacked civics rethink the state; they cobble together various citizenries; they break and reassemble civic life; they don't agree that the answer is technology; and, most of all, they don't agree on civics. At civic hackathons, I want to see this civic hacking. I want to see civic hacking that hacks civics"[16].

A grounded answer to that question requires a more thorough analysis of technologies and practices used and produced at civic hackathons: the usage of free software by coders themselves as opposed to proprietary programs, the choice of centralized or decentralized architectures, the choice of hosting providers, and even the choice of standards and libraries to build on. We need to look at the framing of problems and the related infrastructural choices: who are the problem owners? What are the tech solutions proposed by the actors? How is the public involved in framing the issue and developing the solution? Who owns the data produced by civic applications?

Civic hacking can have both critical and reformist potential, and this will depend strongly on the way publics or problem owners are involved in the process of framing, design and development of the software. It will depend on the organizers of the event as well, and their engagement with public institutions. It will depend, finally, on the political context of the country hosting civic hackathons: in countries like Russia, where civic participation is weak or inefficient, and the trust in political representation is especially eroded, civic hacking can represent, indeed, a solution for the civil society to construct public problems and engage with communities.

Acknowledgments

References

Akrich, M. (1998) *Les utilisateurs, acteurs de l'innovation*, in "Education permanente", 134, pp. 78-89.

Akrich, M., Callon, M. and Latour, B. (2002) *The key to success in innovation: Part 1: The art of interessement*, in "International Journal of Innovation Management", 6 (2), pp. 187–206.

Alyukov, M. et al. (2014) *Politika Apolitichnyh: Grazhdanskiye Dvijeniya v Rossii 2011-2013 godov* [Politics of the Apolitical. Civic Movements in Russia in 2011-2013], Moscow, Novoye Literaturnoye Obozreniye.

Aronowitz, S. (2006) *Left Turn: Forging a New Political Future*, New York, Routledge.

Auray, N. (2012) *De l'éthique à la politique: l'institution d'une cité libre*, in "Multitudes", 1 (8), pp. 171-180.

Auray, N. and Ouardi, S. (2014) *Numérique et émancipation: De la politique du code au renouvellement des élites*, in "Mouvements", 79 (3), pp. 13-27.

Baraniuk, C. (2013) *Civic hackers reshape your government*, in "New Scientist", 218 (2923), pp. 36- 39.

Bennett, E. A. et al. (2013) *Disavowing politics: Civic engagement in an era of political skepticism*, in "The American Journal of Sociology", 119 (2), pp. 518–548.

Bidet, A. et al. (2015) *Publicité, sollicitation, intervention*, in "SociologieS", http://sociologies.revues.org/4941 (retrieved June 20, 2018)

Blondiaux, L. (2008) *Nouvel esprit de la démocratie*, Paris, Le Seuil.

Boussaguet, L., Jacquot, S. and Ravinet, P. (2014) *Dictionnaire des politiques publiques*, 3rd ed., Paris, Presses de Sciences Po.

Callon, M., Barthe, Y., and Lascoumes, P. (2001) *Agir dans un monde incertain. Essai sur la démocratie technique*, Paris, Le Seuil.

Cardullo, P. et al. (2018) *Living labs and vacancy in the neoliberal city*, in "Cities", 73, pp. 44-50.

Cefaï D. and Terzi C. (2012) *L'expérience des problèmes publics*, Paris, Éditions de l'EHESS.

Cefai, D. (2013) *L'expérience des publics : institution et réflexivité*, in Sur la sociologie des problèmes publics 1/2, https://www.espacestemps.net/articles/lexperience-des-publics-institution-et-reflexivite/ (retrieved June 20, 2018)

Code for America (2013). *What is a civic hacker?*, http://www.codeforamerica.org/blog/2013/05/06/what-is-a-civic-hacker/ (retrieved June 20, 2018)

Collins, H. M. and Evans, R. (2002) *The Third Wave of Science Studies of Expertise and Experience*, in "Social Studies of Science", 32 (2), pp. 235–296.

Dafermos, G. and Soderberg, J., (2009) *The hacker movement as a continuation of a labour struggle*, in "Capital & Class", 33 (1), pp. 53-73.

Dewey, J (1927) *The Public and Its Problems*, Athens, OH: Swallow Press Books.

DiSalvo, C., Gregg. M. and Lodato, T. (2014) *Building Belonging*, in "Interactions", 21 (4), pp. 58-61.

Dorstewitz, P. and Kremer, A. (2016) *Pragmatist Perspectives on Science and Technology and Contemporary Dewey Studies*, in "Pragmatism Today", 7 (1), http://www.pragmatismtoday.eu/summer2016/Pragmatist-Perspectives-on-Science-and-Technology-and-Contemporary-Dewey-Studies-Philipp-Dorstewitz-Alexander-Kremer.pdf (retrieved June 20, 2018)

Eliasoph, N. (1998) *Avoiding politics: How Americans produce apathy in everyday life*, Cambridge, Cambridge University Press.

Ermoshina, K. (2016) *Is there an app for everything? Potentials and limits of civic hacking*, in "Observatorio", 10, pp. 116-140.

Eyler-Werve K. and Carlson V. (2012) *Civic Apps Competition Handbook*, Chicago, O'Reilly Media.

Galison, P. (1997) *Image & logic: A material culture of microphysics*, Chicago,The University of Chicago Press.

Gregg, M. (2015) *Hack for Good: Speculative Labour, App Development and the Burden of Austerity*, in "The Fibreculture Journal", 25, pp. 183-201.

Hébert, M. K. (2013) *"E-government is so 1990s": Why smart civic innovators drop the "E-"*, in "ACM 2013 International Conference Proceedings", pp. 287-288.

Irani, L. (2015) *Hackathons and the making of entrepreneurial citizenship*, in "Science, Technology & Human Values", 40 (5), pp. 799-824.

Lachance Shandrow, K. (2013) *Inside the Civic Hacking Movement*, http://www.govtech.com/applications/Inside-the-Civic-Hacking-Movement.html (retrieved June 20, 2018)

Lodato, T. (2016) *Ethnography of Civic Participation: The Difficulty of Showing Up Even when You Are There*, https://www.epicpeople.org/ethnography-of-civic-participation/#_ednref7 (retrieved June 20, 2018)

Lodato, T., DiSalvo, C. (2015) *Issue-Oriented Hackathons as Ad-Hoc Design Events*, https://urbaninnovation.gatech.edu/sites/default/files/attachments/Issue-Oriented%20Hackathons%20as%20Ad-hoc%20Design%20Events.pdf (retrieved June 20, 2018)

McAdam, D., Tarrow, S. and Tilly, C. (2001) *Dynamics of Contention*, Cambridge, Cambridge University Press.

Morozov, E. (2013) *To Save Everything, Click Here: The Folly of Technological Solutionism*, New York, PublicAffairs.

Rosanvallon, P (2006) *La Contre-Démocratie. La politique à l'âge de la défiance.* Paris, Seuil

Shaw, E. (2014) *Civic wants, civic needs, civic tech*, https://sunlightfoundation.com/blog/2014/09/29/civic-wants-civic-needs-civic-tech/ (retrieved June 20, 2018)

Simondon, G. (2016) *On the Mode of Existence of Technical Objects*, Minneapolis, Univocal Publishing

Sterling, B. (2013) *Why civic hacking is good for the cities?*, in "Wired", https://www.wired.com/2013/05/why-civic-hacking-is-good-for-cities/ (retrieved June 20, 2018)

Williams, A. (2013) *Civic hacking and ingenuity ease election technology challenges: As the nation prepares for this year's elections, the state of election IT is being shaped by volunteers*, https://statetechmagazine.com/article/2013/10/civic-hacking-and-ingenuity-ease-election-technology-challenges (retrieved June 20, 2018)

Zhuravlev, O. et al. (2014). *Apoliticism and Solidarity: Local Activism in Russia*, http://www.criticatac.ro/lefteast/apoliticism-and-solidarity-local-activism-in-russia/ (retrieved June 20, 2018)

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[1] https://opensalary.ru/ - Open Salary was developed during a civic hackathon in Moscow in 2012.

[2] Code for America is an organization found in 2009 to "help governments deliver better services to the public by using tools and practices from the digital sphere" (https://www.codeforamerica.org/)

[3] http://www.opengovguide.com/

[4] The Greenhouse for Social Technologies is a Russian non-governmental organization created in 2012. Its mission is, as defined on their website, "to build bridges between NGOs and experts in programming". (https://te-st.ru)

[5] Federal law of Russian Federation 121FZ obliges all NGOs that receive funding from abroad and exercise political activities, to declare as being "foreign agents".

[6] http://te-st.ru

[7] http://www.rhok.org/about

[8] https://itv.te-st.ru/

[9] Geek List is a social network for developers. Geek List was the organizer of the series of international civic hackathons Hack4Good https://geekli.st/home

[10] https://rosyama.ru/ - mobile and web application built by the team of Russian opposition leader Alexey Navalny between 2010 and 2012. It counts more than 117000 potholes declared since the creation of the app.

[11] https://roszkh.ru/ - web application built by the team of Alexey Navalny in 2012. Counts more than 500 000 complaints sent through the app.

[12] http://zalivaet.spb.ru/ - web application built by Fedor Gorozhanko in 2010. Counts more than 5000 complaints and around 2500 users.

[13] http://www.красивыйпетербург.рф - web and mobile application built by the network of "Observers of Saint-Petersburg" in 2012 that counts 54000 users and more than 120000 complaints sent through the app.

[14] https://itv.te-st.ru/about/.

[15] https://itv.te-st.ru/about/

[16] http://thomaslodato.info/writing/three-positions-on-civic-hacking/

Learning by Gaming: ANT and Critical Making

Sergio Minniti
Yachay Tech University (EC)

Stefano De Paoli
Abertay University (UK)

Abstract: Relationships among theory, gaming, learning and socio-technical design are explored in the two contributions which compose the section. The theory in question is ANT, re-interpreted through *critical making* - an umbrella term for various distinctive practices that link traditional scholarship in the humanities and social sciences to forms of material engagement. Sergio Minniti describes an ongoing project called *Game of ANT*, which draws upon the critical making approach to design an interactive technology and a workshop experience through which scholars and students can conceptually-materially engage with ANT, hence exploring and approaching it from novel points of view. *Game of ANT* adopts the Latourian vision of technoscience as war and physically embodies this idea by proposing a sort of war game during which participants play the roles of human or non-human actors engaging with the competitive dynamics of socio-technical life. The commentary by Stefano De Paoli proposes new directions to develop the project, by deepening the concept of game and its value for design and learning processes.

Keywords: Actor-network theory; critical making; critical technical practices; physical computing; game.

Corresponding author: Sergio Minniti, School of Mathematical Sciences and Information Technology, Yachay Tech University – San Miguel de Urcuqui, Hacienda San José s/n, Ecuador – Email: sminniti@yachaytech.edu.ec

A Critical Making Approach to Actor-Network Theory: Game of ANT

Sergio Minniti

Introduction: Making ANT

In the last twenty years, multiple spaces of intersection between design practices and Science and Technology Studies (STS) have emerged, differently contributing to a general attempt to bridge the divide between

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the social and technical sciences (Berg 1998; Bowker et al. 1997; Ingram et al. 2007; Jensen 2008; Latour 2008; Suchman 2007; Woodhouse and Patton 2004).

More recently, scholarly interest in crossing the boundaries between Actor-Network Theory (ANT) and design has grown steadily as part of this endeavor, supporting the double movement of "ANT towards design" and "design towards ANT" (Storni 2015). In doing so, scholars of different disciplines have explored the manifold possibilities of intersection between ANT and design by reflecting, to cite just a few examples, on how ANT might contribute to the design of information systems (IS) (Díaz Andrade and Urquhart 2010; Hanseth et al. 2004), collaborative and participatory design (C&PD) (Binder et al. 2015; Storni et al. 2015), architecture and industrial design (Yaneva 2009), and Human-Centered Design (HCD) (Steen 2011).

