TECNOSCIENZA

Italian Journal of Science & Technology Studies

ISSN 2038-3460

1/2012

Molecular genetics - Laboratory practices - STS in Norway - Participatory design - Azioni tecniche - Piaceri macchinici

copertina / cover

Ospedale a mare, by Andrea Napolitano

"Seaside Hospital" [Ospedale a mare] gathers a set of dismissed and abandoned medical-scientific instrumentations belonging to an old health facility in the Lido of Venice. Among the gathered instrumentation I decided to fix, appropriate and re-enact only those devices whose sound and use made them employ for medical monitoring and reanimation. More in detail the installation is composed by:

Two blood pressure monitors, CRITIKON8100 and AO3316; two ECG monitors, KONTRON 105 and SOXIL 8570; one oxygen concentrator, COMPANION 492A.

Through these tools I assembled a totem of machines able to track electrical impulses at a close distance and elaborate sounds within a computer based video interface. The operation of reactivation and transition from a former health facility to an artistic performance made those machines "reanimated", passing from a state of abandonment to a "recovery" which gives them a new function. Any impulse recorded by the totem is transformed in an audio-video signal projected on the wall of the room. The projection, inspired at the devices original interface, takes place in five different visual settings every 5 minutes: starting from a setting closer to the primary devices use, the projection goes on gradually toward a more abstract interface in order to retrace the two life paths of these objects.
"Seaside Hospital" is a site specific installation, realized for the Bevilacqua La Masa Foundation in Piazza San Marco in Venice. It aims to rise the interest of the audience, showing an often unknown or overlooked feature, yet fundamental: the urban change taking place in Venice over time, which has stressed its spectacular dimension, erasing history and ordinary experience. The public health facility of the Seaside Hospital, built during the '30s of the last century in the Lido of Venice, has been closed in 2003. The estate has been sold to privates for the construction of the latest touristic resort. Thus, at the moment the hospital has become a sort of abandoned city museum, where filing cabinets, microscope's slides, obituaries and medical relicts display themselves and inhabit a surreal reality of recent antiquity.
By showing the abandonment in which various sites and buildings lie in town, the installation becomes a cue for critical reflection as well as civic tribute to public spaces in the Venetian area.

Tecnoscienza è una rivista scientifica che indaga i rapporti tra scienza, tecnologia e società. La rivista è semestrale, open access e peer-reviewed; la rivista è gestita da un Comitato di Redazione, con la supervisione di un Comitato Scientifico Internazionale.

Tecnoscienza *is a scientific journal focusing on the relationships between science, technology and society. The Journal is published twice a year with an open access and peer reviewed policy; it is managed by an Editorial Board with the supervision of an International Advisory Board.*

Tecnoscienza is promoted by **STS Italia** (www.stsitalia.org)
Società Italiana di Studi sulla Scienza e la Tecnologia
Tecnoscienza c/o STS Italia, Dip. di Sociologia, Via Cesarotti, 10-12, 35100 – Padova – Italy
www.tecnoscienza.net – redazione.tecnoscienza@gmail.com – ISSN 2038-3460

TECNOSCIENZA

Italian Journal of Science & Technology Studies

Vol. 3, Nr. 1, June 2012

Table of Contents

Essay

The Molecular Genetics Testing Lab

On the Fringe of Personhood

Daniela Crocetti

Abstract This article proposes to consider the deterministic potential of genetic testing by confronting the genetic "mystique" portrayed in popular culture (and in certain scientific literature), in which DNA is seen as the soul of the cell and genes as master molecules (Lindee and Nelkin 2004), with molecular genetic testing laboratory practices. We will look at the question of what genetic testing does, that is, the practice of genetic testing itself. The particular molecular testing laboratory we will be looking at tests for genetic markers associated with DSD (Disorders of Sex Development). The testing process reveals a previously invisible component of the body through the aid of technology, and a complex picture unravels regarding the role genes play in being considered "un-well".

Keywords 5-alpha reductase; bio-sociality; DSD; genetic testing; laboratory studies.

Introduction

Genetic testing (the search for the presence or absence of genetic material) and genomic testing (the search for factors that may encourage the expression or action of genetic material, Dupré 2004) have entered the field of medicine in numerous ways (O'Malley and Dupré 2005; Lindee 2005; Ankeny and Parker 2002). Genetic and genomic markers can indicate a family history of biologically-linked diseased (as opposed to purely environmentally-linked), can help understand if organ donors should be of similar or mismatched ages (based on mRNA levels), or can indicate the possible variation of developmental pathways in the body, among many other diagnostic practices.

In this article we will be looking at genetic testing in relationship to developmental pathways. More specifically, we will be looking at how this biological data is framed in the context of the laboratory setting and laboratory practice. We are interested in the potential "special status" of DNA/genetics, and the use of deterministic versus systemic models in the framing of genetic material.

TECNOSCIENZA
Italian Journal of Science & Technology Studies
Volume 3(1) pp. 3-28 - ISSN 2038-3460
http://www.tecnoscienza.net

T/S TECNOSCIENZA Italian Journal of Science & Technology Studies

Greatly simplifying, we can describe two extremes of biological models: the deterministic model in which a singular biological component is believed to determine complex biological and/or social factors; and the systemic model in which the body and social factors must be understood as interactional and mutually dependent (regarding genetics see Allen 2002; Portin 1993). The particular laboratory we will be looking at tests for genetic markers associated with DSD (Disorders of Sex Development, referred to as Intersex syndromes from 1917 to 2006; Dreger and Herndon in morland 2009, pp. 205-209). The genetic/biological data found can shift the gender-assignment of a very young individual, and therefore has some very strong implications for the individual's life path and experience of embodied identity.

The relatively new aspect of this biological information in clinical settings (in our case from 2000) begs numerous questions. The testing process reveals a previously invisible component of the body with the aid of technology (Lock, Young and Cambrosio 2000; Clarke *et al.* 2010). Many of the questions that arise revolve around the biological developmental model of the body (deterministic or systemic), and the identity implications of the DSD diagnosis. How is the genetic data framed in the lab? Is it taken to be determining factor in forming the body? How is it interpreted regarding identity factors such as gender identity? Is it seen to be a biological piece in a larger complex puzzle? What is the role of laboratory practices in influencing the significance given to the biological data? What are the implications of the varying positions?

The practices in the lab, aimed at individuating a specific genetic marker that is directly linked to diagnostic nomenclature, points to a deterministic framework. The genetic marker equals the syndrome. And yet, a complex picture unravels regarding the significance of both the syndrome and the role genes play in being "un-well". As a colleague suggested, the genetic testing itself emerges as an artifact that participates in a complex web of techno-scientific practices. Interpretations of the genetic data vary from patient to physician, and from discipline to discipline. We will be looking at the overlap of interpretations in this particular genetics lab, which veers from the deterministic model one might assume.

1. Genetic testing, identity metaphors and laboratory practice

Genetic testing raises a red flag in a multitude of disciplines because it is assumed to propose a biologically deterministic model of personhood and pathology. What we are talking about is the conceptual difference of being genetic diseased (marked as defective in the presence of genetic variance; Billings, Rothstein and Lippman 1992), potentially un-well due to the statistically probability associated with the genetic marker, or simply diverging from the statistical norm regarding a genetic marker (with or without associated biological or social "problems"). Disability theory warns of a new eugenics (Taussig, Rapp and Heath 2003; Shakespeare 2005), in which pre-natal genetic testing could be

used to eliminate undesired and/or socially stigmatized (and often misunderstood) biological difference.

Rose and Novas (2004) discuss the concept of biological citizenship, pointing to patient groups where group identity is based on a biological aspect, such as a genetic marker (variation in a genetic sequence), or a genetically related disease. The genetic marker is pictured as representing a biological entity that has a special status above other biological markers (blood type, hormone levels, etc.), somehow deeply tied to identity. The potential special status of genetic markers has lead policy makers in various nations to propose bioethical guidelines that regulate genetic biobanks as if genetic material were different than other biological material[1].

Genetic material contains information that potentially (symbolically and biologically) refers not only to the individual but also their family (through hereditary markers) (Clayton 2003). This consideration, combined with the special status given to DNA (and genetics) as a primary biological marker in explaining personhood, makes genetic material seem especially sensitive and personal. DNA has rapidly acquired vast symbolic currency in contemporary society, interpreted as the "book of life", or the biological key to who we are (Lindee and Nelkin 2004). The public image of genetic information is often biologically deterministic, relating to individual, family and group identity.

The term biologically deterministic can mean two things: a theory that interprets life from a strictly biological point of view; or a theory that proposes biological factors determine how an organism (such as people) develops, behaves, interacts, etc, to the exclusion of social and/or environmental factors. Popular discourse will often utilize a deterministic image of genetics, transferring the rhetoric of heredity, shared family traits and behavior, to this biological marker: "he's hot headed, it's in his genes" (Lindee and Nelkin 2004).

Biological scientists, however, claim the charge of biological determinism is a simplistic accusation, seeing as a large part of contemporary genetic research looks directly at the interaction between genes and the environment. And yet, biological determinism is the explanatory key between the subtly differing concepts of *being* genetically diseased, seen as unhealthy, flawed, pathological, and *having* a genetically linked syndrome, seen as a possible difference in the development of the organism which may or may not affect the function of said organism.

In this article we will approach the genetic testing (and biological determinism) debate from a different angle; the laboratory practice of genetic testing. In this manner we can directly observe if and how deterministic theories

[1] UNESCO International Declaration on Human Genetic Data (2003), http://www.eu-patient.eu/Documents/Projects/Valueplus/Patients_Rights.pdf, accessed 11/03/2011; Additional Protocol to the Convention on Human Rights and Biomedicine, concerning Genetic Testing for Health Purposes (2008): http://www.jus.uio.no/english/services/library/–treaties/03/3-04/genetic_testing.xml, accessed 11/25/2011.

play out in the practice of genetic testing. Geneticists often propose a systemic biological framework, identifying genetic markers as important biological information that is dependent on an interactional system. For instance, epigenetics looks at the environmental factors, such as heat or timing that affect the manifestation or expression of genetic material, declassifying the genetic material as the determining agent; Evo–Devo genetic theory focuses on evolution and development, yet again proposing a multi-dimensional model regarding the relation of the genotype (genetic composition of the organism) to the phenotype (composite of an organism's observable characteristics or traits) (Jablonka and Lamb 2005). Both of these biological theories dismiss neo-mendelian deterministic models that claim one gene directly represents one biological (or social) trait. If genetic material is declassified from "the book of life" to part of an intricate whole, it loses its potential as the new eugenic threat.

This article proposes to consider the deterministic potential of genetic testing by confronting the genetic "mystique" portrayed in popular culture (and certain scientific literature), in which DNA is seen as the soul of the cell and genes as master molecules (Lindee and Nelkin 2004), with molecular genetic testing laboratory practices. We will look at the question of what genetic testing *does*, that is, the *practice* of genetic testing itself.

As originally proposed by Kuhn (1962), laboratory practices reveal the boundaries of the scientific habitus, and thereby the rationale that creates the practice. Latour and Woolgar (1979) argue that by observing scientific practice we are not discussing whether a scientific fact is valid, but what scientists (and the network of actors involved in reinforcing a scientific fact) think this fact *does* and means. The *meaning* of the scientific object is where the scientific "fact" is transformed into a social object and practice (Latour 1987). In the molecular genetic laboratory, the digital bio-data results of the testing processes are translated into the social realm when practical significance is given to the material being manipulated. Genetic test results in-of-themselves have no innate meaning, they acquire meaning in context.

We hope to demystify the hidden meaning attached to DNA in social discourse in and out of the lab. Medical practice essentially reflects a *useful* model of biological theory, aimed at achieving a specific result. Genetic testing is aimed at finding a biological marker that hopefully inserts itself into a therapeutic protocol that better serves the patient. At the current state of technology genetic testing primarily serves as a diagnostic tool. By achieving a more accurate diagnosis one hopes for better medical care.

Whether the genetic material is interpreted deterministically or systemically can greatly alter the therapy model offered to the patient. In our case, it can also affect the gender assigned to the patient. In addition, how the genetic information is communicated greatly changes the interpretation, or stigmatization, of the diagnostic category. We worry about biological determinism in genetic testing for two primary reasons, the potential threat of a new-eugenics (the elimination of potential humans due to genetic/biological variance), and the conceptual reduction of complex traits such as identity and

behavior to a handful of bio-data. However, are these deterministic concepts part of the theory embedded in molecular genetic laboratory practices? The answer itself is somewhat ambiguous. A deterministic vision can inform the rationale to perform genetic tests, and in turn, inform their interpretation. In some cases the genetic data will shift the deterministic model from some other part of the body to itself. Simply, the genetic artifact is given meaning through a complex web of techno-scientific interactions informed by numerous theories regarding biology, the body and their social relevance.

2. The power of representation

The symbolic power of the gene, DNA and genetic medicine have been explored by Susan Lindee and Dorothy Nelkin (2004), who claim that the "DNA Mystique" has captured the medical and public fancy to a point where the genetic component of a cure or research program *in itself* becomes a marker of validity. This is possible because DNA is portrayed as the symbolic biological *locus* of heredity, the passage of traits from one generation to the next. People often say: "it's in his genes", when someone acts like their parents or family. In molecular biology the passage of complex traits is believed to be an intricate process involving much more than just DNA. However, symbolic logic pushes DNA, and genes, to represent even complex social traits such as behavior and identity.

Lindee and Nelkin argue that genetic symbolism is powerful because it fits so easily into other social metaphors: that kinship is in the blood, that race is biological, that people have "natural" abilities, that physical disability is a sign of overall dysfunction, and so forth. They are quick to point out that these social metaphors are not based on scientific facts, but *use* scientific facts to reinforce the naturalization of social inequality. The overlapping symbolism in eugenic discourse and genetic testing makes the terrain of what genetics *means* and *does* uneasy.

Lindee (2005) discusses the positivist rhetoric surrounding genetics in *Moments of Truth in Genetic Medicine*, rhetoric that offers genetics as a potential miracle for every ailment. Genetic medicine is currently primarily genetic testing, which offers itself as a diagnostic tool that does not add any new therapeutic option to pathology treatment. However, diagnosis itself can be a fundamental aspect of treatment. Lindee points out how patient groups will lobby for genetic research, feeling that they are not being taken seriously otherwise. A genetic marker can put a disease or syndrome on the map of pathologies, creating funding systems, attention, etc. The genetic marker, however, has the primary function of imbuing pathology with an added biological reality. With a genetic marker one can say "I have this" with certainty, as opposed to referring to a set of symptoms.

There is a part of genetic rhetoric (and practice) that is inherently deterministic. The gene was conceptualized, before it was actually considered a

physical entity, as a biological unit of heredity (Morgan 1935). It was proposed as key feature in dictating development. Yet, from the very beginning of what we consider genetic research, the deterministic power of the gene was ambiguous. Genetic research flowered in the fields of agriculture and animal husbandry, where both line-purity and advantageous mutations are sought (Theunissen 2008). Experiments in creating a productive product in these fields (before and after genetic theory) had always highlighted the possible combination of negatively perceived traits with positive ones. In addition, early drosophila fly experiments indicated the role of environmental factors (timing, heat, etc) in gene expression or phenotypic development. The gene was given a dominant and *necessary* role in development (Maienschein 1984), yet there were always other factors to consider.

Of course this symbolic dance with undisputable biological *truth* and identity is what makes the genetic discourse so interesting and tricky. A genetic marker may often aid a linguistic shift from saying, "I *have* this syndrome" to "I *am* this characteristic" as can be the case with mental illnesses and physical differences (I have/am schizophrenic/disabled etc.). Based on the social use and/or prejudice surrounding a medical diagnosis, patient groups might seek or shun genetic testing. In both cases, the genetic marker is imbued with the power of the final truth of biological explanation (Rapp 2000).

Since genetic testing was introduced in DSD diagnosis[2] genetic markers associated with certain syndromes have become biological markers that indisputably *confirm* the presence of said syndromes. The genetic data will generally trump other biological data in the choice of gender assignment. Depending on the position taken by the physician, the genetic data can be seen as more relevant than other aspects of physical gender presentation or expressed gender identity (in older patients).

In some cases the genetic personhood metaphor has been extended to include complex social traits such as behavior and sexual identity. Popular science reporting is rife with discovery of genes for bi-polarism, homosexuality, compulsive behavior, and so-forth. Many molecular biologists argue that it is currently impossible to find a singular biological marker for complex traits, that may or may not have biological components, such as behavior. Utilizing Lindee and Nelkin's argumentation, we could imagine that it is the DNA mystique itself that creates research funding for projects that are potentially scientifically unsound and have no therapeutic value. A prime example is the search for the homosexual gene.

On a lesser scale, DSD patients have seen much funding moved towards identifying genetic markers. Italian DSD patient group members (AISIA and KIO[3], representing respectively Androgen Insensitivity Syndrome and Kline–felter's syndrome) have participated in genetic data collecting for the euro DSD network. While one AISIA member is intrigued by her genetic status (she has a

[2] In the year 2000 for the Italian university hospital used as case study in this article.
[3] http://www.aisia.org/home.html; http://www.klinefelteronlus.it/

pen-pal in Canada with the same genetic marker), she wonders how this genetic information is going to help her with the issues associated with the syndrome, such as adequate hormonal replacement therapy, sterility and the social stigma. She and others in the group hope that a new reading of genetic variance can help reduce the stigma associated with DSD. KIO founder echoes AISIA's concerns, hoping that money will be put towards quality of life research, such as on the health effects of hormones. He and other members of KIO indicate that increased chromosomal testing has helped reduce the stigma of Klinefelter's syndrome specifically because it has shown how common it is (estimated at 1:700 male live births; Fausto-Sterling 2000, p. 53).

Genetic testing can be broken into two primary categories, prenatal and post-natal. Pre-natal testing carries with it the negative association with the eugenics movement and the moralization of normality. Nikolas Rose (2006)[4] discusses the nuance of genetic diagnosis as being "potentially unwell", highlighting the link between the predictive nature of genetics and identity. In a similar manner Margaret Lock (2005) refers to the increase of genetic testing as the new divining, a new diagnostic tool that indicate probabilities, much like the ancient Greek oracles. Pre-natal testing reflects not only our expectations of what technology, or bio-medicalization, should be able to do for us (Ettore 2000), but also the expectation that we *reject* a perceived imperfection (Rapp 2000). Ryna Rapp postulates that this "modern divining" (Lock 2005) incurs social pressure *to do something* about this advanced knowledge. Rapp indicates that potential mothers will be shamed or held accountable for choosing to continue a pregnancy where prenatal testing has revealed a genetic variance associated with syndrome categories.

3. The power of representation. Visualizing molecular genetics.

The laboratory setting we will be looking at instead deals primarily with post-natal testing. Therefore the eugenic threat is an unpleasant shadow that has already been avoided. The genetic markers in question, that we will meet in the next section, evoke Rose's conception of bio-sociality. The genetic markers are laden with the *potential* for the individual to be un-well, as well as implications regarding identity. The genetic markers sought by this specific laboratory have, in a relatively short time, wed themselves with the definitions of the syndromes they represent. The markers therefore affect the identity of the individual, *and* the identity of the diagnostic category.

In genetic testing, DNA is visualized, converted from an invisible component in a blood sample to a visible digital representation. As Luc Pauwels (2005) reminds us, these scientific visualization practices seek not only to render the invisible visible, but also to provide a scientifically useful representation of the biological material. DNA material is converted into bio-data through a complex

[4] Building on his work with Carlos Novas (2000).

series of processes that involve chemical additives, light wave technology and electro-processes. One of the final steps in genetic testing, genetic sequencing, utilizes DNA electrophoresis to separate DNA fragments by size. The end result of this process visualizes the DNA strand as a digital list of letters that represent the nucleotide sequence.

Genetic testing (in its many guises, from adult diagnostic testing, to pre-natal testing, to forensic testing) provokes a wide variety of debate and conflict of opinion, which can be considered on two axes. The scientific axis questions the accuracy and utility of a mechanistic representation of genetic material. The social axis questions the relationship of DNA to personhood and identity. Can a digital representation of biomaterial really tell us who we are, what is right or wrong in our body, whom we came from? The reductionist image of DNA irks our sensibilities surrounding our complex sense of identity, yet it also irks branches of science that insist on a complex model of the organism.

Due to the complexities of development, in certain DSD cases, the "sex" chromosomes (XY,XX) do not "determine" the sex of the individual, let alone their gender. Biological sex has come to be simplistically represented by the sex chromosomes since their "discovery", alternatively represented by the gonads, the genitals, or secondary sex characteristics throughout history. US 1920s and 1930s "sex" hormone research indicates perhaps more accurately that biological sex is the *total* impression of the differences in male and female bodies (Rechtor 1997). The genetic marker linked with a given syndrome is associated with the development of all the biological components of sex, as well as the statistical probability of gender identity.

Genetic testing superficially seems to offer a biological model, which follows the neo-mendelian 'one-gene one trait' model, implying a deterministic and mechanistic vision of DNA, life and the body. This is in contrast with epi-genetics and other branches of molecular biology that view genetic material as part of a systemic process, in which the mere chemical structure of nucleotides does not in itself "code" for anything if taken out of its specific biological context (Jablonka and Lamb 2005). Epi-genetics points to simple factors, such as temperature and timing, which can drastically change the development of an organism while maintaining the same genetic material. Epigenetic, but also bioethical, historical and sociological discussions around the practice of genetic testing question the limits of the mechanistic model of genetics (Ankeny and Parker 2002). The sociological critique mirrors the epi-genetic critique; that life cannot be encapsulated in one biological process (Lippman 1991; Goodman, Heath and Lindee 2003).

In most cases, genetic testing is not seeking to mechanistically define the individual through its genes, it is instead looking for a genetic marker that will confirm what the medical team already thought was the case based on anecdotal information and other symptoms. Finding the genetic marker of a suspected syndrome can greatly aid treatment by canceling-out the use of dangerous or useless therapies. That DNA, genetics, and genomics have taken on more symbolic meaning than the materials themselves can actually provide or perform

is beyond a doubt. The reification of genomic information has lent itself on one hand to a positivistic faith in what this information can provide for humanity, and on the other, a plethora of bioethical quandaries about how to deal with the rise of the new quantities of biological data being gathered and stored.

The scientific visualization process of DNA proposes genetic material as an important biomarker, worth both the economic and temporal investment. Yet it also proposes DNA as an inert object, which must be manipulated in order to be visualized and interpreted, and therefore qualified as bio-data. The DNA manipulation/visualization process is mechanistic, expected to produce consistent repeatable results. Testing for specific genetic markers is also atomistic, in that it practices the belief that biological objects are important and relevant separate from the organism and separate from their dependent biological processes (Allen 2002). And yet, that the biological entity is expected to be consistent and atomistic in a mechanistic testing process, does not imply that the mechanism of the biological entity itself is expected to be atomistic and deterministic.

4. Creating Data

This description of the average process of molecular genetic testing comes from a two-year period of intermittent observation in a University Hospital in Italy. I alternately shadowed the four team-members through their daily routine, as a participant (note-taking, question asking) observer. I charted the arrival of several patient cases/blood samples from their arrival to the communication of the test results/diagnosis to the team physician. I also charted the testing phases, the interaction between the lab members, and the interaction with the larger DSD team. Through situational analysis (Clarke 2005), I hoped to decipher what the team members thought they were doing. What they thought was the aim of the testing procedure, what was a good result, good practice, but also what they thought the role of this bio-data was in the overall treatment procedure. Beside this particular focus on the molecular genetics lab, I also frequented Italian DSD patient groups, and conducted in-depth interviews with other members of the DSD team.

The lab I frequented is a primary Italian lab that tests for a handful of genetic markers that indicate certain DSD (Divergence/Disorders of Sex Development) syndromes. The lab can be considered primarily indicative of the testing protocol for these genetic markers, secondarily of Italian laboratory practice. As Mol (2002) indicates in her own research, this laboratory setting is neither exemplary nor unique to the national context, but provides interesting insight into the practices involved.

This lab receives blood samples from all over Italy, rendered doubly anonymous through a coding system. Molecular testing became routine for DSD in this university hospital in 2000. Since then, the DSD team has been expanding their research on the other DSD health factors implicated by the genetic markers.

At this point, however, molecular testing primarily supports diagnosis accuracy and corresponding gender assignment. They test for 6 genes that are implicated in CAH (Congenital Adrenal Hyperplasia)[5], AIS (Androgen Insensitivity Syndrome)[6] and 5-alpha reductase (Syndrome name and genetic marker are the same)[7]. As we will briefly discuss later, the molecular testing has had the unexpected repercussion of diminishing irreversible non-consensual childhood surgery (one of the bioethical hotspots in DSD treatment), specifically in 5-alpha reductase and PAIS[8] (Partial Androgen Insensitivity Syndrome) diagnoses. from the 1950's onward most centers throughout the world adopted John Money's Optimal Gender of Rearing (OGR) care model (Dreger 1999; Fausto-Sterling 2000; Karkazis 2008). In Money's model social factors such as the childhood rearing environment trump biological factors in the establishment of gender identity (a model which was greatly appreciated in the 70's as it seemed to favor social determinism). However, Money saw the genital *form* as being the most important factor in influencing the rearing environment (unambiguous treatment as one gender or another) and established the protocol of early childhood genital surgery (preferably before the age of three to avoid memory of the experience) (Dreger 1999; Karkasiz 2008) that also lead to a policy of secrecy in which the patient (and at times the parents) was left in the dark regarding their diagnosis and treatment. Unfortunately genital surgical techniques often require

[5] CAH indicates the hyper-activity of the adrenal gland, leading to a high production of steroid hormones (such as hydro-testosterone), that can lead to: salt wasting in some forms; in XX children mild to severe masculinization of the genitals in-uterus, or after birth; early on-set puberty; unusual hair growth. This syndrome is clinically subject to the highly controversial early childhood genital surgery (to de-masculinize the genitals, similar to clitorectomy) and stigmatization of "ambiguous" genitals. It has also suffered clinically from the confusion and erroneous overlap of concepts such as gendered behavior, gender stereotypes (especially regarding energy levels and aggressive play), gender identity, and sexual identity. Varies from 0.35% of Yupik Eskimos to 0.0005% New Zealanders with an estimated average of 0.00779% (Fausto-Sterling 2000). As with most DSD syndromes CAH was subject to a legacy of secrecy, lack of informed consent and shame.

[6] AIS indicates the insensibility to androgens in a XY individual. In the complete form the individual will have "male" gonads and "female" genitals and secondary sex characteristics (1:13,000). In the partial form the genitals may be considered "ambiguous" and subject to early childhood surgery (1:130,000). This syndrome is subject to gonadectomy for psycho-social (not functional) motives, vaginal lengthening surgeries (now dilation is offered) and stigmatization due to the belief that XY chromosomes "means" a person is a man. AISIA is the Italian patient group. http://www.aisia.org/home.html.

[7] 5 alpha-reductase, is caused by a deficiency in the enzyme 4 steriod 5-alpha reductase. In the Dominican Republic it is known as Guevedoche (lit. balls at twelve), due to increased and different forms of androgens at puberty that cause the body to "masculinize". In cultures where this syndrome is common, some individuals raised as girls retained a female gender identity, however most take on a male gender identity (more advantageous in the social hierarchy, Herdt 1996, p. 437). In western bio-medical culture this syndrome is thought to lead to the development of a male gender identity (see Hertz 1996).

[8] Often used as a catchall diagnosis, once very diffused, now primarily in the absence of a genetic marker.

maintenance or repair (e.g. dialation of the vaginal canal), implicating numerous medical visits and examinations often in front of numerous medical students (critically described as medical stripping; Morland 2009) (Dreger 1999), of course children/patients intuit that something is "wrong" with them, and/or their genitals (leading to shame and stigma; Morland in morland 2009, pp. 285-312). In addition, most patients were assigned the female gender, simply because the female genitals were considered "simpler", as a noted surgeon stated it was "easier to dig a hole than built a pole" (Hendricks 1993, pp. 10-16; Dreger 1999).

There is little space in this context to discuss the ethical conundrums of DSD treatment[9], while the entrance of molecular testing into care protocol has had interesting and unexpected repercussions. The gender assignment implications underlying DSD diagnosis highlight the identity aspects of the genetic discourse. Medical curiosity surrounding gender in the body has often had reductionist/deterministic overtones, focusing on one component of the gendered body (such as the gonads or genitals) or another. In contemporary biological models of sex there is debate and controversy over the developmental pathways of biological sex, and the *locus* of sex (that is: the factors that are considered to be most important in swaying the gendered body to develop in one way or another).

At the end of the nineteenth century, hundreds of theories of sexual differentiation could be documented, but by the 1920's all theories would take into account sex chromosomes and sex hormones (Maienschein 1984, p. 457). DSD syndromes displace sex chromosomes as the primary organizer of sex in the body, and since their very conception, researchers looked deeper for the mechanisms leading to sex determination. Already in 1927 the Danish geneticist Øyvin Winge proposed that there must be a 'testis determining factor' on the Y-chromosome, which was linked to the development of the male phenotype (Holme 2007, p. 152).

Genetic markers, in conjunction with hormones and hormone receptors came to be seen as responsible for disrupting the one to one relationship between chromosomal sex and phenotypical sex (the fully developed type or the external appearance of the body). The phenotype is then believed to represent the gender identity of the individual. It is still often popularly believed that the sex chromosomes make one "really" a man or a woman. Shifting the "real" indicator of biological sex from the chromosomes to genetic markers does not entirely depart from a deterministic rationale, yet leaves some space open for a systemic, interactional model.

The genetic marker, in the case of a suspected DSD, is subject to a diversity of explanatory models that range from reductionist to systemic. It is important to keep in mind that the genetic test is performed *when a diagnosis has already been proposed*, and the genetic marker serves to confirm or adjust the suspected

[9] Primarily regarding nonconsensual childhood genital surgery, lack of informed consent, medical stripping, stereotyped idea about both social and physical gender, etc. See Dreger 1999; Fausto-Sterling 2000; Karkazis 2008; http://www.isna.org/index.php

diagnosis. If a genetic marker is found, the diagnosis acquires a higher level of indisputability. If it is not found, other anecdotal and biological information will support the diagnosis. While the genetic marker trumps all other biological material in diagnosis assessment, it is not necessarily taken to determine the development pathway on its own.

As is the case in most medical genetic laboratories, in this lab the technician already knows what they are looking for before they start the testing process. They are specifically asked by the medical team or collaborating hospital to look for the genetic markers associated with the suspected syndrome, therefore they are not directly involved in the diagnostic decision process. The anecdotal and physical data acquired in medical interviews with the patient have already led the medical team (in this hospital led by a pediatric endocrinologist) to suspect a diagnosis, or a potential genetic marker. For instance, several AISIA members have been re-diagnosed from PAIS to different syndromes such as 5-alpha reductase or Leydig Cell Hypoplasia[10]. there has been a general effort to use genetic testing to clear-up earlier ambiguous diagnoses.

One AISIA member had a difficult process digesting her renewed diagnosis as 5-alpha reductase, having long accepted (or at least digested) her PAIS diagnosis and the subsequent negative surgical experience (resulting in almost total lose of genital sensation). She has a female gender identity, non-stereotyped gender behavior and a homosexual orientation. She mourned the possibility that she could have been raised a boy and avoided the type of medical treatment she received, however, after a year or two, she decided she was happier as a woman (despite and because of her experiences)[11]. In the past, non-stereotypical gender behavior and/or homosexual orientation would cause the medical team to reevaluate the gender assignment. The very different categories of gender identity, gendered behavior, gender appearance and sexual orientation are still often confused or overlapped. Historian Elizabeth Reis indicates throughout the medical obsession with then termed pseudo-hermaphroditism in the 17th and 18th hundreds doctors would often put aside the gonadal information (then considered to be the biological determining factor) in order to affirm a gender assignment that rendered the individual heterosexual (doctors had the authority to influence the assignment of legal gender status).

5. Creating Data. Diagnosis

[10] Leydig Cell Hypoplasia is a condition resulting from reduced or absent functioning of Leydig cells which leads to insufficient production of androgens, which can affect sex differentiation.

[11] While there are no conclusive statistics, it appears that there is a higher instance of transgenderism (transition from one social gender category to another) in the general population than among those diagnosed with a DSD, especially since the protocol of assigning most patients the female gender has been revised.

The lab team searches for the genetic marker that has been indicated by the physician. The combination of the identified related genetic pattern results and the tacit knowledge of the technicians leads to either a positive or negative result, there is no grey-scale interpretation of data that may or may not reflect a scientific paradigm[12]. However, each team member may have their own interpretation of what the test results *mean*, regarding diagnosis and the gender identity of the patient.

The laboratory procedure tries to isolate the molecular component that is associated with the diagnosis they are leaning towards. I accompanied different technicians through the steps that lead to the isolation of the genetic marker, who were clearly experts in laboratory procedure, not necessarily in gender or social theory. I was shown how to extract, purify, determine the concentration of, and then amplify the DNA. It certainly seems like a miracle to render DNA sequences visible, through this cleaning and replication process. It also requires a lot of patience. Throughout the various processes we added chemicals and centrifuged, taking always-smaller samples, rendering what had once looked like blood into a clear liquid like water. The DNA is then read and analysed for the specific marker that is being looked for. Hidden in the blood is the significant biological object that will be read. However, this object must be manipulated in several ways and even boned with other chemicals before it is palpable as useful data.

One blood sample will go through the same procedure several times, to test for the different suspected markers but also to guarantee the accuracy of the result. One blood draw provides enough biological material to perform multiple tests, and leave stored material for future use. Blood arrives from all over Italy, or by foot from an adjacent building. The day I arrived, in fact, we received blood from a local source that had already been coded to protect the patient's identity. The only remaining identifying factor was the suspect diagnosis.

One of the technicians brought me to the ward where they took the blood samples, four beds in a room, and on the way, we passed the psychologist and head endocrinologist, with the family of a child with a 5-alpha reductase diagnosis. This family had a hard time coming to terms with multitude of explanatory models they were offered by the medical team and the society at large. They originally wanted to maintain the female gender assignment (due to genital size) and modify their child's genitals to seem less "ambiguous", following Money's OGR model. However the medical team suspected and then confirmed the 5-alpha reductase diagnosis, which made them push for a male gender re-assignment. The 4-year-old child in this case was included in the process to some extent, and knew that their gender was considered "unclear", and would ask which bathroom they should use. The psychologist later indicated that the child did not clearly indicate a gender preference, yet their stress symptoms (jaw clenching) greatly reduced when the finally male assignment

[12] See Turrini (2011) for a discussion of variable visual representation *versus* digital representation.

decision was made (remaining unclear if the stress alleviation was due to the end of ambiguity and intense medical attention, or the male gender assignment).

The 5-alpha reductase diagnosis, through the visualization techniques of the molecular genetics lab, changed the child's life in many ways: from the medicalization techniques he will live through, to the gender he was assigned by the medical team. Equally importantly, this diagnosis led the medical team to advise against irreversible genital surgery and attempt less invasive methods. The child started topical genital androgen treatments to increase the size of the genitals, thereby immediately avoiding sensation reducing surgical techniques, hopefully leaving him the decision to have, or not have, genital surgery at a later date[13].

6. Creating Data. Laboratory Practice

Back in the lab, to extract the DNA we took 3ml of blood and added a patented solution (Cell Lysis Solution) to break the cells. I found it very interesting how much of the testing process was standardized outside the lab, through patented formulas and machinery with specific protocols. These patented processes, of course, still leave room for individual tacit knowledge in practice. Each technician had their area of specialty, their tacit knowledge and their quirks. My first informant had been with the lab for 30 years, from before the time in which you needed a specialized degree to be a molecular lab technician, and he was a local. He explained to me the progression of DSD chemical diagnosis techniques, and abandonment of others, from radioactive processes to siphoning chemicals like one does with gasoline. They used to search for sex hormones and growth hormones, now they look for genetic markers.

My first informant made it very clear that he thought the most important thing in the lab was to be good technician, which is to be clean, organized and thorough. He was not particularly interested in the latest genetic theories. He seemed to portray the idea that the lab techniques were all similar in the end; machines, solutions and protocol changed, but the process was the same. Joking, he answered my questions as to why he did certain things with a little rhyme, "non so per che cosa, so fare le cose" ("I don't know why we do things, I know how to do things")[14]. This was obviously ironic, because he had little things to say about everyone, and every technique. He had been in the lab longer than many others, mastering the techniques as they changed. He implied that he always handled the extraction due to his precision, the others (who all had

[13] Many patient groups advocate the delay of all irreversible early childhood genital surgery, indicating this intimate procedure, with its many side-effects, must be decided by the individual/patient. This decision is supported by the Italian National Bioethical Committee (Comitato Nazionale di Bioetica 2010) but is not part of Italian medical protocol or law.

[14] This direct quote is awkward in Italian.

specialized degrees in genetics) left things a mess, an obstacle to accuracy. There were glass jars everywhere, like a glassmakers workshop, but everything was sterile with surgical plastic inside. Disposable products place the responsibility of sterility on the manufacturer, removing it from the lab.

It was like returning to college chemistry: titration (drip), and centrifugation. Every step used different droppers with differing levels of accuracy, and different centrifuges for differing sample sizes. The first (extraction) process broke the cells to extract the DNA, through the use of a chemical solution and the centrifuge. The second step purified the DNA with a second chemical solution (Nuclei Lysis Solution) and again the centrifuge. One needs to know how to unpack DNA by inviting the unwanted material to separate away. Besides the glass jars, we had entered into the world of standardization and patents. The choice of the *right tools for the job* (Clarke and Fujimura 1992), that is the scientific justification of instruments and protocols, are increasingly being decided outside of the laboratory, by manufactures and increasingly international protocols. Each machine came with a brochure, pre-mixed chemical solutions and a protocol. This repetition of standardization evokes the mechanistic nature of the laboratory process.

For instance, we purified with a Wizard® genomic DNA purification kit. As we followed the instructions from the kit, however, I found every step had its own non-written tacit-knowledge aspect: agitate like this, it should look like this when it comes off the bottom, etc. This tacit knowledge displayed an intimate relationship to the *visual* aspects of DNA in its various manipulated forms, each of which are different forms of readable data. The first several rounds of centrifugation left the blood sample red, a clot floating in the CLS, which is dispersed and then put back together through the aid of a protein solution. Another round of the centrifuge cleans away the red blood cells and we were left with a clear liquid.

The first "miracle"[15] of DNA visualization is performed by Isopropyl alcohol (C3H8O) that reconsolidates the material, and you can see the DNA floating on the bottom of the plastic vile. That is, you have created something you can look at under a microscope. To the layperson it would just look like a little dirt in water. For the technician it is already bio-data, potentially useful information. When you remove the liquid there is a little substance that seems like tiny strands of cotton. The cleaning process is replicated with alcohol and then the DNA is re-hydrated. The samples are then kept in different fridges based on their properties.

On a different day in a different room we determined and amplified the DNA. The previously cleaned sample is "read" by a 260/280 nm wavelength. When DNA is isolated from organisms, frequently some protein remains present in the DNA solution. Protein is tightly bound to the DNA and the complete removal of protein is not always possible. To determine the concentration and purity of the DNA solution, the absorbance of UV light is measured in a spectrophotometer.

[15] As described by the first technician.

Both protein and DNA absorb UV light, but they have different absorbance curves. The peak of light absorption is at 260 nm for DNA and at 280 nm for protein. When you run a spectrum of absorbance with varying wavelength, you should see that both curves slightly overlap in the area between, and including, 260 and 280 nm. Thus, when a solution contains both protein and DNA, absorbance at 260 nm is mainly due to the DNA present, and a little bit by the protein. At 280 it is the other way round. By dividing the two absorbance-values, one can calculate the purity of the DNA solution. These barely visible cotton strands of DNA are visualized in yet a different way, as light absorption, yet this bio-data has no practical application, it needs to be further manipulated.

In the amplification process different enzyme primers are added to a standardized chemical mixture in a process called the Polymer Chain Reaction, which multiplies the chain to seem infinite[16]. The polymer chain reaction method relies on thermal cycling, consisting of cycles of repeated heating and cooling of the reaction for DNA melting, and enzymatic replication of the DNA. 70° C opens the molecule, at 95°C the primer attaches itself, and at 68°C the chain forms. Primers (short DNA fragments) containing sequences complementary to the target region, along with a DNA polymerase (after which the method is named), are key components that enable selective and repeated amplification. As PCR progresses, the generated DNA is itself used as a template for replication, setting in motion a chain reaction in which the DNA template is exponentially amplified. PCR can be modified to perform a wide array of genetic manipulations[17].

The technician indicated the importance of writing everything down and checking each step, so as to not forget anything. The protocols they applied, beyond the protocols in the brochures, seemed aimed at regulating human fallibility, techniques that made sure you incorporated every step, with little room for variability. These first two technicians (one trained in genetic theory and one not) seemed to have little interest in the meaning or the result of their practice (limiting themselves to comments about the importance of an accurate diagnosis), yet they were very proud of their technique, their craftsmanship. The important role the genetic-data has in the diagnostic process is on some levels taken for granted.

The steps in the visualization process indicate an intricate understanding of the materiality of genetic data, how it will behave in certain environments, how to isolate it, how it is made. It was hard to identify any specific genetic theory in the visualization process, whereas many other scientific theories were at play, like thermodynamics, basic chemistry etc. The prepared solutions are complemented by a control and a water sample. Technicians often use their own bio-mater in the control process, as a way to make sure they have not contaminated the samples.

---

[16] As described by the second technician.

[17] Description synthesized from written lab instructions and oral instruction.

The amplified DNA is purified by yet another patented process, using the QIA quick spin kit and the QIAquick Nucleotide Removal Kit. The slogan in their instruction pamphlet reads "making improvements in life possible!". The patented kits included these small bursts of propaganda in their instruction manuals, which reflect the "DNA mystique", however the technicians used them to explain to me why there were not separate lab guidelines. The kit even includes the right size tubes for the machine so there is no need to have separate lab supplies. The technician counted as he laid out the samples in the machine with the buffers, indicating that everyone develops different methods to make sure that they have not skipped any. The tacit knowledge employed in every step seemed directly related to maintaining accuracy and purity of the samples, that is basic lab techniques, as reflected by the observations of the first lab technician. At this point we had 20 samples for every patient tested. The plastic vials had gotten so small there is nothing left visible or even imaginable to the naked eye.

At this point the extracted, purified, determined, amplified, re-purified DNA is loaded on the agarose gel and "data voltaggio" (literally: given voltage). This is where the physical entity of the DNA falls away and is transformed into digital data. The electrogram exploits what we know about charges in molecules to move and order them for measurement and visualization. As in all of the previous processes, chemical or electrical manipulation of the DNA is a means to an end, an essential part of the process, yet not essentially part of the bio-data itself. These manipulations of DNA have the aim of rendering DNA visible, palpable and useful. The assumption is that the essential material of DNA, what it needs to communicate to us, is not changed in any way by these processes, but rather, exposed and emphasized. The genetic data does not seem to acquire special status in the lab practice, yet requires many special instruments adapted to fit the specific purpose.