In these researches - as well as many others whose discussion is beyond the scope of this article - the ways in which ANT and design, and theoretical and physical work, intersect each other are multiple and differentiated. Some common lines of inquiry include: the use of ANT as an analytic device to contrast the "obsession with 'objects'" dominant in design, as well as the asymmetrical human-centeredness of design practices (Binder et al. 2015, 152); the adoption of ANT as a design tool that can be used to problematize the "object-ness" of design objects by articulating the idea of designing "things" as socio-material assemblages or *objects-in-design* (Ehn 2008; Telier et al. 2011), thus rethinking design as a process of heterogeneous engineering (Nickelsen and Binder 2008) through which "things" are "drawn together" (Latour 2008; Storni et al. 2012); and the convergence of ANT and design to support a shared programmatic agenda towards socio-technical democracy (Binder et al. 2015; Storni et al. 2015), merging Latour's call for "making things public" (Latour 2005a) with the objectives of "political design" (Björgvinsson et al. 2010, 2012; DiSalvo 2010, 2012).

Such researches have mostly investigated the ways in which ANT might contribute to design theories, practices, and education, just acknowledging the need for exploring the other way around (Storni et al. 2012). Yet, to offer its best, the crossing of the boundaries between ANT and design should also follow the other direction, that is, it should actually explore the ways in which design might contribute to ANT, making actual the parallel movement of "design towards ANT" that has remained mainly programmatic (Storni 2015).

In this article, I illustrate an ongoing project I am carrying out at Yachay Tech University and in collaboration with Yachay FabLab, which aims at developing novel ways to approach ANT through the design of an interactive electronic game and the organization of workshops during which participants use pre-assembled and coded electronic components to create devices that let them behave as actor-networks, associate and dissociate with each other to gain "power" within an imaginary socio-

technical world, and discuss about their experience as actor-networks to foster both their socio-technical imagination and critical thinking about ANT.

In what follows, I propose some reflections on how a specific design method termed *critical making*, developed and practiced by scholar Matt Ratto in his Critical Making Lab[i] at the University of Toronto (Ratto 2011a, 2011b; Ratto and Hoekema 2009; Ratto et al. 2014), might enrich the ways in which we approach ANT by bridging the gap between physical and conceptual exploration.

In order to do so, in our project we adopt some tools and methods commonly used by *makers* and *fabbers* to rapidly prototype interactive technologies (Walter-Herrmann and Büching 2013). More specifically, we use Arduino-based *physical computing*,[ii] a technical practice that has been widely celebrated as a means to develop ways of thinking with our hands (Banzi 2008) and translate bits into atoms, and atoms into bits (Gershenfeld 2012). This presupposes the use of ANT not merely as a methodology for description, but rather its "translation" into an interactive gaming experience through which scholars and students can conceptually-materially engage with ANT, hence exploring and approaching it from novel points of view.

To summarize the meaning of our project, it could be said that it is about *making* ANT in a double sense: on the one hand, it implies using makers' tools to create interactive physical devices reproducing the behaviour of actor-networks within the socio-technical world; on the other hand, it aims at enriching our understanding of ANT as a practice rather than a theory, respecting an already celebrated feature of ANT ("Far from being a theory of the social… it always was… a very crude method to learn from the actors", Latour 1999a, 20), while also proposing a novel point of view on how it can be engaged with, by moving from the realm of analytic deconstruction to that of conceptual-material construction. "What if ANT starts to be in the business of designing new pieces of technology and not just actor-network accounts of them?" (Storni 2015, 166).

Criticality, Technical Practices, and the Critical Making Approach

Critical making is an umbrella term for various distinctive practices that link traditional scholarship in the humanities and social sciences to forms of material engagement in order to explore new ways of studying the relationship between technologies and social life (Ratto 2011a). The aim of critical making is "to articulate and develop novel modes of intervention into dominant systems of information exchange and knowledge generation" that "focus on assembling rather than deconstructing within the modern technological society" (Ratto et al. 2014, 85).

In order to reach this goal, critical making practices "theoretically and pragmatically connect two modes of engagement with the world that are often held separate - critical thinking, typically understood as conceptually and linguistically based, and physical 'making,' goal-based material work" (Ratto 2011a, 253). Critical making has thus been described as a *materialist interventionist method* (Sánchez Criado et al. 2016), which seeks to "counteract the ineffectual linguistic bias of traditional critiques of technoscience" (Ratto et al. 2014, 86).

As such, it assumes the engagement between design and social research should aim at exploring societal issues and social theories through the fabrication of interactive prototypes, i.e. through *making*: it is "a kind of pedagogical practice that uses material engagements with technologies to open up and extend critical social reflection" (Hertz 2015, 1).

Examples of such a combination of critical thinking with hands-on making are the workshops organized by Matt Ratto, which are conceived as shared making experiences where participants explore and inform discussions about topics such as, for example, distance learning, or the rise of proprietary and closed *walled gardens* on the Internet, by constructing and using interactive *electronic agents* that metaphorically operationalize established sociological concepts through the execution of specific code subroutines (Ratto 2011a; Ratto et al. 2014).

Critical making shares its emphasis on the critical purpose of technical practices with other contemporary design and engineering practices, as well as forms of conceptual art, which also support a shift from focusing on technical sophistication and function to criticality and expression. Relevant examples of practices that explicitly refer to critical reflection as both an integral part and outcome of technical, material work include:

- *Critical design*, a design methodology popularized by Anthony Dunne and Fiona Raby (Dunne 2006; Dunne and Ruby 2001), which "leverages design to make consumers more critical about their everyday lives, particularly how their lives are mediated by assumptions, values, ideologies, and behavioural norms inscribed in designs" (Bardzell and Bardzell 2013, 3297);
- *Critical engineering,* a methodology introduced in 2011 by a group of artists-technologists signatories of the *Critical Engineering Manifesto* (Oliver et al. 2011), whose aim is to prototype devices that reveal the hidden socio-political assumptions embodied by mainstream technology. It looks "beyond the 'awe of implementation' to determine methods of influence and their specific effects," through a sort of hacktivist process of *reverse black-boxing*:[iii] "The greater the dependence on a technology the greater the need to study and expose its inner workings, regardless of ownership or legal provision" (Oliver et al. 2011; see also Parikka 2013, who interprets critical engineering as a more political form of *media archaeology*);
- *Critical technical practice*, an approach to engineering originally developed in the context of artificial intelligence research, which re-

quires engineers to develop "an expanded understanding of the conditions and goals of technical work" (Agre 1997a, 23) and "a split identity – one foot planted in the craft work of design and the other foot planted in the reflexive work of critique" (Agre 1997b, 155). This is made possible by combining a reflexive analysis of dominant and marginalized socio-technical forces with the production of novel technologies that embody alternative socio-technical configurations and redistribute power within society.

However, notwithstanding the communal focus on merging critical reflection with hands-on practice, key differences between the aforementioned critical practices and the critical making approach exist. First, differently from the formers, critical making is *scholarship-oriented*: it establishes explicit connections between the constructive process and specific scholarly literature, which transform the shared experience of making into a site for analysis and scholarly exploration (Ratto 2011a, 253).

Second, critical making is *process-oriented*, in contrast to the general tendency of critical technical practices to be object-oriented (Hertz 2015, 2). Critical methodologies generally focus on building refined objects to generate critique, producing what have been defined as "critically made objects", that is, objects and technologies that overcome the limits of language in stimulating critical reflections:

Things have the strength to hit you powerfully and forcefully. Critically engaged language can do detailed surgery on a topic; critical objects can hit like an emotional sledgehammer." "Critically made objects have the power to be evocative 'things to think with'… [which] enable individuals to reflect on the personal and social impact of new technologies (Hertz 2015, 4-6).

On the contrary, critical making places explicit emphasis on the process (as opposed to the product) of making:

Critical making emphasizes the shared acts of making rather than the evocative object. The final prototypes are not intended to be displayed and to speak for themselves. Instead, they are considered a means to an end, and achieve value through the act of shared construction, joint conversation, and reflection. Therefore, while critical making organizes its efforts around the making of material objects, devices themselves are not the ultimate goal. Instead, through the sharing of results and an ongoing critical analysis of materials, designs, constraints, and outcomes, participants in critical making exercises together perform a practice-based engagement with pragmatic and theoretical issues. (Ratto 2011a, 253).

In the next section, I illustrate how we are adopting the critical making methodology to approach ANT, designing an interactive technology and a workshop experience that aim at fostering socio-technical imagination and generating critical thinking about ANT.

Game of ANT

Drawing upon the critical making approach, I am developing, in collaboration with José Gerardo Acosta Arias from Yachay FabLab, a project called *Game of ANT*, which focuses on the fabrication of interactive devices that reproduce the behaviour of actor-networks within the socio-technical world. Game of ANT adopts the Latourian vision of technoscience as war (Latour 1987) and physically embodies this idea by proposing a sort of war game during which participants play the roles of human or non-human actors engaging with the dynamics of socio-technical life. Using pre-assembled and coded components, participants construct and play with electronic "actors" that are able to associate and dissociate with each other, thus forming multiple actor-networks that compete for gaining "power" within an imagined socio-technical world. To win the game, an actor-network needs to crystallize and become a *black box* (Latour 1999b) before its competitors. The working of the game thus reproduces the basic principles of ANT and "translates" the sociology of translation into a gaming experience through which participants can conceptually-materially engage with ANT.

Though it is an ongoing project that has not been tested in the field, I will briefly describe the prototype and workshop parts of Game of ANT, to illustrate how we aim at crossing the boundaries between design and ANT by adopting the methodology of critical making.

The Prototype

The Game of ANT prototype includes two kinds of devices based on different Arduino microcontrollers: a master, based on Arduino Mega, and a number of slaves, based on Arduino Micro (fig. 1).

The master acts as a central unit, receiving inputs from and sending outputs to the slaves via wired connections, and regulating the game progression according to the players' actions. It emits sounds to communicate to the participants that a round is over, and plays a jingle when the process of black-boxing is complete and the game ends. The master also shows the current state of the game via a 16x2 LCD display, which indicates how many actor-networks exist in each round of the game, and how much "powerful" the strongest actor-network is (see below for a description of how "power" is calculated). From an aesthetics point of view, the central unit is designed as a cube made of black plexiglass, in order to translate the concept of *black box* into physical form (Latour 1999b).

The slaves represent the "electronic agents" through which players exert their agency during the game. Each slave is based on an Arduino Micro and has the following main components:

- 1 potentiometer, a variable resistor controlled by an adjusting knob, which allows players to operate selections within a range of options. By using the knob, at the beginning of the game participants choose whether they prefer to play as human or non-human actors. During the next stages, they use it to select which other player they want to *enrol* to create or empower their own actor-network (Callon et al. 1986);
- 1 7-segment LED display, which shows how much "power" the player has after every round;
- 3 buttons, through which players choose what kind of action they want to exert on the other actors (A, B, or C);
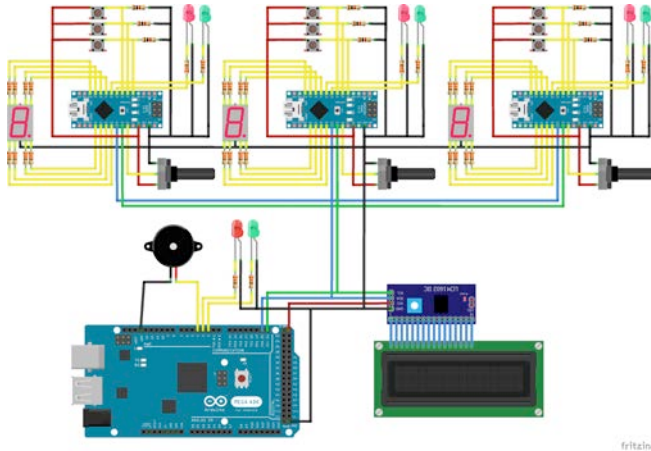- 1 red LED and 1 green LED, which indicate if actions are successful or not.

Figure 1: Electronic circuit of the Game of ANT prototype. For simplicity, it shows only the master (i.e. the *black box*, below) and three slaves (above). Courtesy of José Gerardo Acosta Arias.

The Workshop

The workshop during which Game of ANT is assembled and played with is divided into three phases, each one including different activities: (1) the construction and customization of the "electronic agents" (EA); (2) the game itself; and (3) the informal discussion amongst participants about their experience as heterogeneous parts of actor-networks.