The final result of these chemical electrical manipulations is the series of letters we have come to associate with nucleotide sequences, or genetic patterns. Two technicians spend the rest of the afternoon reading the sequences to each other, first to identify possible contamination or mistakes, then to compare the sequences to "normal" sequences, and already established variant sequences that are associated with certain syndromes. The technicians who read the electropherogram are not just well trained technicians capable of recognizing errors in a long string of letters, they are also well trained in genetic theory.

It is only in this last step that the technicians begin to express opinions about the relevance of the genetic bio-data. In fact, these last two technicians have more direct interaction with the DSD team, and potentially the patients. They are the first to tell you that a genetic marker indicates a spectrum of development possibility, not necessarily a problematic pathology. The meaning they give to the test results is primarily empirical: the digital data says these are the genetic markers present in this part of the DNA. Underlying this meaning is the belief that this digital data will help the medical team treat the patient by giving a more accurate diagnosis.

However, contextually to their hospital team, they give another meaning to the bio-data. Critical of past paternalistic protocols that hid diagnosis and treatment options (including non-surgical options) from the patients (and often their parents too), they read the bio-data as an empirical entity that empowers the patient. They see the genetic test as inherently linked to new protocols of informed consent and full-disclosure, no longer something to be ashamed of and hide. The bio-data is situated as symbolically more modern, technologically advanced, and thereby associated with more modern standards of patient care. The bio-data they provide is linked to a body of scientific literature (easily found on the internet by the patient or family) that avoids stigmatizing terms like pseudo-hermaphrodite, assumes full disclosure to the patient, and contextualizes genetic variance.

The experimental process, and the creation of biodata, is definitely mechanistic and reductionist. It certainly could seem to reflect a biologically deterministic model. And yet, the genetic maker simply indicates a diagnosis, and therefore a pathology (a statistical deviance from the norm), but not necessarily a disease (a disturbance in the organism that incurs dysfunction and/or suffering) or a problem (Billings, Rothstein and Lippman 1992). The difference lies in the interpretation of the genetic material.

7. From data to meaning

The communication of genetic test results relays meaning onto the digital rendering of the DNA. As we saw in the beginning of the article, the scientific debate regarding genetic testing reflects the interpretation of genetic material as either independent/mechanistic or system-dependent. The social debates further question the role of biological variation in disease and identity definition. In the last ten years the new figure of the genetic councilor has been instituted to explain genetic data to the patient. The genetic councilor often translates seemingly determinist digital genetic bio-data into the language of genetic probability and possibility.

This particular DSD team does not have a referring genetic councilor. The genetic test results are communicated by a physician, generally a pediatric endocrinologist. The lab's head geneticist told me that many parents (and adult patients) end up calling her directly to ask for further information and explanation of the genetic data, yet she does not have an official role in diagnosis communication. The geneticist implied that the other doctors (not trained in genetic testing) are more likely to portray the genetic results as deterministic (neo-mendelian, one gene=one trait) biological truths, leading the patient to believe certain *dysfunctional* symptoms will *definitely* manifest. There is a distinct difference between reading genetic variance as linked to physical difference, and interpreting that difference as inherently dysfunctional.

This geneticist's personal opinion is confirmed by research on termination rates in Klinefelter's syndrome diagnosis. Klinefelter's syndrome is a DSD

syndrome that is silently targeted in prenatal cytogenetic testing, evidenced by a third sex chromosome (XXY). Termination rates were found to be much higher, in three different geographic and cultural settings, when the diagnosis was communicated by a gynocologist, pedatrician or general practitioner, than when the communication was conducted by a genetic councilor (Abramsky *et al.* 2001; Hall *et al.* 2001; Hamamy and Dahoun 2003; Yon-Ju *et al.* 2002). These authors explain their findings by proposing that a genetic counselor is more likely to explain genetic indicators as representing a varied spectrum of development than non-specialists, as well as having more updated information about genetically-linked syndromes. As genetic testing has found its way into increasing disciplines, an increased percentage of "invisible" (not particularly symptomatic) Klinefelter cases have been revealed. Genetic councilors accuse non-specialist practitioners of promoting not only a deterministic model, but also a model that over-pathologizes genetic variance. The Italian Klinefelter's patient group (KIO) promotes genetic research *because* they feel it will show how common and diverse the syndrome is.

There can be an understanding gap between popular conceptions of neo-mendelian genetics, and molecular genetics that relies to some extent on the developmental model. The geneticist must explain two factors that have emerged in molecular genetics, the complex model of development that goes beyond the chromosomes, and the difference between a genetically-based syndrome and being un-well. Molecular genetics represents the genomic paradigm, in which the performance of the genes and their interaction with non-genetic factors are the objects of research. The genomic concept has difficulty mapping directly onto the dualistic social model of gender. This philosophical issue regarding the de-moralization of biological variance[18] can be instrumental in helping patients understand and accept a previously unheard of difference.

The practical work of the genetics lab plays out in various ways: diagnosis communication (in this lab), statistical evidence of development and molecular markers, implications for postponing early irreversible interventions. Molecular testing is generally performed after birth, thereby the bioethical debates such as fear of eugenic elimination practices can be limited to chromosomal prenatal diagnosis and not molecular genetic testing as of yet. The geneticist of the lab said, "Parents call me asking, 'they've found this genetic marker, what does it really mean?'". Genetic counselors are appearing in certain medical fields (such as the cancer ward of this hospital) but ironically not always in this sensitive arena where adults/parents must make decisions for children/patients.

The other implication of molecular testing for this lab is gender assignment, the focus of so much of DSD medicalization. Molecular testing provides much greater accuracy in diagnosis, even though even the geneticist indicated that many people diagnosed with DSD do not have any of the established genetic

[18] See Feder in Morland 2009, pp. 225-247 for a historical/philosophical description of the evolution of the morality of physical variance from the eighteenth century in regards to DSD, but also Foucault 1979, pp. 177-184.

markers. However when the genetic marker is present, it will distinguish the diagnosis from the once catchall category of PAIS (Partial Androgen Insensitivity Syndrome). Historian and biologist Ingrid Holme (2007, p. 2) wonders:

> Yet as the historical analysis of the shift between the one sex to two sex model indicates (Laqueur 1990), it remains to be seen whether the social sphere will respond by incorporating this new evidence into the tacit, everyday understandings of sex or seek to maintain the binary and fixed relationship(s) between men and women by governing them as males and females.

In a previously mentioned case, molecular testing revealed a 5-alpha reductase genetic marker, changing the original PAIS diagnosis. This case, among others, gave weight to the members of the DSD team who opposes irreversible early childhood genital surgery. In this case the parents' dis-ease (Kleinman 1986) with their child's non-standard body was medicalized through counseling and hormones instead of irreversible surgical manipulation. The belief in Western biomedicine that 5-alpha reductase indicates a male gender identity directly shifted care protocol in two key manners: the proposed acceptance of a boy child with a micro-phallus, and the advice to postpone surgical intervention until the patient is self-determining. The *locus* of gender identity was to some extent defined by the molecular genetic marker.

Vernon Rosario (2009) hypothesizes that the complexity of genetic expression promoted by molecular research will lead to an equally complex model of sex and gender that he calls quantum sex. However, historian Garland Allen (2002) references his own difficulty in relaying a non-mechanistic or non-deterministic model of genetics in teaching upper-division college students. The one gene=one trait model is inaccurate, but easier to understand. The professional use of genetic counselors may help in the diffusion of a non-deterministic model.

In fact, even experts sometimes express opinions that reflect the influence of appearance, behavior and phenotype on what they think about a patient's genetic make-up. I heard contradictory comments in some cases, for instance, in the case of an XY adult, one technician commented, "poor thing she thinks she's a lesbian, but really she's a man". The patient had an uncontested female identity throughout her life, combined with female sexual object choice. This same technician firmly believes that XY individuals with Androgen Insensitivity Syndrome are women. Yet, the patient in question had a mixed molecular marker similar to 5-alpha redutase that is associated with potential male gender identity in the western bio-medical context. This technician will insist that XY chromosomes do not make you a man, yet sometimes a molecular marker is taken to indicate the same authority that chromosomes once did in gender determination.

Despite occasional opinions that could be perceived as deterministic, the geneticists generally advocate for a complex, developmental model. This genomic model generally refutes the deterministic language of the 'gene for x social trait', but rather, as Fox-Keller (2000) suggests, views genes as processes. The lab

technicians, in fact, seem to interpret their digital data as part of a complex process, while outside of the lab this data is somehow flattened to represent something in-and-of-itself. New genomic research continues to affirm an increasingly inter-relational model of sex development. As Holme (2007, p. 171) indicates:

> The view of the body as an active process is widespread in the discussions of the paradigm shift from studying single genes in genetics to studying genetic networks in genomics (Moss 2003).

In the hospital laboratory individual genes are targeted for very practical reasons in order to promote more accurate diagnosis.

8. Conclusion

> Visual representations in science differ significantly in terms of how they relate to what they purport to represent (i.e. their representational and ontological status). Visual representations in science may refer to objects that are believed to have some kind of material or physical existence, but equally may refer to a purely mental, conceptual, abstract constructs and/or immaterial *entities.* (Pauwels 2005)

The visualization of hidden biological components is part and parcel of DSD diagnosis. Technology has helped shift the *locus* of biological sex to parts of the body that would otherwise remain unknown, invisible. The visualization processes that convert blood samples to electropherograms and genetic digital data are standardized procedures that invoke a myriad of scientific theories and techniques, as well as the social metaphors that DNA represents. By taking a walk through the actual practice of genetic testing we can see that the commitment to the deterministic model implied by the practice is ambiguous. The laboratory practice relies on the assumed predictability of chemical interactions, aided by heat, speed, light and electricity.

By digitally visualizing DNA we are manipulating its material support, as well as its potential and its meaning. The DNA mystique, the positivistic rhetoric surrounding DNA and its cultural symbolic value has induced the *need* to visualize DNA in ever-increasing settings (Lippman 1992). In this manner, it seems the increased practice of genetic testing relies to some extent on deterministic assumptions such as the special status of DNA and genetics in describing the body. However, geneticists indicate that they see this information as only one part of the puzzle.

The practice of genetic testing treats genetic material as a physical chemical entity, which can be manipulated in many ways, without losing its informational value. In fact, it must be chemically and thermically manipulated in order to reveal itself. This would superficially imply that genes are believed to be resistance to external influences, however, the laboratory manipulations hopes to

"clean away" interfering biological information. Genes are initially read atomistically, separate from the organismic context, then inserted into a systemic explanatory model. The explanatory model of the molecular laboratory proposes that genes are partially deterministic, in that genes determine part of development in interaction with other biological processes. However, the primary purpose of the genetic lab is to *confirm* a diagnosis, not explain developmental processes. The genetic information has the explanatory power to support or negate a suspected diagnosis, such as Klinefelter's syndrome or 5-alpha reductase, but does not indicate *how* the syndrome will manifest. The increased diagnosis of these genetically linked syndromes lends statistical evidence to the *variety* of manifestations of these syndromes.

I would argue that the molecular genetic labs practices reflect the belief that genes have an important biological *potential*. That is, in certain biological conditions, the genetic marker will lead the body to develop in a divergent direction, and therefore it is important in the medical context to identify suspect markers to anticipate what *might* happen in the body. There is no strong deterministic paradigm in the lab that indicates that the genetic marker creates individual identity or an un-well individual. The lab tends to adopt the potentially un-well model, indicating that a patient *has* a genetic marker or a syndrome as opposed to *being* genetically diseased. This would indicate that the strong deterministic interpretation of genetic material is created in social discourse and other scientific discourse, not in the lab.

Historians and philosophers such as Lindee (2005) and Moss (2003) highlight the divergence of the scientific practice and social discourse. They indicate the myriad of things that genetics and genetic medicine *cannot* do or describe yet, from creating cures to biologically describing behavioral traits. Lindee in particular indicates that the actual science is far behind the positivistic rhetoric surrounding genetics, while indicating that patients themselves sometimes create these expectations.

As long as the "genetic mystique" reigns in the public image, accompanied by the neo-mendelian deterministic model, genetic testing can be a potential eugenic threat, as well as a tool to stigmatize biological difference as "not right". However, this interpretation is influenced by how genetic information is described to patients, and how patients interpret this information. The deterministic platform is not entirely reflected in laboratory practice. As genetic testing becomes routine in an ever increasing number of medical fields, time will show us if the strong deterministic model continues to dominate the public image of DNA and genetics, or if perhaps genes will slowly lose their special status, becoming a biological marker among many.

References

Abramsky, L., Hall, S., Levitan, J. and Marteau, T.M. (2001) *What parents are told after prenatal diagnosis of a sex chromosome abnormality: interview and questionnaire study*, in "British Medical Journal", 322, pp. 463-466.

Allen, G. (2002) *The Classical Gene: Its Nature and Its Legacy*, in R.A. Ankeny and L.S. Parker (eds), *Mutating Concepts, Evolving Disciplines: Genetics, Medicine, and Society*, Boston, Kluwer Academic Publishers, pp. 11-43.

Ankeny, R.A., Parker, L.S. (eds) (2002) *Mutating Concepts, Evolving Disciplines: Genetics, Medicine, and Society*, Boston, Kluwer Academic Publishers.

Billings, P., Rothstein, M.A. and Lippman, A. (1992) *But is he genetically diseased?*, in "The Hastings Center Report" 22 (4), pp. S18-20.

Clarke A. and Fujimura J. (eds) (1992) *The Right Tools for the Job: At Work in Twentieth-Century Life Science*, Princeton, NJ, Princeton University Press.

Clarke, A. (2005) *Situational Analysis*, London, Sage Publications.

Clarke, A., Mamo L., Fosket J.R. and Fishman J.R. (eds) (2010) *Biome–dicalization: Technoscience, Health, and Illness in the U.S*, Durham-London: Duke University Press Books.

Clayton, E.W. (2003) *Ethical, legal, and social implications of genomic medicine*, in "New England Journal of Medicine", 349 (6), pp. 562-569.

Comitato Nazionale per la Bioetica (2010), *I disturbi della differenziazione sessuale nei minori: aspetti bioetici*, in www.governo.it/bioetica–/pareri_abstract/testo_20100225.pdf

Dreger, A.D. (1998) *"Ambiguous Sex" or Ambivalent Medicine?*, in "The Hastings Center Report" May/June, 28 (3), pp. 24-35.

Dreger, A.D. (1999) *Intersex in the Age of Ethics*, Maryland, University Publishing Group.

Dupré, J. (2004) *Understanding Contemporary Genomics*, in "Perspectives on Science", 12 (3), pp. 320-338

Ettore, E. (2002) *Reproductive Genetics, Gender, and the Body*, London, Routledge.

Fausto-Sterling, A. (2000) *Sexing the Body*, New York, Basic Books.

Foucault, M. (1975) *Surveiller et punir. Naissance de la prison*, Paris, Gallimard (Eng. Transl. *Discipline and Punish: The Birth of the Prison*, New York, Vintage, 1975)

Fox-Keller, E. (2000) *The Century of the Gene*, Cambridge, MAss, Harvard University Press.

Goodman, A., Heath, D. and Lindee, S. (2003) *Genetic Nature/Culture, Anthropology and Science Beyond the Two-Culture Divide*, Berkeley, CA, University of California Press.

Hall, S., Marteau, T.M., Limbert, C., Reid, M., Feijóo, M., Soares, M., Nippert, I., Bobrow, M., Cameron, A., Van Diem, M., Verschuuren-Bemelmans, C., Eiben, B., García-Miñaur, S., Walkinshaw, S., Soothill, P., De Vigan, C., McIntosh, K. and Kirwan, D. (2001) *Counselling following the prenatal diagnosis of Klinefelter syndrome: comparisons between geneticists and*

obstetricians in five European countries, in "Community Genetics", 4, pp. 233-238.
Hamamy, H.A. and Dahoun S. (2003) *Parental decisions following the prenatal diagnosis of sex chromosome abnormalities*, in "European journal of obstetrics, gynecology, and reproductive biology", 116 (1), pp. 58-62.
Hendricks, M. (1993) *Is it a boy or a girl?*, in "John Hopkins Magazine", 45 (6), pp. 10-16.
Herdt, G. (1996) *Third Sex, Third Gender: Beyond Sexual Dimorphism in Culture and History*, New York, Zone Books.
Holme, I. (2007) *Genetic Sex: A Symbolic Struggle Against Reality? Exploring Genetic and Genomic Knowledge in Sex Discourses*, Doctoral Dissertation, University of Exeter.
Jablonka, E. and Lamb, M. (2005) *Evolution in Four Dimensions*, Cambridge, Mass., The MIT Press.
Karkazis, K. (2008) *Fixing Sex: Intersex, Medical Authority, and Lived Experience*, Durham, Duke University University Press.
Kleinman, A. (1986) *Interpreting illness meanings*, in "Medical Encounter", 3 (3), pp. 5-7.
Kuhn, T. (1962) *The Structure of Scientific Revolutions*, Chicago, University of Chicago Press.
Latour, B. and Woolgar S. (1979) *Laboratory Life: The Social Construction of Scientific Facts*, Beverly Hills, Sage.
Latour, B. (1987) *Science in Action. How to Follow Scientists and Engineers Through Society*, Milton Keynes, Open University Press.
Latour, B. (2005) *Reassembling the Social: An Introduction to Actor-Network-Theory*, Oxford, Oxford University Press.
Laqueur, T. (1990) *Making Sex: Body and Gender from the Greeks to Freud*. Cambridge, MAss, Harvard University Press.
Lindee S. and Nelkin D. (2004) *The DNA Mystique: The Gene as a Cultural Icon*. Ann Arbor, Michigan University Press.
Lindee, S. (2005) *Moments of Truth in Genetic Medicine*, Baltimore, John Hopkins University Press.
Lippman A. (1992) *Prenatal genetic testing and genetic screening: constructing needs and reinforcing inequalities*, in "American Journal of Law and Medicine", 17, pp. 15-50.
Lock, M., Young, A. and Cambrosio, A. (2000) *Living and Working with the New Medical Technologies. Intersections of Inquiry*, Cambridge, Cambridge University Press.
Lock, M. (2005) *Eclipse of the Gene and the Return of Divination*, in "Current Anthropology", 46 (S5), pp. S47-S70.
Morgan, T. H. (1935) *The relation of genetics to physiology and medicine* (Nobel Lecture), in "Scientific Monthly", 41, pp. 5-18.
Morland, I. (eds) (2009), *Intersex and After*, in "GLQ", 15 (2).
Moss, L. (2003) *What Genes Can't Do*, Cambridge, Mass, The MIT Press.

O'Malley M.A. and Dupre, J. (2005) *Fundamental issues in systems biology*, in "Bioessays", 27, pp. 1270-1276.
Pauwels, L. (2005) *Visual cultures of science: rethinking representational practices in knowledge building and science communication*, Dartmouth, Dartmouth College Press.
Portin, P. (1993) *The Concept Of The Gene: Short History And Present Status*, in "Quarterly Review of Biology", 68, pp. 173-174.
Rapp, R. (2000) *Testing Women, Testing the Fetus, The Social Impact of Amniocentesis in America*, New York, Routledge.
Rechter, J.E. (1997) *The Glands of Destiny: A History of Popular, Medical and Scientific Views of the Sex Hormones in 1920s America*, PhD Dissertation, University of California at Berkeley.
Rosario, V. (2009) *Quantum Sex: Intersex and the Molecular Deconstruction of Sex*, in I. Morland (es.), "GLQ Intersex and After", 15 (2), pp. 267-284.
Rose, N. and Nova, C. (2000) *Genetic risk and the birth of the somatic individual*, in "Economy and society", 29 (4), pp. 485-513.
Rose, N. (2006) *The Politics of Life Itself*, Princeton, Princeton University Press.
Shakespeare, T. (2005) *Disability, Genetics and Global Justice*, in "Social Policy and Society", 4 (1), pp. 87-95.
Taussig K-S., Rapp, R. and Heath, D. (2003) *Flexible Eugenics: Technologies of the Self in the Age of Genetics*, in A. Goodman, D. Heath and S. Lindee (eds) *Genetic Nature/Culture: Anthropology and Culture Beyond the Two Culture Divide*, Berkeley, University of California, pp. 58-76.
Theunissen, B. (2008) *Breeding Without Mendelism: Theory and Practice of Dairy Cattle Breeding in the Netherlands 1900–1950*, in "Journal of The History of Biology", 41, pp. 637-676.
Turrini, M. (2011) *Se Vedo solo il Bianco e il Nero, non Vedo le Sfumature: Stili Visuali e Incertezza nei Laboratori Clinici di Citogenetica*, in "Etnografia e Ricerca Qualitativa", 4(1), 39-60.
Yon-Ju, K., So-Yeon, P., Jung-Yeol, H., Moon-Young, K., Jae-Hyug, Y., Kyu-Hong, C., Young-Mi, K., Jin-Mee, K. and Hyun-Mee, R. (2002) *Parental Decisions of Prenatally Detected Sex Chromosome Abnormality*, in "Journal of Korean Medical Science", 17, pp. 53-7.

Daniela Crocetti, Università di Bologna
CIS (The International Centre for the History of Universities and Science)
Dipartimento di Filosofia - Università di Bologna
via Zamboni 38 - 40126 Bologna, Italy
Email: terzogenere@yahoo.com

Essay

Sociomaterial Assemblages in Learning Scientific Practice: Margherita's First PCR

Assunta Viteritti

Abstract This paper examines the ways in which apprentice scientists learn how to work in the laboratory day by day, the hypothesis being that practical learning is part of the process of *becoming a scientist*. The paper's theoretical intention is multi-perspective, and unites various approaches: laboratory studies, practice studies, the corporeal turn perspective and that of communities of practice. The paper argues that learning is produced through the bodies of the apprentices. These embed a sociomaterial assemblage of heterogeneous elements, sustaining the collective laboratory work.

Keywords learning; corporeal turn; practice; assemblages; sociomateriality.

Introduction

The paper proposes to discover how apprentice scientists learn to work in the setting of the laboratory. To achieve this scope, diverse research perspectives, all together oriented to the study of practical and situated learning, were examined and adopted. Among these, laboratory studies (Latour and Woolgar 1979; Lynch 1985; Knorr Cetina 1999; Latour 1987), practice-based studies (Nicolini *et al.* 2003; Schatzki *et al.* 2001), the corporeal turn perspective (Yakhlef 2010) and that of the communities of practice (Lave and Wenger 1991). The paper proceeds with a narrative description of learning in the research laboratory by focusing attention on Margherita, a novice, and the sociomaterial events she encounters in her process of incorporating practice.

The theme of learning laboratory practice, though not new, has been the focus of less attention (also from Actor-Network Theory and STS researchers) than "the production of scientific knowledge", while I believe that learning daily

* The paper draws on and extends a previous manuscript: *Practising Science And Technology, Performing The Social*, EASST_010 Conference, University of Trento, September 2-4.

TECNOSCIENZA
Italian Journal of Science & Technology Studies
Volume 3(1) pp. 29-48 - ISSN 2038-3460
http://www.tecnoscienza.net

T/S TECNOSCIENZA Italian Journal of Science & Technology Studies

practice in the laboratory is an important part of the trajectory of *becoming a scientist* and therefore deserves the attention of technoscience studies.

Research practice, in this paper, is intended as a sociomaterial activity situated in networks of bodies and objects, both involved in the (co)production of knowledge.

1. Theoretical approaches

Learning is a *sociomaterial* (Orlikowski 2007) process that takes place in classrooms, lecture halls and workplaces. In educational (Fenwick and Edwards 2010; Sørensen 2009), professional and organisational fields (Lave and Wenger 1991; Gherardi 2000), learning is a social, situated and practical process characterised by the intertwining of heterogeneous aspects, both human and material, which connect people and things across time and space. This understanding of learning (Gherardi 2011) is based on the assumption that knowing and doing are inextricably linked, and that learning processes involve an equally inextricable intertwining of tacit and explicit knowledge (Collins 2010).

Learning is to be regarded as a complex and uncertain process of appropriation and translation (Callon 1986), which requires the commitment and participation of the subjects involved. Joining the laboratory, novices experience an initial phase of disorientation or breakdown. Entering the laboratory is like crossing a cultural threshold, in the sense of the knowledge acquired in the transition between two educational spheres: that of the university lecture hall and that of laboratory practice. The young apprentice scientists discover that scientific knowledge – which, till that moment they had learnt mainly from textbooks and university teaching – is rather a practical, material, social and relational process. During their first period in the laboratory they strive to distance themselves from a vision which perceives knowledge as being a codified, certain result, to one where knowledge is seen as a situated, local action, a relational effect which links people and objects (Latour 2005). Collaborating with a senior (and also working with other colleagues) leads the novice to an *all-practical knowledge vision*, far removed from the codified university variety. Knowledge acquired through laboratory practice is disarticulated, it becomes chaotic, vulnerable, subjected to experimental testing and questing for new order.

Theoretically speaking, the paper follows four main traditions of studies.

The first is that of laboratory studies and the cross-referenced contribution made by Science and Technology Studies (STS), Actor-Network Theory (Latour and Woolgar 1979; Lynch 1985; Knorr Cetina 1999; Latour 1987; Traweek 1988) and their applications in education and learning (Fenwick and Edwards 2010). The second is that of practice-based studies on learning and knowing in organizations (Nicolini *et al.* 2003; Schatzki *et al.* 2001), which have contributed to changing our vision from a stable, mental, individual, codified conception of knowledge to one where *knowing and learning* are emerging processes situated

and negotiated in sociomaterial practices. The laboratory is in fact a special educational setting which favours a curriculum activated and experimented through practice (Fenwick and Edwards 2012) and places the relational effects between sociomaterial events and researchers centre-stage, unlike scholastic and university contexts, which privilege a formal, codified knowledge.

The third tradition refers to theories that explicitly focus on the body in learning practices, the so-called *corporeal turn* (Yakhlef 2010). This contribution suggests that the body is cultivated through practice: the body is seen as a further link with the social, material world, and is also a go-between, a mediating resource in knowing and learning. Learning is corporeal and the body is both an object and a subject in daily working and knowing.

The fourth is that of Communities of Practice (Lave and Wenger 1991). In this regard, the paper aims at questioning and updating the concepts of *novices*, *experts* and *legitimate peripheral participation*. While sharing the theoretical perspectives developed by Lave and Wenger in their 1991 book, where learning is regarded as a form of social participation in situated contexts, the paper does not focus so much on the idea of community – i.e., a holistic, objectified, cohesive and homogeneous sphere where individuals are progressively integrated, gradually acquiring the resources available to their community – as on the idea that learning is based on the active and personal participation in processes of sociomaterial appropriation. As pointed out by Gherardi (2009), the label of Communities of Practice (CoP), especially in the interpretations proposed by Wenger over time (2002), has become a synonym for a welcoming, harmonious, non-conflicting place, where knowledge is a heritage, an outcome, a constantly ongoing process. The idea of CoP fails to consider both the materiality of practice (which is regarded as a mere result of an action, rather than the matter constituting the action itself) and the body working and acting, the agent producing and produced by practice. For this reason, as suggested by Gherardi (2009), it seems more interesting to reverse the concept and turn the idea of Communities of Practice into that of Practices of Community (PoC).

The paper aims to contribute to a multi-theoretical perspective on learning in practice, starting from the assumption that learning processes do not rely on a progressive and linear participation and inclusion in a community (as in the idea of legitimate peripheral participation - Lave and Wenger, 1991), but on a problematic, uncertain, demanding, daily appropriation and embodiment of sociomaterial practices.

2. The field of practice: entering the laboratory

From a STS perspective, laboratories are interstitial spaces between academic and business organisations, basic and applied research, experience-based knowledge and codified knowledge. Scientific research laboratories are places where formal and explicit learning, informal socialisation, tacit knowledge and expert practice intertwine; places where knowledge is always a shared practice,

being the product of human and non-human assemblages. Like other professional settings, laboratories are spaces embodying a pedagogy of practice (Kaiser 2005). The processes by which researchers face problems, search for solutions, learn and embody roles, draw on established knowledge, create new knowledge and make themselves familiar with daily practices, constitute a daily pedagogy, which is not abstract or pre-established, it is not inside people's heads or in handbooks, but is embedded in the process of knowledge appropriation.

In order to describe the body (Yakhlef 2010) and sociomaterial practices of learning I will refer to observations conducted in a leading Italian research laboratory[2] working on stem cells. In this research lab, knowledge practices involve: learning to write; analysing, representing and interpreting data in laboratory; learning to understand the status of cells by observing them through the microscope; learning how to communicate at scientific meetings; learning how to discipline one's body in the laboratory (how to stand at the bench, how to stay under the hood, how to use technological devices, how to take care of non-humans, such as cells, molecules, etc.).

By observing the learning path of young University students, my aim is to show how scientific practice is learned day by day. The idea is to examine the experience of learning scientific practice in the transition between lecture halls (where knowledge is codified and stable) and the laboratory (where knowledge is still hybrid, vulnerable and malleable). Through the narration of crucial events concerning learning and apprenticeship, the paper focuses specifically on some of the basic processes (typical of scientific practice) directly involving the body: learning to stand at the bench; learning the gestures of practice day by day; learning how to recognise and treat valuable objects such as cells; learning to look at cell cultures (embryonic, cerebral, human and animal cells) through the microscope; learning how to register practical knowledge (keeping laboratory notebooks); learning to handle technological devices. All these processes require the construction of profound and tacit knowledge (Polanyi 1966), which is shared, processed, and embodied in bodies and objects. This corporeal knowledge will be observed while it is learned in practice, in personal, relational and material daily work.

Through the detailed account of how Margherita learns to carry out PCR tests in practice, the paper shows how the novice, although under the supervision of a senior researcher, immediately takes centre stage in the practice, thus supporting the texture of practices performed by more expert researchers. The hypothesis is that in research laboratories (as well as in other workplaces) newcomers are im-

[2] The Laboratory of Stem Cell Biology and Pharmacology of Neurodegenerative Diseases is part of the University of Milan and is run by Prof. Elena Cattaneo. It is linked to several international networks and roughly 25 researchers (Italians and foreigners, post-PhD, PhD and students) work there. The laboratory is funded by: Telethon, Huntington's Disease Society of America, Hereditary Disease Foundation, European Union, Ministry of the University and Research, Ministry of Health, Banks such as Cariplo and Unicredit, Valdese Church. Articles on the laboratory have appeared in the following publications: Nature, Science, Nature Genetics, Human Molecular Genetics, Journal of Neuroscience, PNAS, etc.

mediately involved in the construction and organisation of established routines that constitute the crucial and ordinary texture of situated practices. Novices do not just stand and watch the world from the margins, gradually getting the hang of things through increased involvement, but are immediately cast into the practice in order to support and contribute to the work of the community. Novices are quickly called upon to enter into the heart of laboratory practice and soon become productive resources. They are *catapulted* into action and immediately realize that their daily practice is at the basis of all laboratory activities.

From a methodological viewpoint, I adopted an ecological vision, considering the laboratory as a wide, social and material space where apparently chaotic phenomena present regular, evident qualities. I progressively *zoomed in* practice (Nicolini, 2009) and focused on diverse seemingly exemplary episodes whose details might represent wider laboratory dynamics. I assumed an ethnographic perspective which required a lengthy period of observation. Then, little by little, I began to understand the macro-order of daily events and selected a series of practices to observe, choosing those which a novice learns at the initial stages (as in the case of the PCR, on which we will focus in the next paragraph).

For several days, using the *shadowing* technique, I therefore followed Margherita, a young novice and recent newcomer to the laboratory. About two months after having carried out the shadowing, I conducted a long interview with Margherita, reminiscing on my period of observation with her and asking her to reflect on her initial experiences with the PCR.

In the story we are about to enter, thus, we will observe Margherita as she becomes familiar with her work environment and moves from being an insecure, inexperienced novice, to an independent, reflexive and skilled researcher who has embodied laboratory practices.

3. Learning through practice: Margherita in the laboratory

3.1. Discovering the context

Together with Margherita, we find ourselves at the beginning of the story, at the beginning of the internship, at the first impressions of the learner. Margherita begins her adventure, comes into contact with a world that is materially, spatially and temporally disciplined, finds durable and malleable objects, meets colleagues who will be her guides. The laboratory setting she finds herself in has a social and technological installed base. It is an already established environment, a learning field where she will have to inscribe her gestures, find her feet, learn how to correctly position her body and develop knowledge resources (Roth and Lawless 2002). Margherita enters a world where, as Lynch argues (1985), practices performed by the body are subject to time and turn into routines.

Margherita's first days in the laboratory took place in silence. At a superficial glance, Margherita seemed already at ease, though this is really what Merton defines *anticipatory socialization*. Margherita is not a *tabula rasa*, an empty vessel

to be filled: she has already been in another laboratory in the course of her university studies, where she learned how to manage diverse instruments and carried out all the tests used in molecular biology. Margherita, therefore, has some experience of the environment, and knows how to avoid getting in anyone's way, how to move agilely between workbenches and computers. She knows her place within the social and material space of the laboratory, but is also aware that every laboratory is a world in itself, a new, unknown and sensitive terrain to be explored.

In the morning she dons her white coat even though she doesn't exactly know why - for the moment it serves only to cover the embarrassment of her inexperience - while many of the more confident youngsters, but also their seniors, have a more relaxed attitude, donning it when they begin an experiment; when they approach a workbench with a purpose; when they enter the cell chamber; when they change a culture base or when they look through a microscope. In short, when circumstances require it.

Figure 1 – Margherita dons her white coat

These early phases of her learning path are similar to the tailors' learning practices described by Lave and Wenger (1991), with a short period of time defined as "way-in" during which Margherita observes, tries to make herself familiar with the work space, objects and people around her. The "way-in" phase is immediately associated with the "practice" phase, when Margherita starts getting the hang of the various segments of her work. In her first days, she is flanked by another young intern, Giovanna, a girl who has already spent several weeks in the laboratory. It is with her that Margherita begins *to find her feet*,

learns where instruments are kept, familiarizes herself with the *material geography* of the laboratory. She learns about the surrounding together with someone who has already elaborated a map of this reality and can share it with her.

At first, Margherita focuses on elementary but highly important matters: cleaning the workbench, discovering where the most commonly-used objects (such as the containers where events and materials crucial to the laboratory) are kept. She discovers scientific articles scattered around, the students' pipettes, begins to recognize the everyday gestures and experiments the first stages of acting (or rather, acting in its first stages). In a notebook, she writes down details of the information she begins to select: instruments' names, a telephone number, the names of suppliers, some notes on *primers*, the access code to the computer. Small but vital details to hang onto in these first days, in which she feels like she's holding her breath.

The space is densely populated by heterogeneous objects, which are there for theoretical and practical functions and will gradually be embodied and domesticated by Margherita. Scientific papers and notebooks will be her partners in the appropriation of knowledge. Margherita will learn how to write about her practice: she will describe in detail the use of the various devices and protocols, she will summarise the articles deemed relevant for the tests to be carried out, she will go through and file the articles that might be useful in the following phases of the experiments. Pipettes, hood, fridge, computer and microscope will be the instruments she has to gradually become familiar with. Primers, cells, DNA and laboratory animals will be other partners she will have to deal with, and ally herself with, in order to achieve the expected results. On top of that, there are also colleagues, peers and seniors with whom Margherita will share her process of socialisation, becoming familiar with the practice that is going to transform herself from a novice into an expert.

One morning I observe Margherita, watched over by the senior colleague she will be working with (Marta), carrying out her first PCR for an important project in which stem cell knowledge is applied to Huntington's Disease[3]. Margherita is introduced to the practice and is given the key elements to legitimately approach the tasks she has to learn. I therefore decide to follow Margherita's first steps in action.

3.2. Preparing for the first PCR

The Polymerase Chain Reaction (PCR) is a technique that has revolutionized molecular biology. It was conceived by the Nobel Prize winner Kary Mullis in the

[3] This is a hereditary degenerative condition of the central nervous system, which causes patients to lose control of their bodies. This degeneration leads to dementia and death within 15-20 years after the appearance of the first symptoms. The illness usually manifests itself around age 40-50. There are 4000 diagnosed cases in Italy and it is believed that there are at least 12000 more that have not yet been diagnosed. The children of people who suffer from Huntington's Disease have a 50% chance of inheriting the defective gene.

early 1980s and allows scientists to amplify, clone, duplicate specific DNA sequences[4]. The history of the discovery of PCR, the DNA amplification technique, is made up of attempts, perceptions and manipulations, a practical history where the expert's body matters, as proved by Mullis' account of his research experience:

> "Tonight, I am cooking: the enzymes and chemicals I have at Cetus are my ingredients. (…) There was nothing in the abstracted literature about succeeding or failing to amplify DNA by the repeated reciprocal extension of two primers (…). In September I did my first experiment. (…) One night I put human DNA and the nerve growth factor[5] primers in a little crew-cap tube with an O-ring and a purple top. I boiled for a few minutes, cooled, added about 10 units of DNA polymerase, closed the tube and left it at 37° (…). At noon the next day I went to the lab to take a 12-hour sample (…). The first successful experiment happened on December 16, 1983. It was dark outside when I took the autoradiogram out of the freezer and developed it. There, right where it should have been, was a little black band. A tiny little black band." (Mullis 2000, p. 9-20).

Mullis cooks, handles objects at different temperatures, weighs out ingredients, looks at results, uses his hands, his eyes, interconnects with objects, manages knowledge in practice. This is exactly what Margherita is about to do, as she gets ready for her first PCR. Those of Mullis and Margherita are stories of appropriation and discipline. Mullis followed his practical intuition and discovered what has today become an important routine in laboratory practices; Margherita instead approaches this routine as a discovery.

The aim of Margherita's first PCR is to evaluate whether the expression of a new gene, INSIG-1, probably involved in Huntington's Disease, is modulated or not by the presence of mutated huntingtin[6]. Margherita knows Huntington's Disease and she has already studied the molecular biology techniques she is now about to execute. However, she has to carry out a complex conversion. The codified knowledge she learned reading books and articles seems to disappear in front of the new complexity of a practice which now appears uncertain, unknown and mysterious. Margherita knows that what she is about to do is not an experiment or a simulation of a practice, she immediately gets to the heart of the action: what she is going to do, if done correctly, will directly contribute to the work of the laboratory. Margherita enters the practice by participating in the ordinary activities widely distributed in the daily life of the laboratory. The PCR practice is indeed a very common methodology in the daily life of the laboratory. It is a technique that is at the basis of almost all the molecular biology experiments, so much so that a more expert researcher, who had been working in the laboratory for four years and greatly enjoyed laboratory techniques and

[4] Rabinow (1996) carried out an anthropological analysis of the birth and significance of PCR.
[5] The NGF (Nerve Growth Factor), discovered by Rita Levi-Montalcini between 1951 and 1952, is important for the development and maintenance of the sympathetic and sensory nervous systems. This discovery earned the scientist a Nobel Prize.
[6] Mutated huntingtin is the gene involved in the development of Huntington's chorea disease.

instruments, once told me: “I can’t bear to be away from PCR even for a single day!”.

Now, let’s follow Marta and Margherita as they approach the practice that the newcomer will have to learn.

With a quick hand-drawn diagram, Marta shows Margherita how the process they are about to start up will develop. Margherita dons her white coat and gloves and, following Marta's instructions, goes to the fridge to get ice for the biological samples. “First of all, clean the workbench and wash your hands, you have to get ready to manage the situation well” says Marta, and Margherita gets methylated spirit and begins to clean the workbench precisely and thoroughly.

Still following Marta's instructions, she also cleans the pipettes she will be using. Workbench ready, Marta says: “Let’s go to the computer to draw up a plan for carrying out the various phases of the experiment, an action map we can follow”.

While Marta and Margherita set things up for the PCR, all the others in the laboratory are otherwise occupied: at their workbenches, computers, using measurement technologies, quantifying, at the centrifuges, at one of the PCR machines, in the cell room, bent over a workbench or in front of a computer, waiting for the use of a machine, standing at work in the chemical hood or seated and reading with concentration, everyone's material time is programmed.

Figure 2 – Margherita dons her gloves

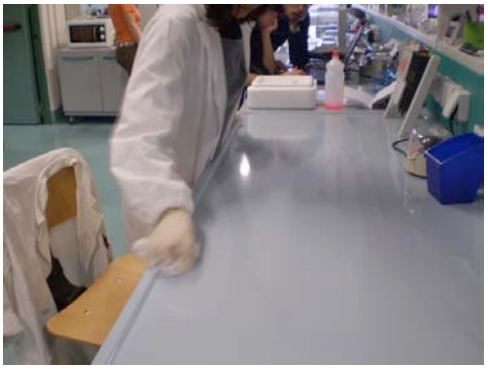

Figure 3 – Margherita cleans the workbench

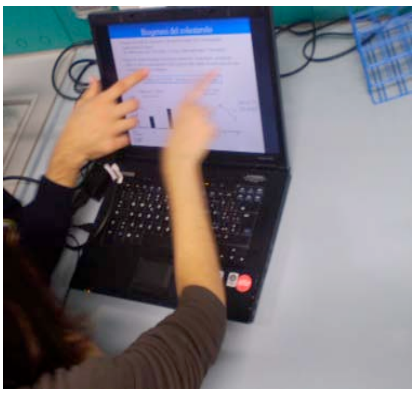

Figure 4 – Marta and Margherita prepare the plan at the computer

Having prepared the plan, they return to the workbench and Marta begins to explain what Margherita is about to do. "We have to get sterile tips, the ones with filters, and place the test-tubes in the racks they rest in during the experiments", says Marta showing to Margherita how to number the rows of little test-tubes which will be used for the samples. They need to establish the number of samples to be used. Their action is mediated by inscriptions, and the procedure they are about to follow is not a way to precisely and accurately *control* the work, but an instrument, a resource to be used to simulate and guide the course of their action. Acting is Margherita's principal cognitive and social resource: in her practical learning, which is made up of continuous assembling between things and self, activity and knowing are closely and intrinsically intertwined.

Back to the workbench, Marta starts explaining what Margherita is about to do: "You have to get sterile tips, the ones with filters, and then the test-tubes. The starting DNA is on ice and now we have to place the test-tubes in the racks".

Then they take a second container with ice where they can put the test-tubes, primers and the various reagents.

Figure 5 – Margherita prepares the test-tubes

Margherita takes down quick details in her notebook. Nearly two hours have elapsed. Now Marta is explaining the steps, the dilutions to be made. Margherita prepares the pipette carefully, and Marta shows her how to use it: "See here, you have to go up and down, no, not like that, change the sterile tip" and shows her how to pick up and hold the pipette. "Now" – continues Marta – "having diluted the primers they have to be brought to 37° to be suspended better". Margherita prepares the test-tubes, makes a note of the dilutions they contain but continually asks for confirmation from Marta, who tells her: "First of all, put in the water, and if you don't touch anything you can use the same tip".

Margherita has to be very careful not to touch the rims of the test-tubes with the tip, as if she manages to do so, Marta tells her, she can continue to use the same tip, otherwise she has to throw the tip away and get another. Margherita notices that she has touched the rim of the pipette with the tip and says: "No, I've wasted one, I touched it!". She is able to feel that she touched the rim of the pipette with the tip, so her sensitivity has already developed. She has enhanced her situated perception skills. Similarly to Gina in Goodwin's study (2003, p. 166-170), Margherita is now able to infer what she is doing from her sensory perception: her body is now a sort of diagnostic instrument. "Let's get our sample now", says Marta to Margherita. Now there is an exchange of perceptions and sensitivity between them, they don't talk much: each of them, to a greater or lesser degree, knows what she has to do.

Margherita makes a note of what she has done until now in her notebook: that night she will go through them, but it's important to memorize the process, the direction, the chain of events in their order.

Figure 6 - Margherita and her notebook on the workbench

In conclusion, Margherita arranges the test-tubes and puts them back on ice. "Now we'll prepare the dilutions checking the measurements with the plan we prepared beforehand on the computer". Margherita needs to concentrate on the movements of her hands and the focus of her attention. Slowly, at first uncertain and then more and more sure of herself, encouraged by Marta, she proceeds. "Now we'll move on to loading the samples into the multiwall", says Marta as she

shows her how to pick up the Petri dish and warns her of the constant risk of contamination: “The Petri dish shouldn't be held between thumb and middle finger leaving the index finger suspended, but should be held using thumb and index finger, look, like this, never move your hands directly over the dish, organize your workspace well”.

Figure 7 – Margherita and Marta starting PCR

Figure 8 – The PCR machine

They load the multiwall onto the PCR machine and from then it will take two and a half hours to achieve results. After the loading, Margherita can relax and takes a deep breath, as if she had been holding it until then. She says: “You're there, a bundle of nerves and concentration, listen to me, I'm hoarse, I'm done in, but it's great”.

While waiting for the results, they place the primers back in the box and put the box in the fridge. Gently, Marta keeps on describing out loud what they need to do: “The aliquots already prepared and left over need to be frozen in a box at minus 20°”. While waiting, they prepare other things that might be useful in future work. The waiting time since the multiwall was uploaded onto the PCR machine has elapsed, so they now look at the results. Marta shows Margherita how to analyse them. Looking at the pattern of data obtained by the machine, she makes her see *again* the curve she had drawn at the beginning of the PCR process. Marta goes on: “Let’s look at the results, so you can see what needs to be improved. From the graphs you can see whether this thing has been done well or not. Today we’ll just have an overview of the results, tomorrow we’ll go into details”. Marta turns off the PCR machine and Margherita asks her, worried: “Did we save the data?” Marta tells her, almost reassuringly, that the system saves data automatically. “Now we take the well plate, we bring it to 4°, we turn off the machine and then the computer. Tomorrow we’ll perform an electrophoresis and we’ll analyse it on an Agarose gel. If necessary, we can run a specificity test”. Margherita looks puzzled. She doesn’t even know what an Agarose gel is… But this is something she will have to deal with tomorrow.

In this first phase, Margherita has tested the sensitivity of her hands, of her eyes, of her touch; she has started perceiving, hearing, seeing, trying to understand. In her dialogue with Marta, she has been engaged in an expert

communication and introduced to the most relevant area of the laboratory practice. She is a novice, but her participation is not peripheral: right from the beginning, she has got to the heart of an experiment that, while it is a routine procedure, is also fundamental for the project they are working on. She has started establishing relationships and becoming familiar with technological and bio-technological artefacts, such as pipettes, *primers*, centrifuge, computer, PCR machine, DNA, measuring instruments, and so on.

In critical moments, Margherita has learned through mistakes; her gestures are not repetitive and taken for granted yet, but her body is receptive. Margherita has plunged into the laboratory world, perceiving it, moving her body in a temporalised space, getting to the heart of a process of embodiment of objects and functions (Yakhlef 2010, p. 416). Her body starts being disciplined without her being fully aware of it. She is still quite tense, but she already feels the corporeal density of the practice she is becoming familiar with.

As already underlined by Lave and Wenger (1991) in CoP there is a shift from teaching to learning in practice: Margherita's access to the practice was not marked by explicit moments of theoretical teaching, but by learning a specific task while carrying it out.

Through her efforts, exemplified here by the episode of the PCR test, Margherita establishes a meaningful and passionate relationship with the materiality of practice: there is no knowledge beyond its practical application. Even developing dexterity in handling tips or creating new concepts is a practical exercise, a learning *effort* that also involves objects (Gibson 1979). Scientific knowledge, as shown in the above-mentioned episode, does not lie somewhere in people's heads or in metaphysical laws, but is constructed through the accumulation and fine-tuning of skills developed, embodied and sharpened to solve everyday problems.

3.3. Margherita some months later: between autonomy and attachment

Some months have gone by and Margherita has become totally familiar with PCR practice. She has inserted it in a wider context of work (and scientific) practices, with regard to which she is now completely autonomous. Now the PCR tests are in the order of hundreds, while at the beginning she did three or four a day. She has become swift and expert. Marta has been an excellent teacher, also because she tends to leave freedom of action to her collaborators, thus allowing them to develop their independence. At the beginning this autonomy was perceived by Margherita as a kind of solitude, but later on she realized that only in that way could she acquire competence in what she was doing and the way she was doing it. Several months later, I interview Margherita, so to ask her what has happened, what she perceived has changed in her acting in practice. Let's hear what Margherita has to say about the conquest of her competence:

"In time, I elaborated my work inside. Marta was there, but I knew that I had to do it alone, that I had to acquire dexterity in my hands and autonomy in my head. During my first PCR, I concentrated exclusively on what I was doing, I wasn't the least bit interested in why I was doing it, while today carrying out a PCR seems so simple, today it's easy, it gives me satisfaction, but there are phases in which you have to be very careful, you have to be precise, very precise, even the slightest mistake... in short, dexterity is all-important. Of course, if I do something wrong today, I'm immediately aware of it, I'm much more sensitive, I see my mistake right away. You acquire this sensitivity through time, I didn't realize this before, I was just concentrated on organizing my work, what I had to do first, what I had to do after that, through time I understood that the job I was doing had a scope and I started to piece the puzzle together in my head, and today PCR is only a small part of that along with others. At the beginning, I worked mainly in molecular biology, then I moved on to cellular biology and I was put in charge of carrying out the proliferation of the stem cells, the ES mouse cells. I started to do the differentiations, and although having the cells means more stress it's great. For months I've had to come here at weekends too... you learn to know the cells, how to behave with regard to them, what dilutions you have to make, when to make them, to understand whether they're well or not, all these things take time... I used to go home and think, I wonder how my cells are. At first Marta was with me and I made a note of all the steps I had to carry out. Of course, I looked around me, I watched the others, asked for advice about everything, about what to do, what to look for, even though all cells are different, each type of cell requires different treatment, some are more stable and need less attention, others are more delicate and need a lot more attention. Now I manage two cell lines, and each line needs specific care, some cell lines have to be changed every day, others don't, you have to understand them, observe them. Slowly, I started to understand how to treat them. I asked everyone: "How do you think the cells are?" I trained my skills and started to elaborate a complete picture of what I was doing. I realized that it wasn't just important how things were done, but also why they were done, why they had to be done in exactly that way, I moved my focus from my hands to my head and my whole body. At first I didn't consider the entire project, I focused on the details, the processes, on how to perform single actions, how to write them, report them, repeat them and then slowly you widen your vision and you see a bigger picture, you see the links between the various elements, between the actions you perform, the objects you use".

Now Margherita clearly masters a richer and more refined language. Instead of talking *about* PCR practice, she talks from *within* the practice, from the inside of it. She is no longer a mere participant in the practice, she has now developed a deeper insight into it. She has learned to move across a plurality of practices, she has also acquired competence in cell biology, she is able to distinguish different cell lines, develop her own work plan, and contribute to the others' tests.

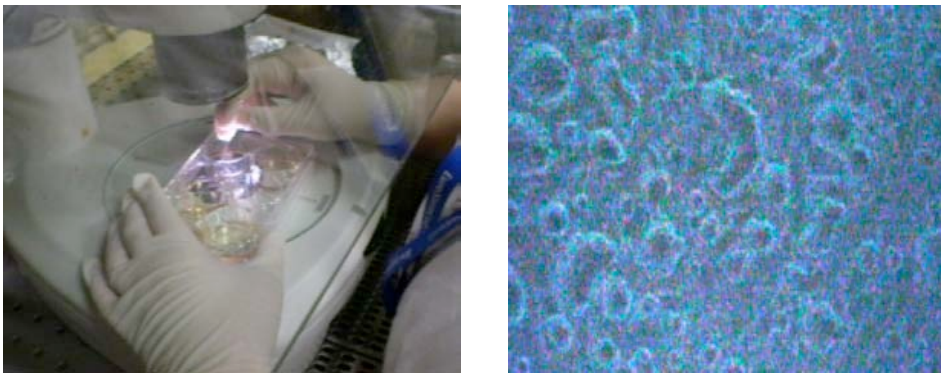

Figure 9 - Margherita and her cell line

When Margherita enters the laboratory, she meets an already established environment, and she ventures into this contest with her hands, her glance, her thoughts, as she slowly becomes familiar with objects circulating in the laboratory: DNA, cells, PCR, notebooks, protocols, primers, articles, papers, test-tubes. Thus her autonomy, her competence of movement and her ability in interpreting events, increase and, as she familiarizes herself with the material context, her attachment (Hennion 2004) to events grows. Margherita has now mastered not only "how things are done", but her actions have acquired a rhythm, a fluidity which is apparent (for example) in her use of language. Autonomy manifests itself in a stronger link with all the human and material events.

Conclusions

The aim of this paper has been twofold: firstly, that of placing the "corporeal turn" centre-stage in observing learning processes in laboratory practice; secondly, that of attempting to go beyond the peripheral conception of novices in practice (an idea central to Lave and Wenger's approach), proposing the idea that novices find themselves at the centre of practice and sustain the daily sociomaterial texture of collective work in the laboratory.

Regarding the forst point, one could say that Margherita is immersed in events guided by what Tarde (1985) defines *les lois de l'imitation*. In fact, she has to go through reciprocal imitation processes before achieving autonomy. She draws inspiration from Marta's indications, but at the same time she copes with other processes tacitly (writing in the logbooks, keeping the practice in order, donning gloves and a white coat, managing the experimental timelines, etc.) Acting represents her sole learning plan, a plan which takes no single direction,

but rather permeates a terrain of constant relationships and connections between human beings and things.

In order to illustrate the type of link that binds Margherita to the events surrounding her, we could perhaps adopt the term *Wechselwirchung* ("interaction") which is at the basis Simmel's approach (1908). This concept regards the most elementary forms of connection in social life, a form of association which binds subjects (and action) together. It is, however, necessary to strengthen Simmel's concept with the dose of materiality which it lacks. The concept expresses a kind of *reciprocal effect* between individuals in interaction. But the events Margherita is involved in are not related just to human interaction (as in Margherita's relationship with Marta) but also to a sociomaterial time-space continuum which is constantly unfolding. She is actively part of a *mutual learning* process (Blumer 1969) in which the significance of actions is to be found in collective coordination, according to situated events. Margherita's learning path takes place within a social and material space where she interacts with heterogeneous actors who develop the activity *with her*.

I chose to focus my attention solely on Margherita, but this methodological choice should not be misleading. Although Margherita is observed singly in her peripheral position, she is in fact surrounded by a more ample space filled with events which involve her and which she contributes to shaping. Her daily practice is closely linked to the practice of others: that of Marta (her senior of reference), for example, or Giovanna, the peer with whom she works and whom she continually asks for input, her colleagues in the laboratory who represent a relevant imitative source (in the open-space workplace, at the workbench, under the chemical hood, in meetings where results are discussed). Margherita builds a learning trajectory on her own, but the trajectory is built through *effectual reciprocity* with the heterogeneous elements she encounters in practice.

The story of Margherita is thus about situated learning, a process of knowledge (and knowing) appropriation which required a laborious work of embodiment. Margherita has domesticated herself, establishing a relationship with objects and learning to develop independence and awareness. Margherita's change of posture, her gaining awareness and getting to the heart of practice are developed through a disciplined set of repeated gestures, through the embodiment of routines and sociomaterial relationships of daily practice. The docility, efforts and difficulties of this process of appropriation are the result of the intertwining of heterogeneous elements, as well as of a self-discipline (Kaiser 2005), which is the individual's contribution to the learning process. The processes Margherita has aligned herself with, have produced an agent able to exercise active control over objects and rituals.

The episodes related to Margherita's learning process show that there is no precise and pre-established order of events, no explicit set of knowledge to be taught: knowledge is rather situated in practice and inscribed in the instruments and in the steps by which a technique is performed. As in the case of the PCR tests, the practice is embodied by Margherita as a *craft knowledge* (in Bernstein's words), a manual, bodily and practical knowledge (Sennett 2008). Margherita is

introduced to the practices of a context where knowledge is embodied and embedded in people's skills and competences, as well as in technologies, objects, rules, procedures. This *knowing in practice* (Gherardi *et al.* 2007) depends on knowledge experienced and developed in specific situations: it is not situated in abstract rules to be acquired, but is activated by physical stimuli and sensory perceptions (Strati, 2007). As a constantly evolving resource, knowledge is *encultured* in social dynamics, in sensemaking and in shared stories; it is related to heterogeneous processes and expressed in the specific language required by the context. Knowledge is also *encoded*, codified and conveyed by signs, symbols and traditional artefacts of codified knowledge (such as books, manuals, codes, procedures and forms of digital coding).

In Margherita's increasing relationships and connections with the field (the management of the workbench, the increasing dexterity in handling pipettes, the relationship with the cells under the hood, the knowledge of instruments and the adaptation of her senses to their use), she experiences an *agency* that is not performed and established individually, but based on a constant relationship with the material playground of the laboratory. The practical knowledge produced by this dense transindividual experience (Simondon 1958) leaves both subjectivities and objectualities unfinished, open to relationships and connections they establish with each other.

Margherita is now interconnected with a world of *objectual practices* (Knorr Cetina 1997; 2001) where material objects (as well as bio-objects) become part of her field of relationships. The materiality of laboratory life (Latour and Woolgar, 1979) is not cold and distant, but becomes absorbing and close: what used to be unfamiliar to Margherita is now conventional and her competent practice reflects her affiliation with the practical culture of the laboratory. Practical culture has been embodied by Margherita as an implicit practice, rather than as an explicit appropriation of normative domains: sometimes, practice precedes theory (Bruner 1996).

We are now able to see Margherita's training as a net of sociomaterial processes, rich of human and non-human elements. It is an *expert situated action* within a field where prescribed rules and standards of action have been established through time and continue to be elaborated day by day *via* researchers' bodies and through the density of sociomaterial relationships. In this sense, the story of Margherita shows that it is much more productive, from an analytical point of view, to develop a post-humanistic approach to learning. Through this theoretical sensitivity, in fact, we can witness how objects, technologies and space are no longer 'matters of fact' (objects in a static sense); they are rather 'matters of concern' in educational practices, for practitioners as well as for researchers (Landri and Viteritti 2010).

Finally, I have underlined how scientific work is an "expert practice" which deeply involves novices: as in the case of Margherita, in laboratories youngsters are often in charge of the routine daily events (caring for the cells on a day-to-day basis; checking infrastructures; managing minor accidents). Their seniors intervene to correct the course of events, to monitor the results, to programme

future steps, but novices govern the everyday laboratory life: they manage crucial routines, keep the workspaces tidy, keep up with the details of experimental work practices, do and repeat everyday tasks with the same care and meticulous attention. Without them, scientific work would lose both density and intensity. Their contribution is therefore in no way peripheral: they are at the very "heart" of daily practice. Of course, in order to gain full recognition, their practice must be firmly anchored to the work of their expert colleagues, whose developments in scientific work, by the way, are *founded* totally in the experimental practices the novices accomplish day by day.

In this process, novices and experts are reciprocally made part of a common process: both are involved in practical activities and are, to a greater or a lesser degree, co-producers of scientific practice.

References

Blumer, H. (1969) *Symbolic Interactionism: Perspective and Method*, Englewood Cliffs, NJ, Prentice Hall.

Bruner, J. (1996) *The Culture of Education*, Harvard, Harvard University Press.

Callon, M. (1986) *Some Elements of a 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 & Kegan Paul, pp. 196-233.

Collins, H. (2010) *Tacit and Explicit Knowledge,* Chicago, University of Chicago Press.

Fenwick, T. and Edwards, R. (2010) *Actor-Network Theory and Education*, London, Routledge.

Fenwick, T. and Edwards, R. (2012) *Researching Education through Actor-Network-Theory*, London, Wiley-Blackwell.

Foucault, M. (1975) *Surveiller et punir. Naissance de la prison*, Paris, Gallimard.

Gherardi, S. Nicolini, D. and Strati, A. (2007) *The Passion for Knowing,* in "Organization", 14 (3), pp. 315-329.

Gherardi, S. (2000) *Practice-Based Theorizing on Learning and Knowing* in "Organizations", 7 (2), pp. 211-223.

Gherardi, S. (2009) *Community of Pratice or Practices of a Community?* in S. Armstrong and C. Fukami (eds) *The Sage Handbook of Management Learning, Education, and Development*, London, Sage, pp. 514-530.

Gherardi, S. (2011) *Organizational Learning: The Sociology of Practice* in M. Easterby-Smith and M. Lyles (eds) *The Blackwell Handbook of Organizational Learning and Knowledge Management*, Oxford, Blackwell, pp. 43-65.

Geertz, C. (1973) *The Interpretation of Cultures*, New York, Basic.

Gibson, J.J. (1979) *An Ecological Approach to Visual Perception*, Hillsdale NJ, Lawrence Erlbaum Associates.

Goodwin, C. (1994) *Professional Vision*, in "American Anthropologist", 96 (3),

pp. 606-633.
Hennion, A. (2004) *Une sociologie des attachments. D'une sociologie de la culture une pragmatique de l'amateur*, in "Sociètès", 85 (3), pp. 9-24.
Hutchins, E. (1995) *Cognition in the Wild*, Cambridge, Mass., MIT Press.
Kaiser, D. (2005) *Pedagogy and The Practice of Science: Historical and Contemporary Perspectives*, Cambridge, Mass., MIT Press.
Knorr Cetina, K. (1997) *Sociality with Objects: Social Relations in Postsocial Knowledge Societies*, in "Theory, Culture & Society", 14 (1), pp.1-30
Knorr Cetina, K. (1999) *Epistemic Cultures: How the Sciences Make Knowledge*, Cambridge, Harvard University Press.
Knorr Cetina, K. (2001) *Objectual practice*, in T.R. Schatzki, K. Knorr Cetina and E. von Savigny (eds), London, Routledge, pp. 175-188.
Landri, P. and Viteritti, A. (2010) *Tracing socio-materiality in education*, Paper for Conference *Theorising Education*, *First International Theorising Education Conference*, Stirling Management Centre, University of Stirling, UK, June 24-26.
Latour, B. and Woolgar S. (1979) *Laboratory Life: The Social Construction of Scientific Facts*, Thousand Oaks, Sage.
Latour, B. (1987) *Science in Action. How to Follow Scientists and Engineers Through Society*, Milton Keynes, Open University Press.
Latour, B. (2005) *Reassembling the Social*, Oxford, Oxford University Press.
Lave, J. and Wenger, E. (1991) *Situated Learning. Legitimate Peripheral Participation*, Cambridge, Cambridge University Press.
Lynch, M. (1985) *Art and Artifact in Laboratory Science: A Study of Shop Work and Shop Talk in a Research Laboratory*, Boston, Routledge.
Mullis, K. (1998) *Dancing Naked in the Mind Field*, London, Bloomsbury Publishing.
Nicolini, D. (2009) *Zooming In and Out: Studying Practices by Switching Lenses and Trailing Connections*, in "Organization Studies", 30 (12), pp. 1391-1418.
Nicolini, D., Gherardi, S., Yanow, D. (2003) *Knowing in Organization. A Practice-Based-Approach*, New York, M.E. Sharpe.
Orlikowski, W.J. (2007) *Sociomaterial Practices: Exploring Technology at Work*, in "Organization Studies", 28 (9), pp. 1435-1448.
Pink, S. (2007) *Doing Visual Ethnography: images, media and representation in research* London, Sage.
Polanyi, M. (1966) *The Tacit Dimension*, New York, Doubleday.
Rabinow, P. (1996) *Making PCR: A Story of Biotechnology*, Chicago, University of Chicago Press.
Roth, W.M., Lawless, D.V. (2002) *When Up Is Down, and Down Is Up: Body Orientation, Proximity, and Gestures as Resources*, in "Language in Society", 31 (1), pp. 1-28.
Schatzki, T.R., Knorr Cetina, K. and Von Savigny, E. (eds) (2001), *The Practice Turn in Contemporary Theory*, London, Routledge.
Simmel, G. (1908) *Soziologie*, Leipzig, Duncker & Humblot.
Simondon, G. (1989) *Du mode d'existence des objets techniques*, Paris, Aubier.

Sørensen, E. (2009) *The Materiality of Learning Technology and Knowledge in Educational Practice*, Cambridge, Cambridge University Press.
Strati, A. (2007) *Sensible Knowledge and Practice-based Learning* in "Management Learning", 38, pp. 61-77.
Suchman, L. (1987) *Plans and Situated Action: The Problem of Human-machine Communication*, Cambridge, Cambridge University Press.
Tarde, G. (1904) *Les lois de l'imitation*, F. Alcan, Paris.
Traweek, S. (1988) *Beamtimes and Lifetimes: The World of High Energy Physicists*, Cambridge, Harvard University Press.
Wenger, E. (1998) *Communities of Practice. Learning, Meaning, and Identity*, Cambridge, Cambridge University Press.
Yakhlef, A. (2010) *The corporeality of practice-based learning*, in "Organization Studies", 31 (4), p. 409.

Assunta Viteritti, Università di Roma "Sapienza"
Dipartimento di Science Sociali
Via Salaria 113
00198 Roma, Italy
Email: assunta.viteritti@uniroma1.it

Disciplined Interdisciplinarity?

A Brief Account of STS in Norway

Knut H. Sørensen

Abstract This paper discusses Science and Technology Studies (STS) in Norway by using interdisciplinarity as an accounting device. I present several ideas about interdisciplinarity in relation to STS, but Sheila Jasanoff's proposal of a disciplined STS seems to fit best with the Norwegian scene.

Keywords Science and Technology Studies; Interdisciplinarity; Institutionalisation; Norway.

Introduction: how to account for STS?

In the mid-1990s, I was involved in an effort to map technology studies in a number of European countries (Cronberg and Sørensen 1995; Sørensen 1997). An underlying idea of this effort was to analyse the emergence of social study of technology as a scholarly field. While we could observe a common set of concerns, above related to innovation policy, the institutional matrix of intellectual development varied considerably.

The underlying expectation was convergence; that we would find national differences in the shaping of technology studies but that these differences would diminish as technology studies was consolidated internationally. We observed a shared international body of scholarly knowledge, but this appeared to be interpreted and used in different fashions. Thus, apparently, there was an interesting relationship between international and national intellectual developments that could not be understood in simple terms like 'reception' or 'national styles'. With respect to Norway, I argued (Sørensen 1995) that technology studies had been shaped above all through an interaction between an economic history of technol-

[1] The paper has benefitted from valuable comments from Helen Jøsok Gansmo, Vivian Anette Lagesen, Nora Levold, Marianne Ryghaug and the editors of *Tecnoscienza*. The remaining faults are my responsibility.

ogy and industrial technology, but with a clear imprint of the international development of technology studies as a field of research.

Now, more than 15 years later, I have been asked to provide a kind of cartography of Science and Technology Studies (STS) in Norway. Would the previous report provide an interesting point of departure for an update? I think no, for two reasons. First, STS in Norway has become more established while catering a broader set of intellectual concerns. This makes it more difficult to account for the Norwegian STS scene. Second, the convergence model that we conversed with in the earlier work, appear less satisfactory as a tool to make sense of the present situation. Rather, reflecting on how to make sense of Norwegian STS, it struck me to use the concept of interdisciplinarity as an accounting device. On the one hand, STS in Norway – like in many other countries – cultivates interdisciplinarity by using the concept as a distinguishing quality. This represents a diversifying force. On the other hand, efforts particularly with respect to education pursue a path of disciplinarity, a unifying feature. Is this a paradox? May we use the situation of STS in Norway to illuminate what the doing of interdisciplinarity could mean?

A potentially important feature is that scholarly fields like STS tend to have a local as well as an international flavour, which may influence the practices of interdisciplinarity. Scholars address concerns that may meet with local as well as international interest and grapple with the issues using local as well as international interpretative resources of disciplinary as well as interdisciplinary character. Arguably, addressing an international audience focused on STS could be seen to be a force of disciplinary convergence, while addressing national communities that have thematic rather than disciplinary interests could be presumed to produce an interdisciplinary and thus more disjointed orientation. However, the effort of Martin et al. (2012) to provide an overview of the knowledge base of STS in general should serve as a warning that this may be more complex. They claim that internationally, STS is fragmented, even if there is some agreement about the scholarly contributions that constitute the core of the field. The fragmentation is in the paper partly attributed to weak institutionalisation but also to an observation that STS – compared to adjunct fields like innovation studies and entrepreneurial studies – has a more 'egalitarian' flavour, which makes consensus building more challenging.

To pursue these issues, the next section presents some main institutional features of STS in Norway as a point of departure for discussing to what extent and through which means institutionalisation has happened. As we shall see, disciplinary forces are at work, raising questions about why the label of interdisciplinarity still is used, eventually what it means to use this label. In response to such questions, I turn to a more general discussion about interdisciplinarity and STS, before getting back to the Norwegian case with a focus on some features of the publication output of Norwegian STS scholars. How is the relationship between national concerns and internationally oriented contributions? What may we learn about scholarly dynamics of a self-proclaimed interdisciplinary field like STS?

1. STS coming of age in Norway: notes on interdisciplinary building of institutions

In 2009, the Norwegian Association of Higher Education Institutions confirmed the establishment of an academic council for Science and Technology Studies. This could be seen as a formal acknowledgement of STS as a scholarly field in Norway. The academic council consists of representatives of three institutions: Centre for the Study of the Sciences and the Humanities, University of Bergen (SVT), Centre for Technology, Innovation and Culture, University of Oslo (TIK), and Department of Interdisciplinary Studies of Culture, Norwegian University of Science and Technology, Trondheim (KULT). These three institutions are the core STS communities in the Norwegian university context; however, as we shall see, STS also has other important outlets.

The history of the three institutions indicate different pathways in the making of STS in Norway, where the establishment of teaching programmes have played an interesting role as a force of convergence. SVT in Bergen was formed in 1987, initially to undertake teaching of theory of science at University of Bergen. The profile of the centre has been dominated by philosophy, but increasingly, the research has been directed at ELSA (Ethical, Legal and Social Aspects) topics. With respect to SVT, it is mainly the engagement in these kinds of inquiries that during the last decade or so have given the centre a distinct STS profile.

TIK was started in 1999 when the previous Centre for Technology and Human Values (TMV) was merged with an innovation studies group. TMV, which comprised the initial STS effort at the University of Oslo, was formed in 1988. This was a result of an initiative from the Norwegian Academy of Science and Letters to initiate research to critically investigate the interaction of modern technology and social values. Such mandate is recognisable as a starting point of many STS programs also in other countries, where a main focus has been to explore in a critical fashion the role of modern science and technology in society, including ethical engagement with the teaching of engineers. TMV became at the outset a stronghold of history of technology in Norway, drawing in particular on economic history approaches. However, other humanist disciplines and social sciences became increasingly important during the 1990s, broadening and solidifying the STS profile of TMV. Leading STS scholars like Donna Haraway and Sharon Traweek visited TMV, and later John Law was appointed adjunct professor. This process of developing an STS community has continued through the new centre, TIK, which was organised with two sections: STS and innovation studies.

KULT was established in 1999, as a merger between Centre for Women's Studies and Centre for Technology and Society (CTS). CTS was formed by the university in 1988 and became the main STS institution in Trondheim. This happen partly as a response to a series of initiatives from STS scholars to get an STS centre established, but also as a reaction to the TMV initiative in Oslo. Like TMV, CTS was to engage in research and teaching in the field of science, tech-

nology and society, with particular emphasis on the interaction between social change and technological development, history of technology and studies of technological R&D and innovation. During its first decade, CTS mainly combined historical and sociological approaches to STS but also information science and philosophy of technology. Later, people with other disciplinary training like anthropology, psychology and political science were recruited.

Thus, all the three core STS university institutions were founded in the late 1980s. While SVT in Bergen was formed with a specific purpose of teaching theory of science, in particular to PhD students, TIK (TMV) in Oslo and KULT (CTS) were initiated as a response to a concern about the social implications of – in particular – modern technology. In the same period, research programmes were launched to fund research related to innovation, social effects of new technologies and social features of technology, in particular information technology. These programmes were intended to cater for a broader set of approaches than STS, but they offered important opportunities for the centres to fund research, in particular PhDs. A growing concern for social and ethical issues in the engineering communities also paved the way for STS in Norway. For example, CTS was called upon to teach environmental ethics to engineering students. However, unlike many other countries, the Norwegian STS centres were not populated by established scientists and engineers, who wanted to critically engage with the effects of science and technology.

In terms of the disciplinary background of the people involved, STS in Norway was formed with an interdisciplinary point of departure. With the exception of SVT, which mainly was a philosophy of science centre, the community grew through a disciplinary matrix where history and sociology of technology were particularly forceful. In addition, interaction with engineering sciences and architecture was important. To what extent was this caused by interdisciplinary ambitions? How should we characterise the interdisciplinary practices of STS in Norway? To deal with such questions, we need to clarify the concept of interdisciplinarity as well as how it has been applied to STS more broadly.

2. Interdisciplinarity and STS: an interacting field?

Arguably, STS is a self-proclaimed interdisciplinary area. The Introduction to the most recent handbook of science and technology studies states bluntly that: "STS has become an interdisciplinary field that is creating an integrative understanding of the origins, dynamics and consequences of science and technology (…). Through three decades of interdisciplinary interaction and integration, shifting intellectual continents and cataclysmic conceptual shocks, perseverance and imagination, STS has become institutionalized and intellectually influential, and STS scholars have become engaged in various arenas of activism and policy" (Hackett et al. 2008, 1). When we look beyond the self-gratulatory rhetoric, it is interesting to note how the concept of interdisciplinarity is left unaccounted for. The Handbook editors do not seem to feel that they have to explain what inter-

disciplinarity means or why this label applies to STS. Apparently, STS is interdisciplinary because it cannot be disciplinary.

Scholarship on interdisciplinarity distinguishes between a multitude of different practices (e.g., Klein 2010). However, Peter Weingart (2010) claims that new interdisciplinary fields are formed either as new specialised fields of inquiry or as fields promoted by funding agencies. The latter are "combinations of disciplines or sub-disciplines that are joined in research centers, journals, and funding programs but that remain intellectually independent and continue to develop individually (…). Thus, disciplines and their derivatives, specialities, and research fields, remain the principal organizational unit for the production and diffusion of knowledge" (Weingart 2010, 13). Weingart's argument applies to interdisciplinarity in general. Is STS a specialised field or a funding agency construction?

Sheila Jasanoff (2010) addresses the issue of STS and interdisciplinarity in a different way. To begin with, she notes that in 2001, STS was included as an 'intersecting field' in the *International encyclopedia of social and behavioral sciences*. Jasanoff claims that this was the first time that "STS was named as a card-carrying field in a comprehensive roster of the social and behavioral sciences" (p. 191). The label 'intersecting field' is an interesting one, because it was intended to emphasise that STS operated in the intersection of social and behavioural sciences on the one hand, and natural and engineering sciences on the other. Accordingly, STS was located in a comprehensive disciplinary matrix, indicating that the field would be engaged in a wide variety of interdisciplinary situations.

Jasanoff interprets this to mean that STS is interdisciplinary in a very particular way. STS has not, she claims, come into being: "principally through exchanges among scholars already belonging to one or another established disciplinary community and trained in its forms of reasoning and research practices" (p. 192). Thus, in her understanding, the interdisciplinarity of STS is not primarily about crossing and bridging borders, which are Julie Thompson Klein's (1996) favoured metaphors for interdisciplinary practices. Rather, Jasanoff sees STS as "an independent disciplinary formation situated among other disciplines". For her, STS is "an attempt to chart unknown territories among islands of disciplined thought in the high seas of the unknown" (p. 192-93).

There are good arguments to support the idea that the topic of STS, to study the practices of science and technology as well as their effects, largely has been ignored by other disciplines. Still, as Jasanoff notes, when STS claims special status as *the* field that analyses science and technology, this is not universally accepted. Other disciplines and specialities maintain that they also study aspects of the topic, and such scholars even participate in STS meetings and publish in STS journals. Moreover, also within STS, there is considerable reluctance to claim special status and to engage in the building of institutions necessary to support the claim. Thus, Jasanoff observes ironically that "Many therefore prefer … to retain STS as a loosely constructed society to which anyone with a passing interest can gain easy entry. This broad-church approach satisfies liberal academics' often deep-seated desire for intellectual democracy, but it also gets in the way of

critical stock-taking, meaningful theorizing, and methodological innovation – in short, of *disciplining*" (p. 204).

In this manner, Jasanoff suggests an ambiguous image of STS, as a potential discipline but where many practitioners are reluctant to realise the potential. What are the consequences of this situation? I shall address the issues by returning to the case of Norway, but let me first briefly suggest a few more concerns that may be relevant to the exploration of interdisciplinarity in STS. In a recent paper, Bruno Latour (2010) complains humorously that his books are difficult to find because they are spread over a number of labels – law, engineering, travel (!), and spirituality. This is a nice example that STS may have a problem with respect to audiences. On the one hand, STS is too small a field to merit its own label, for example in bookstores. On the other hand, STS research is read by many different disciplinary (and interdisciplinary) audiences. Put in another way, STS scholars face an interesting but challenging situation when communicating their findings since STS potentially has a heterogeneous audience of outsiders, in addition to the insiders of the field. In addition, it is unclear how to differentiate between outsiders and insiders in STS.

On several occasions, I have argued the need to distinguish between interdisciplinarity understood as, on the one hand, an encyclopaedically oriented individually based undertaking, and on the other as a team effort of managing distributed but potentially additive knowledges (see, e.g., Sørensen 2010). Latour could, with some reservations, be seen as an instance of the first idea, which seems to resonate fairly well with standard STS practices. Obviously, there are limitations to omniscient knowledge practices. Harry Collins and Robert Evans (2002) usefully suggest the concept of interactional expertise to catch important features of this situation. They define interactional expertise as having sufficient competence to interact interestingly with participants from other specialities and carry out a sociological analysis of their practices (p. 254). They contrast this to contributory expertise, which means that one has to be an insider to the particular field of inquiry. To have contributory expertise in more than one field is very demanding. However, to acquire interactional expertise is more doable even if that also requires substantial effort.

To sum up, we face at least four ways of understanding STS as an interdisciplinary effort. First, following Klein (1996), we may see STS as meeting-place of scholars from a diversity of disciplines and specialities, engaged in border-crossing and bridge-building to explore science and technology. Second, Jasanoff (2010) proposes to see STS as a discipline that explores what is in-between (inter) other disciplines and specialities. Third, drawing on Collins and Evans (2002), we may consider STS a scholarly community whose interdisciplinarity relies on interactional expertise as the main tool of making sense of and translating between other disciplines of science and technology. Fourth and final, drawing on Weingart (2010), we could ask if the self-claimed interdisciplinarity of STS is just a cloak under which a diversity of disciplinary and sub-disciplinary interest are developed and pursued. How does STS in Norway compare to these four perceptions?

3. Towards a room of its own

During the 1980s, several initiatives were taken to develop STS scholarship in Norway, which eventually lead to the establishment of the STS centres in Oslo and Trondheim (Sørensen 1995). A common feature of these efforts was a fairly inclusive strategy with respect to scholarly involvement. For example, the initiatives to develop history of technology comprised not only historians, but engineers, economists, sociologists, ethnologists, and political scientists (Thomassen 1997). Thus, TMV (TIK) as well as CTS (KULT) were established from traditions where interdisciplinarity was a common feature. This also included impacts from the scholarly practices of fields like work life studies and gender studies. However, interdisciplinarity did not happen without controversy. Particularly in the case of history of technology, engineers and historians held different views about how to proceed (Thomassen 1997). In the end, the historians came to dominate this sub-set of STS inquiry but not completely. In STS more broadly, a fairly inclusive approach dominated. Interdisciplinary participation was a given feature in the establishment of Norwegian STS, at least if we understand interdisciplinarity as scholarly interaction of people with diverse disciplinary training. What were the consequences of this interdisciplinary recruitment to STS? To what extent do we observe interdisciplinarity in the resulting knowledge practices?

To begin with, if we look at the publication output of the people involved in the establishment of STS in Norway, we find that most of them published as individual authors or together with people of similar disciplinary orientation. Historians wrote with historians, sociologists with sociologists, with only a few exceptions. Still, the rather cynical proposal of Weingart (2010) that interdisciplinarity mainly is a way of funding the pursuit of disciplinary concerns does not quite match the Norwegian STS situation. Actually, the emerging scholarly practices fitted fairly well with Klein (1996) emphasis on boundary crossing and bridge building because there has been (and still are) considerable cross-disciplinary traffic in theory and methods.

A simple indicator of this traffic is the disciplinary diversity in the lists of reference of Norwegian STS scholars. However, strictly speaking, this is just evidence of cross-disciplinary reading not of interdisciplinary scholarship. The latter issue is more complex. Actually, I will claim that when one reads the scholarly publications of STS people in Norway, it is usually possible to identify disciplinary imprints that suggest that there are anthropological, historical, philosophical and sociological (or social science) versions of STS writing. However, there is still an STS flavour that distinguishes this writing from that of mainstream scholars from the disciplines. Typically, publications of the Norwegian STS community would not be recognised as mainstream contribution of a traditional discipline, even if they may be acknowledged as contributions to historical, sociological, anthropological, philosophical, etc. inquiry.

Another interesting and related feature is the development of care in the scholarly conduct with respect to disciplinary boundaries within the STS community. I know this particularly well from my own institution, CTS (KULT), where this practice emerged from conflicts regarding use of theory, methodology and style of writing. In particular, we had to learn that historically and social science oriented STS scholars often pursued similar agendas in different ways. This produced a kind of competence that Michelle Lamont (2009) calls cognitive contextualisation, namely the skill of relating to pieces of scholarship on their own scholarly premises. Cognitive contextualisation is important in interdisciplinary communities to avoid unproductive disciplinary conflicts in scholarly exchanges. Usually, papers authored by historians would be discussed with that feature of origin in mind, similarly with anthropologists and sociologists, so that the papers receive comments acknowledging different approaches and styles of writing. This does not mean that features originating with disciplines outside STS should not be discussed, but such debates seem best to be conducted while acknowledging the disciplinary border crossing involved.

The ability of Norwegian STS scholars to do cognitive contextualisation was also related to the development of interactional expertise regarding the neighbouring disciplines. A social science oriented STS person would normally not be seen as a contributor to, e.g., history of technology or history of science, and vice versa. However, there would be recognition of what was involved in historical and social science oriented STS scholarship that allowed fruitful interaction.

What about Jasanoff's view of STS as a discipline? Actually, STS in Norway has – at least institutionally – pursued a disciplinary path, in particular with respect to teaching. The previously mentioned recognition of the Norwegian Association of Higher Education Institutions through the establishment of an academic council for Science and Technology Studies is evidence that this pursuit has met with some success. All three university centres have established STS teaching programmes. SVT in Bergen has a PhD programme. TIK in Oslo has two master programmes and a PhD programme in STS and Innovation studies. KULT in Trondheim has a master programme, a PhD programme and a one year undergraduate programme in STS. These programmes have mostly been started during the last decade. Annually, 25-35 MAs and 5-10 PhDs graduate. However, there is no Norwegian STS society and no STS journal. In terms of teaching, Norwegian STS is beginning to look like a discipline, but what about research? So far, I have painted an ambiguous picture. Is Norwegian STS research in the final instance a pursuit of concerns related to traditional disciplines? If not, what kind of interdisciplinarity may we observe?

4. A broad church?

Some STS scholars in Norway publish in disciplinary journals of history, political science, sociology, etc. However, this pattern of publication is fairly marginal. The majority of STS publications are found in other outlets. Actually, when we

look at the journals where Norwegian STS scholars publish, the most striking feature is diversity. We do of course find papers in STS journals like Social Studies of Science and Science, Technology & Human Values, but not very many. Rather, the publications of Norwegian STS scholars are found in quite specialised, interdisciplinary and thematically oriented journal and over a wide spectrum of topics.

Thus, the typical Norwegian STS paper is addressing concerns in other interdisciplinary areas. We find contributions to fields like gender studies, energy studies, building studies, environmental studies, climate science, policy studies, media studies, information and communication technology studies, disability studies, ethics, social studies of genetics, etc. This suggests that Norwegian STS publications are border crossing, but not so much with respect to traditional disciplines as to other interdisciplinary fields that are defined mainly through topical interest. What kind of interdisciplinarity is this?

The way Norwegian STS publications from the last decade are spread thinly over a fairly large number of interdisciplinary, topical journals – about 100 different ones – suggests two features of Norwegian STS scholarship. First, that it is mainly applied and problem-oriented. Second, that it is not so much STS as belonging to other interdisciplinary fields. Nevertheless, these two assumptions are misleading. While the dichotomy of basic versus applied research never was an STS favourite, we should note that many of the publications pursue theoretical agendas. Moreover, these theoretical agendas tend to be either distinctly STS-ish (to the extent we may use that label) or involving the use of STS reasoning when addressing concerns of other interdisciplinary areas. The typical paper would contain at least some reference to core STS literature, like actor-network theory or co-production theory.

Let me give a few examples. Kristin Asdal has in several publications addressed the making of environmental policy in Norway by combining a historical approach with the use of actor-network theory. This has resulted in an interesting development of the Foucauldian concept of political technologies (see, e.g., Asdal 2008, 2011). Thomas Berker (2005) uses actor-network theory to address the issue of energy efficiency in buildings. More particularly, he draws on some recent developments of ANT – political ecology (Latour 2004) and object lessons (Law and Singleton 2005) – that Berker argues to be more useful as tools to account for the fluidity of energy efficiency in buildings without referring to essences and dualisms. Ingunn Moser has made use of ANT to develop new perspectives on disability. She has been concerned with the way disability is enacted in everyday life, raising typical STS concerns about ordering and differentiation (Moser 2005, 2006).

In this manner, Norwegian STS scholarship provides evidence of a disciplined interdisciplinarity not only with regard to teaching programmes but also with respect to publications. This runs counter to the claim of Martin et al. (2012) that STS research is fragmented. The spread of publications over a large number of journals mostly outside the (small) STS core should rather be interpreted as evidence of interactional expertise (Collins and Evans 2002) and that Norwegian

STS really performs as an 'interacting field'. Instead of seeing STS as fragmented, there are good reasons to claim that STS is rhizome-like in the sense that the field is spreading through interaction with, but also in-between, a large number of disciplinary and interdisciplinary fields.