Phase one: assemblage and personalisation of the "electronic agents"

During the first phase, each participant assembles her own EA using a pre-coded Arduino Micro and the other electronic components, under

the guidance of the researcher. When the EAs are ready, they are connected with each other, and with the pre-assembled central unit (*black box*), by wired connections.

A relevant activity, in this phase, is the customization of the EAs: participants will be required to elaborate a brief description of the human or non-human actor they want to impersonate, and to personalise their EAs accordingly, by using common materials such as cardboard, scissors, duct tape, and markers. The aim of this activity is twofold: on the one hand, it aims at differentiating the "actors" participating in the game, thus reproducing the heterogeneity which characterizes actor-networks (Callon 1986); on the other hand, its goal is to make participants develop emotional connections with the EAs through the creation and personalisation processes. This form of *attachment* (Gomart and Hennion 1999) is an essential part of critical making, within which emotional connections work as springboards for critical reflection (Ratto 2011a, 2011b).

Phase two: the gaming experience

The second phase consists of the game itself. Here, participants play by using their EAs to associate and dissociate with each other, thus forming multiple actor-networks that compete for gaining "power" within an imagined socio-technical world.

To create and dismantle associations, during each round of the game players accomplish two actions: (1) select the player they want to target; and (2) choose the kind of action they want to exert on their target (A, B, or C). Once these actions have been performed, the central unit associates the EAs according to the communications established and the actions chosen. This means, for example, that if the EA#1 establishes communication with the EA#2 and selects the option A, and the EA#2 also selects the option A, the EA#1 and EA#2 associate with each other, independently of the target chosen by the EA#2; if, during this same round, the EA#2 successfully associates also with the EA#3, hence the EA#1, EA#2, and EA#3 become part of the same actor-network. Through this mechanism, actor-networks are created according to the multiple choices of the participants and the relations resulting from the sum of their actions. EAs that participate in an actor-network, but are successfully targeted by other EAs, dissociate and change their membership.

The central unit also assigns a "power" value (PV) to the EAs which are successful in creating associations. This means that when two or more EAs associate with each other, their PV reaches the value of 1. This value increases when the association is maintained, and decreases to 1 or 0 when an EA becomes part of a new actor-network or is taken apart and isolated, respectively.

Since the same EAs might be attracted by multiple actor-networks at the same time, conflicts are resolved by assigning their membership according to the different PVs: when, for example, an EA is successfully targeted by two or more EAs participating in different actor-networks,

the former establishes an association with the EA that has the highest PV, becoming a member of its actor-network.

The game ends when two or more members of the same actor-network reach the PV that is pre-defined by the researcher, depending on the number of participants and the desired duration of the game. The reaching of this PV represents the conclusion of the black-boxing process, since it metaphorically means that the actor-network has gained enough power, through the strengthening of the association between some of its entities, to be considered as stable.

Phase three: the concluding discussion

In the last phase of the workshop, the participants who win the game will inform public discussion on their gaming experience. In order to develop their socio-technical imagination, they will be asked to elaborate and discuss, in a few minutes, a common narrative about how all the entities they had chosen to impersonate might stay together, as parts of an actor-network. Through this collective elaboration, prior identities are expected to be manipulated and made coherent with each other, reproducing the idea that the bringing together of actors (i.e. *translation*) is a process of transformation, where actors are changed though their performances and relations (Gad and Bruun Jensen 2010). This activity, together with the direct experience of playing ANT, is expected to be central for stimulating critical reflection on ANT.

The discussion completes the material-conceptual engagement of the participants with ANT, concluding a workshop whereby participants "together perform a practice-based engagement with pragmatic and theoretical issues" through a collective process of prototyping and a joint discussion of concepts and ideas, so as "to extend knowledge and skills in relevant technical areas as well as to provide the means for conceptual exploration," using the prototypes "to express, critique, and extend relevant concepts, theories, and models" (Ratto 2011, 253).

Conclusions

The notion of *critical making* suggests a new form of technical practice, through which theoretical issues are materialized by participatory means and explored both materially and conceptually. By developing Game of ANT I aim at exploring how the dynamics of technoscience, as conceptualized by ANT, could be projected onto an interactive technology, through which ANT can be materially-conceptually engaged with. By creating, personalising, and playing with this technology, as well as by informing discussion on how the singular identities and entities deployed during the game might stay together, the participants can enact a novel mode of "making" ANT through their shared and direct experience.

To accomplish this goal, the working of Game of ANT is designed to reproduce the basic principles and dynamics of ANT. Drawing on the

principle of *generalized symmetry*, the game allows players to choose if they want to play as human or non-human actors, to self-identify with entities of different scale and nature, and to exert their agency through a symmetrical mechanism.

Players also act according to the principle of *free association*, establishing associations between heterogeneous entities that are always unstable, can be loose or strong, and only partially result from deliberate actions, since the process of association depends on the sum of players' actions, as well as their different membership and "power". This way, Game of ANT replicates the process of *translation* through which actor-networks form: each successful action of the players corresponds to a successful translation, which leads to the *enrolment* of the targeted player. By forming actor-networks players automatically become *spokespersons* capable of enrolling other entities to gain more power (Callon 1986).

Game of ANT takes seriously the Latourian vision of technoscience as war (Latour 1987) and physically embodies this idea by proposing a war game that reproduces the competitive dynamics of socio-technical life. It "translates" the sociology of translation into a gaming experience through which scholars and students can conceptually-materially engage with ANT, hence exploring and approaching it from novel points of view.

Acknowledgements

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Commentary on "A Critical Making Approach to Actor-Network Theory: Game of ANT"

Stefano De Paoli

When confronted with the problem of telling what the Actor-Network Theory (ANT) is all about, it is not always easy to present concepts or convince the audience (Latour 1996). This is often true especially for conveying the notions of what it means to treat human and non-human actors symmetrically and to be agnostic about the actors' own accounts of matters. Discussing this with students, especially social sciences

ones, which have been heavily trained in the "sociology of the social" (Latour 2005b), is sometimes even more so difficult, as teachers need to overcome existing preconceptions such as the foundational idea that social actors are by definition humans or institutions with defined roles. Experiencing the critical power of ANT thus is sometimes not easy unless one has spent a great deal reading the core books and articles, or unless one is an engineer or a scientist of course (Bijker et al, 2012). The contribution by Minniti A critical making approach to Actor-Network Theory: Game of ANT has interesting elements to address the problem of telling the ANT to students and the public but also, especially, for experiencing it. The game of ANT translates ANT critical experience from texts and language to a material-designed world via the assemblage of open source electronics and then a phase of playing a game and a final discussion. This offers students (or the public alike) a first-hand practical experience of ANT.

A core point of the discussion with which Minniti opens his contribution is the relation of ANT with other fields and their reciprocal influence. Earlier in the paper, Minniti claims that it is relatively straightforward to see how ANT has influenced other fields. Minniti concentrates in particular on the influences of ANT on the field Design (e.g. Storni 2015). However, Minniti also states that observing the opposite movement, of how Design or material practices more generally could influence ANT is a much less explored area, only perhaps just acknowledged in literature. The umbrella of critical making has some potential in this regard as the making, which entails using cheap and widely available open source electronics that are assembled to produce Do-It-Yourself innovations, is an actor-networking sort-of design practice. This perspective relies on the notion of critical making (Ratto 2011). It does seem then possible to start from the making and move subsequently toward the theory. I am not sure, however, that at the current stage of development, the game of ANT achieves the goal of influencing ANT, but the potential may be there for the future.

The aspect I would like to focus mostly to understand the previous point is the gaming aspect of the contribution. This is perhaps the less theorized area of the manuscript. Minniti proposes a game-like situation (game of ANT) in which participants assemble a circuit (with different Arduino boards, acting with different capacities and other electronic components) and play a game whose goal is to create associations among actants, which then could lead to a black-boxing and the winning of the game. The critical part of this making-gaming exercise is the final discussion of participants (e.g. students) on their respective translation processes. The making part is the assemblage of the game by players. The game effectively seeks to translate concepts such as association or black-boxing into a practical process experienced with the material at hand.

I understand that the author focus is on the strengths of the critical making approach. However, I was intrigued by the fact that Minniti rather than sticking to the notion of Making of ANT, which features in the

introduction title, translates this into the game of ANT. This translation from making to gaming does come with a string of implications, which do not appear acknowledged. There is indeed a question, which lies at the centre of exercises like this one, which has to do with the notion of games and gaming and how they are used to produce or experience knowledge. Going back to the earlier point of the reciprocal influence between ANT and other fields, a few years ago, at the EASST conference in Trento, one of the conference sub-themes was on Digital Games and STS. The convenors had it clear that there was much potential for the use of Science and Technology Studies, with Actor-Network featuring heavily, to better understand and theorise digital games. However, during the opening of the sub-theme, the convenors also raised the point that the relative opposite movement was highly required, focusing on how digital games study could influence and increase the capacity of Science and Technology Studies. Like for the discussion on Design we touched before, this point was just acknowledged but there was hardly any input on this from the participants. Does the game of ANT have this potential to influence the theory?

According to an established definition: "a game is a system in which players engage in an artificial conflict, defined by rules, that results in a quantifiable outcome" (Salen and Zimmerman 2003, 80). Minniti's game of ANT adheres to this definition. The game is a conflict among actants (ANT as war, in the author's words), within a set of rules (the selection of opposing actors, a selection among three actions, the way actants win over associations or lose them) and a quantifiable outcome (the reaching of a set Power Value, or PV). To this extent, then the question translates into whether the game of ANT brings something new to ANT or to the understanding of ANT, that other games may not be capable of bringing. To avoid immediately one potential misunderstanding, I think we should bracket for a moment the question of whether games can be critical or not. That games can have a powerful critical element is something we have known for some time. La molleindustria for example has been producing critical games for over fifteen years.[iv] The question we should ask is rather, in what ways the game of ANT differs from other games? Is there new potential in the game that other games do not have? Does the game of ANT really reflect the dynamics of an actor-networking process?

There certainly is an important element associated with the process oriented nature of critical making on which Minniti relies. The focus is not, apparently, on the object (e.g. the game) but on the making of it, or better the assembling of it. However, the game of ANT is only partially a process. The artificial conflict composed of the rules of the game, its game space (or magic circle as it would be called in games literature) and the winning outcomes are defined by the scholar from the outset. There is an object-oriented component in the game of ANT, which does seem unavoidable to an extent. Otherwise, we would be required to let participants also create the rules and set the space of the game. In other words,

to be entirely process-oriented as the approach of critical making does require, also the rules, the space and the outcomes of a game of ANT should be in themselves a critical making process. Players, although effectively connecting the Arduino boards (and the other required electronics) and creating their "cardboard" characters/actants, play within a set of rules and toward an objective which are defined from the outset. It is not difficult to see that, for instance, we do this every time we play a board game, like Snakes and Ladders or Risk. We take the board out of the box, we assemble the game in the way that it is prescribed by the manual (for instance in Risk we place our tanks on the world map depending on the Territory cards that we have received) and, very likely, more experienced players help out those that are new to the game. We throw the dices after having declared which of the other player we want to attack and the consequences of an attack may have varied impacts on the game for all the players. Thus, the process of the critical making of the game of ANT advocated by Minniti is only partial as it is effectively the assembling of a game-object that somehow already exists (putting together the Master and the slaves, connect them and add the other electronic component such as the switch or resistors, according to the game). The game of ANT does seem to share this aspect with other games, which may perhaps also have the potential of being themselves games of ANT.

Further focusing on the gaming aspect, there is another relevant question to ask: whether a game of ANT could be an "experience through which participants can conceptually-materially engage with ANT", as Minniti suggests. The achievement of this relates ultimately with how we come to say what is ANT. In ANT there are a topological and an ontological components to account for the process of actor-networking (Latour 1996). The point then is whether these components can translate into a game in the first place and then into a game of ANT. There is this very interesting passage in *A Thousand Plateaus Treatise on Nomadology – The War Machine* where Deleuze and Guattari (2004) use game theory as explanatory case for the differences between the State and the war machine. They compare the game of Chess with another board game called Go. Both games have their own space (a board), with rules and pieces that are placed on the board. They notice that "chess pieces are coded: they have an internal nature and intrinsic properties from which their movements, situations and confrontations derive" (Deleuze and Guattari 2004, 389).