We find two more indications of the latter point in Norwegian STS research. First, the STS centres have proven surprisingly successful in attracting funding from a wide range of research programmes. The dominant source has been Research Council of Norway, where we find STS scholars obtaining funding from programmes addressing environmental concerns, sustainable energy, information and communication technologies, culture, new materials, and climate change issues – to mention some of them. This success is not just evidence of the potential of STS to be a relevant mode of inquiry into a fairly large number of scientific – including engineering – fields. It also supports the claim of STS scholars that they have developed interactional expertise with respect to many fields.

The rhizome-like quality of STS is also evident from the fact that STS is drawn upon by scholars outside of the core STS centres. There are STS scholars located in other institutions like departments of sociology, anthropology and social science. The contract research institute Nordic Institute for Studies in Innovation, Research and Education (NIFU) employs a number of STS scholars who for a long time has contributed to and participated in the international STS community. Still, we find references to core STS literature in a much wider community of Norwegian social scientists and humanists. There has also been a marked increase of participation in international STS meetings by scholars outside of the core STS centres.

Does this mean that Norwegian STS will develop through a broad church approach, like Jasanoff (2010) describes? This claim is difficult to assess, above all because of the lack of a reasonably well-defined Norwegian STS arena, like conferences, journals or an association. As I have argued earlier, what is visible is a process of institutionalisation focused on the development of education programmes, related to the three core STS centres. This gives the impression of Norwegian STS as discipline-like. If there is a broad church tendency, this is rather enacted on the international arena through the participation in the meetings of Society for Social Studies of Science and European Association for the Study of Science and Technology of people from a diverse group of disciplines and specialities.

In fact, the lack of a reasonably well-defined Norwegian STS arena may be explained by the fairly strong international orientation of STS scholars in Norway. Much of the publication efforts are addressing an international rather than a national audience. Also, in terms of research collaborations, Norwegian STS scholars tend to work more often with STS scholars from other countries than Norway. In this sense, we could say that Norwegian STS is an open scholarly community. Not by being broad church and fragmented, but by being more concerned with interacting with STS scholars abroad than with constructing a tight Norwegian STS community.

Conclusion: a disciplined interdiscipline

In the final instance, I think it is fair to describe Norwegian STS as having a distinct interdisciplinary orientation. However, as we have seen, the implications of such a claim are not obvious. In this paper, I have discussed what this way of characterising Norwegian STS might mean and some consequences of the implied mode of operation. Previously, I identified several possible features of interdisciplinarity in relation to STS: disciplinary efforts in disguise (Weingart 2010), border crossing and bridge building (Klein 1996), interactional expertise (Collins and Evans 2002), a disciplined effort to research unexplored (or underexplored) concerns in-between other disciplines (Jasanoff 2010), and fragmentation (Martin et al. 2012). None of these characteristics fits exclusively. Weingart's characterisation does not coincide very well with my observations of Norwegian STS, and at least some of the noted features, contradict the claim of Martin et al. about fragmentation. However, the three other suggestions make sense. STS in Norway is engaged in border crossing and bridge building, it is continuously developing interactional expertise, and it shows distinct disciplinary features, in particular with regard to education programmes at the three main universities in Bergen, Oslo and Trondheim.

I believe the engagement in developing STS education programmes is a driver with respect to institutionalisation and the disciplining of the Norwegian STS community. This is because the making of such programmes raise concerns about what are core competences of STS, and these concerns – discussed in relation to developments of STS internationally – implies some level of standardisation. This does not mean the education programmes are very similar, but there are important overlaps in terms of curricular content.

I have also argued that the publication efforts of Norwegian STS scholars have a definite STS core, even if most of the publications are published in interdisciplinary, topic oriented, non-STS journals. Thus, it is above all Jasanoff's proposal of a disciplined STS that seems to provide the most interesting way of characterising the Norwegian scene. Also, her way of outlining the interdisciplinary features of STS as above all related to exploring concerns inter other disciplines make good sense in the analysis of Norwegian STS. This means that the development of interactional expertise is a central feature of the research activities.

STS definitely has rhizome-like qualities as evidenced by the spread of STS into many areas of topical inquiry as well as the increasing use of references to STS literature outside the STS community. I believe these are strengths rather than weaknesses. The important distinction that Jasanoff makes between a broad church and a more disciplined approach to doing STS, appears in the Norwegian context to have an ironic twist: the broad church approach is enacted on the international scene, while within Norway, a disciplined approach dominates.

Maybe this is a convenient situation for STS, at least seen from the perspective of a small country like Norway. In the national context, the concerns of teaching

STS points towards discipline and standards. On the international scene, a broad church approach creates a productive melting pot. This suggests that the characterisation of Norwegian STS as a disciplined interdisciplinarity is a fairly stable description, while the rhizome-like qualities of STS research will contribute to a growing topical scope of scholarship.

References

Asdal, K. (2008) *Enacting things through numbers: Taking nature into account/ing*, in "Geoforum", 39, pp. 123-132.

Asdal, K. (2011) *Politikkens natur. Naturens politikk*, Oslo, Universitetsforlaget.

Berker, T. (2006) *The Politics of 'Actor-Network Theory': What Can 'Actor-Network Theory' Do to Make Buildings More Energy Efficient?*, in "Science, Technology & Innovation Studies", 1, pp. 61-79.

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

Cronberg, T. and Sørensen, K.N. (eds) (1995) *Similar concerns, different styles? Technology studies in Western Europe*, Brussels, DG XII, COST social science.

Hackett, E.J., Amsterdamska, O., Lynch, M. and Wajcman, J. (2007) *Introduction*, in E.J. Hackett, O. Amsterdamska, M. Lynch, J. Wajcman (eds), *Handbook of Science and Technology Studies*, Cambridge, MAss, The MIT Press, pp. 1-11.

Jasanoff, S. (2010) *A field of its own: the emergence of science and technology studies*, in R. Frodeman, J.T. Klein, C. Mitcham and J.B. Holbrook (eds), *The Oxford Handbook of Interdisciplinarity*, Oxford, Oxford University Press, pp. 191-205.

Klein, J.T. (1996) *Crossing Boundaries. Knowledge, Disciplinarities, and Interdisciplinarities*, Charlottesville, VA, University Press of Virginia.

Klein, J.T. (2010) *A taxonomy of interdisciplinarity*, in R. Frodeman, J.T. Klein, C. Mitcham and J.B. Holbrook (eds) *The Oxford Handbook of Interdisciplinarity,* Oxford, Oxford University Press, pp. 15-30.

Lamont, M. (2009) *How Professors Think. Inside the Curious World of Academic Judgement*, Cambridge, MAss, Harvard University Press.

Latour, B. (2004) *Politics of nature: how to bring the sciences into democracy*. Cambridge, MAss, Harvard University Press.

Latour, B. (2010) *Coming out as philosopher*, in "Social Studies of Science", 40, pp. 599–608.

Law, J. and Singleton, V. (2005) *Object lessons*, in "Organization", 12, pp. 331-355.

Martin, B.R., Nightingale, P. and Yegros-Yegros, A. (2012) *Science and technology studies: Exploring the knowledge base*, in "Research policy", 41, pp. 1182-1204.

Moser, I. (2005) *On becoming disabled and articulating alternatives. The multiple modes of ordering disability interferences*, in "Cultural Studies", 19, pp. 667-700.

Moser, I. (2006) *Sociotechnical practices and differences – On the interference between disability, gender and class*, in "Science, Technology & Human Values", 31, pp. 537-565.

Sørensen, K.H. (1995) *Action versus analysis. Making sense of technology studies in Norway*, in T. Cronberg and K.H. Sørensen (eds), *Similar concerns, different styles? Technology studies in Western Europe*, Brussels, DG XII, COST social science, p. 327-367.

Sørensen, K.H. (ed) (1999) *Similar concerns, different styles? Technology studies in Europe.* Vol. 2., Brussels, DG XII, COST social science.

Sørensen, K.H. (2009) *The Role of Social Science in Engineering,* in A. Mejers (ed), *Handbook of the Philosophy of Science. Volume 9: Philosophy of Technology and Engineering Sciences.* Amsterdam, Elsevier, pp. 89-111.

Thomassen, Ø. (1996) *Teknologiryttere og andre cowboyer. Norsk teknologihistorisk forskning 1970-1995*, in "Historisk tidsskrift", 4, pp. 417-453.

Weingart, P. (2010) *A short history of knowledge formations*, in R. Frodeman, J.T. Klein, C. Mitcham and J.B. Holbrook (eds), *The Oxford Handbook of Interdisciplinarity*, Oxford, Oxford University Press, pp. 3-14.

Knut H. Sørensen Norwegian University of Science and Technology
Department of Interdisciplinary Studies of Culture
7491, Trondheim, Norway
Email: knut.sorensen@ntnu.no

Scenario

Innovation Happens Elsewhere, but Where Does Design Happen?

Considerations on Design and Participatory Processes in Emerging Information Technologies

Giacomo Poderi

Abstract By taking as departing point the convergence of emerging technologies and their related production practices, this work reflects on design and participatory processes. This contribution tries to highlight how these processes changed from the traditional Information and Software Systems (ISS) context to the emerging one, where technologies are mainly characterized by decentralized and open-ended processes. The paper presents the traditional conception of design as a linear process and problem-solving endeavour and the role that users' participation has within this frame. It then moves to focus on how design for emergent technologies extends beyond the 'production' phase and on how the distribution of (users-)participants to these technologies intertwine with the endeavour of designing them.

Keywords designing; information and software system; users participation; distribution; continuity.

Introduction

In 2005, two software engineers working at Sun Microsystems wrote the influential book *Innovation happens elsewhere: open source as business strategy* (Goldman and Gabriel 2005). The book primarily targeted practitioners and reflected on the Free and Open Source Software (FOSS) paradigm to argue that a new way of innovating emerged in contemporary society. Innovation processes can happen, and indeed do so in FOSS, without the need of keeping secret the organization's knowledge related to innovative products and confining it within the boundaries of internal Research and Development (R&D) departments. According to the authors, in the case of the production of FOSS programmes 'innovation happens elsewhere' and, more importantly, this new way of innovating can be found in other areas of technology production. Thus, according to them, a

TECNOSCIENZA
Italian Journal of Science & Technology Studies
Volume 3(1) pp. 63-72- ISSN 2038-3460
http://www.tecnoscienza.net

T/S TECNOSCIENZA Italian Journal of Science & Technology Studies

phenomenon worth being observed. Translating by analogy the key argument by Goldman and Gabriel into the focus of this contribution, I suggest that something similar is happening for the concept of design in the domain of Information and Software Systems (ISS), and yet again in connection with aspects that characterise the FOSS paradigm and similar 'participatory technologies'.

Starting from the studies of the electrification of London (Bijker and Law 1994) and the development of modern bicycles, bakelites and light bulbs (Bijker 1995), to the ones of domestic technologies (MacKenzie and Wajcman 1985) and users' led innovations (Oudshoorn and Pinch 2003), Science and Technology Studies (STS) have a sound tradition in opening the 'black-box' of technological production and in studying their 'becoming', broadly understood. However, the emergence of new, participatory technologies of knowledge exchange, information access, and content production which are primarily associated with Internet and new media blurred the traditional relationship between production and consumption, producers and users, design and use. Social networking platforms (e.g. Facebook, LinkedIn), media sharing sites (e.g. Flickr, YouTube), blogging software (e.g. Wordpress), crowdsourcing platforms (e.g. Wikipedia) and the whole FOSS paradigm all bring about new forms of design, development, appropriation and use that crucially differentiate[1] their come into being from the one that traditionally interested the STS community.

This contribution provides a look at emerging practices in the area of ISS and specifically connect emergent technologies paradigms to the processes of design, in general, and of participation, in particular. This work outlines the main differences characterising these concepts in their traditional understanding and in their emergent ones.

1. Solving the requirement problem in traditional Information and Software System

> The hardest single part of building a software system is deciding what to build […] No other part of the work so cripples the resulting system if done wrong. No other part is more difficult to rectify later. (Brooks 1987, 12)

In ISS, the process of design is one that has often escaped formal, clear and shared definitions, mainly for two reasons: (i) formal definitions, typical of rationalist approaches, are rarely satisfactory when the actual design, the design in practice, is carried out; (ii) the application domain of this human activity has rapidly and constantly changed over the past few decades (Greenbaum and Kyng 1991). However, as generally understood, the design of information or software

[1] For an overview of these differences see the works of Napoli (2010) and Bruns (2008).

systems implies the endeavour of deciding, at a relatively detailed level, 'what to produce'. In other words, design can be seen as an interaction between understanding what is needed in the context of future technology deployment and creating an artefact which satisfies those needs (Winograd and Flores 1986, 4). It is an activity usually performed by professional figures, namely the software (or system) designers, who operate within the phases of formal development projects. Here, design is just one phase which has the goal of 'solving the requirements problem'. That is to: (i) identify as objectively as possible the features that the final artefact will have, (ii) improve upon the departing status quo, (iii) take into consideration the needs of all the actors involved, and (iv) defining a suitable mediation amongst these needs (Sommerville 1995).

Depending on the specific development methodology used for the system production, the design phase has its specific position and role. For instance, the Waterfall Model is a linear and sequential design process for system development firstly formalised in Royce (1970) and, until recently, widely adopted in one of its many versions. The typical incarnation of the model has seven phases: requirements specification, design, implementation, integration, testing and debugging, installation, maintenance. During the first phase, designers evaluate whether or not the system is feasible, investigate the work-site and the activities taking place there to understand what 'is needed' and they formally define the features of the new system through the requirements specification. In the proper design phase, the requirements are modelled into a detailed blueprint that can be developed into an artefact during the implementation phase.

This model has the merit of clearly identifying the logical elements of the design process. However, although it enjoyed wide adoption since the 70s, the severity of the consecutive phases and the reliance on the requirements that are specified during the early stage, pose limitations to it and make it difficult to adopt it for contemporary software development. Indeed, it heavily relies on the assumptions that requirements are easily identifiable, remain constant throughout the whole development cycle and that they are decomposable in problems and solutions (Avison and Fitzgerald 2003).

Several development methodologies exist which attempt to mitigate the limits of the Waterfall Model: agile development (Larman and Basili 2003), rapid application development (Beynon-Davies et al. 1999), extreme programming (Beck, 2000), spiral model (Sommerville 1995). However, from a critical standpoint, these methods do nothing more than recursively repeating, or combining in different ways, the steps of the Waterfall Model in the attempt of introducing some mechanisms that are able to fine tuning the initial design and the process of inscribing it into the final artefact. As rationalist approaches, they all share the same fundamental bias: the idea that problems are identifiable, definable and solvable through analytical steps and engineered procedures.

Starting from the late 60s, the idea that the involvement of the (future) users of a new technological artefact would be beneficial both for the technology and for the users, increasingly gained acceptance also in ISS development, becaming a fundamental prerequisite for any development effort. In IS, the term "user par-

ticipation" refers to the involvement of the future end-users into the design and implementation processes of the system they will use. Commonly recognised benefits of users participation are: (i) an increased adoption and diffusion of the system; (ii) an higher system quality in terms of a more accurate understanding of user requirements; (iii) a better and more efficient use of the system deriving from the possibility for participants to understand it 'from within'. The key process at the basis of these benefits it is the fostering of mutual learning between the people who will use the system and the ones who are producing it (Greenbaum 1993; Kensing and Blomberg 1998). Often, designers and developers are highly trained and skilled in creating technically valid artefacts but they lack proper understanding of the working domain the artefact will be used for. Vice-versa users well understand what kind of working practices the new system should adapt to and have sound knowledge of the working domain, however they cannot grasp the potential and limits of system development, therefore they are not always clear about what they need and what they can expect (Bødker et al. 2004).

Mutual learning is supposed to mitigate the distance between these two groups and, thus, to help solving the fundamental design problem that any development effort faces: deciding what to build. Several different techniques such as future workshops, organizational games, contextual inquiries and ethnographic approaches, emerged over the years in the attempt of involving users in the design process and helping them to articulate their needs and ideas in a way that designers could understand and act upon (Schuler and Namioka 1993).

2. Emerging practices for emerging technologies: distributed participation and continuously designed projects

> Design as a continuing process that goes on after the formal end of the software development project is, of course, 'old news'. [...] The 'new news' is, that this is where much of the action is today, and it is a much more complex and diverse scene than it was ten years ago. (Dittrich 2002, 225)

The previous outline of designing poorly fits the 'come into being' of the participatory technologies mentioned in the introduction. They differ from traditional technology production at least for two related aspects: (i) they blur the boundaries between production and use of the artefact, and (ii) they imply the distribution at the spatial, organizational and temporal level of the socio-technical assemblages[2] that are associated with them. These assemblages portray decentralized and open-ended organization of work together with bottom-up and unpredictable innovation processes. Traditional boundaries that were clearly identifiable amongst the parties and processes of producing, adopting and using

[2] "Assemblage" is used to indicate "associations of humans and non-humans" as proposed by Latour (1987).

a technological artefact are difficult to distinguish. This is particularly true for the relationships production/use and producer/consumer, indeed "the production value chain is transformed to the point of being entirely unrecognisable - in the absence of producers, distributors, or consumers, and the presence of a seemingly endless string of users acting incrementally as content producers by gradually extending and improving the information present in the information common" (Bruns 2008, 21). It is difficult to decide whether writing an encyclopedic article through a crowdsourcing platform, such as Wikipedia, should qualify as using it or contributing to its production. Similarly, it is difficult to decide whether to establish connections with other users on a social networking site can be considered as using the technology or contributing to the creation of that 'social network' which the technology was meant to be.

In these participatory technologies, designing processes take place in a context where mediation with actual, rather than projected, use is unavoidable: the 'solution to the requirements problem' is only sketched (or attempted) before actual use starts. The largest part of the 'problem' – e.g. understanding what should be built and deciding how to build it – is tackled during the actual use of the technological artefact. The idea of completing the development of the artefact, before it is officially deployed for wide use, is abandoned and substituted by the acknowledgement that the artefact will undergo improvements, changes and further development for as long as there is enough interest around it. Approaches such as continuing design-in-use (Henderson and Kyng 1991), continuous design and redesign (Jones 1983), unfinished design (Tonkinwise 2003) try to tackle this challenge in different ways while sharing similar roots and goals: they all acknowledge the impossibility of satisfactorily anticipating future users' practices or to provide a durable vision to inscribe in the artefacts, and they strive to provide highly flexible development processes for these artefacts. As such, all these approaches came to recognize the relevance that the project's infrastructure acquires in the logic of continuing design in use.

According to Star (1999, 380) it is possible to think of an infrastructure as a system of substrates that is, by definition, invisible and part of the background for other kind of works[3]. However, as Bowker and Star (2000) highlighted, the fact that this infrastructure operates in the background, it does not imply neutrality in respect to the activities performed with it. For instance, classification systems embed important decisions relating to what attributes of an object are relevant, thus worth being included in the classification, and what not. The classified attributes can be remembered and acted upon, the non classified ones are lost and forgotten. Even in the case of design in use, an infrastructure cannot be considered neutral in relation to the activity of continuing design in use. Therefore, deciding how to build it becomes of pertinence of a designing interest. It should be 'designed to allow (re-)design after the initial design took place', to paraphrase what Ehn (2008) refers to in terms of meta-design.

[3] E.g. the set of tools, rules, norms that allow the fulfillment of other activities.

The infrastructure is also the 'locus' where distributed participation happens and manifests: it makes possible for people to participate from different locations, to engage in heterogeneous working areas while supporting heterogeneity of skills, tasks, roles and activities (Gumm, 2006). In Suchman's words (2002, 96), it promotes "a dense and differentiated layering of people, activities and things, each operating within a limited sphere of knowing and acting". Moreover, it allows them to collaborate without the need to share the same-time interaction. As developers, designers and users now share the same infrastructure, the resulting general distribution of actors affects both the ones who actively engage into the development of the artefact (Farshchian and Divitini 1999) and the ones who constitute the contextual environment in relation to which design decisions are taken (Martin et al. 2007; Iivari 2009).

FOSS development provides a paradigmatic case both for the continuity of design and distributedness of participation. On the one hand, the key tenet "release early, release often" (Raymond 1999) that characterises its development and release cycles, implies that from the very inception of the software project, as soon as the artefact reaches a minimal yet usable status, this is released for public use and testing. From then on, development and use of the software can proceed together for the whole life span of the project thanks to a complex system of parallel development branches, feedback practices and 'release management' (Michlmayr et al. 2007). Therefore, all the logical elements of the designing process, as outlined in the previous section, are no longer sequentially aligned and iterated, but they overlap each other and are continuously enacted: FOSS assemblages never cease to generate bug reports and fixes, to receive and evaluate features requests, to extend old functionalities and add new ones, in other words, to design and re-design the software, while keeping it usable and used by its users (Gasser et al. 2003). On the other hand, participants collaborate through a system of heterogeneous tools and communication channels, where each tool is associated with a specific activity and each channel is used for specific kind of discussions. For instance, while system evaluation happens through bug reporting on the bug-tracker, the implementation of new features is done on the Version Control System. Similarly, while issues that are traditionally open to wide debate are discussed on dedicated mailing lists or on Internet forums, other matters that require quicker and more direct interactions are discussed on media such as Internet Relay Chat (IRC). It follows that the history of the individual contributions, along with their associated development decisions, implications and discussions rest stored in the distributed archives of this infrastructure, which captures and tracks the emerging preferences of the emerging FOSS assemblage, while highlighting its limitations.

3. Concluding remarks

In light of the aspects sketched above it is possible to draw some considerations related to both the concept of participation into designing processes, and to the broader idea of designing *per se*.

For what concerns participation as a phenomenon related to a 'better design', there are two aspects to consider. On the one hand, it is no longer confined within the designing phase, as traditionally understood. It extends into the use phase and it becomes an indicator of the validity, success and efficiency of the technological artefact. A well-designed system is one that, not only has few bugs and works efficiently at the level of the technological artefact, but it is one capable to attract and motivate users into active participation, allowing them to contribute in a satisfactory way and keeping them affiliated to the project. Here, participation is both the means of designing usable and meaningful systems and the goal (or outcome) of well-designed technologies. On the other hand, participation brings to the fore an issue of exclusion from and representativeness in design decisions. This issue was the one that ISS designers tried to minimize through traditional participatory approaches. It is true that users' participation in the continuous design of emerging technologies allows system designers and developers to better tune the artefact to real usage practices and users' requests. However, this fine-tuning happens in relation to actual participants only and exclude marginal users[4] and not-yet-users[5].

For what concerns the design process, emergent technologies portray a fundamentally different process from the traditional one. The idea that system requirements can be inscribed into the artefact thanks to analytical and problem-solving logic and that development can be broke down into 'self-containing', linear, and goal-oriented phases is replaced by an emergent process. Designing is no longer confined in a specific time frame, neither in the same spatial space. It implies the continuous, parallel and yet interrelated processes of identifying requirements, implementing changes and evaluating them. Designing is no longer an easily identifiable activity confined within clear boundaries and stated goals. On the contrary, it is a process that needs to be reconstructed by observing how people make sense of what is needed and what is the best way to implement an answer to these needs, by building on the knowledge that is dispersed throughout the projects' infrastructure and amongst the people they collaborate with.

As such, while in traditional ISS development, Winograd and Flores' definition of design could be understood more directly in its substantive terms, in the case of emergent technologies this definition acquires a new meaning. In the former case, designing is the phase between requirements analysis (i.e. understanding) and implementation (i.e. creation), it is the bridge allowing the two

[4] Those who 'only' use the artefact but are not involved in the participatory activities of the project. For instance, they never submit any kind of feedback.

[5] For some reflections on the relevance of non-users in technology production see Wyatt (2003).

phases to interact. In the latter, there is no clear-cut separation amongst phases: requirements analysis and implementation are continuous processes that happen without the formal mediation of a design phase. Therefore, design no longer portrays an interaction. Designing becomes the continuous sensemaking of that enacted and ongoing interaction.

References

Avison, D.E. and Fitzgerald, G. (2003) *Information Systems Development: Methodologies, Techniques, and Tools*, McGraw-Hill Higher Education, 2nd ed.

Beck, K. (2000) *Extreme programming explained. XP Series*, Reading, Mass., Addison-Wesley.

Beynon-Davies, P., Carne, C., Mackay, H. and Tudhope, D. (1999) *Rapid application development (RAD): an empirical review*, in "European Journal of Information Systems", 8 (3), pp. 211-223.

Bijker, W. E. (1995) *Of bicycles, bakelites, and bulbs: Toward a theory of sociotechnical change*, Cambridge, Mass., MIT Press.

Bijker, W.E. and Law, J. (eds) (1994) *Shaping Technology/Building Society. Studies in Sociotechnical change*, Cambridge, Mass., MIT Press.

Bowker, G.C. and Star, S.L. (2000) *Sorting Things Out: Classification and its Consequences*, Cambridge, Mass., The MIT Press.

Bødker, K., Kensing, F. and Simonsen, J. (2004) *Participatory IT Design: Designing for Business and Workplace Realities*, Cambridge, Mass., MIT Press.

Brooks, F.P. (1997) *No silver bullet: Essence and accidents of software engineering*, in "IEEE computer", 20, pp. 10–19.

Bruns, A. (2008) *Blogs, Wikipedia, Second Life, and Beyond: From Production to Produsage*, New York, Peter Lang Publishing.

Dittrich, Y., Eriksén, S. and Hansson, C. (2002) *PD in the Wild: Evolving practices of Design in Use*, Participatory Design Conference, Malmö, Sweden, CPSR, pp. 124–134.

Ehn, P. (2008) *Participation in design things*, In "Proceedings of the Tenth Anniversary Conference on Participatory Design 2008", pp. 92–101.

Farshchian, B.A., and Divitini, M. (1999) *Using email and WWW in a distributed participatory design project*, in "ACM SIGGROUP Bulletin", 20, pp. 10–15.

Gasser, G. R. L., Scacchi, W. and Penne, B. (2003) *Understanding continuous design in F/OSS projects*, in "16th International Conference Software & Systems Engineering and their Applications."

Goldman, R. and Gabriel, R.P. (2005) *Innovation happens elsewhere – Open source as business strategy*, San Francisco, CA, Morgan Kaufman Publishers.

Greenbaum, J. (1993) *PD a personal statement*, in "Communications of the ACM", 36 (6), pp. 47.

Greenbaum, J.M. and Kyng, M. (1991) *Design at Work: Cooperative Design of Computer Systems*, Hillsdale, NJ, USA: L. Erlbaum Associates Inc.

Gumm, D.C. (2006) *Distributed participatory design: An inherent paradoxon?,* Denmark, Helsingoer.

Henderson, A. and Kyng, M. (1991) *There's no place like home: Continuing design in use*, in *Design at work: cooperative design of computer systems*, Hillsdale, NJ, L. Erlbaum Associates Inc., pp. 219-240.

Iivari, N. (2009) *"Constructing the users" in open source software development – an interpretive case study of user participation*, in "Information Technology & People", 22 (2), pp. 132–156.

Jones, J. (1983) *Continuous design and redesign*, in "Design Studies", 4 (1), pp. 53-60.

Kensing, F. and Blomberg, J. (1998) *Participatory design: Issues and concerns*, IN in "Computer Supported Cooperative Work: The Journal of Collaborative Computing", 7 (3/4), pp. 167-185.

Larman, C. and Basili, V.R. (2003) *Iterative and incremental development: A brief history*, in "Computer", 36 (6), pp. 47-56.

Latour, B. (1987) *Science in Action: How to Follow Engineers and Scientists Through Society*, Cambridge, Mass., Harvard University Press.

MacKenzie, D.A. and Wajcman, J. (eds) (1985) *The Social Shaping of Technology: How the Refrigerator Got its Hum*, Milton Keynes, PA, Open University Press.

Martin, D., Rooksby, J. and Rouncefield, M. (2007) *Users as contextual features of software product development and testing*, In "Proceedings of the 2007 international ACM conference on Supporting group work", Sanibel Island, Florida, ACM, pp. 301-310.

Michlmayr, M., Hunt, F. and Probert, D. (2007) *Release management in free software projects: Practices and problems*, In "Open Source Development, Adoption and Innovation", Limerick, Ireland, pp. 295-300.

Napoli, P.M. (2010) *Audience Evolution: New technologies and the Transformation of Media Audiences*, New York, Columbia University Press.

Oudshoorn, N. and Pinch, T.J. (Eds.) (2003) *How Users Matter – The Co-Construction of Users and Technology*, Cambridge, Mass., MIT Press.

Raymond, E.S. (1999) *The Cathedral & the Bazaar: Musings on Linux and Open Source by an Accidental Revolutionary*, Cambridge, Mass., O'Reilly Media.

Royce, W.W. (1970) *Managing the development of large software systems*, in "Proceedings of IEEE Wescon", 26, p. 9.

Schuler, D. and Namioka, A. (eds) (1993) *Participatory design: Principles and practices*, Hillsdale, NJ, CRC Press.

Sommerville, I. (1995) *Software Engineering*, International computer science series, Wokingham, England, Addison-Wesley, 5th ed.

Star, S.L. (1999) *The ethnography of infrastructure*, in "American Behavioral Scientist", 43 (3), pp. 377–391.

Suchman, L. (2002) *Located accountabilities in technology production*, in "Scandinavian Journal of Information Systems", 14 (2), pp. 91-106.

Tonkinwise, C. (2003) *Interminable design: techné and time in the design of sustainable service systems*, in *Techné's strategic nature*, Barcelona, European Academy of Design, pp. 1-16.

Winograd, T. and Flores, F. (1986) *Understanding computers and cognition: a new foundation for design*, Noorwood, NJ, Ablex Publishing Corp.

Wyatt, S. (2003) *Non-Users also Matter: The Construction of Users and Non-users of the Internet*, In N. Oudshoorn and T.J. Pinch (eds), *How Users Matter – The Co-Construction of Users and Technology*, Cambridge, Mass., MIT Press, pp. 67-79.

Giacomo Poderi Università degli Studi di Trento
Dipartimento di Sociologia e Ricerca Sociale
Via Verdi, 26, 38122 - Trento
Email: giacomo.poderi@soc.unitn.it

Scenario

Corpo, ambiente, tecnicità.

Azione tecnica ed esperienza tra Ragni e Formiche

Guido Nicolosi

Abstract Nell'ambito della letteratura scientifica, diverse letture (tecno)pessimistiche sostengono il principio secondo cui l'avvento della tecnologia nella società moderna avrebbe provocato il deterioramento del rapporto tra percezione e azione e la separazione tra esperienza corporea e realtà materiale. In particolare, l'avvento delle tecnologie elettroniche e digitali avrebbe provocato la perdita delle abilità di esplorazione del mondo e la chiusura solipsistica del corpo nel mondo virtuale generato artificialmente dalle macchine. L'articolo mira a criticare tale lettura presentando un'interpretazione dell'idea di tecnicità basata sull'intimo e indissolubile intreccio che esiste tra corpo e ambiente. Per far ciò, l'autore definisce l'azione tecnica nel quadro di un modello, definito SPIDER (Skilled Practice Involves Developmentally Embodied Responsiveness) e fondato sulla prospettiva ecologica di Tim Ingold, che presenta alcuni punti di attrito con quanto proposto dalla ANT (Actor-Network Theory) di Latour e colleghi. Infine, l'autore suggerisce di applicare tale modello alle pratiche di utilizzo delle moderne tecnologie digitali.

Keywords tecnica; corpo; azione; percezione; contesto.

Introduzione

La contrapposizione tra "apocalittici e integrati" (Eco 1964) e tra utopie e distopie (Galimberti 1999; Feenberg 2010) ha caratterizzato spesso il dibattito filosofico e antropologico sul tema dello sviluppo tecnologico (analoghe contrappo-

* Questo articolo è il frutto della rielaborazione dei risultati di una ricerca che l'autore ha condotto su "Life science technologies and body images" nell'ambito delle attività svolte come *External PhD Student* presso la Wageningen University and Research (NL).

TECNOSCIENZA
Italian Journal of Science & Technology Studies
Volume 3(1) pp. 77-93- ISSN 2038-3460
http://www.tecnoscienza.net

T/S TECNOSCIENZA Italian Journal of Science & Technology Studies

sizioni si ritrovano, in realtà, anche nel dibattito pubblico corrente[1]). Nell'ambito della letteratura scientifica, ci sono diverse letture (tecno)pessimistiche[2] ancorate ad un'interpretazione della relazione tra soggetti e tecnologie che potremmo definire "regressiva". L'assunto implicito e, a volte, esplicito di tali letture consiste nel sostenere enfaticamente il principio secondo cui l'avvento della tecnologia nella società moderna avrebbe provocato il deterioramento del rapporto tra percezione e azione. Spesso questo nodo critico è stato estremizzato fino a postulare, non senza subire l'influenza di una certa letteratura fantascientifica di successo, un'assoluta separazione tra esperienza corporea e realtà materiale, dagli esiti psicologici e sociali catastrofici (Virilio 1988; Berardi 1995; Baudrillard 2005).

È nostra convinzione che una parte rilevante di questa interpretazione sia riconducibile alla forza pregnante che ha avuto, nella definizione del pensiero occidentale moderno, un radicato connubio epistemologico tra un antico dualismo mente/corpo (Le Breton 1990) e un pregiudizio "strumentalista". Per pregiudizio strumentalista, qui, intendiamo una tendenza ad interpretare l'azione tecnica alla luce di una presunta "dipendenza" dell'attore umano dallo strumento meccanico. Questa interpretazione, sconfinata spesso in un vero e proprio determinismo tecnologico, ha accompagnato frequentemente la riflessione sulla tecnica a partire dall'avvento della società industriale in poi[3] (Bourdon 1997). Inoltre, a nostro avviso, essa ha contribuito a sostenere una sostanziale identificazione concettuale del lavoro "vero" con il lavoro manuale e, contemporaneamente, un'accezione negativa, alienante ed espropriativa del lavoro macchinico *tout court*. In questo quadro, il processo di progressiva meccanizzazione del lavoro è stato inevitabilmente interpretato come una pericolosa erosione delle capacità creative e realizzative dell'attore umano.

Un esempio emblematico di questo sguardo, in ambito specificatamente socio-antropologico, è dato dal lavoro prestigioso e magistrale di André Leroi-Gourhan (Ingold 1999). Nel suo fondamentale *Le geste et la parole* (1964), infatti, Leroi-Gourhan presenta un'interpretazione del rapporto tra mano e tecnica che,

---

[1] Diverse indagini hanno dimostrato come il rapporto degli italiani con la tecnologia sia difficile e controverso. Spesso oscillante tra entusiasmo acritico e disprezzo profondo. Simili contraddizioni sono state rivelate negli anni passati, a livello europeo, anche dalle survey di Eurobarometer (Bucchi e Neresini 2006; Nicolosi 2006).

[2] Semplificando rozzamente, casi esemplari, pur se diversissimi tra loro, di tecnopessimismo sono: il pensiero di Heidegger, la produzione teorica della Scuola di Francoforte (in particolare Marcuse) e, più recentemente, autori come Postman (1993), Kompridis (2006), Stiegler (1998), Hardt e Negri (2000), assieme a una buona parte delle interpretazioni (specie italiane) del concetto di biopolitica di Foucault. Una versione estrema e violenta di una tale impostazione ha generato recentemente un fenomeno sociale e politico eversivo e terroristico nominato Neo-luddismo. L'esponente più famoso del Neo-luddismo è certamente Theodore J. Kaczynski (2010), anche tristemente noto come "Unabomber".

[3] Ad esempio, nella storia del pensiero sociale, un caso emblematico di pregiudizio strumentalista è rappresentato dall'analisi di Karl Marx (quantomeno quella proposta nei suoi scritti politici come il "Manifesto").

a nostro avviso, anticipa un principio che influenzerà direttamente e indirettamente diverse generazioni di studiosi: l'obsolescenza del corpo[4] (Capucci 1994; Maestrutti 2011).

Leroi-Gourhan presenta un'argomentazione evoluzionistica[5], nella quale l'origine stessa della *tecnicità* è ricondotta alla "liberazione" della mano nel processo di sviluppo filogenetico dell'*Homo sapiens.* Tale liberazione è ricondotta ad una catena di modificazioni anatomo-morfologiche che ha come epicentro la conquista della posizione eretta, con la conseguente riconfigurazione della colonna vertebrale, lo sviluppo del volume del cranio (e quindi della massa cerebrale contenuta al suo interno), e, appunto, la liberazione delle mani che possono adesso svolgere funzioni prensili e manipolative (che precedentemente venivano assolte in maniera rudimentale dalle fauci e dai denti)[6].

Cruciale nella sua analisi il concetto di "esteriorizzazione", ovvero la delocalizzazione della fonte del comportamento operativo dal *locus* fisiologico dell'essere umano. Leroi-Gourhan, descrive questo processo mostrando che, pur avendo origini antiche[7], esso avrebbe raggiunto l'apice con l'avvento della moderna automazione macchinica e, aggiungiamo noi, in epoca contemporanea, con l'affermazione delle nuove tecnologie digitali e della robotica. Per Leroi-Gourhan, dunque, la liberazione della mano ha portato all'origine della tecnicità, ma col tempo è stata la tecnicità stessa a liberarsi dalla mano, mediante una sua progressiva ma radicale marginalizzazione. Leroi-Gourhan descrive questo processo come una progressione evolutiva suddivisa in cinque fasi e completata con l'affermazione dell'azione automatizzata, in cui alla mano non rimane altro da fare che premere un bottone o girare un interruttore per dare inizio o concludere un processo programmato meccanicamente. Oggi sappiamo che, nel caso di alcune esperienze tecnologiche incorporate estreme (Cerqui 2005), l'interazione con l'ambiente esterno prevede l'obsolescenza della mano e del corpo *tout court*. Nella prospettiva di Leroi-Gourhan è, dunque, centrale l'enfasi posta sul processo di separazione tra percezione e azione imposta dall'avvento delle macchine

[4] Aspetto solo apparentemente paradossale è che tale principio sia condiviso da "fazioni" anche contrapposte come i tecno-pessimisti, da una parte, e i post o trans-umanisti (Stelarc, 1994; Moravec 2000; Warwick 2004; Kurzweil 2005; Hugo de Garis 2005; Bostrom 2002), dall'altra.

[5] L'evoluzionismo di Leroi-Gourhan in diversi passaggi si presenta condizionato da un determinismo eccessivo e probabilmente dovuto dai debiti teorici contratti con l'analisi paleoantropologica di Teilhard de Chardin (1955).

[6] Tale liberazione avrà come effetto "secondario" anche la riconfigurazione del cavo orale adesso pronto a ridefinirsi in una nuova funzione linguistica o, più in generale, comunicativa.

[7] Per l'antropologo francese, l'origine è da far risalire all'affermazione dell'abilità umana di utilizzare gli oggetti come strumenti attraverso gesti manuali incapsulati nella "memoria sociale", una memoria non biologica e sopra-individuale posseduta esclusivamente dagli umani (l'eccezione umana) che trasmette operazioni meccaniche routinarie di generazione in generazione. L'avvento di questa memoria sociale ha cominciato ad espropriare l'individuo della sua agency per trasferirla dal corpo zoologico a quello sociale.

nella società moderna. Egli descrive una vera e propria *rimozione* del gesto dal contesto di partecipazione sensoria e l'incorporazione dello strumento e del gesto nel processo macchinico.

L'avvento delle tecnologie elettroniche e digitali ha convinto molti della bontà dell'analisi gourhaniana. Si parla spesso, oggi, di ciberspazio per deplorare la perdita delle abilità di esplorazione del mondo e la chiusura solipsistica del corpo nel mondo virtuale generato artificialmente dalle macchine (Barcellona 2005). Una regressione che negherebbe l'incontro tra la materia e gli umani e la possibilità di un'esperienza "artigianale" del mondo, riducendo gravemente i margini di reale innovatività del lavoro umano. Nella società contemporanea, in effetti, l'esperienza umana sembra essere ridotta a mera merce, impacchettata e fruita da un consumatore passivo che non partecipa più alla produzione tecnica della realtà.

L'obiettivo che ci proponiamo non è quello di discutere la prospettiva gourhaniana, che qui abbiamo succintamente presentato a mero titolo esemplificativo. L'intento è di evidenziare, più in generale, come un'eccessiva concentrazione sulle proprietà della mano nell'ambito dell'analisi socio-antropologica della tecnica possa creare un errore di prospettiva in grado di ostacolare l'emersione di un'interpretazione più articolata del ruolo della tecnologia nel mondo contemporaneo.

Per raggiungere questo obiettivo, nel primo paragrafo cercheremo di definire la tecnicità con riferimento all'intimo e indissolubile intreccio che esiste tra organismo e ambiente. Nel secondo paragrafo definiremo l'azione tecnica, nel quadro della prospettiva ecologica di Tim Ingold, come una proprietà emergente dell'intero processo che coinvolge sinergicamente gesti, strumenti e materia in un determinato spazio e tempo di un concreto *essere-nel-mondo*. Il terzo paragrafo, invece, sarà dedicato ad una digressione teorica finalizzata a mostrare come la prospettiva ecologica qui adottata possa entrare in conflitto con la *Actor-Network Theory*. Nel quarto paragrafo, mostreremo come la centralità assunta dal concetto di *skill* nella definizione dell'azione tecnica da noi adottata sia, in forme nuove, validamente coniugabile con riferimento alle tecnologie digitali avanzate. Infine, cercheremo di applicare tale modello alle pratiche di utilizzo delle moderne tecnologie digitali.

1. Tecnicità, organismo e ambiente: il concetto di *skill*

> Cominciando lo studio della percezione troviamo nel linguaggio la nozione di sensazione, che sembra immediata e chiara […]. Tuttavia, vedremo che essa è oltremodo confusa e che, per averla ammessa, le analisi classiche hanno fallito il fenomeno della percezione. (Merleau-Ponty 1945, trad. it. 2009, 35)

Dal punto di vista epistemologico, negli ultimi decenni abbiamo assistito ad un'accelerazione nella progressiva erosione del consenso che per secoli ha sostenuto il modello dualista di matrice cartesiana d'interpretazione della realtà. Per uno di quegli strani paradossi cui la storia delle idee ci ha ormai abituato, proprio lo sviluppo di nuovi paradigmi scientifici (Kuhn 1962) nelle scienze della vita (Jablonka e Lamb 2005; Lewontin 2000; West-Eberhard 2003) e nelle neuroscienze (Damasio 1995; Edelman 1992; Rizzolatti e Sinigaglia 2006) ha aiutato un importante riavvicinamento tra scienze della natura e scienze dello spirito nella lettura del rapporto tra organismo (umano o animale) e ambiente (Nicolosi e Ruivenkamp 2011). In particolare, molti studiosi considerano organismo e ambiente indissolubilmente legati da una relazione ecologica[8] fondata su due cardini concettuali: *flessibilità* e *plasticità*. Sempre più chiaramente l'essere umano appare come un *essere-nel-mondo,* ovvero un corpo intenzionale che vive una relazione di reciprocità con l'ambiente circostante[9]. In questo quadro di trasformazioni radicali, a nostro avviso, l'analisi socio-antropologica della tecnica[10] non può limitarsi a proporre, come spesso accade, una catalogazione museale degli strumenti e delle tecniche adottate nelle varie epoche e culture del mondo. Essa richiede l'individuazione di una nuova cornice interpretativa socio-epistemologica.

In questa direzione si è mosso l'antropologo britannico Tim Ingold. Superando il classico binomio oppositivo *Nature-Nurture* (Oyama 1998), Ingold rifiuta l'alleanza e il reciproco sostegno dei tre paradigmi informazionali complementari (*tesi della complementarità*) che hanno egemonizzato per decenni il panorama scientifico contemporaneo: neo-darwinismo in biologia, scienza cognitiva in psicologia e teoria culturalista in antropologia (Ingold 2000a). Per Ingold, i soggetti non sono la mera giustapposizione di tre pacchetti informativi: corpo (informazione genetica), mente (informazione cognitiva) e cultura (informazione normativa), ma entità che *emergono* dal (e nel) rapporto bio-socio-antropologico con l'ambiente che li circonda, nella forma di un *organismo-persona.* Sfumando la nettezza con cui si suole separare il dominio delle relazioni sociali e di quelle ecologiche (nonchè tra il concetto di persona e quello di organismo), Ingold tenta di dimostrare che l'agire intenzionale è collocato nella persona, ma che lo sviluppo

[8] La scienza ecologica è un approccio multidisciplinare allo studio dei sistemi viventi fondato sull'analisi della relazione di reciprocità che si instaura tra questi e i loro rispettivi ambienti. Tradizionalmente, l'analisi ecologica mette l'accento sulle basi biologiche degli scambi di energia tra ambienti fisici e organismi animali a diversi livelli (cellule, organismi, ecc.).

[9] Esiste un importantissimo filone di studi filosofici esternalista o sensomotorio che va proprio in questa direzione (Clark 2007; Jacob e Jeannerod 2003; Noë 2005; Varela et al. 1991). Inoltre, Alva Noë (2009) ha recentemente affermato che il meglio della scienza e della filosofia del futuro ci condurrà ad una visione di noi stessi come esseri dotati di corpo e di mondo. Laila Craighero (2010), invece, fa appello alle neuro-scienze affinché adottino una visione del mondo che ribalti il vecchio motto cartesiano. *Sum ergo cogito*, dunque: è il nostro essere agenti che ci rende pensanti.

[10] La tecnica è, per eccellenza, il "medium" antropologico per "operare" nel mondo (Arendt 1964).

di questa è integrale allo sviluppo dell'organismo; poiché l'organismo[11] è un sistema aperto generato in un campo relazionale che taglia trasversalmente l'interfaccia con l'ambiente.

Ispirandosi alle ricerche di biologia dello sviluppo, alla psicologia ecologica[12], alla filosofia fenomenologica (specie Merleau-Ponty) e all'antropologia della pratica (specie Bourdieu), Ingold individua nel concetto di *skill* lo snodo cruciale di connessione e continuità tra organico e sociale (Moss e Pavesich 2011). Per Ingold, il corpo è un organismo non vincolato ad alcuna codifica (*design*) culturale o bio-genetica specifica. Il corpo, fronteggiando processi di crescita, sviluppo e decadenza, introflette (*enfolds*) nella sua anatomia, muscolatura, neurologia (e così via) particolari pratiche, abitudini e *skill* che sono allo stesso tempo biologiche e sociali (Ingold 2000a, 239). Gli *skill* sono proprietà degli organismi viventi che consistono di postura e gestualità e che, attraverso l'esercizio ripetuto, si trasformano in una conformazione corporea sedimentata (Connerton 1989). Si tratta di un sapere tacito (Polanyi 1966) che non può essere codificato linguisticamente o in regole formali e procedure algoritmiche (*savoir-faire*)[13].

Partendo da questa prospettiva epistemologica, Ingold considera la *tecnicità*[14] come un complesso processo legato al rapporto ecologico che si instaura tra organismo e ambiente[15]. L'azione tecnica è una *skilled practice* che emerge in termini processuali nel corso dello sviluppo di un coinvolgimento attenzionale, intenzionale e percettivo del soggetto con l'oggetto in un contesto definito. In questo processo, imitazione e innovazione sono due facce della stessa medaglia (Lave e Wenger 1991).

---

[11] Nel lavoro di Ingold, il concetto di organismo coincide sostanzialmente con quello di corpo.

[12] È stato lo studioso James J. Gibson a fondare la psicologia ecologica per analizzare più compiutamente il rapporto tra azione e percezione. La sua idea-chiave consisteva nel considerare i concetti di "fisico", applicato all'ambiente, e "biologico" o "psicologico", applicati all'organismo, come reciprocamente e mutuamente dipendenti.

[13] E' facile comprendere che tale prospettiva mette decisamente in crisi la nettezza con cui Marx (1867), ad esempio, amava distinguere il lavoro umano (inteso come guidato da un modello o un progetto) dal mero comportamento animale, privo di tale capacità (Ingold 1983).

[14] La tecnicità non prevede necessariamente la presenza di uno strumento. Parlare di azione tecnica solo in presenza di uno strumento è un pregiudizio modernista, secondo il quale l'essenza della tecnica non risiederebbe nell'abilità dell'utilizzatore, quanto nel *corpus* di regole formali che sono incapsulate nell'oggetto tecnologico (Ingold 2000b). Questo aspetto Mauss (1936) lo aveva colto perfettamente; ma allo stesso tempo, le sue tecniche del corpo erano riferite ad un'entità intesa in maniera eccessivamente individualizzata, laddove l'approccio ecologico ci invita a considerarle come proprietà di un sistema di relazioni che si instaura tra agente (umano o non umano) e ambiente circostante (Ingold 1997: 111).

[15] In questa prospettiva, qualsiasi separazione netta tra tecnico e sociale è considerata assolutamente fuorviante. Gli *skill* sono pratiche sociali sedimentate e trasmesse. Anche se tale trasmissione non implica rappresentazioni codificate, perché gli *skill* sono refrattari alle codificazioni culturali; così come l'organismo è refrattario alle codificazioni genetiche.

2. L'azione tecnica: corpo, strumento e abilità

Demand for dexterity is not in the movements themselves but in the surrounding conditions. (Bernstein 1996, 23)

A partire da questa definizione teorica del concetto di tecnicità e per comprendere cosa significhi concretamente "agire tecnicamente", dunque, diventa essenziale definire cosa sia uno strumento. In un'ottica ecologica, un oggetto non può essere considerato, in sé e per sé o sulla base di presunti attributi oggettivi, uno strumento. Al contrario, in linea con la cosiddetta *"affordance theory"* (Gibson 1977)[16], un oggetto è uno strumento solo in *relazione* ad altri oggetti all'interno di un *campo* di attività in cui esso è in grado di esercitare un certo effetto. Francois Sigaut ha correttamente affermato che "isolated objects do not tell us nothing" (Sigaut 1993, 383) proprio per criticare la pratica assai diffusa tra gli archeologi e gli antropologi a classificare, in modo decontestualizzato e senza alcun riferimento ai processi di adattamento[17] spazio-temporali, gli strumenti del passato. Una tendenza basata su modelli di ricostruzione *analogica* e, quindi, di retro-proiezione delle conoscenze e degli usi attuali.

Ciò avviene perché, generalmente, siamo abituati a definire uno strumento con riferimento ad una presunta *funzione* che leghiamo a degli specifici attributi considerati oggettivi. In realtà, ci dice Ingold (2006), le cosiddette funzioni sono mere *storie* o *narrazioni* implicite che, descrivendo il modo in cui gli strumenti vengono usati, finiscono per definire normativamente il loro "corretto" utilizzo. Ma, come è noto, il significato di ogni narrazione non è né "pronta per l'uso", né da reinventare volta per volta *ex novo.* Così, le funzioni degli strumenti devono essere necessariamente *riconosciute* mediante un ri-allineamento (creativo) del significato della narrazione implicita alle circostanze attuali che l'utilizzatore vive. Ecco che, in questa prospettiva, l'utilizzatore esperto (*skilled*) è come un cantastorie i cui racconti siano narrati dalla pratica del suo agire tecnico. In tal senso gli strumenti hanno una qualità processuale, simile a quella delle attività che essi rendono possibile.

Ma il punto centrale dell'argomentazione di Ingold riguarda il ruolo del corpo nell'ambito dell'azione tecnica. Sia essa una mera "tecnica del corpo" (Mauss 1936) o un'azione mediata da uno strumento, in entrambi i casi il corpo (le mani, gli occhi, il cervello, ecc.) è il soggetto principale dell'azione tecnica. In questa prospettiva, non siamo noi ad "usare" il nostro corpo, come si suole semplicisti-

[16] La *affordance theory* di Gibson afferma che gli esseri umani percepiscono il mondo non solamente in termini di forma degli oggetti e di relazioni spaziali, ma anche in termini di "possibilità di azione".

[17] Secondo Ingold, assimilabili ai processi biologici di *exaptation*. Ovvero la cooptazione funzionale realizzata dagli organismi per riadattare "opportunisticamente" per nuove funzioni le strutture bio-anatomiche già a loro disposizione (Gould e Vrba 1982).

camente affermare nel linguaggio ordinario; bensì, siamo noi, *dunque* il nostro corpo, a usare lo strumento o ad agire tecnicamente nel mondo seguendo le tracce memorizzate delle performance già realizzate e inscritte (letteralmente) nella nostra destrezza corporea. Questo aspetto è centrale, anche se troppo spesso rimosso. Infatti, le *performance* sono memorizzate dal corpo (dalla sua destrezza gestuale), ma non dallo strumento e, dunque, esiste una fondamentale e irriducibile *asimmetria* tra corpo e strumento (torneremo nel prossimo paragrafo su questo aspetto)[18].

Come lo stesso Leroi-Gourhan aveva osservato, non sono solo gli oggetti a diventare strumenti in relazione al campo di attività all'interno del quale vengono collocati; anche il corpo e i suoi organi subiscono la stessa sorte. Una mano non è una "cosa" oggettiva in sé (nonostante la sua struttura bio-anatomica sia un fatto reale e concreto), ma ha, anch'essa, una *storia* fatta di gesti e di abilità; e questa storia influisce, nel tempo, su questa struttura in un rapporto di reciproca e ineliminabile influenza. Utilizzare uno strumento, dunque, significa congiungere (non sovrapporre) queste storie, ma in un contesto caratterizzato da altri oggetti e strumenti. Ecco perché, in realtà, noi non ci troviamo mai di fronte a semplici strumenti, ma interagiamo con processi sinergici tra i corpi dei praticanti, gli strumenti e la materia. È stato il noto scienziato Nicholai Bernstein (1996) a dimostrare ampiamente che le abilità tecniche del praticante non possono rimandare meramente al gesto in sé, quanto alla "sintonia" (*tuning*) che si instaura tra gesto, compito (*task*) e condizioni ambientali circostanti (cangianti). È questa sintonia che fa l'essenza della destrezza. Ma proprio questo ci dimostra che se l'intelligenza non risiede nel cervello, essa non risiede neanche nella mano. Essa risiede proprio nella tecnicità. In una sintonia, cioè, che non è riconducibile ad un individuo isolato, e neppure ad un suo specifico organo; ma che è una proprietà emergente dell'intero processo che coinvolge sinergicamente gesti, strumenti e materia, in un determinato spazio-tempo (sociale), di concreti *esseri-nel-mondo*.

3. Digressione teorica: tra "ragni" e "formiche"

Tim Ingold, lo abbiamo già visto, afferma con nettezza l'esistenza di una fondamentale quanto irriducibile *asimmetria* tra corpo e strumento. Questo principio rivela, nella definizione del ruolo dell'attore, un delicato punto di attrito tra la sua argomentazione e la principale delle scuole di pensiero sviluppate nell'ambito dei contemporanei STS (*Science and Technology Studies*): l'Actor-Network Theo-

[18] Questo principio viene solo parzialmente scalfito dallo sviluppo delle tecnologie digitali interattive. Eppure, necessario riconoscerlo, oggi viene insidiato da uno degli ambiti di ricerca tecnologica più avanzati e promettenti: la "robotica epigenetica" (Morgavi 2011). Ma, per adesso, siamo ancora nel dominio delle promesse e delle potenzialità.

ry (ANT)[19]. Nel modello ANT, infatti, l'attore (definito *attante*) è qualunque agente individuale o collettivo che sia in grado di entrare o uscire da associazioni reticolari (*networked*) con altri agenti. In questa prospettiva, è proprio l'associazione di rete che definisce e attribuisce sostanza, azione, intenzione e soggettività all'attante, il quale è in sé privo di un'essenza o sostanza *a priori.* Ora, semplificando, uno dei fondamenti teorici caratterizzanti l'approccio ANT è quello in base al quale gli attanti possono essere sia attori umani che non umani (ad esempio le macchine o qualsiasi *device* tecnico) interconnessi e vicendevolmente influenzati in un *network* di relazioni. In questo modo, l'ANT enfatizza il principio secondo cui la cosiddetta *agency* risulterebbe essere distribuita *simmetricamente* in un network. Tale assunto, negli ambienti STS, è noto anche come principio di simmetria generalizzata (*generalized symmetry*).

Proprio questo principio di simmetria generalizzata rappresenta il punto di maggior lontananza tra i due approcci. Tanto che, recentemente, Tim Ingold (2008) ha sistematizzato criticamente un "contro-modello" in grado di riassumere le linee essenziali dell'approccio antropologico ecologico che abbiamo tentato di delineare nelle sue linee essenziali nel paragrafo precedente. La scelta, ironica, dell'antropologo britannico è stata, poi, quella di presentare questo modello con un acronimo che rappresentasse bene anche simbolicamente questa contrapposizione. Per tale ragione, al modello ANT (in inglese, "formica"), Ingold ha deciso di contrapporre un modello SPIDER ("ragno", in inglese). Dove SPIDER sta, qui, per: *Skilled Practice Involves Developmentally Embodied Responsiveness*.

In realtà, due sono gli aspetti, tra loro correlati, che segnano in modo decisivo la discontinuità tra SPIDER e ANT. Il primo riguarda l'idea di network. In un'ottica SPIDER, infatti, la rappresentazione ANT di una *agency* ubiqua ed estesa attraverso reti di relazioni materiali rimanderebbe, questa è l'accusa, ad un'interpretazione epistemologica "debole" del rapporto tra le entità associate. Anzi, ancor più esplicitamente, possiamo asserire che per Ingold il concetto di network non sarebbe in grado di esprimere concettualmente una vera *relazione* tra entità. Tutt'al più, una loro semplice reciproca *connessione*. Non si tratta, ovviamente, di una mera disputa terminologica. La critica è sostanziale e riguarda la capacità di rappresentare una materialità del mondo che non sia interamente inclusa (*comprehended*) nelle entità connesse (Ingold 2008, 210). Per il ragno (SPIDER), le linee della propria tela sono tessute con il materiale trasudato dal proprio corpo e sono dispiegate grazie al proprio movimento fisico. In altri ter-

[19] L'*Actor-Network Theory*, nota anche come "the sociology of translation", è un frame concettuale emerso nella metà degli anni '80 dal lavoro di autori come Bruno Latour, Michel Callon e John Law (Callon 1986; Latour 1987; Law 1987; Latour 2005). Elaborata per esplorare i processi collettivi socio-tecnici, nata da un interesse STS (Science and Technology Studies) e fondata su un rifiuto di entrambe le letture naturalistiche (realismo) e culturalistiche (costruttivismo), l'approccio ANT ha l'ambizione di mostrare come la scienza sia un processo di ingegneria eterogenea in cui il sociale, il tecnico, il concettuale e il testuale sono continuamente intrecciati e trasformati (tradotti).

mini, queste linee sono estensioni dell'essere per come esso si *dispiega* lungo il proprio percorso di vita che traccia nell'ambiente che lo circonda. Esse sono le linee lungo le quali l'essere vive e conduce la sua percezione e la sua azione nel mondo[20]. Insistendo con la metafora, la tela del ragno non è considerata dal ragno stesso come un'entità, ovvero un oggetto in sé conchiuso e distinto che può congiungersi o giustapporsi ad altri oggetti per sostenere una *agency* distribuita.

Allo stesso tempo, questa visione mette in discussione la portata euristica di uno dei concetti più utilizzati dalla formica (ANT): il concetto di *ibrido.* Se, ad esempio, una formica (ANT) definirebbe la congiunzione ragno-tela come un'entità ibrida, in grado di funzionare come trappola solo se sostenuta da un network di altri elementi (i ramoscelli, i cespugli, l'erba ecc.), un ragno (SPIDER) considererebbe tutti questi elementi come un fascio di filamenti che aggroviglia in maniera intricata e inestricabile altri fasci di filamenti che sono, a loro volta, le punte visibili di invisibili, sotterranei e complessi sistemi radicali. Per tale ragione, Ingold fa dire al suo immaginario ragno che dialoga con l'altrettanto immaginaria formica:

> It is as though my body were formed through knotting together threads of life that run out through my many legs into the web and thence to the wider environment. The world, for me, is not an assemblage of heterogeneous bits and pieces but a tangle of threads and pathways. (Ingold 2008, 212)

Per tale ragione, Ingold preferisce il concetto di *meshwork* (Ingold 2007) a quello di *network*. Preso in prestito dal filosofo e sociologo francese Henri Lefebvre (1974), il concetto non rinvia a linee di connessione di punti separati, quanto a percorsi reticolari tracciati dagli esseri viventi. I quali, muovendo il proprio corpo nello spazio, *intrecciano* e *tessono* un ambiente che, prima di essere architetturale, è innanzi tutto "archi-testuale". Interessante evidenziare che la struttura a *meshwork* riprende pattern di sviluppo legati a processi biologici di tipo cellulare (si veda la figura 1).

Da questa visione, è evidente, deriva il rifiuto radicale del principio di simmetria. Infatti, solo gli organismi viventi agiscono percettivamente e costruiscono linee di relazione. Le entità con cui Latour costruisce i suoi ibridi sono in realtà insiemi di media all'interno dei quali i viventi sono immersi. Al contrario, per Ingold, la "*blanket-category*" utilizzata per indicare genericamente i *non-umani* (animali, vegetali, macchine, ecc.)[21] ha il limite epistemologico di rimuovere il fat-

---

[20] Andy Clark (2008) parla in proposito di *wideware*.

[21] Anche Francois Sigaut (2007) critica il concetto di negoziazione tra attori umani e non umani (a meno di non voler interpretare il termine fino a snaturarne drasticamente il significato). Il rapporto con la materia richiede, infatti, l'"apprendistato della necessità", in cui non vi è margine per alcuna negoziazione. Un apprendistato anche faticoso e duro, in grado però di spiegare la dimensione centrale dell'azione tecnica: l'invenzione. In ciò, credo, Sigaut si mostra in linea con il pragmatismo di Peirce nella sua critica radicale alla teoria del dubbio cartesiano. Per Peirce (1932-58) il vero dubbio è quello generato dall'azione nella vita reale, in cui è

to che è la capacità di realizzare movimenti *attentivi* che qualifica il movimento stesso in *azione* e l'essere che lo realizza in *agente*.

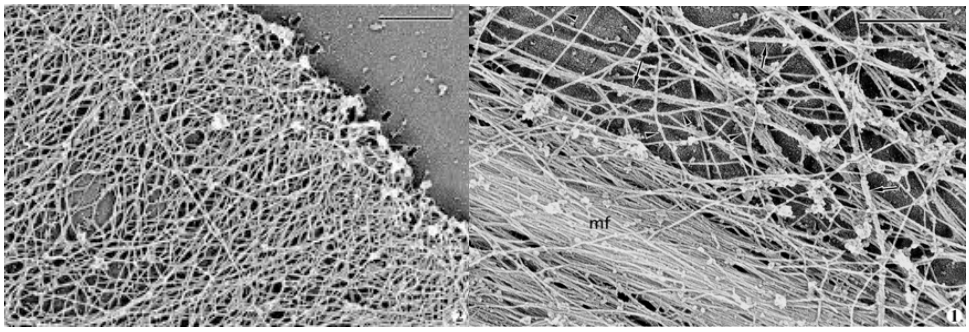

Figura 1: *meshwork* cellulare (processo di differenziazione dell'actina).

Dunque, l'essenza dell'azione giace nell'intimo intreccio che esiste tra corpo e percezione. Ciò significa che, per il ragno, la tela non è un oggetto con cui interagire, né un agente in sé. Essa è, più semplicemente, il "terreno sul quale è possibile costruire ogni possibilità di interazione e di *agency*" (Ingold 2008, 213). Ogni azione, invece, è in qualche misura sempre abile (*skilled*) e l'abilità non è fondata sull'intelligenza, intesa come capacità di pianificare e prevedere le conseguenze dell'azione; bensì sulla capacità di accoppiare i movimenti corporei alla percezione. Una capacità che non è incapsulata e pronta per l'uso, ma che si *sviluppa* insieme all'organismo nella sua interazione con un determinato ambiente.

4. Lo sviluppo tecnologico e la lettura pragmatista di Sennett

L'impostazione analitica fin qui descritta potrebbe essere accusata di riproporre, in modo anacronistico, un approccio romantico e non in grado di cogliere, in tutta la loro portata, gli sviluppi più radicali del progresso tecnologico attivati dalla modernità.

I processi di *sradicamento* e *astrazione* del lavoro e dell'azione tecnica imposti dalla meccanizzazione radicale, e già ampiamente descritti dalla stessa letteratura socio-antropologica classica (Durkheim, Marx, Weber), sembrano lasciare alla destrezza dell'Uomo, al suo corpo, un margine di manovra ridottissimo. La reale responsabilità dei movimenti degli strumenti nell'agire tecnico appaiono sempre più incorporati in un *design* tecnologico, in un *corpus* seriale e immodificabile di

il mondo ad incaricarsi di frantumare continuamente le certezze che la fondano. L'azione umana è, perciò, intrappolata nella tensione tra pratiche ricorsive e apparentemente non riflessive e azione creativa (*skilful problem-solving*).

regole e algoritmi, così confermando il monito di Leroi-Gourhan da cui siamo partiti nella nostra disamina.

Eppure, in questo quadro apparentemente caratterizzato da un'inesorabile disgiunzione tra azione e percezione, Francois Sigaut ha mostrato, con la sua "*law of the irreducibility of skills*", come questo processo non potrà mai essere portato a compimento perché: "costantemente nuove abilità tendono a svilupparsi attorno alle nuove macchine" (Sigaut 1994, 446). Questa "legge" affonda le sue radici in una relazione antropologica fondante tra corpo e strumento che Sigaut (2007) descrive[22] e le cui tracce sarebbero rinvenibili anche nella stessa radice etimologica del termine *organo* (del corpo): la parola ὄργανον, che in greco antico significa "strumento". Importanti conferme di questa legge arrivano da diverse analisi teoriche[23] ed empiriche. In Francia, ad esempio, Caroline Moricot (1997) ha dimostrato magistralmente come, malgrado l'alto livello di automatizzazione degli aerei moderni, i piloti siano ancora impegnati a "fronteggiare" in maniera decisiva le macchine con le proprie abilità corporee.

Inoltre, come già ricordato, in questa stessa direzione esiste un'importante produzione filosofica e socio-antropologica[24] che affonda le sue radici nella ricca tradizione pragmatista americana (Peirce, Mead, Dewey, James). Una tradizione che Hans Joas (2005) ha definito succintamente, ma efficacemente, come una "teoria della creatività situata"[25]. Nell'ambito del variegato e fecondo universo del dibattito STS, sia sufficiente qui ricordare, a mero titolo esemplificativo, il lavoro magistrale di Lucy Suchman (2007). Criticando una certa tendenza diffusa nella stessa letteratura STS a sovrastimare la dimensione razionale

[22] Sigaut racconta la tecnica come il fondamento della sociabilità umana. Infatti, nella sua prospettiva, la relazione reciproca tra reale, ego e altro, che egli chiama il "triangolo del senso", si costruisce proprio con l'azione tecnica e attrezzata (*outillée*). Alla base di questa azione vi è la condivisione dell'esperienza, la quale rende la tecnica fonte di piacere e sociale nella sua essenza.

[23] Dal punto di vista teorico, vorrei segnalare la rilevantissima opera di Jacques Perriault (1989). Definendo la "logique de l'usage", egli ha descritto la dimensione del technotopo: una nicchia ecologica dell'oggetto tecnologico che, mettendo insieme componenti individuali, strumentali e socio-culturali, garantisce percorsi originali di una sua reinterpretazione.

[24] La ricerca microsociologica della Scuola di Chicago, dell'interazionismo simbolico, dell'etnometodologia e dell'analisi della conversazione.

[25] Essa, infatti, rifiuta la teoria analitica dell'azione (o dell'azione razionale) e le sue varie derivazioni economiche, sociologiche e psicologiche. In particolare, rifiuta di considerare l'agente astratto dal proprio contesto situazionale e biografico. Sarebbe, infatti, proprio il sottodimensionamento della dimensione corporea dell'azione a provocare la distorsione prospettica della teoria razionale dell'azione. Il corpo, invece, nella prospettiva pragmatista, non è un semplice strumento (di azione o comunicazione) sempre a disposizione dell'intenzionalità. E' questa accezione "strumentalista" l'errore epistemologico di fondo che i pragmatisti rimproverano anche a grandi autori come Elias o Foucault (Giddens 1984). Al contrario, facendo tesoro della riflessione sul corpo e sulla intercorporeità (Merleau-Ponty 1945; Mead 1934), il pragmatismo dimostra come non sia l'azione ad essere contingente al contesto, ma al contrario come sia il contesto (fisico e sociale) ad essere costitutivo dell'azione (Joas 2005, 160).

dell'attore/designer e, soprattutto, la capacità di quest'ultimo di *inscrivere* nell'artefatto la definizione che esso ha dell'utente e dell'*uso*[26]*,* Suchman afferma con forza che, rispetto agli artefatti, noi siamo degli *"embodied user"*; condizionati nell'uso dagli specifici, effettivi e storici contesti, più che da *script* codificati e inscritti nell'oggetto tecnologico.

Recentemente, infine, attingendo proprio da questa tradizione, Richard Sennett ha mostrato che si può ritrovare (con rischi e opportunità nuove) la mitologica presenza vitale di *Efesto,* ovvero i fondamenti della creatività tecnica artigianale, anche nel rapporto che istauriamo con le nuove tecnologie. Per perseguire tale scopo, Sennett ha preferito sostituire il termine "destrezza" con quello di "maestria". Una scelta molto significativa che evoca chiaramente la volontà dell'autore di superare il rischio di un utilizzo riduttivo del concetto di esperienza esperta (*skill*). La maestria, infatti, è una qualità del rapporto che il lavoratore instaura con il suo compito (*task*) e la sua attività; essa non è riducibile esclusivamente all'attività manuale, essendo legata ad "un impulso umano sempre vivo, il desiderio di svolgere bene un lavoro per se stesso" (Sennett 2008, trad. it. 2010, 18). La maestria, inoltre, è una qualità del lavoro che dipende più dalle condizioni sociali del contesto che circonda il lavoratore che dagli strumenti o macchinari utilizzati. Essa sarebbe fondata sull'intimo rapporto antropologico (una sostanziale unità) che esiste tra mano[27] e testa.

Sennett dimostra che anche il lavoro intellettuale deve confrontarsi con le medesime pratiche che caratterizzano il lavoro manuale: lavorare con la resistenza e l'ambiguità, la coordinazione e la collaborazione, la prensione e la concentrazione. Queste, per il sociologo americano, emergono filogeneticamente e ontogeneticamente dalla costruzione di abilità manuali altamente specializzate e, aspetto fondamentale, risultano applicabili anche alla costruzione delle relazioni sociali. Sennett, infatti, riprende il principio pragmatista che stabilisce una continuità tra organico e sociale. In questa prospettiva: "le capacità che il corpo possiede di conformare oggetti fisici sono le medesime capacità a cui attingiamo nelle relazioni sociali" (Sennett 2008, trad. it. 2010, 275).

In conclusione, che si tratti di un lavoro condotto con le mani, oppure con una *embodied mind,* o nell'ambito di una relazione sociale, non siamo di fronte a differenze paradigmatiche incolmabili. In tal senso, per Sennett, un falegname, un direttore d'orchestra e un tecnico di un laboratorio scientifico possono essere considerati artigiani alla stessa stregua. La sola condizione necessaria affinché tale equiparazione possa effettivamente avvenire è che nell'esercizio delle loro attività essi imparino a non separare artificiosamente quell'unità tra testa e mano che definisce la maestria del lavoro artigianale. Dunque, nel pensiero di Sennett

[26] Mi riferisco ad esempio al lavoro di Akrich (1992) o di Woolgar (1991).

[27] Sennett utilizza il termine mano per riferirsi al corpo nel suo complesso e al rapporto che esso instaura con il contesto circostante. La testa, ovviamente, rappresenta una sineddoche che sta per "pensiero", "ragionamento", "astrazione", "progettazione", ovvero il lavoro intellettuale.

l'avvento della tecnologia non implica necessariamente una marginalizzazione delle abilità artigianali. Anzi, l'avvento delle più evolute tecnologie digitali stanno rendendo possibile un recupero di tali abilità.

L'abilità, infatti, può essere definita come "una capacità pratica ottenuta con l'esercizio" (Sennett 2008, trad. it. 2010: 44), e le nuove tecnologie dell'informazione rendono sempre più possibile un *feedback* dinamico in grado di "apprendere" dall'esperienza. Così, tutti gli elementi presenti nell'inno a Efesto realizzato da Platone, in particolare l'aspirazione alla qualità, il controllo sui processi, la dimensione partecipata e condivisa, l'unità tra abilità individuali e comunità sociale, sono, ad esempio, presenti nelle nuove forme di organizzazione del lavoro impiegate per sviluppare i software *open source* (vedi *Linux*) e, più in generale, di tutte le forme di sviluppo informatico definite "a bazar" da Eric Raymond (1999). Ovviamente, ci si riferisce ad una potenzialità non necessariamente attualizzata. Sennett, infatti, mostrando le opportunità fornite dalle nuove tecnologie digitali[28] sottolinea come esse possano anche invogliare ad un loro utilizzo "scorretto" (ripetitivo, statico, alienato), ovvero orientato ad uno scollamento tra realtà e simulazione:

> I moderni programmi per computer sono in grado di imparare dall'esperienza, perché i dati di feedback riscrivono gli algoritmi. Il problema […] è che c'è il rischio di demandare alle macchine questo processo di apprendimento, limitandoci a fungere da testimoni passivi e da consumatori di abilità tecniche sempre più ampie, senza parteciparvi […]. Questo è il risvolto sociale del problema dell'abilità tecnica: testa e mano non sono separate soltanto intellettualmente, ma anche socialmente. (Sennett 2008, trad. it. 2010, pp. 50-51)

Conclusioni e possibili sviluppi di ricerca futuri

L'obiettivo principale di questa rassegna è stato duplice. Da una parte, abbiamo tentato di mostrare come sia riduttivo e fuorviante concentrare l'analisi dell'azione tecnica su un organo specifico del corpo: la mano. In particolare, col supporto dell'opera dell'antropologo britannico Tim Ingold, abbiamo enfatizzato il principio "ecologico" secondo cui non è mai soltanto la mano a rappresentare il *locus* privilegiato delle *skill* tecniche, essendo queste annidate, più in generale, nella "tecnicità", ovvero nel particolare allineamento (sintonia) tra la corporeità, il contesto situazionale, la materia e gli strumenti utilizzati.

In maniera correlata, e col sostegno di contributi teorici ed empirici di stampo pragmatista e fenomenologico, abbiamo provato a dimostrare come la riduzione della dimensione manuale del lavoro (la cui scomparsa è a nostro avviso assai improbabile) non implichi necessariamente una regressione dell'innovatività e

[28] In particolare, egli analizza dettagliatamente il caso della progettazione dai sistemi CAD (*Computer Assisted Design*).

dell'unicità dell'azione custodite nell'esperienza umana. Per tale ragione, lo sviluppo della tecnologia meccanica ed elettronica e, più recentemente, di quella digitale non ha portato a realizzare molte delle profezie pessimistiche che negli anni hanno preconizzato la fine delle abilità creative artigianali legate all'utilizzo esperto degli strumenti.

Il nostro ragionamento ha provato ad evidenziare che se non è un solo organo (la mano) a rappresentare il *locus* privilegiato degli *skill* tecnici, essendo questi legati alla sintonizzazione del nostro corpo con l'ambiente circostante, allora l'avvento delle moderne tecnologie non può spiazzare in termini assoluti tale *locus*, trasferendolo nel *design* tecnologico incapsulato in un *set* di regole e algoritmi definiti. Infatti, l'utente è ancora e sempre un corpo che opera in un contesto.

Inoltre, lo abbiamo ribadito, l'avvento delle nuove tecnologie digitali sta aprendo dei margini potenziali interessanti di recupero di un *feedback* dinamico tra operatore, strumento e ambiente (fisico e sociale). Certamente, esso non è più, come in passato, prevalentemente centrato sulla dimensione manuale e corporea del gesto (che comunque non scompare, ma anzi può essere ri-valorizzata[29]), quanto su quella intellettuale e socio-relazionale. Dunque, la nostra tesi è che oggi esistono (almeno potenzialmente) margini teorici e pratici rilevanti per stimolare un recupero del valore dell'azione tecnica esperta e abile. Ciò, ovviamente, non significa tornare al lavoro manuale, quanto ricreare le condizioni sociali e istituzionali che la rendono possibile.

A nostro avviso, l'appello di Anthony Giddens (1991) a sviluppare pratiche sociali di riappropriazione della tecnologia (*reskilling practices*) va letto proprio in questa direzione. Si tratta di pratiche volte ad un *empowerment* delle comunità grazie alla ri-abilitazione partecipata e condivisa della produzione tecnologica (*ex-ante*) e non solo del suo uso (*ex-post*).

Esempio importante di *reskilling practices* è quello realizzato, in ambito agrobiotecnologico, presso la Wageningen University and Research (WUR) da Guido Ruivenkamp (2008) e dai suoi collaboratori. Partendo dall'assunto che lo sviluppo biotecnologico, come ogni altro processo tecnico, debba essere considerato intrecciato con le altre dinamiche sociali che caratterizzano il contesto locale di riferimento in un processo reiterativo di *co-creazione,* il gruppo di lavoro della WUR ha sviluppato un progetto di *tailor-made biotechnologies.* L'obiettivo di tale progetto è di coniugare un più equo sviluppo alimentare (sovranità alimentare) nei paesi in via di sviluppo (PVS) con la limitazione dei danni provocati dal processo di sistematica espropriazione delle risorse simboliche e materiali attuate da opachi e sradicati *knowledge network* internazionali.

Infatti, la produzione del cibo e lo sviluppo delle tecniche agricole sono il frutto di un deposito secolare di risorse sociali, culturali e simboliche. Tale depo-

[29] Pensiamo al recupero dell'abilità gestuale e corporea che le tecnologie digitali hanno reso possi bile nell'ambito della nuova generazione di videogame dotati di *motion controller* (Meneghelli 2011).

sito viene marginalizzato dai processi di produzione scientifica, provocando uno sradicamento del cibo e dell'agricoltura dalle tradizioni locali e un arricchimento diseguale a tutto vantaggio di *big players* globalizzati. Le *tailor-made biotechnologies* operano un tentativo di sviluppo tecnologico *bottom up* che re-incapsuli le biotecnologie nelle tradizioni sociali, culturali ed ambientali delle comunità locali, attraverso la collaborazione partecipata di tecnologi, scienziati, contadini e cittadini in un meccanismo virtuoso di partecipazione e condivisione che recuperi tutti i saperi e le risorse ambientali locali.

A nostro avviso, è a queste esperienze e pratiche di riappropriazione (Feenberg 1999) *ex-ante* della tecnologia che si legano i più interessanti sviluppi futuri di un'azione tecnologica innovativa. Le nuove tecnologie digitali e l'applicazione di modelli cooperativi *open source* rendono queste esperienze sempre meno un traguardo utopico.

Bibliografia

Akrich, M. (1992) *The De-scription of Technical Objects*, in W. Bijker and J. Law (a cura di), *Shaping Technology/Building Society*, Cambridge, MA, MIT Press, pp. 205-224; trad. it. *La de-scrizione degli oggetti tecnici* in A. Mattozzi (a cura di) (2006), *Il senso degli oggetti tecnici*, Roma, Meltemi.

Arendt, H. (1964) *Vita activa*, Milano, Bompiani.

Barcellona, P. (2005) *La parola perduta. Tra polis greca e cyberspazio,* Bari, Dedalo.

Baudrillard, J. (2005) *Violenza del virtuale e realtà integrale*, Firenze, Le Monnier.

Berardi (Bifo), F. (1995) *Neuromagma. Lavoro cognitivo e infoproduzione*, Roma, Castelvecchi.

Bernstein, N. A. (1996) *On Dexterity and its Development*, in M. L. Latash e M. T. Turvey (a cura di), *Dexterity and Its Development,* Mahwah, NJ, Lawrence Erlbaum, pp. 1–244.

Bostrom, N. (2002) *Anthropic Bias: Observation Selection Effects in Science and Philosophy*, London, Routledge.

Bourdieu, P. (1972) *Esquisse d'une théorie de la pratique*, Genève, Droz; trad. it. *Per Una Teoria Della Pratica. Con Tre Studi Di Etnologia Cabila*, Milano, Cortina, 2003.

Bourdon, J. (1997) *Introduction aux médias*, Paris, Montchrestien; trad. it. *Introduzione ai media*, Bologna, Il Mulino, 2001.

Bucchi, M. e Neresini, F. (2006) *Cellule e cittadini. Biotecnologie nello spazio pubblico*, Milano, Sironi.

Callon, M. (1986), *Some Elements of a Sociology of Translation: Domestication of the Scallops and the Fishermen of St Brieuc Bay*, in J. Law (a cura di), *Power, Action and Belief: A New Sociology of Knowledge*, London, Routledge and Kegan Paul, pp. 196-233.

Capucci, P.L. (1994) *Il corpo tecnologico. L'influenza delle tecnologie sul corpo e sulle sue facoltà,* Bologna, Baskerville.
Cerqui, D. (2005) *Humains, machines, cyborgs. Le paradigme informationnel dans l'imaginaire technicien,* Lausanne, Université de Lausanne.
Clark, A. (2007) *Beeing There*, Cambridge, Mass., MIT Press.
Clark, A. (2008) *Where Brain, Body and World Collide*, in C. Knappett e L. Malafouris (a cura di), *Material Agency. Towards a Non-Anthropocentric Approach*, New York, Springer, pp. 1-18.
Connerton, P. (1989) *How Societies Remember*, Cambridge, Cambridge University Press.
Craighero, L. (2010) *Neuroni specchio*, Bologna, Il Mulino.
Damasio, A. (1995) *L'errore di Cartesio. Emozione, ragione e cervello umano,* Milano, Adelphi.
De Garis, H. (2005) *The Artilect War: Cosmists vs. Terrans: A Bitter Controversy Concerning Whether Humanity Should Build Godlike Massively Intelligent Machines*, Palm Springs - CA, ETC Publications.
Eco, U. (1964) *Apocalittici e integrati*, Milano, Bompiani.
Edelman, G. (1992) *Bright Air Brilliant Fire. On the Matter of the Mind*, New York, Basic Books; tr. it. *Sulla materia della mente*, Adelphi, Milano, 1993.
Feenberg, A. (1999) *Questioning Technology* Routledge, London; trad. it. *Tecnologia in discussione. Filosofia e politica della moderna società tecnologica*, Milano, Etas, 2002.
Feenberg, A. (2010) *Between Reason and Experience. Essays in Technology and Modernity*, Cambridge - MA, MIT Press.
Galimberti, U. (1999) *Psiche e techne. L'uomo nell'età della tecnica*, Milano, Feltrinelli.
Gibson, J.J. (1977) *The Theory of Affordances*, in R. Shaw e J. Bransford (a cura di) *Perceiving, Acting and Knowing*, Hillsdale, NJ, Erlbaum.
Gibson, J.J. (1979) *The Ecological Approach to Visual Perception*, Boston, Houghton Mifflin.
Giddens, A. (1984) *The Constitution of Society*, Cambridge, Polity Press.
Giddens, A. (1991) *Modernity and Self-identity: Self and Society in the Late Modern Age,* Cambridge, Polity Press.
Gould, S.J. e Vrba E.S. (1982) *Exaptation a missing term in the science of form*, in "Paleobiology" 8 (1), pp. 4–15.
Hardt, M. e Negri, A. (2000), *Empire*, Cambridge, Harvard University Press; trad. it. *Impero*, Milano, Rizzoli, 2003.
Ingold, T. (1983) *The Architect and the Bee: Reflections On the Work of Animals and Men*, in "Man (NS)", 18, pp. 1-20.
Ingold, T. (1997) *Eight Themes in the Anthropology of Technology*, in "Social Analysis", 41 (1), pp. 106-138.
Ingold, T. (1999) *Tools for the Hand, Language for the Face: An Appreciation of Leroi- Gourhan's "Gesture and Speech",* in "Studies in History and Philosophy of Biological and Biomedical Sciences", 30 (4), pp. 411-453.

Ingold, T. (2000a) *Evolving Skills*, in Rose, H., Rose S. (a cura di) *Alas Poor Darwin. Arguments Against Evolutionary Psychology*, London, Jonathan Cape, pp. 225-246.

Ingold, T. (2000b) *The Perception of the Environment: Essays on Livelihood, Dwelling and Skills*, London, Routledge.

Ingold, T. (2005) *Walking the Plank. A Meditation on the Process of Skill*, in J.R. Dakers (a cura di), *Defining Technological Literacy: Towards an Epistemological Framework*, New York, Palgrave Macmillan, pp 65-80.

Ingold, T. (2007) *Lines. A Brief History*, London, Routledge.

Ingold, T. (2008) *When ANT Meets SPIDER: Social Theory for Arthropods*, in C. Knappett e L. Malafouris (a cura di), *Material Agency. Towards a Non-Anthropocentric Approach*, New York, Springer, pp. 209-215.

Jablonka, E. e Lamb, M. (2005) *Evolution in Four Dimensions: Genetic, Epigenetic, Behavioral, and Symbolic Variation in the History of Life*, Cambridge, mass, MIT Press; trad. it. *L'evoluzione in quattro dimensioni*, Milano, UTET, 2007.

Jacob, P. e Jeannerod, M. (2003) *Ways of Seeing*, Oxford, Oxford University Press.

Joas, H. (2005) *The Creativity of Action*, Oxford, Polity Press.

Kaczynski, T.J. (2010) *Technological Slavery*, Port Townsend, WA, Feral House.

Kompridis, N. (2006) *Critique and Disclosure: Critical Theory Between Past and Future*, Cambridge, MIT Press.

Kuhn, T. (1962) *The Structure of Scientific Revolution*, Chicago, Chicago University Press; trad. it. *La struttura delle rivoluzioni scientifiche*, Torino, Einaudi, 1979.

Kurzweil, R. (2005) *The Singularity is Near*, New York, Viking.

Latour, B. (1987) *Science in Action: How to Follow Scientists and Engineers Through Society*, Milton Keynes, Open University Press; trad. it. *La scienza in azione: introduzione alla sociologia della scienza*, Torino, Edizioni di Comunità, 1998.

Latour, B. (2005) *Reassembling the Social: An Introduction to Actor-Network-Theory,* Oxford, Oxford University Press.