We could see chess pieces as actors in a sociological sense, with essential properties, whose properties codify in a rather strict and binary way the relations among the pieces. Stretching a little bit this idea, we could see chess pieces as actors possessing social roles in a Parsonsians way, where the unfolding of social relations is dependent on the properties-roles of social actors. On the contrary, "go pieces are elements of a non-subjectified machine with no intrinsic properties, only situational ones" (Deleuze and Guattari 2004, 389).

Go pieces are not coded like bishops or towers in a game of chess, they are simple disks and have a "milieu of exteriority". They are actants whose agency is dependent on the relations they have with other actants. This is an interesting intuition because it draws attention on the differences between games (or more generally social organisations) whose elements are in non-essential relations of becoming and games whose elements are in pre-defined binary relations (such as object and subject, us and them). In games of becoming, the movement is not that of going from point A to point B (like in chess) but one of occupying a smooth space (topology) and the pieces relate to a non-essential ontology that allows this topology to unfold, as a Go piece can be anything like "a man, a woman, a louse, an elephant" (Deleuze and Guattari 2004, 389). The right question to ask then is whether the game of ANT is a game of becoming like Go with a non-essential ontology and a topological construction of networks or a game of binaries with elements or pieces having already codified properties which then determine a more or less linear spatial unfolding of the game. The shape cutting of the actants (the Electronic Agents or EAs) at the beginning of the game of ANT is an open ended, becoming process. However, at the beginning of the game these actants seem to play largely a non-human figurative role (Latour 1992), with limited or no agency. The game of ANT evolves with players' targeting of one of the other participants and selecting to exert one among three actions (A, B, C). The properties of each of these actions are not specified in advance in the game rules (it is not A a punch, B the use of a sword or C a diagonal movement or else), they possess exteriorities. This makes it a promising indication that these actions can be anything, depending on the shaping topology of the actor-network. They are not pre-codified in the game as properties or roles of the actants. They seem indeed relations of becoming. Moreover, the associations (or failed associations) which are outcome of the selected action are not limited to the targeted participant but independent and can extend to other actants in the network depending on their power. When there are conflicts in the potential associations, brute force determines which actor-network is successful. It does seem there is also a component of becoming in the association process. The final discussion, although not strictly part of the game, sees network-builders (the players) offering an account of their actor-networking. This is where the agency of the non-human figurative actants, shaped at the beginning of the game, is revealed by players. There is, in my view, thus great potential in the game of ANT to "enrich the way we approach ANT", though the game is not yet there to offer something that can influence ANT.

To conclude, it was enjoyable learning about this experience, but I would suggest that what is perhaps worth developing further in the contribution is a reflection on the game of ANT as a game in the first place and as a game of becoming in the second place. While from what I see the game displays the right topological and ontological elements, much of

the discussion seems conflated on the making aspect rather than accompanying this also with a discussion of the gaming aspect. Both aspects should be acknowledged and theorised upon. I would speculate indeed that it would be possible to have a critical-making experience by designing a game in which actors have defined properties and where the game unfolds with a linear spatiality, like a game of chess with Arduinos. This game may still be classed as critical making, but an imaginary game thus conceived will not enrich our understanding of ANT. This is the translation from making to gaming that I was signaling earlier in the commentary, which is somehow implicit in the paper. The implications of this translation I would suggest deserve reflections.

References

Agre, P.E. (1997a) *Computation and Human Experience*, Cambridge, Cambridge University Press.

Agre, P.E. (1997b) *Toward a Critical Technical Practice: Lessons Learned in Trying to Reform AI*, in G. Bowker, S.L. Star, W. Turner and L. Gasser (eds.), *Social Science, Technical Systems and Cooperative Work: Beyond the Great Divide*, Hillsdale, Erlbaum, pp. 131-157.

Banzi, M. (2008) *Getting Started with Arduino*, Sebastopol, O'Reilly Media.

Bardzell, J. and Bardzell, S. (2013) *What is "Critical" about Critical Design?*, in W.E. Mackay, S. Brewster and S. Bødker (eds*.), Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI 2013), New York, ACM Press, pp. 3297-3306.

Berg, M. (1998) *The Politics of Technology: On Bringing Social Theory into Technological Design*, in "Science, Technology & Human Values", 23 (4), pp. 456-490.

Bijker, W. E., Hughes, T. P., Pinch, T., & Douglas, D. G. (2012). *The social construction of technological systems: New directions in the sociology and history of technology*, Cambridge, MA, MIT press.

Binder, T., Brandt, E., Ehn, P. and Halse, J. (2015) *Democratic Design Experiments: Between Parliament and Laboratory*, in "CoDesign", 11 (3-4), pp. 152-165.

Björgvinsson, E., Ehn, P. and Hillgren, P.-A. (2010) *Participatory Design and "Democratizing Innovation"*, in K. Bødker, T. Bratteteig, D. Loi and T. Robertson (eds.), Proceedings of the 11th Biennial Participatory Design Conference (PDC '10), New York, ACM, pp. 41-50.

Björgvinsson, E., Ehn, P. and Hillgren, P.-A. (2012) *Agonistic Participatory Design: Working with Marginalised Social Movements*, in "CoDesign", 8 (2-3), pp. 127-144.

Bowker, G., Star, S.L., Turner, W. and Gasser, L. (1997) *Social Science Research, Technical Systems and Cooperative Work: Beyond the Great Divide*, Hillsdale, Erlbaum.

Callon, M. (1986) *Some Elements in the Sociology of Translation: Domestication of the Scallops and the Fishermen of St. Brieuc Bay*, in J. Law (ed.), *Power, Action and Belief: A New Sociology of Knowledge?*, London, Routledge, pp. 196-229.

Callon, M., Law, J. and Rip, A. (1986) *Mapping the Dynamics of Science and Technology: Sociology of Science in the Real World*, London, Macmillan.

Deleuze, G., and Guattari, F. (2004) *A Thousand Plateaus*, London, Continuum.

Díaz Andrade, A. and Urquhart, C. (2010) *The Affordances of Actor Network Theory in ICT for Development Research*, in "Information Technology & People", 23 (4), pp. 352-374.

DiSalvo, C. (2010) *Design, Democracy and Agonistic Pluralism*, in D. Durling (ed.), *Proceedings of the Design Research Society Conference (DRS '10)*, Montreal, Université de Montréal, pp. 1-10.

DiSalvo, C. (2012) *Adversarial Design*, Cambridge, MA, MIT Press.

Dunne, A. (2006) *Hertzian Tales: Electronic Products, Aesthetic Experience, and Critical Design*, Cambridge, MA, MIT Press.

Dunne, A. and Raby, F. (2001) *Design Noir: The Secret Life of Electronic Objects,* Basel, Boston and Berlin, Birkhäuser.

Ehn, P. (2008) *Participation in Design Things*, in J. Simonsen, T. Robertson and D. Hakken (eds.), *Proceedings of the Tenth Conference on Participatory Design (PDC'08)*, New York, ACM, pp. 92-101.

Gad, C. and Bruun Jensen, C. (2010) *On the Consequences of Post-ANT*, in "Science, Technology, & Human Values", 35 (1), pp. 55-80.

Gershenfeld, N. (2012) *How to Make Almost Anything: The Digital Fabrication Revolution*, in "Foreign Affairs", 91 (6), pp. 42-57.

Gomart, E. and Hennion, A. (1999) *A Sociology of Attachment: Music Amateurs and Drug Addicts*, in J. Law and J. Hassard (eds.), *Actor Network Theory and After*, Oxford, Blackwell, pp. 220-247.

Hertz, G. (ed.) (2015) *Conversations in Critical Making*, Victoria, CTheory Books.

Ingram, J., Shove, E. and Watson, M. (2007*) Products and Practices: Selected Concepts from Science and Technology Studies and from Social Theories of Consumption and Practice*, in "Design Issues", 23 (2), pp. 3-16.

Jensen, C.B. (2008) *CSCW Design Reconceptualised Through Science Studies*, in S.P. Gill (ed.), *Cognition, Communication and Interaction: Transdisciplinary Perspectives on Interactive Technology*, London, Springer, pp. 132-147.

Latour, B. (1987) *Science in Action*, Cambridge, Harvard University Press.

Latour, B., (1992) *Where are the missing masses? The sociology of a few mundane artefacts.* In: Bijker, W.E., Law, J. (Eds.), *Shaping Technology/Building Society*, (pp. 205–224), Cambridge, MA, MIT Press.

Latour, B. (1996) *On actor-network theory: A few clarifications*, in "Soziale Welt", 47, 369–81

Latour, B. (1994) *On Technical Mediation: Philosophy, Sociology, Genealogy*, in "Common Knowledge", 3 (2), pp. 29-64.

Latour, B. (1999a) *On Recalling ANT*, in "The Sociological Review", 47 (S1), pp. 15-25.

Latour, B. (1999b) *Pandora's Hope: Essays on the Reality of Science Studies*, Cambridge and London, Harvard University Press.

Latour, B. (2005a) *From Realpolitik to Dingpolitik: Or How to Make Things Public*, in B. Latour and P. Weibel (eds.), *Making Things Public: Atmosphere of Democracy*, Cambridge, MA, MIT Press, pp. 4-31.

Latour, B. (2005b). *Reassembling the social: An introduction to actor-network-theory*, Oxford, Oxford university press.

Latour B. (2008) *A Cautious Prometheus: A Few Steps Toward a Philosophy of Design (with Special Attention to Peter Sloterdijk)*, in J. Glynne, F. Hackney and V. Minton (eds.), *Networks of Design: Proceedings of the 2008 Annual International Conference of the Design History Society*, Boca Raton, Universal Publishers, pp. 1-13.

Nickelsen, N.C. and Binder, T. (2008) *Design and Heterogeneous Engineering: Toward an Actor Network Perspective on Design*, in "Artifacts", 2 (3-4), pp. 164-175.

Oliver, J., Savicic, G. and Vasiliev, D. (2011) *The Critical Engineering Manifesto*, in: http://criticalengineering.org/ (Retrieved March 14, 2018).

Parikka, J. (2013) *Critically Engineered Wireless Politics*, in "Culture Machine", 14, pp. 1-26.

Ratto, M. (2011a) *Critical Making: Conceptual and Material Studies in Technology and Social Life*, in "The Information Society", 27, pp. 252-260.

Ratto, M. (2011b) *Open Design and Critical Making, in P. Akinson*, M. Avital, B. Mau, R. Ramakers and C. Hummels (eds.), *Open Design Now: Why Design Cannot Remain Exclusive*, Amsterdam, BIS Publishers, pp. 202-209.

Ratto, M. and Hoekema, S. (2009) *Flwr Pwr: Tending the Walled Garden*, in A. Dekker and A. Wolfsberger (eds.), *Walled Garden*, Rotterdam, Virtueel Platform, pp. 51-60.

Ratto, M., Wilie, S.A. and Jalbert, K. (2014) *Introduction to the Special Forum on Critical Making as Research Program*, in "The Information Society", 30, pp. 85-95.

Salen, K., and Zimmerman, E. (2004) *Rules of play: Game design fundamentals*, Cambridge, MA, MIT press.

Sánchez Criado, T., Rodríguez-Giralt, I. and Mencaroni, A. (2016) Care in the (Critical) Making. Open Prototyping, or the Radicalisation of Independent-living Politics, in "ALTER - European Journal of Disability Research", 10 (1), pp. 24-39.

Snake-Beings, E. (2016) *The DiY ['Do-it-Yourself'] Ethos: A Participatory Culture of Material Engagement*, PhD Thesis, University of Waikato, in https://researchcommons.waikato.ac.nz/bitstream/handle/10289/9973/thesis.pdf?sequence=3 (Retrieved March 10, 2018).

Snake-Beings, E. (2017) *Maker Culture and DiY Technologies: Refunctioning as a Techno-Animist Practice*, in "Continuum: Journal of Media & Cultural Studies", 32 (2), pp-121-136.

Steen, M. (2012) Human-Centered Design as a Fragile Encounter, in "Design Issues", 28 (1), pp. 72-80.

Storni, C. (2012) *Unpacking Design Practices: The Notion of Things in the Making of Artifacts*, in "Science, Technology & Human Values", 37 (1), pp. 88-123.