Lave, J. e Wenger, E. (1991) *Situated Learning: Legitimate Peripheral Participation*, Cambridge, Cambridge University Press.

Law, J. (1987) *Technology and Heterogeneous Engineering: The Case of Portuguese Expansion*, in W.E. Bijker, T.P. Hughes, e T.J. Pinch (a cura di), *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology*, Cambridge, Mass., MIT Press.

Le Breton, D. (1990) *Anthropologie du corps et modernité*, Paris, PUF.

Lefebvre, H. (1974) *La production de l'espace*, Paris, Anthropos.

Leroi-Gourhan, A. (1964) *Le geste et la parole*, Paris, Albin Michel.

Lewontin, R. (2000) *The Triple Helix: Gene, Organism, and Environment*, Cambridge, Harvard University Press; trad. it. *Gene, organismo e ambiente,* Bari, Laterza, 2002.

Maestrutti, M. (2011) *Imaginaires des nanotechnologies. Mythes et fictions de l'infiniment petit,* Paris, Vuibert.
Marx, K. (1867) *Das Kapital, vol. I*, Dietz, Hamburg; trad. it. *Il capitale. Critica dell'economia politica*, Roma, Editori Riuniti, 1964.
Mauss, M. (1936) *Les techniques du corps*, in "Journal de Psychologie", 32 (3-4); trad. it. *Le tecniche del corpo,* in M. Mauss *Teoria generale della magia e altri saggi*, Torino, Einaudi, 1966.
Mead, G. H. (1934) *Mind, Self and Society*, Chicago, The University of Chicago Press; tr. it. *Mente, sé e società*, Milano, Giunti, 1966.
Meneghelli, A. (2011) *Il risveglio dei sensi. Verso un'esperienza di gioco corporeo*, Milano, Unicopli.
Merleau-Ponty, M. (1945) *Phénoménologie de la perception*, Paris, Gallimard; trad. it. *Fenomenologia della percezione*, Milano, Bompiani, 2009.
Moravec, H. (2000) *Robots, Re-Evolving Mind*, Carnegie Mellon University Robotics Institute.
Morgavi, G. (2011) *Robotica epigenetica ed implicazioni socio-psicologiche*, in G. Nicolosi (a cura di), *Robot. La macchina, il corpo, la società*, Firenze-Catania, ed.it.
Moricot, C. (1997) *Des avions et des hommes*, Lille, Presses Universitaires du Septentrion.
Moss, L. e Pavesich, V. (2011) *Science, Normativity and Skill: Reviewing and Renewing the Anthropological Basis of Critical Theory*, in "Philosophy and Social Criticism", 37 (2), pp. 139–165.
Nicolosi, G. (2006) *Biotechnologies, alimentary fears and the orthorexic society*, in "Tailoring Biotechnologies", 2 (3), pp. 37-56.
Nicolosi, G. e Ruivenkamp. G. (2011) *The Epigenetic Turn. Some Notes About the Epistemological Change of Perspective in Biosciences*, in "Medicine, Health Care and Philosophy", August.
Noë, A. (2005) *Action in Perception*, Cambridge, Mass., MIT Press.
Noë, A. (2009) *Out of Our Heads. Why You Are Not Your Brain, and Other Lessons from the Biology of Consciousness*, New York, Hill & Wang; trad. it. *Perché non siamo il nostro cervello. Una teoria radicale della coscienza,* Milano, Cortina, 2010.
Oyama, S. (1998) *The Evolution's Eye. A Systems View of the Biology-Culture Divide*, Durham, Duke University Press.
Peirce, C. S. (1932-58) *Collected Papers*, C. Hartshorne and P. Weiss (a cura di), Cambridge, Harvard University Press.
Perriault, J. (1989) *La logique de l'usage*, Paris, Flammarion.
Polanyi, M. (1966) *The Tacit Dimension*, London, Routledge; trad. it. *La conoscenza inespressa*, Roma, Armando, 1979.
Postman, N. (1993) *Technopoly: The Surrender of Culture to Technology*, New York, Vintage Books.

Raymond, E. (1999) *The Cathedral & the Bazaar Musings on Linux and Open Source by an Accidental Revolutionary*, Sebastopol, O'Reilly Media; trad. it. *La cattedrale e il bazar*, Milano, Apogeo, 2001.

Rizzolatti, G., Sinigaglia, C. (2006), *So quel che fai*, Milano, Cortina.

Ruivenkamp, G. (2008) *Biotechnology in Development: Experiences from the South*, Wageningen, Wageningen Academic Publishers.

Sennett, R. (2008) *The craftman*, London, Allen Lane; trad. it. *L'uomo artigiano*, Milano, Feltrinelli, 2010.

Sigaut, F. (1993) *How Can We Analyse and Describe Technical Actions?,* in A. Berthelet e J. Chavaillon, *The Use of Tools by Human and Non-Human Primates*, Oxford, Clarendona Press, pp. 381-400.

Sigaut, F. (1994) *Technology*, in T. Ingold (a cura di), *Companion Encyclopedia of Anthropology: Humanity, Culture and Social Life*, London, Routledge, pp. 420-59.

Sigaut, F. (2007) *Les outils et le corps*, in "Communications", 81, pp. 9-30.

Stelarc (1994) *Da strategie psicologiche a cyber strategie: prostetica, robotica ed esistenza remota*, in P.L. Capucci (a cura di) *Il corpo tecnologico. L'influenza delle tecnologie sul corpo e sulle sue facoltà,* Bologna, Baskerville, pp. 61-76.

Stiegler, B. (1998) *Technics and Time, I*, Stanford, CA, Stanford University Press.

Suchman, L. A. (2007) *Human-Machine Reconfigurations*, Cambridge, Cambridge University Press.

Teilhard de Chardin, P. (1955) *Le phénomène humain,* Paris, Éditions du Seuil.

Varela, F., Thompson, E. e Rosh, E. (1991) *The Embodied Mind*, Cambridge, Mass., MIT Press.

Virilio, P. (1988) *La machine de vision*, Paris, Editions Galilée.

Warwick, K. (2004) *I, Cyborg*, Champaign, University of Illinois Press.

West-Eberhard, M.J. (2003) *Developmental Plasticity,* New York, Oxford University Press.

Woolgar, S. (1991) *Configuring the User: The Case of Usability Trials*, in J. Law (a cura di), *A Sociology of Monsters: Essays on Power, Technology and Domination*, London, Routledge, pp. 57-99.

Body, environment, technicity.
Technical action and experience between SPIDERs and ANTs.

Abstract Various (techno)pessimistic readings support the idea that in modern society the advent of technology has led to a deterioration of the relationship between perception and action and between body experience and material reality. Particularly, the advent of electronic and digital technologies would have caused the loss of the ability to explore the world and the solipsistic closure of the body in the artificially machine-generated virtual world. The aim of this article is to criticize this perspective presenting an interpretation of 'technicity' based on the intimate interweaving between organism (the body) and environment. To do this, the author defines technical action in the framework of the SPIDER (Skilled Embodied Practice Involves Developmentally Responsiveness) model, based on Tim Ingold's ecological perspective, Such a model is interpreted has having some points of friction with the ANT (Actor-Network Theory) perspective, by Latour and colleagues. Finally, the author suggests to apply the SPIDER model to understand uses and practices of modern digital technologies.

Keywords technique; body; action; perception; environment.

* * *

Guido Nicolosi
Università di Catania
Facoltà di Scienze Politiche
Via Vittorio Emanuele II, 49 - 95131 Catania
Email: gnicolos@unict.it

Scenario

Piaceri macchinici e interpellanze

John Law

Abstract In che modo gli oggetti ci interpellano? Quali sono i piaceri delle macchine? E quali sono, in particolare, i piaceri maschili costruiti nel conoscere e raccontare le tecnologie? A partire da una riflessione intorno ad alcuni piaceri macchinici, l'articolo prende in considerazione l'ecologia delle distribuzioni soggetto-oggetto ed esplora le forme di interpellanza attraverso cui ci costituiamo quali soggetti conoscenti e grazie alle quali gli oggetti sono a loro volta costruiti e conosciuti.

Keywords Interpellanze; performance; piaceri; tecnologia; posizione del soggetto.

Passione, erotismo e metodo. Conoscenze incarnate. La loro incarnazione e performance in soggetti marcati che sono anche soggetti disciplinari. Soggetti disciplinari che performano se stessi in ambiti come l'analisi sociale della tecnologia. In discipline che preferiscono performarsi come se fossero i prodotti di soggetti eroticamente non marcati. Come dare un senso a questa dimensione incarnata? Come comprendere la performance delle distribuzioni soggetto-oggetto? La definizione della conoscenza, dell'oggetto e dei soggetti?

Il posizionamento dell'etnografo è un argomento di profondo interesse in epoca post-moderna[1]. Ci sono molti modi con cui potremmo renderne conto ma

---

Testo originale: *Machinic Pleasures and Interpellations*, Centre for Science Studies, Lancaster University, Lancaster LA1 4YN, UK, 2001 – http://www.comp.lancs.ac.uk /sociology/papers/-Law-Machinic-Pleasures-and-Interpellations.pdf. La traduzione è autorizzata dall'autore ed è frutto di un lavoro collettivo: Restituta Castiello ha tradotto l'Introduzione e il primo paragrafo; Silvia Fornasini ha tradotto i paragrafi 2, 3, 4, 5, 6, 7 e le Conclusioni; Attila Bruni ha rivisto il testo finale in italiano.

* Vorrei ringraziare coloro che, più o meno consapevolmente, hanno contribuito a creare l'ambiente intellettuale e politico che mi ha permesso di scrivere questo articolo: Ruth Benschop; Brita Brenna; Michel Callon; Bob Cooper; Mark Elam; Donna Haraway; Bruno

in questo articolo propongo di utilizzare la nozione strutturalista di "interpellanza" di Althusser. Il filosofo utilizza questo concetto per parlare della produzione di differenza tra soggetto e oggetto in un processo di riconoscimento istantaneo (Althusser 1971). Perché senza dubbio ci sono molte interpellanze, punti fissi che ci hanno reso ciò che siamo. Eppure non possiamo decostruire tutte le nostre soggettività allo stesso tempo. E può anche darsi che queste componenti non possano essere affatto decostruite. Ma questo non significa che siamo costretti ad accettare e performare tutte le nostre interpellanze né a riprodurre tutte le distribuzioni che identifichiamo come naturali; che identificano *noi* come naturali.

Ecco perché, dunque, potremmo, anzi dovremmo, indagare l'ecologia dell'interpellanza. Perché dovremmo considerare l'ecologia della distribuzione soggetto-oggetto ed esplorare come siamo chiamati a diventare soggetti di conoscenza e come gli oggetti vengano prodotti e conosciuti in un modo specifico. Lo scopo sarebbe comprendere il processo di produzione dell'ovvietà analitica e politica e il modo in cui la si potrebbe distorcere, compromettere, contrastare.

Dunque, questa è la questione. In che modo gli oggetti ci interpellano? È scontato che esistano molti oggetti e molti soggetti. Per rendere conto di questa molteplicità racconterò delle storie che hanno a che fare col piacere (il che non significa che le macchine non interpellino in maniera dolorosa o in altri modi del tutto diversi). Storie che parlano di piacere macchinico, di una piccola selezione nella varietà dei piaceri macchinici[2]. Poiché mi occupo di tecnologie militari e dei modi in cui esse e le storie che raccontiamo su di esse possono impersonare la cecità, e in particolare la cecità dei "giochi da ragazzi", molte di queste storie hanno a che fare con le tecnologie militari.

1. Eroismo Macchinico[3]

L'erotismo dell'eroismo. Gli aviatori e le loro macchine.

Nel suo libro "La Stoffa Giusta", Tom Wolfe[4] racconta la storia di Chuck Yeager, il decano della squadra di piloti che collaudavano gli aerei ultraveloci che sarebbero potuti diventare le prime navi spaziali statunitensi se le cose fossero

---

Latour; Nick Lee; Annemarie Mol; Ingunn Moser; Marilyn Strathern; Sharon Traweek; Helen Verran-Watson.

[1] Per interessanti esempi recenti nel campo degli STS, si vedano Gusterson (1995a; 1995b), Stone (1995a) e Traweek (1988; 1995a; 1995b).

[2] Altri piaceri macchinici potrebbero includere quelli del bricolage. E della tortura.

[3] Sono grato a Mark Elam dai cui studi ho adottato il termine "heroic agency".

[4] Il libro di Tom Wolfe "The right stuff" (1980) descrive le prime fasi del programma spaziale statunitense e, in particolare, le differenze di erotismo tra chi credeva che la navicella spaziale avrebbe dovuto essere presidiata da piloti che avrebbero volato nello spazio, e chi, volente o nolente, si ritrovò di fronte all'enorme serbatoio di carburante che lo avrebbe spedito nello spazio, senza alcuna possibilità di intervenire. Per una breve discussione, nel contesto della mascolinità della cultura, vedere Wajcman (1991).

andate diversamente. Se gli Stati Uniti, cioè, non avessero optato alla fine per le tecnologie missilistiche del programma Mercury.

Yeager aveva vissuto ogni tipo di esperienza. Per non parlare delle sofferenze e delle tribolazioni. Era quello che aveva volato più in alto e più veloce. Si era assunto i rischi più disparati. Era stato ferito gravemente. Lui e i suoi amici avevano guidato macchine super-veloci attraverso il deserto. Si erano ubriacati infinite volte fino a perdere i sensi. E avevano scopato (e uso di proposito il termine per sottolineare l'asimmetria meccanica e di potere) tutte le volte che ne avevano avuto l'opportunità. Nonostante tutto – oppure proprio per questo – incarnavano, Yeager in particolare, esattamente i soggetti con "la stoffa giusta". "La stoffa giusta" era l'espressione che i piloti stessi usavano per descrivere ciò che serviva per affrontare questa forma di volo particolarmente pericolosa e qualificata. Ed essendo l'incarnazione della stoffa giusta, Yeager disprezzava quelli che non la possedevano. Inclusi quelli che si presentarono volontari per il programma spaziale Mercury.

Fare a dadi con la morte; eroismo; spingersi oltre il limite; volare più veloce, più lontano, più in alto di chiunque altro. Un'abile ma spericolata noncuranza della sicurezza personale. Abilità e competenza che assicuravano l'invulnerabilità. In un modo o nell'altro, così viene performata questa ben accreditata economia dell'eroismo.

È una cosa semplice e, si fa intendere di solito, molto maschia – cioè, maschia in un modo molto particolare. Dunque, è una cosa semplice ma, dopotutto, non così tanto, in parte perché ci sono molte maschilità[5], e in parte perché questa forma di eroismo è fatta indubbiamente di molte componenti. Primo, il piacere di una forma di cameratismo maschile, solidarietà maschile, omosocialità. Secondo, un senso di trascendenza nel combattimento. Terzo, la sensazione che l'invincibilità trasformi la vita del guerriero in un gioco, un ruolo da interpretare. Quarto, la performance di un rapporto intimo tra i piaceri del corpo e quelli della tecnologia, del macchinico, in cui la macchina diventa l'oggetto del desiderio[6]. Quinto, un forte legame tra piacere e morte (Rosenberg 1993). E sesto, la sensazione di non essere del tutto umani. Così recita Stanley Rosenberg un pilota del Vietnam:

"Noi non vediamo corpi morti, gente ferita, persone colpite con armi da fuoco. Se non ritorni, non ritorni. Vedi solo metallo bruciato sul lato di una montagna, una fiamma in lontananza. Non ci sono corpi smembrati". (Rosenberg 1993, 62)

---

[5] Un argomento sostenuto da diversi autori. Si veda, ad esempio, de Lauretis (1987).

[6] È evidente che l'erotismo degli aerei militari è stato soggetto a cambiamenti, almeno negli Stati Uniti. Stanley Rosenberg (1993), esplorando i racconti dei piloti bombardieri della Seconda Guerra Mondiale, e confrontandoli con quelli dei piloti USAF in Vietnam, osserva che i piaceri diventano sempre più legati alla macchina stessa. Il 'modello Yeager', con i suoi racconti di bevute e scopate, è rimpiazzato da un esplicito erotismo tecnologico.

Esperienze extra corporee: ne parlerò meglio a breve, dal momento che sembra che ne esistano di molti tipi e che siano collegate a molte forme di piacere. Qui voglio solo mettere in evidenza il distacco, il potenziale distacco dal corpo implicito in questa citazione. C'è una sorta di indifferenza in questo eroismo, indifferenza per il destino del corpo. Il pilota trascende le banalità di questo mondo. L'eco delle parole "una fiamma in lontananza": lavoro troppo di fantasia, oppure è un concentrato di trascendenza, di superamento dell'esperienza umana? Una sensibilità spirituale che nasce dall'immunità del corpo alle fatiche del mondo? Dalla sua traslazione verso altri luoghi, verso altri piaceri[7]?

Immaginiamo che queste forme di erotismo macchinico siano importanti per noi. Supponiamo di essere interpellate/i in questo modo. Dunque, cosa significherebbe? Come funzionerebbe questo erotismo macchinico? In che modo questa interpellanza strutturerebbe la conoscenza delle tecnologie, dell'aeronautica militare, la loro performance narrativa? Cosa ci impedirebbe di vedere o di essere?

Come altre narrative di combattimento, anche questa performerebbe un mondo costruito su una serie di dualismi. Primo, quello tra noi e il nemico, "la minaccia". Secondo, tra il mondo naturale e l'abilità del nostro corpo-macchina, tra natura e cultura[8]. E terzo, tra gli eletti e il resto del mondo che fatica, intrappolato in corpi, corpi mortali, al suolo, corpi che non vanno da nessuna altra parte e che non ricevono la promessa di quella fiamma in lontananza.

Ma quali implicazioni ha il dualismo sulla struttura delle nostre narrative?

Tanto per iniziare, c'è una risposta semplice. Creerebbe degli Altri, oggetti che sono Altro, Alterità che sono necessarie per le nostre fantasie narrative ma ad esse aliene. Come "la minaccia", oppure come la natura stessa, nella sua tipica collocazione occidentale come Altro dalla cultura, gli Altri sono quelli che ci permettono di essere noi stessi. Quindi ci sarebbe una performance di dualismi invece che di continuità, divisione del lavoro invece che lavoro per contrastare le divisioni. Questo è il primo pericolo: avremmo narrative sbagliate perché avrebbero un senso compiuto solo se costruite in funzione di questi Altri immaginati.

Secondo, saremmo interpellati come estranei, dal momento che *noi* non saremo mai parte di quella magia, della magia del volo, ma saremmo costretti a riprodurre un erotismo del volo di seconda mano (in questo caso come facciamo a

---

[7] Qual è la relazione tra discorso e performance? Le interviste ai piloti britannici del Tornado responsabili di alcune delle più pericolose missioni nella Guerra del Golfo (che sono apparse nella seconda parte di una serie in quattro parti chiamata "Thunder and Lighting" trasmessa dalla BBC alle 10.45 di martedì 9 gennaio, 1996) rivelano che ci sono stati lunghi momenti di terrore. La trascendenza è un lusso per il responsabile del disordine?

[8] Allucquère Rosanne Stone (1991) suggerisce che la natura è una strategia per mantenere i confini, mantenendo visibile la tecnologia, e quindi distinguendola dai nostri "io naturali". Nel contesto specifico del volo militare, questo interessante suggerimento funziona forse meglio per i piloti della generazione di Yeager che per quelli che hanno volato durante la Guerra del Golfo.

opporci alla colonizzazione?)[9] o a ignorare del tutto l'erotismo e a focalizzarci sulla tecnicizzazione della repressione (di cui parlerò a breve). Perché parlare di carisma è sempre difficile e, checché se ne dica, il volo militare è una performance carismatica[10].

Terzo, c'è la questione della tecnicizzazione della repressione. Per intenderci, ci sono motivi apparentemente tecnici che giustificano il bisogno di aerei più veloci, capaci di volare a maggiori altitudini, più pericolosi, più efficienti. Aerei che vengono percepiti come desiderabili o, addirittura, indispensabili. In ogni caso temo questa retorica per le narrative dell'aeronautica militare e per le sue macchine. Perché le storie delle "pagine dei ragazzi" non esistono più e ci sono rimaste solo storie di necessità tecniche e strategiche.

Per esempio, c'è un aereo che ho studiato, il TSR2. Si trattava di una aereo da attacco e ricognizione concepito per la Royal Air Force britannica. Le sue caratteristiche di volo erano molto significative dal momento che nel 1957, quando stava per essere progettato, sembrava che sarebbe stato molto probabilmente l'ultimo aereo da combattimento della Royal Air Force. Eppure, benché molti uomini desiderassero volare su aerei velocissimi, questo aspetto (questo era il punto) non emerse mai nei documenti ufficiali che, invece, venivano analizzati in un linguaggio tecnico che non lasciava spazio al piacere dell'eroismo. La mia conclusione: dobbiamo stare in guardia contro le narrative tecniche. Non perché siano sbagliate o perché non siano performate. Al contrario, proprio perché sono performate nella struttura del macchinico, vi scorrono attraverso, aiutano a costituirla. Dobbiamo stare in guardia perché oscurano un'importante dimensione dell'erotismo. È dato per scontato che i generali della forze aeree non vedano di buon occhio gli eroi, che debbano auspicare un'azione militare efficace, finanche la conta dei caduti. Il che suggerisce che nella distribuzione delle giustificazioni nelle narrative tecnicizzate, l'erotismo tanatologico dell'eroismo verrà occultato, reso privato – oppure estruso dal testo e incluso nel materiale visuale, nelle illustrazioni dell'aereo, dove esso viene performato in forma non verbale bensì in forma estetica. E questa precisa distinzione, "estetica/tecnica" è un'altra distribuzione, una collusione interpellativa, di cui si potrebbe benissimo fare a meno[11].

Questa è la prima interpellanza: l'eroismo macchinico e le sue elisioni.

---

[9] In ogni caso, le storie che conosco in ambito STS tendono ad evitare di performarsi in questo modo - si tratti di missili piuttosto che di aerei da combattimento, le possibilità dell'erotismo di una morte eroica sono limitate. Si vedano in proposito gli studi di Donald Mackenzie (1990) sulla tecnologia missilistica, e lo studio del programma Polaris di Harvey Sapolsky (1972).

[10] Ho esplorato alcune difficoltà del ricercatore nel trattare il carisma in Law (1994), anche se il contesto era molto diverso.

[11] È evidente che le narrazioni tecnicizzate delle macchine militari sono giustapposte al materiale visivo che racconta una storia diversa, eroica e di genere. Ho approfondito quest'argomento in Law (2001).

2. Combattimento virtuale

Non ricordo il nome del gioco. Forse era Doom, non so. Ma una volta un amico mi ha invitato a giocarci sul suo computer. Lui ci gioca al lavoro a fine giornata, cioè per pochi minuti prima di andare a casa la sera.

La grafica era, come si dice in questi casi, sensazionale. Mi sono ritrovato interpellato in un personaggio – un ruolo, un ruolo in un mondo di stanze e corridoi, di gallerie e spazi aperti, dove potevo uccidere o essere ucciso. C'erano diverse sfide. Non ricordo tutti i dettagli ma credo che l'obiettivo principale fosse superare il livello del gioco e passare al successivo. E per farlo, beh, c'erano diverse necessità e risorse. Per esempio, c'erano scorte da raccogliere, fiale vita, chiavi con cui aprire porte chiuse, armi potenti. Mentre tutt'intorno c'erano bestie di vario tipo, cyborg, guerrieri, non so cos'altro, che cercavano di uccidermi. E io dovevo combattere. Dovevo farli fuori prima che loro facessero fuori me.

Il mio amico mi disse che, per i pochi minuti che avevo giocato, l'avevo fatto bene, ma ciò non sembrava avermi dato nessun particolare entusiasmo. Al contrario, avevo scoperto che mi stava rendendo ansioso, e devo dire che sono stato contento quando il gioco è finito.

Molto è stato scritto sul piacere che provocano i giochi per computer e il cyberspazio (Turkle 1984; Stone 1991): senza dubbio si tratta di piaceri complessi, che tuttavia hanno spesso a che fare con il controllo. Ma parlare di "controllo" *tout court* è troppo semplice, dal momento che esso si manifesta in una varietà di forme. Ad esempio, nel controllo totale di un universo semplificato, ma di questo parlerò in seguito. Oppure nel potere visivo, il controllo dell'occhio che si distacca da una superficie fatta piana. Si potrebbe trovare qualcosa a riguardo nei giochi per il computer, ad esempio nello sforzo di controllare una resistenza (che è, tra l'altro, la più comune definizione di potere)[12]. E poi, forse in modo simile, si può intendere il controllo come un aspetto del combattimento, in questo caso il combattimento virtuale: ed è ciò di cui voglio occuparmi qui, poiché nei giochi al computer esso non è del tutto 'reale', dal momento che (ed è questo il passaggio cruciale) si svolge in uno spazio che è reale e irreale al tempo stesso. Ciò permette, performa, sia la realtà che l'irrealtà della competizione.

Il reale e l'irreale. Una cosa è reale perché, dopo tutto, si trova qui, e poiché si crea un posizionamento del soggetto nello spazio di combattimento: ne deriva quindi un contesto mortale, in cui ci sono un vincitore e un vinto. Dunque, tutto questo è reale e irreale allo stesso tempo. È irreale perché è *anche* disincarnato, poiché il soggetto non può rinunciare alla sua posizione, che sia vincente o per-

[12] Michael Heim (1991: 61) scrive: "Il nostro fascino verso i computer è più erotico che sensuale, più profondamente spirituale che utilitaristico. L'Eros, come gli antichi Greci avevano capito, nasce da un sentimento di insufficienza o inadeguatezza. Mentre l'esteta si sente attratto da flirt e giochi casuali, l'amante erotico tende ad una soddisfazione che va al di là del distacco estetico".

dente. L'incarnazione nel gioco (il *gioco*, si noti) è volontaria. È come svegliarsi da un sogno, quando si realizza di non essere chi si pensava di essere, salvo che nel gioco lo slittamento tra le posizioni del soggetto, tra la disincarnazione e l'incarnazione, è a doppio senso, oscillatorio. Il che significa, *tra l'altro*, che i giochi di combattimento possono essere interpretati come tecnologie che performano il piacere mentre limitano il dolore. Tecnologie in cui il fatto di muoversi dentro e fuori dai corpi consente sia il coinvolgimento che la mancanza di coinvolgimento.

Senza dubbio, quest'ambivalente incarnazione/disincarnazione è un fenomeno comune. Come ho già detto, ritengo che i piaceri siano spesso correlati ad esperienze extracorporee, che non sono necessariamente legate al combattimento. Immaginari di ogni tipo potrebbero (perdonate la ripetizione) essere immaginati. E, per quel che riguarda le sfumature, i gradienti tra ciò che è reale e ciò che non lo è, anche qui ci sono molte possibilità e molte promesse[13]. Ma nel meno promettente ambito del combattimento dobbiamo aggiungere il rischio, le relazioni tra soggettività, abilità, strategia e pericolo. Abbiamo bisogno, cioè, di aggiungere la possibilità di vittoria o il rischio di distruzione alla consapevolezza che questa distruzione sia *virtuale*, libera da costi e disincarnata. Che si trovi in una forma di combattimento che termina alla fine della giornata, poiché il corpo non è, come si suol dire, "in prima linea", dal momento che ha la possibilità di tornare nel suo proprio (altro) posto al di fuori del gioco.

L'erotismo del combattimento virtuale: dove possiamo trovarlo? Nei giochi per computer, e forse anche nell'arena sportiva, un mondo fatto di squadre, competizioni e risse[14]. Oppure, nelle fiction e nei film. Ed infine, nelle simulazioni di guerra, dai soldatini-giocattolo sul pavimento della nursery della borghesia vittoriana, attraverso i dettagliati mondi neo-gotici creati dai contemporanei ideatori di Games Workshop[15], fino alle agghiaccianti simulazioni di vita reale giocate dagli strateghi militari, come ad esempio i giochi di tattica nucleare della Rand Corporation descritti da Carol Cohn (1993).

Passando dall'arcade game alla 'conta dei caduti', attraverso l'aspro realismo del gioco di guerra, il nocciolo di quanto propongo è questo: c'è un erotismo specificatamente interpellativo del combattimento strategico, che si performa attraverso la simulazione, nella variabilità tra incarnazione e disincarnazione. Ciò significa che il soggetto viene performato come un corpo in cui scorre del sangue, ma in un'area senza sangue e corpi, in cui il dolore è transitorio e non è mai reale, fisico, sia per il soggetto, sia (e senza dubbio questo è molto più inquietante) per l'oggetto antagonista. È un luogo in cui le emozioni ci sono, ma con conseguenze

---

[13] Ho ripreso il termine "immaginario" da Helen Verran-Watson (1994). Per un'ulteriore discussione delle implicazioni politiche del dualismo reale/non-reale e la politica ontologica (o immaginario epistemico) che può esistere tra il reale e il non-reale, vedere Law (1995).

[14] Le metafore sportive sono onnipresenti nel mondo militare (Cohn 1993).

[15] Per mescolare gli stili, si sarebbe tentati di dire che sia un neogotico intriso di barocco. C'è una vera e propria economia del piacere qui, che si performa per esempio nei romanzi di Tolkien, con la sua maestria nell'esaustività dei dettagli. Ne parlerò brevemente in seguito.

irrilevanti, dove si può giocare nel ruolo dell'eroe. Questo è il punto: è un luogo in cui puoi *giocare* a fare l'eroe , e considerare parte di questo giocole radicali distribuzioni di attività/passività sempre implicite in un combattimento. La speranza di vincere. La paura di perdere. Essere disaggregati. Con - ma quindi senza - il corpo, senza il pericolo che corre il corpo in un combattimento[16].

Supponiamo di essere interpellati in questo modo, nei piaceri oscillatori del combattimento virtuale: che forma prenderebbero le nostre narrazioni?

Fornirò qui alcuni suggerimenti. In primo luogo, esse presuppongono che il soggetto sia centrato. Sarebbe un soggetto calcolatore e stratega, poiché dovrebbe gestire le risorse per respingere e vincere la resistenza, e subordinare altri sforzi e legarli all'immaginazione, all'obiettivo di ottenere la vittoria per mezzo di una serie di mosse che fanno parte del più ampio sforzo di vincere. Si tratta di una soggettività decisa, una soggettività che si fa depositaria di un particolare tipo (razionale?) di azione, dove il mancato raggiungimento dello scopo è davvero un fallimento, un'incapacità di stabilire un ordine gerarchico, e dove la passività, la calma, l'indecisione, la non-omologazione, sono inconcepibili come posizioni del soggetto[17].

In secondo luogo, le nostre narrazioni *appiattirebbero* il campo agonistico. Infatti il soggetto interpellato in quel campo potrebbe Risolvere complessi rompicapo e importanti problemi logistici. Ma, "in ultima istanza" il campo, l'arena, l'area delimitata della simulazione, performa se stessa come piatta. È senza dubbio una piattezza complessa con regole, strategie, collegamenti e reazioni. Tuttavia è piatta come un codice informatico o come lo spazio dello schermo di un computer o come gli scenari descrittivi di un gioco di guerra o come la mappa strategica in una war room. Questi sono tutti posti dove i problemi possono essere immaginati e combinati per performare un mondo a sé stante in cui, ossimoricamente, non c'è posto per l'inassimilabile e per l'ambivalente, per il mistero. Infatti, questi sono posti in cui *non c'è* nessun mistero[18].

In terzo luogo, le nostre narrazioni si *disincarnerebbero* e si renderebbero inaffidabili. Il soggetto interpellato è sia reale che irreale. È reale perché è un mondo, un 'mondo inventato', un oggetto che rende sé stesso reale. E non è comunque ancora reale. Perché? Perché è solo una simulazione – che permette i piaceri del combattimento, ma senza le sue conseguenze. Così abbiamo un soggetto oscilla-

---

[16] Il rapporto tra soggettività e corpo è molto dibattuto. Vedere, per una sintesi, Allucquère Rosanne Stone (1991). Pur sostenendo che la soggettività sia in un processo di profondo cambiamento, essa, alla fine, ci fa tornare al corpo.

[17] Il che significa che le narrazioni del combattimento virtuale sono gerarchiche. Che operano cioè una distinzione tra mezzi e fini, se ci è dato di conoscere i fini attraverso le interpellanze. E i mezzi? Devono essere assemblati, come si suol dire, in modo fruttuoso. Questo suggerisce che le questioni di etica o di politica sono spinte al di là dell'ambiente di gioco. Diventano Altro, una parte dell'inassimilabile.

[18] Il movimento comporta una conversione dell'incertezza, o del mistero, in rischio. Che può, almeno in un caso ideale, essere calcolato.

torio, che può essere sia del tutto serio, sia del tutto irresponsabile[19]. La questione è un po' diversa da quella descritta da Donna Haraway (1991) riguardo all'illusione dell'occhio di Dio, poiché qui il piacere non è puramente esteriore. Ma la discussione conduce comunque nella stessa direzione, che suggerisce di *stare in guardia dalle simulazioni oscillatorie*, dai piaceri corporali della rappresentazione, che ci rimuovono dal nostro corpo e ci conferiscono la capacità, il bisogno, il desiderio, di correre rischi senza correrli davvero. Il desiderio di agire senza dover prendere seriamente in considerazione le conseguenze delle nostre azioni. Per poter essere degli eroi senza provare niente di più di un dolore temporaneo.

In un certo senso, questa è una storia già sentita. Racconta del carattere anodino del linguaggio tecnicizzato, che è poi lo strumento del mestiere della pianificazione militare. Racconta del conteggio dei caduti, dei bilanci di guerra, degli attacchi in profondità, della superiorità aerea, della ricognizione armata, del supporto aereo ravvicinato[20] o dei 'danni collaterali'. Ma questo linguaggio ha a che fare non solo con l'omissione del dolore fisico del "nemico": performa anche l'interpellanza oscillatoria del combattimento virtuale che garantisce il piacere fisico senza il dolore fisico, e mette così in atto una sorta di "cecità narrativa"[21].

Una seconda forma di piacere macchinico è quella del combattimento virtuale. Credo che si performi nell'intreccio delle nostre narrazioni, e in quelle di chi studiamo. E forse questo è particolarmente pericoloso, perchè potrebbe essere che la simulazione diventi l'"oppio degli intellettuali"[22].

---

[19] Il gioco tra la rappresentazione e la realtà/non realtà del referente. Tra la realizzazione del soggetto nel mondo e quella all'esterno di esso. Com'è possibile? Sembra che ci siano due possibilità. La prima parte da un luogo che non performa il mondo 'reale' esterno, e si sforza comunque di creare e performare il realismo. Usando, per esempio, la "splendida grafica" del gioco per computer e creando in questo modo quella che chiamiamo "realtà virtuale". Una realtà virtuale che performa un posizionamento del soggetto in quella realtà. Questo è il primo approccio. E l'altro? L'altro, al contrario, si performa come rappresentazione di un mondo pre-esistente, che lo simula. Simula qualcosa che (come si suol dire) è già qui, e lo fa "realisticamente". Mentre, allo stesso tempo, se ne distacca. La logica di queste varie possibilità è stata esplorata da Jean Baudrillard (1988).

[20] Tutti termini comuni nei discorsi sul volo militare nel 1960. Li ho estrapolati dal resoconto di Stanley Rosenberg (1993) sui valori dei piloti durante la Guerra in Vietnam.

[21] La mia posizione è legata all'importante questione della pericolosa "anodinità" del linguaggio militare. Per un esempio recente in quest'ambito, si veda Robins e Levidow (1995). Si noti, comunque, che qui non ho sostenuto che la simulazione sia inumana. Non c'è dubbio che il linguaggio anodino e disumano sia spesso usato per sollevare l'azione militare e genocida dal disagio dei discorsi morali. E a questo si collega il fatto che i combattimenti debbano sempre avere una forma corporea (per un esempio in fantascienza - Tepper 1989). Ma qui mi riferisco in particolare, al piacere del combattimento virtuale, che credo, come ho sostenuto, si ricolleghi all'oscillazione nel corpo/fuori dal corpo, e all'irresponsabilità che questa performa.

[22] Seguendo le orme di Weber, Colin Campbell (1987) afferma che il Protestantesimo ascetico ha offerto la possibilità di un'intensa vita interiore, che ha condotto non solo all'attività economica, ma anche, attraverso vari sfasamenti, al consumismo. Molti dei piaceri qui descritti sembrano dipendere da una tale vita immaginaria.

3. Passività

Questo è un argomento un po' diverso. Ne ho parlato con un certo numero di persone, uomini e donne, e molti, sebbene non tutti, ne hanno avuto esperienza, come me, anche se in grado minore. Si tratta di quella sorta di brivido, mescolata a una piccola dose di paura, che proviamo quando l'aereo su cui stiamo viaggiando inizia a decollare.

L'attesa in fondo alla pista di decollo è finita. Il pilota effettua gli ultimi controlli pre-volo, e dà pieno gas ai motori. Il rumore si trasforma da un lamento ad un vero e proprio ruggito, la cabina scricchiola, i finestrini crepitano, e improvvisamente veniamo premuti contro i nostri sedili mentre acceleriamo nella corsa per il decollo. I primi secondi sono il più alto momento di eccitazione: tutto quel potere, tutto quella potenza, la sensazione di un pugno nella schiena. E poi l'eccitazione diminuisce nel momento in cui, acquistata velocità, il carrello anteriore viene sollevato, e un secondo dopo anche il carrello principale si stacca dalla pista. Con un tonfo, le ruote vengono ritirate. Siamo in volo ed improvvisamente c'è molto meno rumore.

È una procedura estremamente banale. Succede migliaia e migliaia di volte al giorno, e le reazioni sono svariate. Alcuni sono semplicemente terrorizzati, sudando afferrano i braccioli, le nocche bianche. Altri semplicemente sembrano dimenticarsi di ciò che sta accadendo: forse quest'anno hanno già volato duecento o cinquecento volte. In ogni caso, si dedicano tranquillamente alla lettura per tutta la durata del decollo. Il rumore, l'accelerazione, nulla di tutto questo sembra fare alcuna differenza. Altri ancora sono entusiasti, e senza dubbio provano una qualche versione del piacere declinante che ho sopra descritto. Ma qual è la caratteristica di questa interpellanza che progressivamente sbiadisce? Per riflettere su questo vorrei tornare a Tom Wolfe e raccontare un'altra delle sue storie.

Il pilota disapprovava coloro che avevano scelto di partecipare al programma NASA, e li aveva definiti "carne in scatola".

E, in un certo senso, aveva ragione (erano *davvero* come carne in scatola). Il primo astronauta è stato uno scimpanzé, a cui furono assegnati piccoli compiti da svolgere durante il primo volo, che non avevano nulla a che fare con il controllo della missione. E non fu molto diverso per gli esseri umani che in seguito occuparono le piccole cabine del Mercury. Infatti, essi trascorsero molto tempo a discutere con l'amministrazione riguardo al loro ruolo: avrebbero potuto avere un finestrino per guardare all'esterno? I controlli sarebbero potuti essere riorganizzati per permettere loro qualche ruolo di pilotaggio?

L'amministrazione fece in modo di soddisfare entrambe le richieste, ma alla fine le concessioni furono minime. Seduti in cima a tre razzi messi insieme e controllati da un bunker a Cape Canaveral, i piloti semplicemente avrebbero garantito il buon funzionamento della missione. Naturalmente con la consapevolezza che, se qualcosa fosse andato storto, sarebbe stata la fine.

"Carne in scatola": la definizione spregiativa di Yeager mette in luce un punto importante del programma Mercury. Ma anche dei passeggeri di un aereo civile, poiché le due circostanze sono simili. *Anche noi* siamo 'carne in scatola'. Schiacciati insieme all'interno di una cabina, e legati ai nostri sedili, non possiamo muoverci, e non abbiamo la minima possibilità di controllare nulla. Ma per tutto il tempo, enormi forze fisiche stanno lavorando al loro meglio o al loro peggio sui nostri corpi – sono vissute nei nostri corpi o dai nostri corpi. C'è una gravità a cui non si può resistere, un peso che ci lega ai nostri sedili, insieme alla consapevolezza o alla paura che, se qualcosa andasse storto, non ci sarebbe niente da fare. I nostri corpi verrebbero distrutti irreparabilmente.

Qual è allora il piacere di questa performance? Senza dubbio ci sono molte risposte, ma vorrei riflettere in particolare sulla distribuzione dell'*agency*, e il modo in cui questa distribuzione gioca attraverso il corpo e ciò che gli è 'altro'.

Per quanto riguarda l'*agency*, ossimoricamente si tratta della capacità di agire. Ma cosa significa? Significa spirito d'iniziativa, capacità di controllare e abilità di fare la differenza. Soffermiamoci sull'abilità di fare la differenza. In un combattimento virtuale, come in un'*agency* eroica, il soggetto è costruito in modo tale da poter fare la differenza. Ma non è questo il caso. Qui, *niente di ciò che facciamo farà differenza*. Siamo passati dall'attività alla passività. Il luogo dell'agire ci è stato sottratto ed è stato distribuito in materiali al di là del corpo. 'Carne in scatola', appunto.

E i piaceri? In questo caso si può parlare di un'economia che gira intorno alla rinuncia All'*agency*, e ritengo ci siano almeno tre concetti correlati a questa economia.

Il primo: *non c'è* possibilità di agire. C'è invece una distribuzione interpellativa che non riguarda necessariamente un problema di disperazione o dolore. Infatti all'incapacità di agire è correlato il piacere, la lussuria del fatalismo, dell'aspettare, che il macchinico, il naturale, il divino, agiscano sul corpo e attraverso di esso. Un piacere che è stato interpretato in modo negativo, per lo più a torto, nella maggior parte delle trattazioni occidentali. Questa 'distribuzione nella passività' è davvero una forma di piacere, di benessere.

Il secondo concetto riguarda la questione della cura, poiché esiste il piacere di essere curati, accuditi, custoditi nel "ventre del mostro" o dalle "ali del divino". Il termine "fiducia" è stato trattato con troppa leggerezza all'interno delle teorie sociali, ma qui ho bisogno di usarlo: infatti c'è un piacere nel fidarsi abbastanza da "permettere" la distribuzione dell'agency al di fuori del corpo, in altri materiali: le mani di un accompagnatore, il ventre di una "balena tecnologica" o di una "madre macchinica"[23]. Questo è il piacere dell'essere curati. Di nuovo, l'argo-

[23] Sono grato ad Annemarie Mol per la discussione in cui sottolinea il legame tra responsabilità, irresponsabilità, e genitorialità. La metafora è sviluppata in modo originale da Sara Ruddick (1993) nel suo studio sul carattere del controllo, in cui sottolinea che i genitori - e senza dubbio le madri in particolare, in una società soprattutto patriarcale - possono avere potere di controllo sui loro figli, e la responsabilità deriva dal non abusare di tale potere.

mento non è stato ben focalizzato dalla maggior parte dei discorsi della cultura occidentale contemporanea, nelle cui trattazioni questi piaceri sono spesso costruiti come una regressione, o riguardano gli asimmetrici complessi di genere che dividono il pubblico dal privato – divisioni che possono, in un mondo costituito in termini così asimmetrici, essere accettabili nella misura in cui funzionano. E senza dubbio collegarsi col loro rifiuto nella forma dell'eroismo e di altre forme di controllo, e degli interminabili discorsi sull'"intraprendenza". Ma ritengo che potremmo trattare la passività, il non-performarsi dell'*agency*, come un erotismo interpellativo a sé stante, che si esprime in molti luoghi, compreso quello pubblico.