Storni, C., Linde, P., Binder, T. and Stuedahl, D. (2012*) Exploring ANT in PD: reflections and implications for theory and practice.*, In *Proceedings of the 12th Participatory Design Conference: Exploratory Papers, Workshop Descriptions, Industry Cases*, Vol. 2, ACM, New York, pp. 145-146.

Storni, C. (2015) *Notes on ANT for Designers: Ontological, Methodological and Epistemological Turn in Collaborative Design*, in "CoDesign", 11 (3-4), pp. 166-178.

Storni, C., Binder, T., Linde, P. and Stuedahl, D. (2015) *Designing Things together: Intersections of Co-design and Actor–network Theory*, in "CoDesign", 11 (3-4), pp. 149-151.

Suchman, L. (2007) *Human-machine Reconfigurations: Plans and Situated Actions*, New York, Cambridge University Press.

Telier, A., Binder, T. De Michelis, G., Ehn, P., Jacucci, G., Linde, P. and Wagner, I. (2011) *Design Things*, Cambridge and London, MIT Press.

Walter-Herrmann, J. and Büching, C. (eds.) (2013) *Fab Lab: Of Machines, Makers and Inventors*, Bielefeld, Transcript Verlag.

Woodhouse, E. and Patton, J. (2004) *Design by Society: Science and Technology Studies and the Social Shaping of Design*, in "Design Issues", 20 (3), pp. 1-12.

Yaneva, A. (2009) *Making the Social Hold: Towards an Actor-Network Theory of Design*, in "Design and Culture", 1 (3), pp. 273-288.

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[i] Http://criticalmaking.com/ (Accessed March 12, 2018).

[ii] Arduino is a single-board microcontroller created at the Ivrea Interaction Design Institute, commonly used for fast prototyping and to build interactive devices that can sense and control objects in the physical and digital world. See https://www.arduino.cc/en/guide/introduction (Accessed March 13, 2018).

[iii] According to Latour (1994), the notion of *reverse black-boxing* describes the process through which the invisible features of a technology become visible due to an 'error' or failure to function correctly. Recent contributions by Snake-Beings (2016, 2017) highlight how DIY practitioners and makers often refunction technologies on purpose, transforming reverse black-boxing into a strategy for increasing the participatory potential of materials. Here I adopt the notion of reverse black-boxing in a similar way, to underline how critical engineers intentionally reveal the hidden features of mainstream technology through their creations.

[iv] http://www.molleindustria.org/ (Accessed March 12, 2018).

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Leonardo Chiesi and Silvia Surrenti (eds.)
L'ospedale difficile. Lo spazio sociale della salute [The difficult hospital. The social space of health], Napoli, Liguori, 2014, pp. 182

Laura Lucia Parolin *University of Southern Denmark*

The difficult hospital. The social space of health is a small edited book that focuses on data from a research project led by an interdisciplinary team on hospital spaces. The research project, called SPACES, aims to reflecting on the interplay among architectural spaces, medical practices, and users' practices related to health care services. It also investigates the consequences of this entanglement on the reconfiguration of the meaning of the right to health. The book deals with the right to health on the account of its relational dimension. The right to health and health itself are considered not states, but relationships that connect the individual with him/herself and his/her physical, architectural, and social environment. Therefore, the right to health does not only result from an access to services (physical, economical, and psychological), but it also entails what is required to connect seamlessly the health care experience with the enjoyment of everyday life. This right is defined as the fulfilment of complex needs, such as care, the feeling of being looked after, and of being considered as a part of a social network that interacts with healthcare professionals.

The volume deals with the otherness of a hospital experience, where primacy is given to the patient-doctor dyadic relationship, underlining hospital users' need for co-partnership, for visibility, and, at the same time, for privacy. It shows how careful attention to the space/time dimension can offer an interpretative key to succeed in reading the different hues of the right of co-partnership, visibility and privacy.

The volume unfolds through a series of chapters with a careful examination of specific aspects of the organization of the hospital time/space, based, as it is, on empirical material taken from the SPACES research.

The volume does not draw from STS literature but leans on the phenomenological reading of the experience in the subject's relationship with the hospital and clinical practices. The first chapter by Leonardo Chiesi develops an interpretative frame to share the coordinates to read both human and social experience inside the planned space. The outcome leads to a theorization that promises an account of the dynamic relationship between the plan's defined inscriptions and the ones emerging from the practices in use. Chiesi suggests that the planned space, intended as experience, is the emerging entwining of two different series of "intentions." On one side the designer's expectations and intentions inscribed inside the planned space, on the other side the intentions of the subjects called to inhabit the spaces, manifested as they are in the social practices and in their behavior when they use the mentioned space. By Chiesi's

conceptualization, the two intentions are symmetrical and specular, but it is only the understanding of their entwined dynamics that allows us to read the human and social experience of space.

The author's references are phenomenology and the theory of the relationships with the objects as developed by James J. Gibson through the concept of affordance (Gibson 1979). Chiesi acknowledges that the concept of affordance has the capacity to shift the theorization from the social effects of the space to the relationship with the subject. If you conceive of space as a container of affordances, or of indications as the author names them , you shift your attention from the function of space to the subjects taking part in that relationship. The designed space is thus conceived in its dual meaning as the "producing product" (Thrift 1983) of socially organized practices.

Chiesi proposes different typologies of affordances in his model: proxemics, of movement, of pause, and of relationship. He means for proxemics affordances all those opportunities that take place thanks to the body plasticity. They, then, refer relationships related to spaces' penetrability when in relation with bodies. Movement and pause affordances refer instead to indications inscribed in the empty space, suggesting its crossing or pauses within it. The last class of affordances refers instead to the relationship between space and bodies intended as connected (social) subjects. We are thus dealing with space opportunities for sociability that influence the modalities of social interaction when inhabiting spaces.

The classification proposed seems promising. Unluckily, the volume does not offer a reading of affordance classes as analytical categories in order to inform empirical research to investigate the cinematic and social dwelling of hospital spaces. Chiesi's very chapter lingers on the categories of understanding, meaning, and taste, committed, as he is, in introducing a theory of the dwelling of the architectonic space. In the end, he does not dedicate enough attention to the development of the different classes of affordance and, in particular, how they could inform research on hospital spaces. Moreover, the rest of the volume, does not refers to the Chiesi's affordance classification in developing the analyses.

The chapters following Chiesi's introductory one focus on space dimension entwined with time dimension, bound to the time length of experience. Silvia Surrenti's work concentrates on the time/space dimension of the treatment experience by underlining the experience of otherness that a hospital awakens in the involved subjects. The author highlights how the site is a perceptive field meant as a space open to particular information flows, by mobilizing interpretative categories taken from communication sociology (Meyrowitz 1986). The author shows how, through this reading, the expectation of the performance is characterized by the experience of the "visibility field." The author highlights – through the empirical observation in the waiting rooms of the doctor's office – the violations the users enact when the areas preset for waiting

are not in the proximity of the performance sites. While waiting outpatient performances, patients stand in the corridors and in other passage areas in order to satisfy their own need of being made visible, a need born from wanting to see and be seen. The patients need to have control on the information flow regarding the access to the doctor's office and, at the same time, they need to be seen by the health providers. Moreover, the waiting time is never neutral, but charged with waiting concerning the treatment relationship. "If on one hand you wait for something or someone (the waiting), on the other we expect from that someone something (the expectation). An example could be given by the expectation of being considered in order to enjoy sufficient relationship time with the professionals" (Surrenti 2014, p. 67). The attention to the time-space dimension is thus able to show the mismatch between the experience of the patients' perceived time and the technical-organizational management of the hospital space. Surrenti's chapter ends with the indication of a design of "equipped waiting", so that articulated rights are satisfied in order to receive approval from the citizen.

An explicit focus on the dimension of rights as the product of the interaction between spaces and use practices is at the center of Paolo Costa's chapter. He deals with the topic of privacy and confidentiality within the hospital service. The author analyzes some cases of violation of space use prescriptions by showing how criticalities bound to confidentiality rights are often the outcome of complex relationships of the users' legitimate relationship needs and of space-material elements. The author underlines how some design choices of hospital spaces are not able to satisfy the relationship needs of accompanying users, who, through forms of violation of use prescriptions, end up invading the patients' confidentiality. A careful design choice should provide consideration for the often-conflicting interests and use prescriptions of the behavior inscribed in the space-material elements, according to the author. Although he does not refer to STS, Costa's ethnographic interest for the right to confidentiality for patients leads us to shift our attention to the missing masses (Latour 1992) in the social relationships of health care service.

Livia Buscaglioni's chapter introduces a reflection on the organizing cultures of the treatment space by highlighting a tension between the co-partnership cultures, and the one more oriented towards the separation of the spaces between stage and backstage. In this case, too, the empirical material used to tackle the issue comes from the ethnographic observation of the waiting areas to access health care. According to the author, the various cultures have distinct basic assumptions on the same conception of the treatment relationship. The centrality of the patient-doctor dyadic relationship implies the design of spaces that neatly separate the waiting areas from the performance areas. A culture of co-partnership would instead foresee the use of open spaces, where also the accompanying people can access the doctor's performance.

The chapter by Tomas Madonia is dedicated to the same topic of the opening of the doctor's relationship to relatives-visitors. It is by focusing on a process of change in an intensive therapy unit that Madonia notices how, by extending the visiting times, more opportunities to include those who support the patient in the treatment relationship can take place. The presence of the visitor-relative in the unit can, in fact, help the personnel to contrast the patient's breakdown process, within the parameters of the vital functions of the scientific-technical assemblage (Berg 1997). If by extending the visiting times the health staff is helped in bringing back the patient to his totality, on the other hand it represents an occasion to include relatives in the health care trajectory.

The volume thus introduces an articulated review of the relationships between time-space dimensions and the right to treatment in the development of the chapters. Taken as a whole, the volume is curious, empirically oriented, and it asks questions on the humanization of the treatment relationship by paying attention to the dimension of the right as the element emerging from the meeting of those we could define complex material-social practices. Anyhow, if the book succeeds in showing the importance of the interest in such dimensions by suggesting the need of a new overall design of spaces, times, and health care practices, the lack of an integrated theorization limits the value of the volume.

Several topics treated in the volume are close to STS interests and because of that, the volume is of interest for an STS readership working in the domain of healthcare or in the domain of architecture/design. Moreover, some theoretical and or analytical categories here elaborated, meet some of the categories nowadays elaborated within STS or related fields as, for example, the proxemics affordance category is analogous to the way in which interactions among bodies can be seen by Actor Network Theory (ANT) (Parolin and Mattozzi 2013) or by other approaches dealing with material relationships, as proposed in Ash (2015) or in Ingold (2007).

Despite such analogies with STS and STS related approaches, the phenomenological roots of the reflection provided by the volume, lead to focus on the human body, by limiting the attention to the perception of the experience of the space by human actors, without considering in detail how non-humans bodies take part in these relationships.

References

Ash, J. (2015) *Technology and Affect: Towards a Theory of Inorganically Organised Objects*, in "Emotion, Space and Society", 14 (2), pp. 84–90.

Berg, M., (1997) *Rationalizing Medical Work*, Cambridge, MA, MIT Press.

Gibson, J.J. (1979) *The ecological approach to visual perception*, New York, Houghton Mifflin.

Ingold, T. (2007) *Materials against materiality*, in "Archaeological Dialogues", 14 (1), pp. 1–16.

Latour, B. (1992) *Where Are the Missing Masses? The Sociology of a Few Mundane Artifacts*, in Wiebe E. Bijker and John Law (eds.), *Shaping Technology/Building Society: Studies in Sociotechnical Change*, Cambridge, MA, MIT Press, pp. 225–258.

Meyrowitz, J. (1986) *No sense of place: The impact of electronic media on social behavior,* Oxford, Oxford University Press.

Parolin, L.L. and Mattozzi, A. (2013) *Sensible translation. Sensitive dimension and knowledge within two craftsmen's workplaces*, in "Scandinavian Journal of Management", 29(4), pp. 353—366.

Thrift, N. (1983) *On the determination of social action in space and time*, in "Environment and Planning D: Society and Space", 1(1), pp. 23-57.