Il terzo concetto riguarda il piacere della non-responsabilità. Si noti che non si intende un'irresponsabilità che implica un giudizio morale distributivo, che per il momento voglio evitare. Non "irresponsabilità", quindi, bensì "*non-responsabilità*", che significa non essere tenuti ad assumersi la responsabilità di niente, sia nei confronti degli altri, o, addirittura (e questo è il punto cruciale), di se stessi. Tutto ciò è profondamente legato al performarsi dell'*agency*. È come se coloro che agiscono fossero costruiti come ultima risorsa morale, creati come luoghi che potrebbero dover rendere conto delle proprie azioni a se stessi, agli altri o a Dio, poiché avrebbero potuto agire diversamente, poiché (come la narrazione rivela) hanno avuto la possibilità di scegliere. Ma rinchiusi nel ventre della "madre macchinica", della "balena macchinica", resi passivi per un momento, non abbiamo scelta. La carne non può scegliere: piuttosto, viene trasportata. E qualsiasi errore o dimenticanza sia commessa, come già fatto altrove, verrà distribuita all'Altro. Ed è l'Altro, una qualche componente dell'Altro, che verrà reso responsabile[24].

Il fatalismo, l'essere curati, la non-responsabilità, la distribuzione dell'*agency* e le sue appendici all'interno e all'esterno del corpo. Ancora una volta, il piacere gioca su ambiguità e oscillazioni nel-corpo e fuori-dal-corpo. È la questione dell'agency eroica e del combattimento virtuale, ma qui la performance è diversa, poiché in questi casi il piacere ha a che fare coi modi in cui la soggettività si distribuisce in una forma di oscillazione, all'interno e all'esterno del corpo. Qui ciò che si muove non è più la soggettività. Si tratta invece dell'*agency* – mentre la soggettività è collocata ostinatamente ovunque nel corpo, nel piacere della passività e della non-responsabilità di *agency*. Considerando che si tratta di un'*agency* che svolazza dentro e fuori la carne.

Cosa significa questo per le nostre narrazioni?

Ruddick usa questo concetto come metafora per una riflessione sulla guerra e la pace, raccomandando un approccio basato su questa particolare forma di "cura".

[24] È lo spazio dove si performa l'irresponsabilità. Dove gli agenti che avevano una scelta, o meglio, che possono performarsi come se avessero una scelta, hanno scelto di fare ciò che era sbagliato.

Rispondere a questa domanda potrebbe portarci molto lontano dalle macchine – ad esempio, nell'ambito della filosofia politica. Cercherò di dare una risposta semplice divisa in due parti.

In primo luogo, la passività, e in particolare i piaceri che ne derivano, saranno repressi. Perciò, la lezione è questa: il corpo, o almeno così credo, riconosce un'interpellanza nella passività che è discorsivamente molto meno facile da praticare, per lo meno nel mondo degli oggetti e delle tecnologie militari. O, più precisamente, il corpo riconosce i piaceri, di tipo fisico e non solo, nella passività, dove le narrazioni dell'*agency* riconoscono solo fallimenti. Questi forse possono essere errori che riguardano competenze tecniche, e/o responsabilità morale (come nella frase "Ho solo eseguito un ordine"), che sono quindi tenuti ai margini o inseriti successivamente in una performance di denuncia morale – che, però, anche se accade, non centra la questione. Infatti, se l'interpellanza nella passività è un piacere a sé stante, allora la questione riguarda quanto quei piaceri siano presenti nella performance delle macchine militari. E questa non è, penso, una questione che emerge dai racconti sugli aerei da guerra. Ma non sappiamo perché Non sappiamo quanto questi piaceri interpellativi siano rimossi da altri racconti di interpellanza militare che riguardano l'avere la stoffa giusta. Tutto ciò, tuttavia, suggerisce che sarebbe opportuno, come forse lascia intendere Sharon Traweek, essere sospettosi se ci troviamo a performare storie in cui gli unici attori umani passivi sono gli stessi che hanno fallito, in un modo o nell'altro[25].

In secondo luogo, potrebbe essere saggio stare in guardia se trovassimo, o più precisamente se ci trovassimo, a performare narrazioni in cui fosse possibile essere attivi solo se si è delle persone. Si tratta, naturalmente, di semiotica, ed in particolare di un actor-network, visto che la demistificazione del mondo non dovrebbe agire come un punto fermo nelle narrazioni e che altri -come gli aerei – potrebbero agire per performare il piacere della passività su, o in relazione a, il soggetto umano. Voglio semplicemente sottolineare che la distribuzione dell'*agency*, il modo in cui si muove, non è semplicemente un problema di analisi, ma anche di pratica, e precisamente della pratica del piacere. Agenti non umani possono essere immaginati come umani che provano piacere e soggetti passivi. Questa è, tuttavia, una forma narrativa piuttosto lontana da quelle che si performano nelle principali storie di aeronautica militare.

Dunque è questa la terza forma di piacere macchinico: la passività, la rinuncia all'*agency*, il giacere nelle braccia della macchina.

4. Enumerazione

Immaginate di essere in una libreria, ad esempio la grande Dillons a Londra, ma anche una qualsiasi andrà bene. Siete interessati alla tecnologia, alle macchi-

[25] Il suo è un commento sullo stile narrativo dominante nella fisica delle alte energie: "la natura associata al genio autorizza la scienza" (Traweek 1995a: 217).

ne, e nello specifico agli aerei militari. Quando chiedete indicazioni, venite mandati in un angolo piuttosto grande da qualche parte al piano di sotto, con un sacco di mensole e libri: si tratta di libri sull'aviazione militare.

Molto bene. Avete trovato ciò che stavate cercando, e dunque iniziate la vostra esplorazione. Ma poi scoprite che pochi libri, o forse nessuno, sono organizzati in un modo che abbia qualcosa a che fare con una concezione sociale di tecnologia. E, allo stesso modo, pochi riguardano le narrazioni della storia – benché, se si è fortunati, si possano trovare alcuni racconti della Royal Air Force, o resoconti di compagnie aerospaziali. Invece gli scaffali sono pieni di descrizioni di tipologie di aerei. Ci sono libri che elencano, descrivono e illustrano l'aereo della Royal Air Force, o della US Air Force, o aerei da combattimento occidentali, o elicotteri; e poi ci sono libri che descrivono le differenti versioni di uno specifico aereo: l'Harrier Jump Jet, il Tornado, il Mirage 4, il Jaguar, la serie F111, e altri.

Osservando con attenzione tutti questi libri, vi accorgete della loro varietà. Alcuni sono monografie integrali che descrivono il processo di progettazione ed evoluzione di un particolare tipo di aereo. Opere di questo tipo sono fondamentali. Possono non fare uso dell'apparato disciplinare degli STS, ma ciò di cui si occupano è comunque riconoscibile secondo quella modalità. Altri libri invece sono molto più piccoli. Si trovano ad esempio compendi di diverse tipologie di aerei, con svariate fotografie a colori, spesso integrate dai disegni dei primi piani o dei profili delle macchine, e con una breve descrizione tecnica, orientata soprattutto verso ciò che può essere quantificato: dimensione, ruolo, centrale elettrica, massima velocità, missione tipica e velocità di crociera, altitudine massima, armamento, qualcosa (anche se forse non molto) sulla parte elettronica del velivolo; missione e limite di velocità, costruttore, nomi o numeri seriali delle differenti versioni, differenze fisiche tra queste, anche in termini di ruolo e armamento; i numeri di ogni manufatto, le forme di mimetizzazione, ed infine una cronologia organizzata attorno ad una serie di date specifiche: il primo volo, l'introduzione nelle diverse forze aeree, le date o circostanze di combattimento, e (se questo è avvenuto) le date di ritiro dal servizio.

Quali sono in questo caso i punti narrativi fissi?

Vorrei proporre una risposta in termini di una serie di assenze/mancanze, poiché queste sono descrizioni che non rispondono a quelle che si potrebbero ritenere le domande narrative standard sulle connessioni tra cose, eventi o oggetti. Ritengo che non riescano a farlo per due motivi particolari: primo, non ci dicono praticamente nulla sul *perché* un particolare aereo sia stato costruito, sul perché fosse necessario farlo, sul perché abbia preso la forma che ha assunto; sul perché sia stato introdotto, oppure non introdotto. Sono una cronologia non esplicativa, una mera serie di dati, senza spiegazioni. Secondo, non ci dicono nulla su *come* le cose sono collegate tra loro, sulle relazioni, ad esempio, tra le tipologie e le componenti del velivolo: tra questo e ciò che ci piace chiamare i suoi "Altri". Non ci offrono, quindi, una semiotica riconoscibile della tecnologia.

Non c'è un perché e non c'è un come. Allora cosa rimane? La totale concentrazione sul *cosa*, su quello che è l'oggetto in questione, e su quello che sembra.

Dunque, qual è il soggetto interpellato da queste pubblicazioni? La risposta è questa: siamo in presenza di una *soggettività di enumerazione e distinzione*. Queste pubblicazioni performano un mondo di oggetti che rientrano in gruppi o classi (benché la nozione di classe implichi un problema semiotico con il carattere di differenza che non credo riguardi questo caso). È il piacere di *enumerare* gli oggetti, distinguendoli tra di loro, in modo completo e spesso in termini di riconoscimento visivo[26].

Ciò significa che l'oggetto è appiattito, reso passivo. È posto, si potrebbe dire, all'interno di una gamma fornita da una "teca delle curiosità" bidimensionale, come nella episteme classica esplorata da Foucault[27]. E per quanto riguarda la posizione del soggetto? Si sarebbe tentati di dire che questa sia un'altra versione della questione dell'occhio di Dio, e di sicuro questo è sintomatico di qualcosa. Ma fermarsi a questo non rende giustizia alle sue specificità. Perché questa è una forma di ottica che non è analitica, ma alquanto sintetica. Questo perché il piacere ha poco a che fare con i legami tra diverse specificità, i loro meccanismi e, soprattutto, ha poco a che fare con l'intervento o il controllo. Infatti, mantenere un legame con il mondo può essere inteso come una rinuncia al controllo. Non c'è alcun desiderio di intervenire, di fare la differenza. Piuttosto, il piacere sta nel *riconoscere* quel qualcosa che è là fuori. E, in particolare, nel riconoscere le specificità. Si noti che questo non è un riconoscimento del dettaglio, poiché il dettaglio è gerarchicamente ordinato per gradi. Come dire, un modo per rimpicciolire la specificità Mentre invece il piacere qui non è stratificato. Piuttosto è piatto. L'occhio guarda la specificità di una superficie fatta di dettagli.

Dunque, la posizione del soggetto si realizza nel riconoscimento. Questo non è il riconoscimento che fa gridare: "Terra! Terra!" all'eroe, ma l'impronta su un piano, una serie di specificità già presenti nel mondo che si offrono alla superficie ricettiva del soggetto, una superficie simile ad un insieme ordinato di lastre fotografiche. Che raggiunge i piaceri della posizione di soggetto registrando, riconoscendo, enumerando, completando il riconoscimento, riconoscendo il proprio posto nel mondo e ricordandosi di quel posto, nell'atto del riconoscimento.

Dubito che una forte posizione soggettiva si performi nelle narrazioni delle forze aeree del mondo o in quelle degli studenti di STS. Ma l'ho inclusa perché, almeno nel Regno Unito, questa versione pre-moderna del piacere è piuttosto comune, e poiché si ricollega alle più estese narrazioni su controllo, sistema ed eroismo, in modi che potrebbero integrarla. L'ho inclusa, in altre parole, perché è

[26] Sarebbe un errore immaginare che l'erotismo dell'enumerazione sia specificamente tecnologico. Anche se ci sono molte versioni macchiniche (un altro esempio potrebbe essere quello dei *trainspotters*, un fenomeno interpellativo comune almeno nel regno unito), alcuni amanti del birdwatching sono senza dubbio interpellati allo stesso modo. Perché queste due interpellanze contrapposte? Non ne ho idea.

[27] Si veda Foucault (1970), e per una discussione analoga nel contesto della fisica delle alte energie, Traweek (1995a).

una forma di piacere macchinico che performa un problema politico intertestuale.

5. Compimento

Il Tern Valley Steam Festival si svolge, una volta all'anno, in un campo alla periferia della cittadina in cui vivo, e riunisce gli appassionati di vecchie macchine. Enormi motori a trazione, camion d'epoca, motociclette, trebbiatrici a cinghia, auto d'epoca. Alcune di esse sono esteticamente interpellative - sono, per lo meno agli occhi dei più, molto belle. Ma il mio interesse è attirato da altre forme di piacere, dal momento che un'intera sezione del festival è dedicata a vari tipi di motori di piccole dimensioni.

Se li si guarda attentamente, il modo in cui sono disposti sembra seguire una regola. I proprietari li sistemano su tavoli o cavalletti. Li nutrono con carburante, ad esempio carbone e acqua, e quelli funzionano, da motori quali sono. Ma il fatto che funzionino non basta: è anche importante, o almeno così sembra, dimostrare che sono capaci di compiere un lavoro visibile. Così vengono disposti in modo da pompare acqua che raccolgono da un secchio attraverso un tubo, per poi farla fuoriuscire da un rubinetto in modo che ricada nel secchio. E, per completare il ciclo, l'acqua viene risucchiata dal tubo ancora una volta, e così via.

Per qualche motivo l'acqua (suppongo che sia acqua) è quasi sempre di un luminoso verde fluorescente.

Mettere in mostra una di queste macchine sembra essere il pretesto per una gita di famiglia, un week end lontano da casa. Le persone, tendenzialmente coppie anziane, spesso si portano dietro un caravan. Si siedono, bevono del tè e sorvegliano le loro macchine. E tu sorvegli loro.

Dove sta qui l'erotismo? Ho un'ipotesi, a proposito del perché io sia stato lontanamente interpellato. La mia ipotesi è che si tratti di un erotismo del compimento macchinico. Ogni cosa è, per così dire, auto-contenuta, si auto-alimenta, si auto-regola. Le macchine pompano acqua in un circuito chiuso. In senso figurato (sicuramente non in senso letterario) è come se si auto-alimentassero. E l'isomorfismo dei proprietari (che si auto-alimentano) e delle macchine è piuttosto sorprendente. Fiducia in se stessi, autonomia, e all'interno di questa autonomia la performance del controllo perfetto.

Il controllo perfetto. Il sogno di una macchina così perfetta da non dipendere più dal suo ambiente; così perfetta, in altre parole, da essere autonoma; così perfetta da mantenere se stessa. Ci sono così tanti tropi possibili. La cibernetica. I regimi epistemici nella fisica dell'alta energia descritti da Knorr-Cetina (1996); i grandi sistemi tecnici, centri del calcolo e delle sue traduzioni[28]; si pensi, in generale, ai regimi fondamentali, che possono cioè sfidare il tempo, l'entropia, e performarsi immutabilmente e in maniera affidabile, per sempre.

[28] Sui grandi sistemi tecnici, si veda Hughes (1979); sui centri di calcolo, Latour (1990).

Si tratta dunque del piacere del controllo: il controllo attraverso la regolazione, attraverso l'auto-regolazione, l'addomesticamento, l'inclusione nel sistema di nulla che possa essere interrotto; attraverso la colonizzazione dell'Altro[29]. E c'è un'altra implicazione: quella dell'appiattimento. Un sistema che si auto-regola può essere eterogeneo, e questo è ciò che riguarda l'actor-network theory. Ma non può essere radicalmente eterogeneo nel senso inteso da Lyotard (Lyotard e Thébaut 1985). Non può, cioè, essere immaginato senza essere assimilabile – il che significa, ancora una volta, che l'inassimilabile è non assimilabile.

Ma se siamo interpellati in questo modo, se riconosciamo e rispondiamo al bisogno di perfezione, allora quali sono i punti narrativi fissi?

La risposta più semplice è che se veniamo interpellati in questo modo, poi tenderemo a performare l'autonomia, la perfezione, l'integrazione e la reazione, in opposizione a tutto ciò che potrebbe 'sconvolgere' questa autonomia. Ciò significa che i punti fissi gireranno intorno al dualismo ordine/disordine[30]. Non siamo bravi a far fronte o a raccontare l'incompletezza, poiché tendiamo ad immaginarla come uno sconvolgimento che potrebbe essere risolto solo compiendo un altro sforzo.

Tutto ciò suona tristemente familiare. Anzi, suggerisco che si presenti, in una forma o nell'altra, sia nelle nostre narrazioni, sia in quelle performate con e attraverso gli oggetti che studiamo. È una cosa a cui prestare attenzione: la miopia della dedizione alla perfezione, all'olismo, alla coerenza, all'integrazione impliciti nel progetto moderno. Se ho considerato l'esempio delle macchine a vapore è perché non sono così lontane da molte altre storie performate per progetti più ampi e contemporanei. L'unica differenza è di scala: i campi intorno a Market Drayton ospitano una versione modesta di modernismo, che può realmente resistere all'entropia e raggiungere il completamento per un giorno o due.

6. Estensione

C'era un uomo a guidarci durante il corso di falegnameria: il suo nome era John. Alto, gentile. Non ha dato lezioni a noi neofiti, ma ci ha suggerito dei progetti, oggetti che avremmo potuto costruire, casette per uccelli, scolapiatti, qualunque cosa. Nel corso saremo stati una ventina. E lui si aggirava intorno a noi, offrendo consigli, aiutandoci dov'era necessario. Aveva questo talento di essere lì, a portata di mano, quando qualcuno stava per fare un errore irrimediabile. E conosceva anche gli strumenti, ad esempio la pialla. Così si è scoperto che piallare il legno non è una questione così semplice. Se lo fai con l'entusiasmo del principiante, ottieni una bella superficie liscia, ma che è anche leggermente curva. Cosa fare, dunque?

---

[29] Sul 'continente sconosciuto' che implica il termine 'colonizzazione', vedere Lee e Brown (1994).

[30] Un argomento splendidamente sostenuto da Bob Cooper (1986).

C'è un consiglio che può essere dato a voce: applicare una leggera pressione nel mezzo del pezzo di legno e ridurre la pressione verso ciascuna estremità della tavola. Oppure, premere giusto un po' qui su un lato della tavola, e poi lì sull'altro lato. Con la pratica, con questo consiglio, e con una mano a guidarci, molti di noi pian piano hanno acquisito abilità, hanno incarnato l'abilità di cui c'è bisogno per piallare un pezzo di legno, e farlo in modo soddisfacente: liscio, piatto e quadrato.

Qual è la logica qui, la logica del macchinico, o forse dovrei dire tecnica, o amore? Poiché di questo si tratta, o per lo meno all'inizio, quando viene provato un forte piacere.

La spiegazione che voglio avanzare è che si tratti di un 'piacere prostetico', della piatta estensione del corpo in quello che Philip Fischer, parlando di arte e natura morta, chiama lo spazio "hand-made" (Fisher 1991). Lo spazio "hand-made" è il luogo in cui il confine tra il corpo e lo strumento non è più distinto; in cui avviene la coordinazione mano-occhio; in cui è presente una sorta di controllo. Ma è anche il luogo dove il controllo è limitato alla fine del braccio ed alla sua estensione. E dove (più importante) il controllo dipende da, o performa, una sorta di continuità. Infatti, se si dicesse che la pialla è "controllata", questo non riguarderebbe più l'esperienza, o parte di essa. Inoltre il piano è diventato parte del corpo – o il corpo si estende sul piano.

Continuità. Che implica una distribuzione, una sorta di versione decentrata di agency tra persona-e-piano.

Così funziona con molti strumenti. Strumenti da falegname, violini, biciclette, automobili, sedie a rotelle e, per quanto ne so, aerei. Ma se fossimo interpellati in questo modo, cosa significherebbe? Come potrebbero i punti fissi performare se stessi?

Suggerisco di stare in guardia dagli elogi olistici, dalle celebrazioni umanistiche, e dalle narrazioni che tentano si sedurci sviandoci nell'amore per l'artigianato manuale. Queste continuità tra il corpo e la materia sono naturalmente importanti. Infatti la loro narrazione è un importante filo conduttore negli studi tecnologici e si performa in tutti i modi attraverso il materiale macchinico. Ma abbiamo ancora bisogno di opporci a queste narrazioni, ad ogni costo se ci portano nella direzione del mestiere-e-comunità, raccontando di soggetti interi e dello stretto rapporto tra il soggetto umano e i suoi strumenti – invece di, per esempio, raccontare dei cyborg con il loro decentramento e le loro multiple soggettività[31].

7. Bellezza

L'aereo militare che stavo studiando, il TSR2, inizialmente ha dato del filo da torcere. Ci sono stati problemi con il carrello, e difficoltà potenzialmente fatali

[31] Come, per esempio, nel celebre saggio di Donna Haraway (1991) ma si veda anche Stone (1991; 1995b).

con i motori. Ma nessuno all'interno dell'opinione pubblica era a conoscenza di queste difficoltà. Così, ciò a cui abbiamo assistito in un giorno dell'autunno 1964, è stato il decollo di un aereo al suo primo volo. Non un vecchio aereo, ma un aereo bianco, elegante, con le ali arretrate, un insieme di bordi taglienti e angoli affilati. Ciò che abbiamo visto era, lasciatemelo dire, un oggetto di bellezza che accelerava lungo la pista, e impennava poi nell'aria. La televisione ha mostrato il suo decollo, e le fotografie sui giornali hanno immortalato il momento, con le ruote a forse un metro dalla pista. E le fotografie congelano l'aereo per sempre così, sospeso come un uccello tra il cielo e la terra. Sospeso. Congelato.

O fluttuante.

Dove sta qui l'interpellanza? A dire il vero, il termine "bellezza" in questo caso è rivelatore. Riconoscere la bellezza di una macchina è esserne interpellati. È la performance di una soggettività che si pone in una relazione estetica col soggetto. La Monna Lisa. L'Unité d'Habitation di Le Corbusier. Il Forth Railway Bridge.

Il termine "estetica" è fastidioso; è legato troppo strettamente ad una filosofia essenzialista della bellezza[32]. Ma senza andare ad impantanarsi nell'estetica, possiamo ancora chiederci quali siano le conseguenze dell'interpellanza della bellezza macchinica. Quali siano gli effetti dell'apprezzamento estetico di un aereo.

Senza dubbio ci sono molte possibilità, ma vorrei immaginarne due: la contemplazione, e la redenzione.

La bellezza: nella trattazione svolta, si tratta di una bellezza visuale, una specifica forma di ottica. Ma qual è la posizione ottica del soggetto? Risposta: è una posizione contemplativa. È una forma di ottica che sottrae una certa distanza dall'oggetto. Uso deliberatamente l'espressione "una certa distanza" poiché, se ci muoviamo troppo veloci, non vediamo l'oggetto in tutta la sua bellezza, mentre se siamo troppo vicini, di nuovo non lo vediamo. Invece, cominciamo a vedere qualcosa dei suoi dettagli, forse del modo in cui è costruito. Cominciamo, per usare un'espressione di Oliver Cromwell, a vedere tutte le "verruche" delle cose. Ma la costruzione di un soggetto contemplativo situato nella media distanza è la ricetta per l'ammirazione passiva, per scannerizzare in assenza di azione. Si tratta di una sorta di passività[33].

La contemplazione è la produzione di una particolare posizione del soggetto. Ma dopo la contemplazione viene la redenzione: l'atto di adempimento, di salvataggio, di recupero; dell'essere liberati dal peccato, secondo il messaggio Cristia-

---

[32] Sono grato a Michel Callon e Antoine Hennion per questa discussione.

[33] Due commenti: in primo luogo, nel campo dell'ottica di solito l'oggetto è immaginato come passivo. Si veda l'analisi della presunta sfiducia Francese nell'occhio in Jay (1993). Ma leggendo ciò che afferma Michel Foucault sulla soggettività, il problema non è così semplice. Vedere, per esempio, Foucault (1979; 1982). In secondo luogo, ciò è senza dubbio correlato a quello che Donald MacKenzie ha chiamato "abbeveratoio della certezza" (*certainty trough*). "Tra quelli molto vicini al cuore tecnico dei programmi di produzione di conoscenza, e quelli lontani e impegnati in programmi opposti, si trovano i lealisti del programma e quelli che 'semplicemente credono a ciò che leggono sugli opuscoli informativi'." (MacKenzie 1990, 371).

no[34]. Così la redenzione riguarda il completare, il congiungere, e quindi l'assorbire, l'essere uniti. È questo, penso, il carattere interpellativo della visione del TSR2 che decolla. Per usare le parole di Louis Althusser, questo ha a che fare con l'unire il soggetto al Soggetto, un Soggetto che può trascendere le scissioni tra il soggetto conoscente e l'Oggetto e, non ultimo, tra il cielo e la terra. Tra la libertà vertiginosa dei cieli e la prigionia delle mondanità del corpo terreno[35].

La contemplazione esige sia distanza che passività. E la passività, ironicamente, dà forma ad uno spazio per l'assorbimento in un intero immaginato, un intero essenziale. Il che suggerisce che siamo in presenza di un'altra oscillazione nel-corpo/fuori-dal-corpo, che forse condivide alcune caratteristiche con l'eroismo, il primo dei piaceri macchinici.

È forse questo un problema per le narrazioni della tecnologia? La risposta è: non lo so. Si tratta, naturalmente, di un'enorme trappola per i racconti d'arte, la ricerca estetica della bellezza redentrice contro cui hanno combattuto così tante teorie dell'arte contemporanea. Ed è anche una pesante trappola di genere. Nella visione maschile, l'oggetto della bellezza, il Soggetto, si performa come una qualche versione della Madonna. Ma non sono così sicuro che succeda nella tecnologia. La tecnologia porta con sé narrazioni redentrici – e quelle sull'eroismo rientrano senza dubbio in questa categoria – ma sono meno sicuro che queste siano suscettibili di essere passive e contemplative.

Forse è strano, ma questo aereo, il TSR2, mi ha in parte interpellato in questo modo. Il riconoscimento che mi ha performato come un soggetto passivo quando l'ho incontrato anni dopo in un museo ed ho deciso di studiarlo come un oggetto STS ha in parte a che fare con la redenzione[36]. Il senso della possibilità di essere reso intero, nell'atto di essere assorbito. Una redenzione che mi ha restituito vent'anni. Per un oscuro senso di perdita che avevo incontrato quando era stata annunciata la cancellazione. Per un luogo sospeso, più bello, tra cielo e terra.

Naturalmente mi stavo sbagliando, poiché non è possibile allo stesso tempo contemplare la possibilità di redenzione attraverso la bellezza e anatomizzare quella bellezza: almeno, non nella stessa narrazione. Ma questa è un'altra storia.

---

[34] Sulla struttura iconografica e narrativa dei racconti tecnologici, scientifici e personali euro-americani, e sui legami coi suoi precursori giudaico-cristiani, si veda Haraway (1997).

[35] Si potrebbe dire molto di più sulla questione del perdere peso. Del galleggiamento. Nel primo caso, in un modo specificatamente fisico. Dopo il decollo i motori rallentano. Si tratta di un piacere che un numero considerevole di passeggeri, sia uomini che donne, apprezzano. Spostarsi dentro e fuori dalle nuvole. Fuori e dentro il sole. Così lontani dalla terraferma. Apparentemente immuni alla forza di gravità, come un uccello. Il corpo libero dalle solite costrizioni. Un'altra esperienza fuori-dal-corpo. Ma un'esperienza, in effetti, con connotazioni religiose e trascendentali. Si vedano in proposito gli studi di Bruno Latour (1995) sull'Assunzione e la sua rappresentazione nell'arte.

[36] Tra i vari collegamenti alla letteratura che vorrei fare, sceglierò il racconto di Donna Haraway (1989) sui diorami delle grandi scimmie costruiti all'American Museum of Natural History. Per il caso particolare del TSR2 si veda Law (2000; 2001).

Conclusione

Mi sono trovato invischiato nella questione dell'interpellanza macchinica nel corso di un progetto sull'aviazione militare. Ne ho parlato in vari modi, e alcuni esempi hanno avuto a che fare con l'aereo che stavo studiando, il TSR2. Quando ho iniziato a studiare i racconti del progetto dell'aereo, sono diventato sospettoso, sia per i racconti in sé, sia per i collegamenti tra quelli e il mio interesse personale verso l'aereo. Questa è una storia che approfondisco altrove, ma è questo sospetto che mi ha portato a chiedermi, come ho fatto in quest'articolo: in che modo i soggetti sono interpellati dalle macchine? Quali sono i piaceri delle macchine? Quali sono, in particolare, i piaceri maschili che emergono nel conoscere e nel parlare di macchine? E quali sono le ovvietà e le cecità insite in questi piaceri?

Io stesso ero sospettoso dei racconti di tecnologia militare. Ma ero ugualmente sospettoso di quei racconti che parlano in maniera semplice dei piaceri macchinici maschili come se fossero univoci o uniformemente desiderabili. La mia sensazione, ed è una sensazione che ho cercato di esplorare ed illustrare in questo articolo, è che le interpellanze dell'erotismo macchinico siano complesse e specifiche. E che molti di questi piaceri siano abbastanza innocenti. Mentre, per essere precisi, alcuni, forse molti, non lo sono. Quindi, o almeno così sto suggerendo, è importante esplorare le complessità della specificità, se vogliamo capire qual è la causa del desiderio, dell'amore per il macchinico – oppure della repulsione. E se vogliamo capire questo, allora dobbiamo anche fare i conti con il fatto che certi tipi di relazioni strutturano le nostre narrazioni, e qualunque cosa diciamo sulle macchine. Ed è con questo pensiero che voglio fermarmi. Il pensiero che ci siano davvero tutte le ragioni per essere sospettosi riguardo alle nostre narrazioni macchiniche. Anche su queste, siano fatti i silenzi dei nostri desideri. Poiché di quei silenzi possiamo certo prenderci cura.

Riferimenti bibliografici

Althusser, L. (1971) *Lenin and Philosophy and Other Essays*, London, New Left Books (trad. it. *Lenin e la filosofia*, Milano, Jaca Book, 1974).

Baudrillard, J. (1988) *Selected Writings*, Cambridge, Polity Press.

Campbell, C. (1987) *The Romantic Ethic and the Spirit of Modern Consumerism*, Oxford, Blackwell.

Cohn, C. (1993) *Wars, Wimps and Women: Talking Gender and Thinking War*, in M. Cooke and A. Woollacott (a cura di), *Gendering War Talk*, Princeton, Princeton University Press, pp. 227-246.

Cooper, R. (1986), *Organization/Disorganization*, in "Social Science Information", 25, pp. 299- 335.

de Lauretis, T. (1987) *Technologies of Gender: Essays on Theory, Film and Fiction*, London, Macmillan.

Fisher, P. (1991) *Making and Effacing Art: Modern American Art in a Culture of Museums*, New York, Oxford University Press.
Foucault, M. (1970) *The Order of Things: an Archaeology of the Human Sciences*, London, Tavistock (trad. it. *Le parole e le cose: un'archeologia delle scienze umane,* Rizzoli, Milano, 1967).
Foucault, M. (1979), *Discipline and Punish*, Harmondsworth, Penguin (trad. it. *Sorvegliare e punire: nascita della prigione,* Torino, Einaudi, 1976).
Foucault, M. (1982) *The Subject and Power*, in H.L. Dreyfus e P. Rabinow (a cura di), *Michel Foucault: Beyond Structuralism and Hermeneutics, with an afterword by Michel Foucault*, Brighton, Harvester.
Gusterson, H. (1995a) *Becoming a Weapons Scientist*, in G.E. Marcus (a cura di), *Technoscientific Imaginaries: Conversations, Profiles and Memoirs*, Chicago, University of Chicago Press, pp. 255-274.
Gusterson, H. (1995b) *Short Circuit: Watching Television with a Nuclear-Weapons Scientist*, in C.H. Gray (a cura di), *The Cyborg Handbook*, New York e London, Routledge, pp. 107-117.
Haraway, D. (1989) *Primate Visions: Gender, Race and Nature in the World of Modern Science*, London, Routledge and Chapman Hall.
Haraway, D. (1991) *Simians, Cyborgs and Women: the Reinvention of Nature*, London, Free Association Books (trad. it. *Manifesto Cyborg. Donne, tecnologie e biopolitiche del corpo*, Milano, Feltrinelli, 1995).
Haraway, D. (1997) *Modest_Witness@Second_Millenium.FemaleMan©_ Meets_Oncomouse™: Feminism and Technoscience*, New York and London, Routledge (trad. it. *Testimone_modesta@femaleman_incontra_OncoTopo,* Milano, Feltrinelli, 2000).
Heim, M. (1991) *The Erotic Ontology of Cyberspace*, in M. Benedikt, *Cyberspace: First Steps*, Cambridge Mass, MIT Press, pp. 59-80.
Hughes, T.P. (1979) *The Electrification of America: the System Builders*, in "Technology and Culture", 20, pp. 124-161.
Jay, M. (1993) *Downcast Eyes: the Denigration of Vision in Twentieth-Century French Thought*, Berkeley, University of California Press.
Knorr-Cetina, K.D. (1996) *The Care of the Self and Blind Variation: the Disunity of Two Leading Sciences*, in P. Galison e D. Stamp (a cura di), *The Disunity of Science. Boundaries, Contexts, and Power*, Stanford, Stanford University Press, pp. 287-310.
Latour, B. (1990), *Drawing Things Together*, in M. Lynch and S. Woolgar (a cura di), *Representation in Scientific Practice*, Cambridge, Mass., MIT Press, pp. 19-68.
Latour, B. (1995) *The Assumption*, Paris, Mimeo.
Law, J. (1994) *Organizing Modernity*, Oxford, Blackwell.
Law, J. (1995) *Against Politics*, Keele University, Mimeo.
Law, J. (2000) *On the Subject of the Object: Narrative, Technology and Interpellation*, in "Configurations", 8, pp. 1-29.
Law, J. (2001) *Aircraft Stories: Decentering the Object in Technoscience*, Durham, N.Ca., Duke.

Lee, N. e Brown, S. (1994) *Otherness and the Actor Network: the Undiscovered Continent*, in "American Behavioural Scientist", 36, pp. 772-790.
Lyotard, J.F. e Thébaut, J.L. (1985), *Just Gaming*, Manchester, University of Manchester.
Mackenzie, D. (1990) *Inventing Accuracy: a Historical Sociology of Nuclear Missile Guidance*, Cambridge, Mass., MIT Press.
Robins, K. e Levidow, L. (1995) *Socializing the Cyborg Self: the Gulf War and Beyond*, in C.H. Gray (a cura di), *The Cyborg Handbook*, New York and London, Routledge, pp. 119-125.
Rosenberg, S.D. (1993) *The Threshold of Thrill: Life Stories in the Skies over Southeast Asia*, in M. Cooke e A. Woollacott (a cura di), *Gendering War Talk*, Princeton, Princeton University Press, pp. 43-66.
Ruddick, S. (1993) *Notes Towards a Feminist Peace Politics*, in M. Cooke e A. Woollacott (a cura di), *Gendering War Talk,* pp. 109-127.
Sapolsky, H. (1972) T*he Polaris System Development: Bureaucratic and Programmatic Success in Government*, Cambridge, Mass., MIT Press.
Stone, A. R. (1991) *Will the Real Body Please Stand Up?: Boundary Stories about Virtual Cultures*, in M. Benedikt (a cura di) *Cyberspace: First Steps*, Cambridge Mass, MIT Press, pp. 81-118.
Stone, A.R. (1995a) *Innocence and Awakening: Cyberdämmerung at the Achibe Research Laboratory*', in G.E. Marcus (a cura di), *Technoscientific Imaginaries: Conversations, Profiles and Memoirs*, Chicago, University of Chicago Press, pp. 177-195.
Stone, A.R. (1995b) *Split Subjects, Not Atoms; or, How I Fell in Love With My Prosthesis*', in C.H. Gray (a cura di), *The Cyborg Handbook*, New York and London, Routledge, pp. 393-406.
Tepper, S.S. (1989) *The Gate to Women's Country*, London, Bantam Press.
Traweek, S. (1988) *Beamtimes and Lifetimes: the World of High Energy Physics*, Cambridge, Harvard.
Traweek, S. (1995a), *Bodies of Evidence: Law and Order, Sexy Machines, and the Erotics of Fieldwork among Physicists*, in S.L. Foster (a cura di) (1995) *Choreographing History*, Bloomington and Indianapolis, Indiana University Press, pp. 211-225.
Traweek, S. (1995b) *Bachigai (Out of Place) in Ibaraki: Tsukuba Science City, Japan*, in G.E. Marcus (a cura di), *Technoscientific Imaginaries: Conversations, Profiles and Memoirs*, Chicago, University of Chicago Press, pp. 355-377.
Turkle, S. (1984) *The Second Self: Computers and the Human Spirit*, New York, Simon and Schuster (trad. it. *Il secondo io*, Frassinelli, Milano, 1985).
Watson-Verran, H. (1994) *Re-Imagining Land Title and Ownership: Working Disparate Knowledge Traditions Together*, paper presentato al seminario 'Working Disparate Knowledge Systems Together', Deakin University, 26-27 Novembre.
Wajcman, J. (1991) *Feminism Confronts Technology*, Cambridge, Polity Press.
Wolfe, T. (1980) *The Right Stuff*, London, Jonathan Cape.

Abstract How do objects interpellate us? What are the pleasures of machines? What, in particular, are the male pleasures that are made in the knowing and telling of machines? Reflecting upon a small selection of the variety of machinic pleasures, the paper considers the ecology of subject-object distribution and explores how it is we are called to become knowing subjects, and how it is that objects are constituted and known in particular ways.

Keywords Interpellation; performance; pleasures; technology; subject position.

***

John Law The Open University
Faculty of Social Sciences
Walton Hall - MK7 6AAj - Milton Keynes
United Kingdom
Email: j.law@open.ac.uk

Book Reviews

Cecilia Åsberg, Martin Hultman and Francis Lee (eds)
Posthumanistiska nyckeltexter
2012, Studentlitteratur, 233 pp.
by Ane Møller Gabrielsen

Dawn Goodwin
Acting in Anaesthesia. Ethnographic Encounters with Patients, Practitioners and Medical Technologies
2009, Cambridge University Press, 187 pp.
by Ericka Johnson

Scott Lash
Intensive Culture. Social Theory, Religion and Contemporary Capitalism
2010, SAGE, 247 pp.
by Letteria Fassari

Martin G. Weiß (ed)
Bios und Zoë. Die menschliche Natur im Zeitalter ihrer technischen Reproduzierbarkeit
2009, Suhrkamp, 388 pp.
by Ingrid Metzler

Federico Neresini and Paolo Magaudda (eds)
La scienza sullo schermo. La rappresentazione della tecnoscienza nella televisione italiana
2012, Il Mulino, 250 pp.
by Paola Pallavicini

Gabriel Gatti, Iñaki Martínez de Albéniz and Benjamín Tejerina (eds)
Tecnología, cultura experta e identidad en la sociedad del conocimiento
2010, Servicio Editorial de la Universidad del País Vasco, 275 pp.
by Barbara Pentimalli

Dominique Vinck
Les nanotechnologies
2009, Le Cavalier Bleu, 127 pp.
by Bernard Reber

Giuseppina Pellegrino (ed)
The Politics of Proximity. Mobility and Immobility in Practice
2011, Ashgate, 178 pp.
by Andrés Felipe Valderrama Pineda
Cecilia Åsberg, Martin Hultman and Francis Lee

TECNOSCIENZA
Italian Journal of Science & Technology Studies
Volume 3 (1) pp. 119-145 - ISSN 2038-3460
http://www.tecnoscienza.net

T/S TECNOSCIENZA
Italian Journal of Science & Technology Studies

Post-humanistiska nyckeltexter

(Post-humanist Key Texts)

2012, Studentlitteratur, 233 pp.

Ane Møller Gabrielsen
(Norwegian University of Science and Technology)

What is posthumanism, and how can we as scholars best meet "the posthumanist challenge"? In the anthology Post-humanistiska nickel–texter, Swedish for Post-humanist key texts, seven texts from the fields of feminist theory and STS are translated into Swedish. Oriented towards "all those interested in a wider ethic discussion, increased democratization and more valid approaches in research and society" (p. 26), the editors and translators Cecilia Åsberg, Martin Hultman and Francis Lee want to present a "smorgasbord" (the Swedish word for buffet) of texts (p. 7) in an attempt to answer the questions above.

The first three chapters in Post-humanistiska nyckeltexter are intro–ductory texts where the editors explain their take on posthumanism as well as introducing some central topics and discussions. The first chapter, "Reading Skills Beyond the Comfort Zones of the Humanities" is written by Cecilia Åsberg, while "Material-semiotics, Translations and Other Connections" and "Meet the Posthumanist Challenge" are written by the three editors together. Each of the next seven chapters consist of an introduction to an author and guide to further reading, followed by a translated text. The last part of the book is a "Posthumanist dictionary", explaining about 40 key terms, starting with "affect" and ending with "sociology of translation" (in Swedish: översettningssociologi). All the translations and introductions are done by Åsberg, Hultman or Lee, who thus become not only editors, but also translators and authors. However, to avoid confusing them with the translated authors, I will refer to them as "editors" throughout this review.

Post-humanistiska nyckeltexter could be termed as "posthumanism for beginners", a guidebook for those curious about entering this emerging theoretical and analytical field. However, it is not just a collection of texts, but offers concrete guidelines for posthumanist analyses. Focusing on the performative function of the analysis and "onto-epistemological ethics", the editors stress that posthumanist analysis should write the changes one wants to see in the world instead of repeating problems we are already aware of (p. 15). Thus, the posthumanism in this textbook is not just a tool to think with. But what is posthumanism? It is a concept with many different, and also opposing, connotations, ranging from utopian visions of technologi-cally and genetically enhanced transhumans to dystopian and misanthropic views of humanity. The posthumanism presented in this book positions itself within the material, or ontological, turn in the

Humanities and social sciences. Challenging humanist anthropocentrism as well as the views and analytical range of the humanities, Åsberg, Hultman and Lee wants to take the (Scandinavian) reader "directly into a dynamic and unfinished phase of theory building and development of concepts which open up for fundamental questions of ontology and epistemology; ethics, technology and (environmental) politics; affect and pedagogics" (p. 26).

Åsberg, Hultman and Lee have chosen authors who have illustrated how posthumanist approaches relates to the prediscursive agency of the non-human, or who have formulated posthumanist insights formative for the field (p. 24).