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Manuel De Landa
Assemblage Theory, Edinburgh, Edinburg University Press, 2016, pp. 198

Dario Minervini *Università di Napoli "Federico II"*

Assemblage Theory is the most recent effort of Manuel DeLanda. It accounts his own reframing of Gilles Deleuze and Felix Guattari's work. The book was published in 2016 as part of a series put out by Edinburgh University Press, which has hosted the debate on the "Speculative Realism", since the seminal conference held in 2007 at Goldsmiths College in London on the topic.

Delanda was fully committed with this intellectual challenge against the post-modern linguistic turn in humanities and for banishing heuristic textualism (Bryant, Srnicek and Harman 2011). An intense intellectual dialogue with the authors of *Thousand Plateaus* has opened up significant insights into sociological thought and for STS scholars, since the publication of DeLanda's *A Thousand Years of Nonlinear History* (1997).

"*Agencement*" is a concept at the core of the argument explored in the current book. "Assemblage", as admitted by the author himself, is a slippery linguistic solution, which was used to substitute the illustrious French word with an Anglophone one. Indeed, "assemblage" is intended as both the process and the outcome of a connection, that is to say a *multiplicity* of *heterogeneous* entities interrelated by *symbiotic* liaisons. Assemblage is the pattern of a flat ontological plane consistent with a non-reductionist account of reality and overcoming the conceptualization of

society as a self-sufficient whole.

The first chapter clearly addresses this point. Both micro and macro reductionism, respectively detected within phenomenological subject-oriented sociology and with that establishing structured paths and roles of actors, are contested. Even if this appears to be a very hurried critique towards too vague sociological approaches, the proposal to focus on exteriority (again a concept taken from Deleuze) is intriguing. Indeed, the external relationship between the parts, which constitute emergent social aggregates are reversible relationships that never crystallize the reduction of the parts to the whole and vice-versa. DeLanda provides the readers with an example in order to make this argument on exteriority explicit. When talking about how authority and legitimacy work in organizations, he writes (p. 12):

Nevertheless, and however centralised and despotic an organization may be, its members remain ultimately separable from it, their actual degree of autonomy depending on contingent factors [...]. It is this type of irreducible social whole produced by relation of exteriority, a whole that does not totalize its parts [...]. We can refer to these social wholes as "assemblages".

These assemblages, he continues, are emergent, immanent and contingent as the properties they express. Thus, there is no room for an "essence" of the assemblages that are individual, since the individuals are the parts that constitute the whole. The reference to the individuality clarify that all the entities at every scale (from *individual* persons to *individual* planet systems) are unique, historical aggregates. At first sight, it can be said that this point sounds controversial for those sociologists who endorse the added value of the comparative method in order to unfold the same "type" of assemblages. At the same time, the argument on individuality does not completely deny the possibility of comparison between assemblages, but invite one to take seriously in consideration historical and geographical differences. Fernand Braudel's work is quoted in order to reject the reification of heuristic models in favour of a modular scheme provided for socio-economic phenomena. In doing so, the famous *set of sets* is translated in aggregates of *individual* infrastructures, accountability techniques, situated spaces of exchange, temporal repetition of habits, traders, clients at different levels (from the cities to the international flows). The aim is to unravel what we usually put aside as general wholes: the State and the Market. DeLanda emphasizes the urgency to dedicate a specific commitment to the understanding of the production and maintenance of assemblages more than to the explanation of genuine causes of social wholes. This is not the only point of contact with a pragmatic sociology sensitivity.

Moreover, the way DeLanda conceptualizes the stabilization of assemblages leads to insights into the social sciences. In this case, the question is related to the processes that allows an individual aggregate being

stable and legitimate. The parameters, which are used to address the problem include both the degree of territorialisation/deterritorialisation and that of coding/decoding. As usual, the vocabulary is directly taken from Deleuze and Guattari in order to depict either the homogeneity of an assemblage or the conflicts between its parts. While the first couple of concepts are intended to address how singularity is stabilized in time and place, the second couple makes reference to "the role played by special expressive components in an assemblage in fixing the identity of a whole" (p. 22). It is interesting how DeLanda uses this meta-vocabulary to expose the "*imperialist pretension*" of the linguistic turn in humanities. The figured, self-consistency of language in respect to material realities are the ingredients of that representationalist epistemology which several leading STS scholars have contested from different theoretical perspectives (Latour 2004; Barad 2007). In chapter two, this *liason* is made more explicit through the performative argument, shifting from a linguistic to an ontological realm. Assemblages are considered, coherently with some Actor-Network Theory's assertions, performed by the entities that both constitute and affect them. A point of divergence seems to arise from the issue of relationality with respect to performativity dynamics, but we will deal with this later.

DeLanda insists several times on another *vexata quaestio*: the micro and macro analytical levels. A flat ontology, even flexible and scalable in terms of *assemblage of assemblages*, cannot be consistent with any form of analytical reductionism. This is why even Foucault and Deleuze are considered too worried about a social "totality", the first conceptualizing the pervasive "disciplinary institutions", the latter postulating the level of the "social field". However, the main target of the controversy seems to be Marx and his scientific-political heritage. Capitalism, as a whole, and the reification of those generalities, on which the thinking of the left still remains tied up, are, of course, criticized. The message of DeLanda is clear. Revolution can affect only partial, specific and heterogeneous assemblages that are just parts of a mind-independent reality. So, the claim of the ultimate dictatorship of the proletariat is "diminished" here to a more pragmatic and situated process of social change.

In the third chapter, an account of the evolution of the army and weapons is the narrative pretext to clarify how to reconstruct and unfold assemblages of assemblages. The interplay between the material/expressive dimensions, territorialisation/deterritorialization dynamics, and the changing in codes and parameters are addressed here. Within a complex conceptual framework, the distinction between properties and capacities is also displayed. This has been a pivotal point of reasoning since the first elaboration of Assemblage Theory. While properties are the proof of the irreducibility of entities, capacities are enacted when assemblages perform and are performed by the entities involved. As Graham Harman, the editor of the "Speculative Realism" book series noted,

the emphasis on capacities, which are actualized when relationality occurs between entities, seems to be risky in respect to the very realism of the ontology DeLanda deals with (Harman 2008, p. 378). As said, relationality constitutes a sensitive point within DeLanda's construction.

The second part of the book is centred on the heuristics of scientific fields, which means the distance between knowledge procedures (axiomatic versus inductive logic) and phenomena under scrutiny. These fields are treated as assemblages of assemblages. The heuristic of chemistry, for instance, is accounted in terms of an historical process of reterritorialization of its domain through the Periodic Table. Once again, the *cartographic* discussion of Delanda is quite close to those STS scholars who, in the last 20 years, have been committed to observing scientific laboratories "in action", as well as in deconstructing reified generalities such as Science and Nature. However, in this part of the book it seems that any attempt of translation of the ontological stances in terms of sociological inquiry appears quite difficult. A kind of meta-reflection on concepts, diagrams, and non-linear historical trajectories complicates the discussion on both how assemblages work and how these can be reconstructed. So, if "the objectivity of problems, their autonomy from their solutions, implies that what is problematic is not just what strikes our minds as being in need of explanation" (p. 178), what could be the role of a social scientist who feels inspired by this ontological framework? The book of Delanda does not provide a first-hand response, but instead, raises another helpful question: Which kind of political action stems from such a theoretical elaboration? I deem that the answer to the latter question sketches a hypothesis for the first one. If post-Marxism looks too materialistic, but not realistic enough in the eyes of DeLanda, I see that the work on *ontological politics* developed by John Law (2004), among other STS scholars, could be a fruitful path to follow. The *trait-d'union* is twofold: the real can be seen as ontologically multiple, while the method (i.e. the sociological one) can be seen as a partial and situated connection with the real.

If reality is not dependent on the mind of sociologists, and these minds cannot be reduced to the assemblages they take part in, sociologists are still not "innocent" and contribute to the making of reality (Law and Urry 2005, p. 404). This means that the speculative effort in unfolding reality is, in itself, a political action, even when it consists in the updated empiricism performed by Assemblage Theory.

References

Barad, K. (2007) *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning*, Durham, Duke University Press.

Bryant, L., Srnicek, N. and Harman, G. (eds.) (2011) The Speculative Turn: Continental Materialism and Realism, Melbourne, re.press.

Delanda, M. (1997) *A Thousand Years of Nonlinear History*, Zone Books, New York.

Harman, G. (2008) *DeLanda's ontology: Assemblage and realism*, in "Continental Philosophy Review", 41 (3), pp. 367-383.

Latour, B. (2004) *Why has critique run out of steam? From matters of fact to matters of concern*, in "Critical Inquiry", 30, pp. 225-248.

Law, J. (2004) *After Method*, London, Routledge.

Law, J. and Urry, J. (2005) *Enacting the Social*, in "Economy and Society", 33 (3), pp. 390-410.

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Benoît Godin and Dominique Vinck (eds.)
Critical Studies of Innovation. Alternative Approaches to the Pro-Innovation Bias, Cheltenham and Northampton, Edward Elgar, pp. 335

Alessandro Mongili *Università di Padova*

Studying innovation, I found processes addressed as "innovations", which did not change anything, and processes, which had a relevant impact, with many consequences, which were not considered "innovations" (Mongili 2015). What do we make then of the concept of "innovation" and its incongruities?

The book *Critical Studies of Innovation. Alternative Approaches to the Pro-Innovation Bias* (*CSoI*), edited by Benoît Godin and Dominique Vinck, is an attempt to remediate the lack of analysis concerning such incongruities and, at the same time, it is a relevant effort to develop a new research program, in order to include innovation within a broader framework, avoiding an ideological use of this concept.

The main issues tackled by *CSoI* are: (a) the reconceptualization of the very notion of innovation, as it appears in scholarship and in public discourse; (b) the analysis of the phenomena, which are excluded from current concepts of innovation; (c) the development of a theoretical proposal, *NOvation*, aimed at a more comprehensive approach to socio-technical phenomena, both included and excluded from the current definition of innovation.

The book is organized in four parts containing a total of seventeen contributions, enclosed within Godin and Vink's "Introduction" and "Conclusion".

In the first part, inconsistencies of the usual ideas of innovation are analyzed. For instance, Godin's opening article reflects about the fact that imitation has no place in current analyses of innovation; whereas Tiago Brandão and Carolina Bagatolli's one analyzes the double bind between technoscience and politics focusing on the innovation policies in

the "peripheral countries", implemented throughout the use of "best practices", seen as a-contextual idea of technological – and organizational – transfer from more developed milieus to peripheral ones. The contribution of Sebastian M. Pfotenhauer and Joakim Juhl is similarly focused on the connection between politics and innovation, however looking at the Global North and its state policies, like the National Innovation Systems.

In the second part, what is left out by the "pro-innovation bias" is taken into account by considering, for instance, "withdrawal" as proposed by Frédérick Goulet and Vinck. They brilliantly argue the insufficiency of a way of framing innovation as something, which is added. Indeed, innovation can also take place by subtracting. Through withdrawal complex dynamics "entailing delegitimization, disqualification and dissociation, all of which can lead to controversy" can occur because the elements to be "withdrawn are associated with entities or properties that are criticized or devalued and portrayed as incurring risks" (p. 110).

The third part is dedicated to reactions to innovations and especially to resistance. Within the traditional innovation frameworks, resistance is negatively labelled and it is often connected with backwardness, given that innovation is considered an "always good" process. By introducing a different point of view, for instance, Hernan Thomas, Lucas Becerra and Santiago Garrido analyze innovation not so much as a neutral improvement or stabilization of a socio-technical process, but as a matter of conflict, which involve technology itself. Karl-Heinz Leitner, in turn, in his "'No' and 'slow' innovation strategies as a response to increased innovation spread", describes how many companies prefer not to innovate, despite their public claims, thus finding a way to escape or to resist fashionable innovative push.

The last part of the book focuses on how to tackle the inconsistencies of the current idea of innovation. Among the various essays composing this part, Vinck's one shows how failure can be intended as a resource for technological improvement, whereas Lee Vinsel's one helps to widen the view of other incongruities of the idea of innovation by noticing that most of the technologies around us are relatively old, and most innovations are small and incremental (pp. 261-271), so that focusing on standards, forms of classification, taxonomies, law enforcement, and other regulatory activities results more relevant than innovation in order to understand technology. Carolina Cañibano, Maria–Isabel Encinar and Félix Fernando Muñoz's essay, in turn, explores the concept of *NOvation*, understood "not just [as] an outcome of action or an equilibrium state but as a dynamic socio-economic process which is different from innovation as conventionally defined" (pp. 240-241). This concept is thus "concerned with the theoretical treatment of the situation in which the ex post outcome of an action is the absence of innovation, either because the agent did not plan to innovate (…) or because it did not manage to achieve its innovative goals" (p. 243).

Besides other essays by Gérarad Gaglio, Johan Söderberg, Karl-Erik Sveiby, Martin W. Bauer, Beata Segercrantz, Karin Berglund and John Langrish, the book is framed by Godin and Vinck's "Introduction" and "Conclusion", where they emphasize the lack of accuracy of the concept of innovation, as well as its ideological distortion. Godin and Vinck discuss also the "pro-innovation bias", which is grounded in the shared belief that "innovation is good, always good", but also in a view of innovation as a planned process, following a rational vision, or state- or companies-oriented strategies. They argue that this frame produces a neglect of a huge amount of phenomena, relative to socio-technical processes. In order to recover these phenomena they propose to give a crucial relevance to imitation, incremental innovation and learning from failure, but also to "that major part of the iceberg composed of user engagement, re-shaping, adaptation and translation (not transfer) into situations that are generally specific and unexpected" (p. 322, see also pp. 2-3). Therefore, Godin and Vinck with *CSoI* clearly aim at developing a more comprehensive framework, in order to make room for other aspects of innovation, as well as for aspects that are not less relevant than innovation for understanding technology and for explaining the very innovation (p. 319), even if these aspects can appear mindless or sub-rational (p. 3). They propose to include all these issues into the concept of *NOvation*, thus developing a new field of inquiry, which gives the title to the book. The main justification for this turn toward critical studies of innovation is to free innovation, considered as a process, which does not necessarily produce outcomes, from any ideological framing, thus having the possibility to consider thoroughly conflicts, power and interests.

Because of such approach, *CSoI* pays a great attention to what we could called the "orphans" of the pro-innovation bias, like imitation, standards, maintenance and repair, incrementaility, failure and resistance.

As for imitation, Godin (pp. 17-31) shows that it has no place in innovation studies, despite it is a pivotal mechanism of diffusion, which is not necessarily passive, though often determined by uncertainty, as Brandão and Bagattolli remind us (p. 58). Imitation allows introducing a practice gradually in a new context, usually adapting, transforming or re-inventing it, so that while imitating, people torque artifacts and systems. Therefore, imitation as a process of diffusion is very relevant and complex: it presupposes interactions where practices are crucial.

Throughout the book, the idea that relevant technologies for our everyday life are mostly old emerges, and that ascertainment makes maintenance and repair, incremental innovation and standards very crucial research fields.

Since technologies are old, many activities addressed toward them are aimed at maintaining and repairing them, keeping them going, using, re-using, re-cycling, "rather than creating anything truly novel" (p. 261). Therefore, diffusion and "articulation work" are characterized also by widespread and continuous practices of care (p. 262) – a dimension

called "broken World thinking" by Steven Jackson (2014). Through such framework, our World is not viewed as ordered and stabilized thanks to the works of institutions, but as an arena of on-going processes, in which decay, vulnerability, material and organizational fragility of things and systems reign, so that a logic of care or fixing is at the very core of everyone's socio-technical experience – see, for instance, the *Tecnoscienza* Special Issue on "Maintenance and Repair" (Denis, Mongili and Pontille 2015).

The fact that most of our technologies are old entails that most innovations are not radical, but incremental, i.e. a change to certain part of an unchanged technological system or device, as it occurs with the automotive system (pp. 257-258), as already noticed by various scholars, among which John Urry. "Incremental innovation" is actually strictly related to maintenance and repair practices, because it can emerge in relation to these activities, when new solutions may be invented (Graham and Thrift 2007, p. 5). On the other hand, "incremental innovation" is also connected to standards, since, as already noticed by Susan Leigh Star, the stabilization that allows "incremental innovation" is made possible by standards and regulatory activities (pp. 257-258; 267).

As a result, failures have also their role in processes of innovation and change, since they point out limits or mistakes to innovators or other relevant actors. Therefore, failures can play a positive role in socio-technical processes, as shown in the present book by Vinck.

Finally, resistance to innovation is explored in detail by Bauer, by Leitner and by Thomas, Becerra and Garrido, who identify three forms of resistance present in socio-technical processes: an interpretive negotiation regarding technologies, a conflict between different or oppositive technologies, and generation of "counter-hegemonic public policies" (p. 183).

CSoI relates with many streams of researches about technologies going on today within and outside STS. It also offers a way to critically look at STS and to integrate them. Indeed, for long time STS used to enact their own "pro-innovation bias", so that analysis have been quite unbalanced, marginalizing use and articulation work. In SCOT approaches, for instance, the chain artefacts-problems-solutions-new artefact is seen in an evolutionist-like way, as directed towards stabilization, through a conflict of interpretations. As noted by Goulet and Vinck (p. 102), Actor-Network Theory (ANT) translation model, conceptualizing innovation as a "rearrangement of a variety of entities (actors, objects, institutions, norms, meanings), which mutually redefine themselves and their relations", allows to take into account complex processes, which can also include, for instance "the power dimension" (p. 188). Notwithstanding that, approaches like ANT tend to overlook the role of politics, by privileging local arrangements of actors. However, "the state continues to play a central role in framing contemporary public policy, including innovation policy" (p. 80), as noticed by Pfotenhauer and Juhl.

The opportunity of an integration of STS comes also from the fact that *CSoI* pays attention to pre-STS social researches on innovation, and above all to Everett Rogers' *Diffusion of Innovations* (1962) – from which also the expression "pro-innovation bias" is taken. Godin notices also that Rogers' idea of diffusion is not so different from Tarde's imitation, which is becoming today so relevant for STS.

Through all its contributions and all the issues it tackles, *CSoI* is able to promote a new research program, based on the idea of *NOvation*, articulated in four levels, or avenues. The first aims at clarifying the very concept of innovation; the second aims at developing a deeper inquiry on the mechanics of different forms of resistance and of discourses produced by or being part of these processes; the third aims at studying unintended consequences of mainstream innovation, often disruptive or unexpected; the fourth aims at fully considering the central role that regulations, maintenance and repair and standardization play in innovation processes.

I deem developing such research program very important. However, I think it should, on the one hand, focus less on economic dynamics, which risk to make the interesting contribution it can deliver unripe or not immediately fruitful for other fields of analysis, even if terminologically rich. On the other, more attention should be paid to design and making practices, which are closely related to use and to the care, involving aspects of de-assembling, assembling and re-assembling, in order to produce newly designed networks.

References

Denis J., A. Mongili and D. Pontille (2015) *Maintenance and Repair in Science and Technology Studies*, in "Tecnoscienza", 6 (2), pp. 5-15.

Graham, S. and N. Thrift (2007) *Out of order: Understanding maintenance and repair*, in "Theory, Culture and Society", 24 (3), pp. 1–25

Jackson S.J. (2014) *Rethinking repair*, in T. Gillespie, P.J. Boczkowski and K.A. Foot (eds.), *Media technologies: Essays on communication, materiality, and society*, Cambridge, MA, MIT Press, pp. 221–240.

Mongili. A. (2015) *Topologie postcoloniali. Innovazione e modernizzazione in Sardegna*, Cagliari, Condaghes.

Rogers E.M. (1962) *Diffusion of Innovations*, New York, The Free Press.

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Sophie Houdart
Les Incommensurables, Brussels, Zones Sensible, 2015, pp. 192

Assunta Viteritti *Sapienza Università di Roma*

"The Large Hadron Collider (LHC) [...] is the largest and most powerful particle accelerator in the world. It is in the form of a 26.659-kilometre ring and located 100 meters underground beneath the small town of Meyrin, on the border between France and Switzerland. It's a huge machine made of magnets, superconductors and acceleration structures that increase the energy of particles that circulate in it. Every day, two beams of particles circulate inside the accelerator in opposite directions at very high levels of energy before they collide. The particles, launched at 99.99999991% of the speed of light, complete 11,245 revolutions of the accelerator per second and collide approximately 600 million times per second. *Les Incommensurables* is a meticulous field study of this buried "cathedral". It offers us the opportunity of connecting with the mysteries and immensity of the universe and access something that, while it goes well beyond humanity, also contains it, a modern expression of transcendence."

The back cover of the book encourages the readers and the volume doesn't betray their expectations. Increasingly large instruments for studying the infinitely small, developed over decades across numerous fields of physics research; thousands of physicists from around the world working with and on the machine; thousands of practical observations conducted every day; the constant accumulation over time of data and knowledge produced collectively; the stratified construction over time of a machine that grows on itself in order to peer into the depths of matter: this is the world of CERN (European Centre for Nuclear Research) seen through the eyes of Sophie Houdart who, with a marvellous and lucid narrative, takes us, historically and geographically, inside, through and over the Large Hadron Collider (LHC). The LHC is an underground place where generations of physicists from around the world accelerate and intersect particles in a circular underground tunnel, twenty-seven kilometers in circumference and built one hundred meters below ground. The author leads her readers into the world of particle physics research with an ethnographic work conducted together with two artists – a photographer and a visual artist – in order to connect languages and create resonances and bridges between science and the outside world.

Sophie Houdart is an anthropologist and researcher at the French National Centre for Scientific Research (CNRS). She is the author of numerous books and research papers and is a passionate scientist of human and non-human things (Houdart and Thiery 2011), insects – such as the drosophile – included (Houdart 2008). She specialized in Japanese studies, taking a particular interest in methods of construction, on a local scale, of

modernity, innovation, science and technology. Her body of work is a journey from the scientific culture of Japanese microbiology laboratories to the world's largest particle accelerator. On the long trail of STS studies, her research focusses on the key area of laboratory studies (Latour and Woolgar 1979) taking us inside the world of science, like Lilliputians in the world of Gulliver. Scientific practice, in all fields, is not immune to be investigated by social sciences (as Robert Merton normatively prescribed).

In this book, Houdart leads and challenges her readers through a work of scale and measurement, from the large to the small, attempting to track all connections that make this passage possible (p. 8). She draws us inside and around a place that has acquired the image of a sacred monument of contemporary science, highlighting the massive nature of the LHC, while finding a language that allows us to appreciate the dizzying size of knowledge of the universe. She describes how the great machine, ever since its inception, has been a mobile process that seeks to stabilize connections in order to render commensurable the incommensurable.

The author takes us on a journey into the history and the geography of the CERN. We begin at the end of the 1950s, when the CERN was a European expression of Big Science. Governments, countries and populations were all involved in the decision to install it on the border between Switzerland and France. She describes the site inspections, the negotiations of accords, the controversies on a local and global level between administrators, politicians, international agencies, physicists and farmers with their pasturing cows, allowing us to witness first-hand the conception of a highly exceptional machine. In the same way that Bruno Latour, in his work on microbes and Pasteur, took us into the pasteurization of France, here Houdart shows us how the setting up of CERN and the LHC built the culture of modern physics in post-war Europe. The geography of the place became a laboratory, not in the open air – as in Pasteur's case (Latour 1984) – but underground and precisely on the border between countries and cultures, but also the geography of the place – le pays de Gex –, becomes a laboratory. It is indeed this incommensurable tension between territory and laboratory that Houdart describes (pp. 177-178).

In her description we see how Mertonian communitarianism challenged history and geography with a thousand compromises, the financial effort involved, the accumulation of projects, and the ceaseless struggle in the search for the Higgs boson – the subatomic particle involved in the formation of stars, planets and life itself after the Big Bang of 13.7 billion years ago – that fueled years of work at the LHC, culminating in the Nobel Prize for Higgs in 2013.

The author takes us alongside the work of various researchers, technicians, operators and, as readers, we become knowledgeable. We follow, in the trails of laboratory studies, the routine nature of the work of pro-

ducing scientific data and, thus, we see how permanent maintenance of the great machine require the uninterrupted production of data and the subsequent elaboration of the mountain of data produced. We follow her description of the daily and nightly work in the control center and see how routines break down whenever a critical mechanical failure occurs, which is also a significant event in the daily life of the workers involved. The work of the scientists moves back and forth between the machine, the data and the particles. It is an uninterrupted task of constant connections between the many work teams, where routine is everything and also nothing. What the ethnographer follows is the bricolage work, where the profession of the scientist fluctuates between the maximum precision of measurements in a highly-sophisticated device and the daily challenges of an artisan: the practical aspect of knowing how to do science. The scientists, who live night and day next the great machine (which is always under construction), are described by Houdart as the artisans that meticulously, and with daily care, live with and love their machine. Houdart's work shows how discovering the Higgs boson was not the result of some miraculous collision, but rather the final result of billions of statistical elaborations of billions of measurements taken in a constant work of refining, homogenising and monumentalising science, but also the work of a constant monitoring of the environmental conditions taking place above and around the CERN. The book takes us inside the machine rather than inside the theories of physics and highlights the symmetry of the social and material dimensions of the scientific work. Houdart gives us a highly impassioned description and displays sensitivity towards something that we do not understand, demonstrating the sociomaterial heterogeneity of the knowledge produced around this enormous scientific device.

In the first chapter, "Le pré des vaches" [The cows' pasture], the author writes as a historical anthropologist. She tells, through many details, anecdotes, photos and documents, how the CERN was born, and how farmers, scientists, and administrators of different countries found agreements, over time, to decide where to build the research center.

The second chapter called "Maillage" [Mesh] tells how as ethnographer she entered in the field. As readers, we are immersed in the daily life of the ethnographers who build trust and relationships with the scientists, technicians and operators who constantly monitor the territory above and around the CERN and that allow it to work properly.

In the third chapter "Le LHC, the vaisseau spatial et les opérateurs" [The LHC, the spaceship and the operators] the ethnographers get in the big underground spaceship. Night and day operators (the working scientists) are at work. They monitor the body of the machine and every one of its breath.

In the fourth chapter titled "Précisions" [Precisions] we follow the uncertain and the ambiguous work, in which the scientists are engaged: the measurements. What we find, through the storytelling of Houdart,

are distortions, deviations and continuous attempts to find alignments between the different measurements – forms of commensurability. This is the everyday work of scientists: looking for alignments between measurements.

The fifth and last chapter, "Grandeurs et certitudes" [Magnitude and certainties] assuming the non-visible appearance of the Higgs boson on the scene, and the quantification of the certitude of such appearance at 99,9999% proposes a summarizing reflection on the tension between commensurability and incommensurability across many scales that the precision of measurement of the CERN requires.

Assumed theoretically by Higgs from the beginning of the 60s, the boson now enter in the (im)material world produced by the LHC hard work. Though not seen, the detection of the traces left by its mass allows it to change mode of existence passing from a virtual to a real entity. But such detection has been made possible by the constant work of monitoring, controlling, maintaining of the scientists, technicians and operators above and below the pays de Gex, so wonderfully described by Houdart.

In 2017 the film *The Sense of Beauty* was released. It had been shot inside the CERN, under the direction of Valerio Jalongo. A steadycam takes us inside the mysterious, almost sacred international laboratory of research physics and face-to-face with the LHC, the poetic machine, the particle accelerator that allows us to approach the very brink of the Big Bang. The film goes inside the community of scientists working like bees in a hive on and around the machine. It creates a resonance between the vision of the machine and the works of international artists inspired by the discoveries of physics: art revealing the invisible of physics. As Sophie Houdart shows, the machine of the incommensurable is the result of enormous economic investments (estimated at more than six billion euros), the largest mobilisation in the world of the scientific community of physicists, the contribution of governments, computers, machines, ingenuity, theories, bodies and journals; what Houdart defines as "le texture de la cosmologie moderne" [the texture of the modern cosmology]. What will happen now, after the discovery that led to the Nobel Prize? Where will Fabiola Gianotti take the CERN after the invisible vision of the Higgs boson?

References

Latour, B. and Woolgar, S. (1979) *Laboratory life: The social construction of scientific facts*, Beverly Hills, Sage.

Latour, B. (1988) *The Pasteurization of France*, Cambridge, MA, Harvard University Press.

Houdart, S. and Thiery, O. (eds.) (2011) *Humains, non-humains. Comment repeupler les sciences sociales*, Paris, La Découverte.

Houdart, S. (2008) *La cour des miracles: ethnologie d'un laboratoire japonais*, Paris, PUF.

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Deborah Lupton
The Quantified Self. A sociology of Self-tracking. Cambridge, Polity, 2016, pp. 240

Letizia Zampino *Sapienza Università di Roma*

As Deborah Lupton argues in *The Quantified Self*, everyday practices and bodily functions have been monitored, measured and recorded since ancient times. These practices are now reconfigured trough self-tracking technologies, which are designed to be mobile, implantable and wearable, to collect and transform – automatically or not – the everyday elements of individual and urban life into graphics, statistics, and behavioral patterns.

The sociological literature on self-tracking is recently beginning to emerge in a fragmented debate, given the complexity of this open-ended phenomenon. Indeed, several scholars have criticized self-tracking technologies for the further level of surveillance trough data (Kitchin and Dodge 2011). On the contrary, others underline the reflexive impact of data upon the users through a constant self-improvement and self-management (Ruckenstein 2014), as well as the emergence of new ways of participatory democracy with the formation of citizen-science and citizen-subjects (Gabrys 2014). The book outlines the discussions on self-tracking practices from various sociocultural theoretical perspectives, using the concept of "self-tracking cultures" in order "to encapsulate the view […] that the practices, meanings, discourses and technologies associated with self-tracking are inherently and inevitably the product of broader social, cultural and political processes" (p. 1).

The first chapter deals with the various and huge range of devices and technologies engaged in self-tracking practices, from early lifelogging project to quantified self. The rise of small-scale computerized technologies inspired a variegated range of methods for tracking and displaying bodily elements until the emergence of the Quantified Self movement in 2007. The lifelogging project is the first form of self-tracking. Gordon Bell has used this term in 1998 to specify his habit of recording through technologies the different aspects of everyday life like conversations, e-mails, films, photos, and so on. Examining how often the terms "self-tracking", "lifelogging" and "quantified self" have been used in Google searches, Lupton establishes the popularity of the term "quantified self" that overtakes definitively the other two in 2012. The term "Quantified Self" invented by two editors of the magazine *Wired*, Kevin Kelly and Gary Wolf, becomes a general term for indicating self-tracking practices that

have an important role in health promotion and in everyday life.

Moreover, she shows that the list of self-tracking tools available to track daily activities is very vast from wearable, implanted and mobile technologies, to sensors embedded in bodies and in the urban space. Nevertheless, the author underlines that sociological academic studies on how people are engaging in quantified self-practices are very few.

In the second chapter, Lupton explores the different theoretical perspectives for analyzing self-tracking cultures, underling the importance of the sociomaterial perspective for studying the digital life. According to the author, sociomaterialism is relevant to understand the assemblages of human and nonhuman actors in order to analyze "the ways in which people incorporate objects into the routines of their everyday lives – or effectively how they become entangled in assemblages with these objects" (p. 41).

Then the author pays attention to the notion of *knowing capitalism* to denote the new form of global economy, in which digital data and particularly big data become commercially profitable because offer unprecedented opportunities to make predictions and trend patterns on human behaviors, healthcare and public wellbeing, healthy environmental and so on. Moreover, the self-tracking cultures promote the ideal neoliberal citizen, who must be responsible and capable of self-reflection and acquire self-knowledge. From another perspective, the self-tracking practices are just another approach to manage and control owns embodiment. Here, the attention is on the body intended as a site of identity and information that can be transformed in digital data in order to master the uncertainties of the contemporary society. Nevertheless, the digital data raise important privacy issues. As Lupton underlines, some scholars used the Foucault's concept of panopticon in order to highlight "how external rationales of surveillance may be internalised, so that people engage in self-monitoring not only because they can never be sure whether hidden others are watching them, but also because they have accepted these rationales as part of practices of the self" (p. 59). This form of invisible but participate surveillance is defined *dataveillance*.

The third chapter presents an overview of the ways in which self-tracking cultures are shaping the concepts of self and body. Therefore, she reports some interview and articles in which self-trackers underline the achievement of self-knowledge, self-management, and self-improvement through the uses of these technologies. In this sense, self-trackers monitor reflexively their own selfhood, who becomes viewable, quantifiable, thus comparable through digital data, endorsing the ideal notion of responsible, productive, flexible and efficient citizen. Therefore, the body is portrayed as a machine that produces measurable and quantifiable data, which can be used to understand selfhood in a scientific way. At the same time, self-tracking technologies are personal and biographical, becoming an archive of everyday practices, interactions and bodily functions, so a repository of significance and emotions.

The author underlines that the uses of these technologies are reconfiguring the concepts of public and private. They promote a voluntary self-surveillance with the possibility by second and third parties to surveil private life, but also the opportunity to extend citizens' control into public spheres. According to Lupton, users become part of heterogeneous network of human and nonhuman actors, in which the opportunity to share experiences offers both new ways to facilitate a participatory surveillance, but also the generation of reflexive self-monitoring practices in order to became expert users of their selves.

The fourth chapter explores the diverse aspects of keyword "data". Recording personal information, the users generate assemblages' data that can be useful to visualize and materialize with graphs or statistics some elements of body/self not otherwise perceptible, in order to change or just analyze their behavioral patterns in a reflexive way. Beyond, Lupton emphasizes that even if the numbers are presented as neutral and objective they are always socially constructed.

The last chapter discusses the political and privacy issues arising from the spread of big data and predictive algorithms. Indeed, the small data aggregated in big data are valuable for second and third parties in order to monitor and control but also to manipulate the population. In this perspective, there is a fine difference between pushed and imposed self-tracking.

Hence, some agency, particularly health-insurance agencies, are persuading people to participate in self-tracking practices. As Lupton underlines, the type of pushed self-tracking adheres to the soft power of neoliberalism governance, that encourage citizens to engage in the approach of promoting and preventive health in which the focus is on the develop of self-responsibility in order to achieve the ideal self. While imposed self-tracking can be used in drug programs, or in family law, but also in some workplace. This arise controversial consequences and important political issues about the loss of privacy. However, there is a communal self-tracking, for example the community of Quantified Self movement or the initiatives of citizen science, in which the open and accessible data sets are seen as a way for the citizens to learn from data shared by others and to plan their activities in the smart city. Moreover, the users can respond at the dataveillance with resistant strategies as the choice of certain devices or the use of several software that obscure personal information with the production of ambiguous and false data.

This book incorporates different theoretical frameworks, in which the sociomaterial perspective is represented as one of the most useful for analyzing "the nature of humans' intertwinings with technologies" (p. 39), and for capturing the different aspects of self-tracking cultures. Adopting a thorough STS theoretical framework means, instead, considering cultures as elements of heterogeneous assemblages, in which technical, social, and conceptual bits and pieces are not distinct. In this way, techno-

logical practices exist only in a heterogeneous alignment, in which science and technology – technoscience – work by translating material and social from one form into another (Latour 2005). This could suggest studying the intra-actions between humans and nonhumans actors, objects and subjects in their mutual constitutions, and rethinking the notions of embodiment that "is a matter not of being specifically situated in the world, but rather of being of the world in its dynamic specificity" (Barad 2007, p. 377).

Nevertheless, the book has the merit of being a map of the emerging and fragmented self-tracking literature. It looks like a captivating challenge for STS scholars, called to focus on the ontological and epistemological strength of techno-scientific approaches, in order to put into question the digitalization processes.

References

Barad, K. (2007) *Meeting the universe halfway: Quantum physics and the entanglement of matter and meaning*, Durham, SC, Duke University Press.

Gabrys, J. (2014) *Programming environments: environmentality and citizen sensing in the smart city,* in "Environment and Planning D: Society and Space", 32 (1), pp. 30-48.

Kitchin, R. and Dodge, M. (2011) *Code/space: Software and everyday life*, Cambridge, MA, MIT Press.

Latour, B. (2005) *Reassembling the social: An Introduction to Actor-Network-Theory*, Oxford, Oxford University Press.

Ruckenstein, M. (2014) *Visualized and interacted life: Personal analytics and engagements with data doubles*, in "Societies", 4 (1), pp. 68-84.