The first text is, not surprisingly, by Donna Haraway. In the text "Companion Species", an excerpt from When Species Meet, Haraway uses her dog Cayenne, Derrida's cat and the baboons of Ebburu, to demonstrate how actors are the products and effects of relations. This text sets the tone for the entire collection of texts. Still, in her own text, Haraway refuses to be called a posthumanist, hence the title of the introduction: "The reluctant posthumanist", which again underlines the many inconsistencies in this field. The next chapter, "Karen Barad: a Posthumanist Quantum Physicist" introduces Barad's agential realism, followed by excerpts from Karen Barad's "Posthumanist Performativity: Toward an Understanding of How Matter Comes to Matter", which focuses on how the phenomena which constitutes the world are the effects of intra-action. Then follows Gilles Deleuze and Félix Guattari's introduction to "A Thousand Plateaux", introducing the concept of rhizome to challenge the traditional notion of binary structures so central to many forms of analyses. The following translation of Rosi Braidotti's "Becoming Woman, or Sexual Difference Revisited", is the first time Braidotti is translated into Swedish. Åsberg writes in her introduction that this reluctance may have to do with Braidottis's sexual difference-approach, an approach that doesn't necessarily blend well with the Swedish focus on equality. Following Braidotti, Michel Serres and his text of quasi-objects from The Parasite, demonstrating how objects and subjects cannot be separated, brings us over to the more ANT-oriented part of the collection. Being one of the inspirators for actor-network theory, it seems only reasonable that the next author is Michael Callon, represented by excerpts from "Some Elements of a Sociology of Translation". The last key text is an excerpt from "Ontological Politics: A Word and Some Questions" by Anne Marie Mol, where she argues that different medical practices not only deal with different aspects of reality, but actually enact different versions of it.

The seven texts and excerpts are translated into Swedish for the first time. Translation is also a key term for this particular take on post-

humanism - the translation of knowledge changes the actors involved as well as the knowledge itself, and in translating these texts, the editors have also changed them. In her introductory chapter, Åsberg descrybes how they have adapted the original texts in an effort to create a common posthumanist ground, "transposing" the texts into a posthumanist language to enable communication between different disciplines and fields (p. 16-17). Through the introductions and the translations, they put these texts into dialogue with each other as well as with the posthumanist field. Still, in selecting, introducing and translating these texts, they have also been excluding. And although the editors assure us that they do not want to create any form for canon, the texts they have chosen inform us that the effects may be something quite different from the intention. The definitions in the dictionary at the back also remind us as readers that this is a specific version of posthumanism. Translated from other languages into Swedish, it creates something new, something that might be termed Swedish, or Scandinavian posthumanism. Histories, actors, agents, objects, relations, effects, materiality and meaning is what this posthumanism is all about. The posthumanist challenge posed in this book might be summed up like this: How to make sense of the complex realities of humans and non-humans in ways that includes the material, challenges anthropocentrism and are ethically valid? Posthumanistiska nickeltexter offers numerous points of departure for anyone eager to venture into this landscape as well as a range of interesting, and creative answers to this challenge.

***

Dawn Goodwin

Acting in Anaesthesia. Ethnographic Encounters with Patients, Practitioners and Medical Technologies

2009, Cambridge University Press,

187 pp.

Ericka Johnson

(University of Linköping)

This book is about how anaesthesiology practices are formed, maintained, challenged and extended, and how these anaesthesiology practices are learned through doing, in an apprenticeship relationship. It is based on ethnographic research, both detailed, real-time observations and in-depth interviews, but it also benefits from Goodwin's past experiences as an anaesthetic and recovery nurse. It is obvious that she knows her ethnographic field very well, a knowledge which allows her to provide the reader with very detailed and helpful descriptions of otherwise confusing medical proce–

dures. But she has also succeeded in distancing herself from the field to analyse actions and taken-for-granted practices with an astute eye to the learning and identity construction occurring.

The book consists of six chapters, and through out, Goodwin illustrates her discussions with rich, descriptive scenarios, transporting the reader between the hospital and her theoretical analysis.

In the first chapter, the author introduces the fields, both the field-work environment of the anaesthesia practices; the operating and recovery rooms, and the academic field of learning in doing, within which this book's theoretical arguments are placed. In chapter 2, Goodwin discusses the concept of agency, demonstrating the relational aspects of the concept in the context of 'silent' bodies and anaesthesiology technology. Using the term cyborg, she shows that the anaesthetised body is not so much silenced and disabled as merely transformed. It can communicate, but in different ways and through augmenting technology. This communication changes the trajectories a patient can take through anaesthesiology, interesting in itself, but it also allows for Goodwin to demonstrate one way agency without intentionality may look, indicating that "Agency is not contained within the body, or within the machines – it is enacted in relations'"(p. 57).

How anaesthesiologists deliver care and achieve accountability, even when the bodies and technologies are sending incoherent messages, is discussed in chapter 3. Goodwin shows that sometimes the body-machine patient of anaesthesiology is not communicating clearly, yet actions must both be taken and later accounted for. Her examples and her discussions of other work in STS show how incoherencies and disunity are prevalent in medical practices, and that these elements also problematise the concept of accountability. In her words, while "certainty may be highly valued, it is also an ideal, and in some circumstances, practice, actions and interventions must go on in spite of intense uncertainty" (p. 103).

In the next chapter, Goodwin expands her ethnographic view to include the work of nurses and operating department practitioners, exploring the abilities and limits these participants have in shaping anaesthetic care. Doing so allows her to show how knowledge, practice and agency are distributed asymmetrically across an organisation, and what the consequences of enacting or transgressing different remits of participation are, at least in the UK context. Goodwin's approach in this chapter allows her to expand on existing work in discussions about communities of practice because her material comes from a multidisciplinary community with very regulated hierarchies.

The final empirical chapter examines how space and material resources are involved in embodied anaesthetic knowledge. Discussing situations when routine work is interrupted

because of disturbances in the regular arrangements of tools, patients or practitioners, Goodwin is able to convincingly suggest that such disturbances are actually a contributing factor to the development of expertise. "Learning to see "normal appearances" from a different perspective, and to accomplish anaesthetic techniques from these altered positions, furnishes a repertoire of techniques that can be used when facing unanticipated difficulties" (p. 165).

Some of the chapters in this book have previously been published as articles. Collecting them into one volume is very useful for those of us who have long been inspired by Goodwin's work, and it is a pleasure to be able to read a substantial quantity of this research at once. But collecting the work this way has also allowed Goodwin to draw larger theoretical lessons from her research and present more nuanced ideas about learning and acting in anaesthesia for the reader. Thus, because of this book, she has been able to develop her ideas about health care as practice populated by clinicians, patients, medical technologies, machines and devices, all acting in concert, and all relationally shaping action, which she discusses further in the final chapter.

These ideas are useful to us working in the field of science, technology and medicine studies and to those interested in the interplay between learning-in-practice, cognition and technology, so the work is well placed in Cambridge's 'Learning in Doing' series. However, her work also has much to contribute to the debates about standardizing health care work and accountability. Her descriptions of how knowledge is embodied and situated in practices, her ability to make invisible anaesthesiology work visible, and her arguments about "the primacy of the immediate context of action in understanding how trajectories of care are shaped" (p. 32) ought to be incorporated into policies regarding medical technologies and clinical guidelines. Her book would force policy makers to ask: if agency is recognized as enacted in relations between bodies and machines, should this not also change our understanding of who can be held accountable for what within medicine and health care?

***

Scott Lash

Intensive Culture. Social Theory, Religion and Contemporary Capitalism

2010, Sage, 247 pp.

Letteria Fassari

(University of Roma La Sapienza)

As often happens in the lives of scholars who have achieved a deserved success, Lash allows himself the luxury of an exploration, philosophically founded, on contem-

porary culture, which he calls "intensive culture". Many of the arguments drawn by the author have been published in the well-known scientific journal "Theory, Culture and Society" (2001, 2003, 2007), but now Lash draws a line of continuity building a very ambitious theoretical platform. For this purpose, Lash re-reads key thinkers such us Leibniz, Nietzsche, Simmel, Deleuze and Guattari, Benjiamin and many others in order to extract the "spirit" of the topics which are introduced in the text. To define contemporary culture, he uses a substantial number of dichotomies, the first and most important of which is the dichotomy "extensive/intensive". Contemporary culture, capitalism and global information are, nowadays, according to the author, widely extensive and tend to expand: we can find clear examples looking at the large corporations, the intergovernmental organizations, the growing exten–siveness, the extensive contemporary social relations and the universaliza-tion of contemporary culture. This growing extensivity manifests itself in terms of geographical spread and process of homogenization that makes distant shares of the globe substantially identical. At the same time, but on another level, there is an opposite process that leads to experiencing a culture that is defined "intensive": experiences of drugs, sex, daily life in global cities but also convergence of media, social net–works, processes, and downloading streaming. All these experiences are defined as intensive.

To explain what he means by "intensive culture", Lash uses again a series of dichotomies: homogeneity versus difference, actual versus virtual, things-for-us versus thing in itself, life versus mechanism, onto–logy versus religion. "Intensive culture" is a culture of difference, of inequivalence. For instance, intensive is the brand's virtuality where what is in potentia may grow, flourish, or come into being. The intensive is full of possibilities, is the extensive actualization of what was, at first, a potentiality. Things in themselves are intensive: to be treated in their singularity and not through general categories such as ethnicity, gender, race means to be treated as intensive. For Lash we live in a culture that is both extensive and intensive: the more globally stretched and exten–sive social relations become, the more they seem to take on this intensity.

Lash is necessarily redundant when he traces with great creativeness the shift from the intensive to the extensive in different key areas of social life and social thinking including: sociology, philosophy, language, capitalism, politic, religion and theology.

With this book Lash also presents a case for the revaluation of vitalism in sociological theory. It argues for the relevance of such a Lebenssoziologie in the global information age. The core of this part is naturally centered on vitalistic sociology of Georg Simmel. In defining the modern vitalism, Lash refers, among others, to Nietzsche, Bergson, with regard to

the classical thinkers, and Deleuze, Foucault and Negri with regard to contemporaries. The currency of vitalism has re-emerged in the context of the changes in the sciences correspondently to the rise of ideas of uncertainty and complexity, and the rise of the global information society. This is because the notion of life has always favoured an idea of becoming over one of being, of movement over stasis, of action over structure, of flow and flux. The global information order seems to be characterized by "flow". Lash's central question is to put the issue of vitalism in the context of the "information age". Central to this shift is the concept of mediatisation. Today media as technological forms are given meaning-making powers; but they are largely outside the control of the subject and of the social institution. Media nomination yields a shift from the externally causing power of mechanistic form to power that is wielded through, self causing and takes cybernetic forms. Externalized flows of the information society are in fact abstract infor–mation, communication, finance flows; flows of technology, media, immigrants even desire or libido.

Simmel provides to Lash the bases for an intensive sociology, especially in Simmel latest works vitalist socio–logy assumes greater importance as it becomes ontological. Simmel, Lash says, was influenced by the study of Leibniz and especially from Leibniz's monadology. The monad is simple substance as difference. It is self-organizing, conceived on the lines of not the extensivity of *res extensa*, but the intensivity of *res cogitans*; the monad is possessed with memory as trace; it is comprised of relations of perception; it is reflexive. In today's global informational culture, inten–sity and extensity are increasingly fused together. The result is that substance increasingly becomes system. The fusion of substance and system, of the intensive and the materiality of social life is seen above all in information and communica-tions. Information in its difference is necessarily intensive. System itself, Lash says, becomes substance. Substance leaves its place in the human subject and itself becomes system: system itself now becomes intensive. Media machines of information and communications (the semantic machines of Luhman and of Varela which produce meaning) have taken powers of predication.

The substance of Aristotle and the Leibniz's monad are key concepts for understanding contemporary capita–lism. This, with its new media, its brands, the dominance of finance and biotechnology, logic design and constant innovation as a result of the investigation, metaphysical, and their shapes become substantial. What characterizes contemporary capita–lism is that the thing, the object, the good, the service is in-itself. Goods and services become metaphysical capitalism. In classical capitalism, the exchange of equivalents leads to equilibrium (and reproduction), in the capitalism of today, the exchange of non-equivalent objects leads to

imbalance and "production". Here, Lash highlights the question of production and innovation without limits, where under the principle of naturalized difference, it is always possible to produce something new, perhaps very similar to its previous version, but with a renewed sense in the market. For Benjamin, Lash writes, capitalism worked through the extensity of the commodity but commodities are physical. Here the logic of the commodity, of the cause and effect of economic structure on superstructure, is modelled on and consistent with Newtonian physics. But the capitalism of today, on the contrary, is a capitalism of difference in which, like Aristotle's substance and Leibniz's monad, each thing is different from every other and self-sufficient. There is a shift from the abstract homogenous labour to the abstract heterogeneous life. Material cause changes from the commodity's units of equivalence to consist of informational units of inequivalence.

How does capitalism stand in relation to metaphysics? Lash refers to Antonio Gramsci for whom the superstructure is metaphysical. Gramsci stresses the contrasts bet–ween economic infrastructure, which works like a physical mechanism, like a mechanical body, and the mind, the spirit of the superstructures. Indeed 'hegemony', which is super-structural is essentially meta–physical. But today with the determination of the economy, and the subordination of superstructures to economic repro–duction, the metaphysicality of the superstructures is relegated to a mere function.

Following Gramsci footpath, Lash poses the question of how to define the post-hegemonic power. In his answer Lash tries to show that the extensive power or the extensive politics are being progressively displaced by a politics of intensity. Correspondently a change has occurred from an extensive (and hegemonic) regime of representation to an intensive regime of commu–nications.

The passage from hegemony or extensive politics to intensive politics shall be translated, in Lash's terms, into the following shifts: a transition to an ontological regime of power, from a regime that in important respects is 'epistemological'; a shift in power from the hegemonic mode of 'power over' to an intensive notion of power from within (including domination from within) and power as generative force; a shift from power and politics in terms of normativity to a regime of power much more based in what can be understood as a "facticity". This points to a general transition from norm to fact in politics and from hegemonic norms to intensive facts.

Lash merges the issue of power with the neo-vitalist look of social sciences. Is contemporary mediatised politics about transforming flow into flux? Lash's answer lies in framing the today's neo-vitalism as an attempt to put flux back into the flow. To put flux into flow is to put reflexivity (flux is always reflexive) into globalization.

Lash's book is not an easy reading

but it is constructed as a major challenge to the traditional socio–logical theory. It is permeated by an interpretive vitality that leaves the reader with the conviction that the path taken is going in the right direction. It requires, however, the effort and the modesty to abandon most of the conceptual equipment commonly used to interpret cultural and social changes.

***

Martin G. Weiß

Bios und Zoë. Die menschliche Natur im Zeitalter ihrer technischen Reproduzierbarkeit

(Bios and Zoe. Human nature in the age of mechanical reproduction)

2009, Suhrkamp, 388 pp.

Ingrid Metzler

(University of Vienna)

At first glance, *Bios und Zoë: Die menschliche Nature im Zeitalter ihrer technischen Reproduzierbar–keit* – which might be translated into English as "Bios and Zoe: Human nature in the age of technical" or perhaps, indeed, "in the age of mechanical reproduction" – seems to be a collection of philosophical works. It is edited by Martin Weiss, a German philosopher who has held academic positions in Austria, Germany, Italy, and the United States, and is now at the University of Klagenfurt in Austria. The title itself alludes to the work of the Italian philosopher Giorgio Agamben, whose *Homo Sacer* (Agamben 1995) in particular helped to revitalize the two Greek terms "bios and "zoë", as well as to Walter Benjamin's "The Work of Art in the Age of Mechanical Reproduction" (Benjamin 1963). Moreover, *Bios und Zoë* is published by the prestigious publisher Suhrkamp, whose recognizable brown paperback books often indicate a zone of philosophical reasoning.

Yet this first glance is misleading. This book is more than a purely philosophical collection. Assembling a plethora of authors with very different modes of reasoning and styles of writing, the book is just as heterogeneous and difficult to categorize as the beast it seeks to study: life in the bio-age. Containing chapters that discuss such different phenomena as synthetic biology, DNA codes, stem cells, egg cells, and post-genomic configurations, the collection provides not only a snapshot of the many frontiers and heterogeneous directions of contemporary bio-technology, but in fact a fairly suggestive picture of the different modes of reasoning and styles of writing that have emerged within those fields of inquiry that have sought to make sense of the ways in which the life sciences have unsettled our ways of thinking on life and our ways of acting on it, fields such as philosophy, history of

science, political science, anthro–pology and science and technology studies. As editor, Weiss has managed to gather many of the big names of those fields.

"Bios" and "zoe", the two terms that constitute the main title of the book, mark the ambiguous zone on whose past, present, and possible futures the contributors seek to reflect upon. "[N]ew insights of the life sciences" and "biotechnology's capability to manipulate", Martin Weiss writes in his brief introduction to this volume, have moved "life in its double meaning as 'mere biological life' [zoë] and 'qualified human life' [bios] as well as the relationship between these two concepts at the center of interest of the social sciences and humanities" (p. 7; my translations throughout). This book, Weiss goes on, is meant to be a collection of "Werkstattberichte", that is, reports from the workshops of these fields.

The contribution by Hans-Jörg Rheinberger and Staffan Müller-Wille is the first of these reports. It reflects upon the "[t]echnical reproducibility of organic nature" from the perspective of a "history of molecular biology", whose practices, "tool boxes", and machineries the authors carefully unpack in their chapter, distilling some of those "epistemic changes" – such as the ability to read life and to rewrite life, or to blur boundaries between species – that provide the meat of some of the following chapters. In the next chapter, Martin Weiss seeks to think through the connections between what he depicts as "dissolution of human nature" in biological laboratories and the dissolution of the individual in the "communitarian turn of bio-ethics". He argues that biotechnologies not only "reduce human beings to the materiality of their genes" but also increasingly "dissolve these [mate–rial] molecules in the immaterial probabilities of potential gene expressions" (p. 45) – which Weiss reads as an interesting symmetrical movement to the dissolution of human subjects in those kinds of political projects that call upon individuals to govern themselves in light of collective truths. In the following chapter, Karin Knorr Cetina seeks to think "[b]eyond the enlightenment", reflecting on the emergence of a "culture of life". "Citizens" and "biological citizens" more precisely are at the center of the contribution by Thomas Lemke and Peter Wehling, which is an excellent reconstruction and discussion of the proliferation of that concept, whose critical power they seek to revitalize. Michel Foucault's work provides the bridge between this chapter and the next one, in which Rosi Braidotti first critically discusses Foucault's work and subsequently introduces a post-human reading of "zoe" as starting point for an ethics of becoming. Such a post-human perspective is similarly developed by Stefan Helmreich in his contribution titled "Human nature on sea", in which he reflects upon the efforts of "environmental marine metagenomics" to genetically profile

not individual organisms but "life in the sea". At a distance from this, Nikolas Rose draws upon Erwin Schrödinger to reflect upon what life is, and seeks to revitalize this question to catch some answers in an age in which what life is and what it should be is no longer tamed by informational epistemologies.

Rose's chapter is followed by a block of philosophical contributions. These start with Gianni Vattimo's more programmatic attempt to reflect upon the possibilities and directions of a post-metaphysical ethics. Similarly – yet, perhaps less programmatically – in their chapters Kurt Bayertz and Dieter Birnbacher both reflect upon the limits and problems of ethical reasoning that are grounded in notions of "human nature". Subsequently, Ulrich Körtner tackles not "human nature" but the concept of the "person". After these philosophical contri–butions on ethics, Anna Durnová and Herbert Gottweis reflect upon "politics between death and life", using examples from human embryonic stem cell research debates and end-of-life debates to distill some cardinal features of the politics of life today.

Striking more empirical paths, Charis Thompson discusses materials from ethnographic studies in clinics of reproductive medicine, and discusses the many ways in which "race" emerges and persists in egg donation practices in the United States. Paul Rabinow and Gaymon Bennett subsequently report from a work–shop that is more experimental in kind, describing the past failure in setting up symmetrical collaborative projects with bio-scientists, and mapping some lines for such a collaboration in the future. In the final chapter, Bruno Latour contributes to this debate through a chapter that seeks to find some middle-ground between modern(ist) dichotomies.

The book as a while might be difficult to digest for those who are altogether new to the literature on the "bio-age". Yet, it is helpful for all those who are not completely new to this body of literature and for those who have wrestled with making sense of the life sciences and its implications and wish to think outside their own box. Many of the chapters are worthy reading as such. For example, Rheinberger and Müller-Wille give a remarkably succinct but nevertheless deep and detailed report on the history of molecular biology, unpacking its toolboxes in detail whilst embedding them also in regulatory debates. Moreover, some themes cut across chapters: "post-genomic" research practices, which are introduced in Rheinberger and Müller-Wille's contribution, are taken up in Weiss's, Lemke and Wehling's, and Rose's chapters; "human nature", and its biological and normative reconfi–guration, features prominently across the chapters, in particular the more philosophical ones; and many contri–butions are conversations not with Giorgio Agamben, as the title somehow suggests, but with Michel Foucault's work on biopolitics.

However, overall this book shows that even if the various fields of the social science and humanities are assembled in one volume, they do not necessarily speak to one another. The book does not give a coherent message and a tension between different modes of reasoning persists. For instance, whilst some chapters take pains to show that "biotechnology" is not a coherent actor, others tend to take biotechnology – and its power and agency – as a given. This tension is addressed in Latour's contribution, which, however, re–mains at a distance from the volume's topics. Yet, such a tension does not necessarily detract from the value of this volume. Rather, it is productive and thought-provoking, triggering reflections not only on what kind of phenomena we are witnessing, but also on how we might want to reflect on them and engage with them.

References

Agamben, G. (1995) *Homo sacer. Il potere sovrano e la nuda vita*, Einaudi, Torino.

Benjamin, W. (1963) *Das Kunstwerk im Zeitalter seiner technischen Reproduzierbarkeit; drei Studien zur Kunstsoziologie*, Suhrkamp Verlag, Frankfurt am Main.

***

Federico Neresini and Paolo Magaudda

La scienza sullo schermo. La rappresentazione della tecnoscienza nella televisione italiana

(Science on the Screen. The Representation of Technoscience in the Italian Television)

2011, Il Mulino, 250 pp.

Paola Pallavicini

(University of Torino)

The volume, edited by Federico Neresini and Paolo Magaudda, collects the main results of a research project on technoscience in Italian television programs. Started in 2007 at the Department of Sociology of Padova University, the project was led by the PaSTIS research unit (Padova Science, Technology and Innovation Studies) and, inside a strictly sociological frame, involved scholars from both the fields of Science and Technology Studies and Media and Communication Studies. The common reference to the sociological culture has oriented the intradisciplinary analytic work toward the long tradition issue of the agency of media contents in social context (i.e. the way in which media content acts socially), investigating how the television communication takes part in and, at the same time, gives form to the social sharing of technoscience knowledge.

Starting from the assumption that

television communication – seen as a particular and specific field in media communication, and identified with television programs broadcasted – is part of the process of social construction of technoscience knowledge (today a common understanding in STS studies), the authors suggest a step forward, that consists in considering media "as they actually are": not a neutral arena for debates or information circulation, but an autonomous actor in the process, with its own logic and its own interests. A step that opens, in the authors' explicit intentions, to a privileged dialogue with the studies on public communication of science and technology (PCST), more than to a critical revision of the basic assumptions of media sociology, today deeply challenged by the radical outcomes – technological as well as social – of digitalization.

Throughout the very large database produced (two full years of television programs recorded from the seven major free channels with national distribution in Italy), the research group selected those useful for the eight case studies presented in three distinct sections of the volume: technoscience and television genres, expert and disputes, bodies and machinery.

In the first chapter Federico Neresini illustrates the structure of the research project, providing a very clear and articulate description of the different frames of reference faced, and of the analytical relevance of the issues specific to each of them (as they have been developed in the single articles collected in the volume).

A first reference horizon is the interweaving of public policies that, since the eighties, have been designed to support a socialization of technoscientific knowledge as a structural element of economic and political development: starting from the Royal Society Report on "The public understanding of science" (1985) up to the assessment in communication strategy included in EU funding policy for R&D projects, the public communication of science and technology has become, internationally, a stable issue involving public and private subjects, media professionals and scientist, politicians and company executives. As Neresini points out, today scientific research lives in this frame.

A second frame of reference may be identified in the growing popular interest in science and technology issue – perhaps backed by the impetuous growth of the new media market. Although this is a long lasting tradition in Italy, the present widespread circulation of scientific metaphors in common language bears witness of a culturally open attitude towards technoscience, which finds confirmation in the media audience's good welcome towards every new form of scientific popularization: news, publications, public events, as well as television programs.

The third frame of reference consists of the specific role that the television medium plays in the media system, or better, the role it was still playing in

2007-2010, before the web became a serious competitor either in the television audience choices, either in the contention (between media) for authoritativeness in scientific issue debates. At that time (recent but far, in Italian television history) was easier and possible considering television like an insulated medium – as the research group does, more for a methodological purpose, than for theoretical choice – because of the actual dominion that it had on other mass media (newspaper and radio in primis), not only by its economic supremacy, but even in defining agenda-setting and aesthetic rules.

Given this analytical background, Neresini highlights how the presence of technoscience in television programming largely outreaches the canonical boundaries of popular science television programs and creeps in non-specialized areas – such as news, advertising, fictions, talk shows – showing today a great capacity to inhabit the territories of the present social experience and imagination. This theme is studied in deep in the two following chapters of the volume – by Stefano Sbarchiero and Cosimo M. Scarcelli, and by Paolo Magaudda – focused respectively on television news programs and on television advertising.

The complexity of the mediation conducted by television in the social sharing of scientific knowledge is recognized by Neresini mainly on two levels, both textual: by intervening directly in the generation of multiple levels of significance of the single technoscientific knowledge data, from the information level up to the imagery level, seamlessly; and by creating a new scene, different from that in which scientific knowledge is originally formulated and validated, where the authority of scientific knowledge is negotiated anew, according to new and different principles proper to the medium. Television has an ambiguous and complex position in this negotiation. From one side, television confirms social utility and reliability of technoscientific data, using them as starting point for debates or as sources for news; on the other side, television continues to impose and reproduce the old model of scientific undisputed objectivity – as la Follette already remarked in 1982 – pretending the existence of homogeneous hierarchies and scale of values, without ever showing the process of scientific knowledge production, with its own conflicts. At the same time television tends to impose its own criteria (from audience approval up to political interests) in the selection of topics as well as of "telegenic" experts, superimposing them to the criteria of the professional scientific community. Likewise in the television context the role of scientist as expert is, by itself, ambivalent: from one side, her or his professional expertise actually represents the scientific world in the media world, becoming a sign for it; from the other side, aside of the actual complexity of scientific world, this same emphasis on professional expertise tends to

confirm the traditional "deficit model" of scientific knowledge transmission, so hardly criticized by scientists because of the simplification it produces in presenting technoscience.

This theme is common to all the contributions collected in the volume, but finds an articulated analysis in the three chapters of the second section, which consider the role of experts in talk-shows and infotainment programs (Renato Stella), the function of scientific evidence in television debates (Andrea Lorenzet), and the differing configuration of the representation of scientific controversies in two popular science television programs (Michela Drusian)

The third section of the volume is less consistent, perhaps because of a short circuit generated by the title – "Bodies and machinery" – that allows expectations outside the analytical apparatus that gives coherence to the volume. Coherently with the previous sections, both bodies and machinery are considered more a textual theme than an object (i.e. human or non-human beings in Latour's hypothesis). The three articles deal with three case studies, respectively on how the body is presented in talk-shows on medical issue (Mauro Turrini), on the way television debates trivializes the eating disorders issue (Claudio Riva), and on the way the main infotainment Italian programs argued into the concept of "technological failure" in the Thyssen-Krupp case (Marco Rangone).

Looking at television from an historical point of view it seems to be impossible to ignore the technological changes that, during the last three decades, so deeply altered its traditional pattern of agency. The ancient analogical broadcasting model – which has been the matrix of the mass communication paradigm – lost its constituent elements when digitalization allowed the broadcasters to control the access to the signal. The authority that television communication gained during the Sixties, coming to be considered the most powerful medium in the mass media system (due to the possibility to reach "all" the people at the same time), has been rapidly eroded by the Internet growth; and it is not currently (and will not be) compensated by the broadcasters involvement in it. Television studies and media studies still tend to ignore how this technological process historically worked on the definition of the television social authority in the media system.

Nevertheless it is still true that the current social discourse about the television social authority is today still strong enough to allow us – or better to allow those of us involved in public communication studies – to think that since "so many people" still watch television, the television may be still considered "by itself" a powerful and influential medium. But this is a way to look at the past before us. What we need to face the present change. The technological history of television tells us that the authority of television has changed,

rather than ended: this is why we need to find the way to consider together text and technology to understand how television socially worked and works.

***

Gabriel Gatti, Iñaki Martinez de Albéniz and Benjamín Tejerina (eds)

Tecnología, cultura experta e identidad en la sociedad del conocimiento

(Technology, Expert Culture and Identity in the Knowledge Society)

2010, Servicio Editorial de la Universidad del País Vasco, 275 pp.

Barbara Pentimalli

(University of Roma La Sapienza)

The book is a collection of contributions presented at the seminar "Knowledge Society, Identity and Social Change – The Material Supports of Identity", organised in 2005 at the University of País Vasco, Bilbao, by the CEIC (Centro de Estudios sobre la Identidad Colectiva) and the Department of Sociology, and it is a material proof that Actor-Network Theory (henceforth ANT) is becoming a very dynamic field of investigation in Spain, thanks to an increasing number of conferences and publications promoted by universities and research centres.

As the three editors state in the introduction, the volume aims to fill two gaps in social sciences focusing on how society and identity are shaped in the knowledge society, which is characterised by the pervasiveness of technology. The first gap is the lack of attention given to the impact of social scientists' representations on their analyses of society and identities (sociology is not purely descriptive but also performative). The second gap is related to the material dimension of the construction of identity, which is mediated by technologies, embedded in heterogeneous artefacts, rather than being the exclusive result of social construction, as a phenomenological perspective has claimed so far, privileging symbolic and intersubjective aspects. The book is organised into two sections, dedicated to these two points.

The first section, "Expert Knowledge and Identity", adopts a sociology of science perspective to point out the influence of scientific representation in the construction of identity and society, which are not static or given once for all, but must be regarded as dynamic, heterogeneous, fluid, porous, hybrid and malleable.

The first chapter, "The Problem of Materiality in Science and Technology Studies", is written by Miquel Domènech and Francisco Javier Tirado, members of the GESCIT (Grup d'Estudis Sociales de la Ciència i la Tecnologia), at the Department of Social Psychology of the Autònoma University of Barcelona. The authors have actively

contributed to the translation, diffusion and development of ANT in Spain (in 1998 they edited *Sociología simétrica*, the first book dedicated to ANT, with translations of works by Callon, Law and Latour). This chapter also shows how in Spain ANT is mainly rooted in a sociology of knowledge framework and moves from the techno-science field to update the traditional concepts of sociology, social psychology and anthropology (Castillo Sepúlveda 2011). The chapter is the theoretical manifesto of the book, proposing a new approach able to question the modern dualism and "a priori" distinction between nature and society, humans and artefacts. By recognising the contribution of Science and Technology Studies, especially of the socio-technical (Hughes 1987), SCOT (Social Construction Of Technology - Pinch and Bijker 1987) and ANT approaches, the authors refer to the principle of symmetry (Latour 1992) and to the postulate of heterogeneity (Law and Bijker 1992) to embrace a "third" perspective, able to overcome the tension between the social and the technological determinism. Adopting a symmetric approach means blurring the boundaries between social, material and natural, highlighting the heterogeneous work of engineering by which social, technical and material aspects intertwine with each other. When we consider agency as only human and social, we neglect the materiality of the world: that is, all the missing masses which are also provided with agency and are actively implicated in social practices. After this chapter, which clarifies the theoretical approach of the volume, we get to the heart of the research projects, which show how expert and scientific knowledge contribute to the configuration and naturalisation of society and identities.

The chapter by Pablo Marinis, "Expert Knowledge and its Power to Make and Unmake 'Society'", focuses on the role of a new professional agent, a new personification of expert knowledge, a 'new servant of the prince': that is, the symbolic analyst, whose identity is fluctuant, adaptable, and neither corresponds to the old ideal-typical figure of the intellectual or the academic nor to the social engineer of the Keynesian rational model. The symbolic analyst is a pragmatic expert, a counsellor with mobile and flexible institutional affiliations. He participates in government policies, is involved in think tank activities, or works for NGOs as a consultant, dealing with the development and management of contingent projects. He maps the territory of social action; creates new communities and identities (with the cold know-how of the expert who believes in the malleability of the world) as a "beneficiary of program", "neigh–bour", "consumer", who ideally participate in cosmopolitan governmental policies through committees and assemblies.

The chapter by Benjamín Tejerina, "Knowledge Society, Social Mobili-

sation and Collective Identity", focuses on how scientific knowledge turns into common sense when social movements acquire it and adapt it to their life-world. By giving voice to environmentalists, feminists and peace campaigners, Tejerina shows that social movements are a symbolic and material support for the construction and maintenance of identity. Their organizations and interaction systems work as spheres of socialisation and knowledge transmission. The techno-scientific debates sparked by their action challenge the dominant scientific knowledge and point out the necessity for activists to adopt a more professional profile. They should be able to transform their alternative practices into expert knowledge, and learn, enhance and use this expert knowledge (and convey it to the militants) to support their claims and their battles for social change, but they should also acquire the pragmatic knowledge to orient public policies.

The second section of the book, "Material Supports of Identity", collects a series of empirical studies carried out in a wide range of contexts and focused on a variety of topics (cultural heritage, social meaning of trash, gastronomy, mobile phones). These studies show the relevance of the technological mediation in the construction of identity, analysing the material supports where identities are embedded. Here, materiality is not regarded as a latent, inert and intrinsic quality of the object, or as an element that only emerges when the object 'resists' some specific use or social representation, or as a mere social construction.

The chapter by Antonio Ariño, "The Construction of Cultural Heritage" and its Paradoxes, presents two conflicting approaches to materiality – the immanent and the constructivist one – analysing how societies and communities attribute a patrimonial and aesthetic value to specific objects. Cultural heritage is generally associated with an intrinsic quality of the objects, which only experts can identify, or with a network activated by specific social groups and involving conflicts for the attribution of the status of "cultural heritage". Today, cultural heritage is related to the identity policies of an increasing number of communities. The society produces cultural and identity value, but it is the material construction of cultural heritage that makes identity more solid, stable and visible, and therefore socially representable. Cultural heritage creates four paradoxes: ontological (the rapid obsolescence of techno-scientific objects requires the conservation of a growing number of ordinary items, which are consequently devaluated), methodological (the meaning of the objects changes and turns them into fétiches and objects of consumption), pragmatic (the proliferation of patrimonial objects creates conflicts involving antique dealers, dealers of cultural goods and restitution-related issues) and ecological (the increasing number of tourists visiting cultural sites spoils art treasures and historical

or cultural relics) .

The chapter by Gabriel Gatti, "The Materiality of the Dark Side (Notes for a Sociology of Waste)", considers waste as a form of materiality opposed to that of cultural heritage. While the construction of cultural heritage is aimed at enhancing the aesthetic value of objects, bringing their materiality out and turning it into the symbol of an identity, waste materials question this materiality. Through a set of significant vignettes illustrating various forms of materiality (the debris from the Madrid train bombings; the Diogenes Syndrome, i.e. the compulsive hoarding of rubbish; the remains used by CSI investigators; the cartoneros), Gatti shows the meaning that social sciences have attributed to the waste of society: initially regarded as unclassified, anomic materials, it has later been considered as a danger to be controlled (but according to the Chicago School, marginal urban areas are consistent, meaningful and parallel worlds with their own social order and culture), and today it is the object of active development policies. As the volume of garbage grows, people become responsible for it: the rubbish is re-used (as in the case of recycling or second-hand shops) or transformed into energy. In the knowledge society, trash is more a product than a waste material: the more its volume increase, the less waste is considered as such. Our society provides rubbish with new uses and identities; it creates new experts and allows new ways of expression (such as forms of art where waste materials are exhibited in museums, taking on new meanings and new life).

Iñaki Martínez de Albemiz, in his chapter "Talking with Your Mouth Full. The Social as a Regime of (In)compatibility between Eating and Talking", shows that when we eat and talk simultaneously, words (discourse) and things (food) combine and collide with each other in our mouth. The fight against materiality here takes the form of a rule of etiquette ("don't talk with food in your mouth") stating the incompatibility between talking and eating. Socialisation implies the passage from nature to culture, from the uncontrolled oral expression to the articulated language. To make this transition possible, it was necessary to remove materiality, which was seen as an obstacle to the self-sufficient rationality of modernity, and create a greater distance between eating and talking. From the regimes of the past, where eating and talking were compatible (such as in the Christian Agape Feasts and Carnival Banquets), we move to other social regimes. In the bulimic regime of the capitalist bourgeois society, eating is regarded as a public ritual and is the background for a stylised sociality or a public-political dialogue (illustrated banquet), whereas in the private sphere the individual eats in compulsive way. The anorexic regime of the knowledge society is instead characterised by a theoretical curiosity about eating. In this society we do not talk as much about what

we eat as what we don't (scientific banquet). The combination of cooking and science, the so-called molecular gastronomy, the high-tech kitchens where everything is exhibited as if they were laboratories, the visibility of cooks on the media, and the introduction of new technologies and scientific methods in the cooking field, constitute the socio-technical framework of the knowledge society, where materiality emerges as a distinctive element.

After interviewing mobile users and observing their daily use of technology (in London, Madrid and Paris), Amparo Lasén, in "Affective Technologies - How Mobile Phones Contribute to the Shaping of Subjectivities and Identities", points out the necessity to explore how the relation with and the use of technology shapes and is shaped by users' identity. In our society, where sociality is related to multiple and transient identities in variegated groups, subjectivity emerges from and through a network of heterogeneous material and immaterial interactions. Mobile phones, as a part of this network, are an affective technology that allows us to share emotions with others, to construct and maintain social and affective ties, to manage and materialise the others' virtual absence and presence, to defer social encounters and take emotional distance from embarrassing situations, to personalise services (ring tones, screensavers), to record personal stories and keep track of significant past life events. The tactility of mobile phones embodies the relationship between the materiality of the body and the object (as when we play with our phone while waiting in a café, or when we hold it in our hands when we go jogging). While the design of mobile phone shapes our gestures, postures and code dressing, it also allows us to acquire new perceptive abilities. The possibility to be always reachable, to immediately communicate emotions and obtain information, creates addiction and attachment (Gomart and Hennion 1999; Jaureguiberry 2003). When we forget our mobile phone we feel anxious, isolated and incomplete; we are afraid of losing opportunities and we are worried because friends and family cannot contact us. Mobile phones mediate, transform and affect the meaning and the use of urban spaces and spatio-temporal habits (such as the habit of expressing feelings in public, which was once relegated to the private sphere). Users also delegate some choices to technical devices (it is the phone mnemonic capacity that decides when to remove the virtual presence of people from one's life by deleting a phone number)

The last chapter by Javier Izquierdo, "The Authentic False: Things inside People", shows the limits and opportunities created by socio-technical assemblages. By studying scientific, legal and political controversies, the author analyses the cognitive and the moral ability to attribute responsibility in the cases when human actions are carried out through the mediation of complex technological systems. Izquierdo

points out the absence of a jurisprudence about rights and obligations, credits and responsibilities attributed to these new techno-scientific bodies, or subject-machines, which are slowly and imperceptibly populating our societies and can easily escape human control.

In conclusion, we can agree with the authors that in a world where social actions and identities are performed and shaped through the use of an interconnected system of technological prosthesis, it is necessary to regard materiality (food, material waste, mobile phones) as the place of a new agency and to urge social sciences and anthropology to take all these assemblages of humans and non-humans as their object of analysis.

References

Castillo Sepúlveda, J. (2011) *Cartographies from the Margins: Outline of the Development and Application of Actor-Network Theory in Spain*, in "Tecnoscienza, Italian Journal of Science & Technology Studies", 2, (1), pp. 93-111.

Domenech, M. and Tirado, F. (1998) *Sociología simétrica. Ensayos sobre ciencia, tecnología y sociedad*, Barcelona, Gedisa.

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

Jaureguiberry, E. (1995) *Les branchés du portable*, Puf, Paris.

Latour, B. (1992) *Where are the Missing Masses? A Sociology of a Few Mundane Artefacts*, in W.E. Bijker, T.P. Hughes and T.J. Pinch, (eds), *The Social Construction of Technological Systems. New Directions in the Sociology and History of Technology*, Cambridge, MIT Press, pp. 225-258.

Law, J. and Bijker, W.E. (1992), *Postscript: Technology, Stability and Social Theory*, in W.E. Bijker and J. Law, (eds), *Shaping Technology/Building Society: Studies in Sociotechnical Change*, Cambridge, MIT Press, pp. 290-308.

Pinch, T.J. and Bijker W.E. (1987) *The Social Construction of Facts and Artefacts: Or How the Sociology of Science and the Sociology of Technology Might Benefit Each Other*, in W.E. Bijker, T.P. Hughes, T.J. Pinch, (eds), *The Social Construction of Technological Systems. New Directions in the Sociology and History of Technology*, Cambridge, MIT Press, pp. 17-50.

***

Dominique Vinck

Les Nanotechnologies

(Nanotechnologies)

2009, Le Cavalier Bleu, 127 pp.

Bernard Reber

(CNRS Research Center Meaning, Ethics, Society CERSES)

Written by the sociologist Dominique Vinck – professor of sociology of sciences and innovation at the Lausanne University, and former professor at the University Pierre Mendès-France – this very clear book introduces the reader to the controversies associated with nanotechnologies and tries to answer to these questions: What are the nanotechnologies? What are they for? Are the fears related to them

unfounded?

The book pretends not to be a book for scientific popularization of nanotechnologies but to treat what moves the "actors": problems of technological and scientific policy, market creation, regulation through law or ethical committees, forms of public debate and research, and risk strategy.

The problem of nanotechnologies' definitions runs throughout the book: they are controversies about their domain. Some of the chapters focus on different possible definitions of the nanotechnologies. According to the answer to the questions along the book, their ensemble could be broader or more precise.

Are they only objects which size is nanometres? If so, what are their sizes? Equal or inferior to 100 nanometres? Some definitions are based on their size, while others are based on their contents and their properties. Some are bottom-up (aggregation), while others are top-down (miniaturisation). The chemical reactivity of nanoparticules, for instance, is higher and reaches some quantum effects that change mechanical, optical, electrical and magnetic properties. Other definetions play with the possible applications of nanotechnologies or they answer to the question: Are they changing (revolutionizing) the science or not?

Possible applications and novelty are the two elements that could convince the investors and future users with possible new applications and problem solutions: nanomedicine, sustainable development, communi–cation, security or comfort. Despite some of these promises are closer to science fiction and far to be ready for uses, ethical controversies appear on possible uses or side effects that are welcome for some actors and frighten some others, who are speaking of "Yuck". Vinck introduces here a connection with the transhumanist movement that want to be "more than human" and to go over the biological (mental and physic) aspects of the contemporary human being (p. 62). Owing to this Vinck deals with the political issues related to nanotechnologies and the equilibrium between actors, suggesting an orientation to the future, defining some priorities and game rules (p. 73). Furthermore, chapter three gives some examples of actors fighting against nanodevelop-ment. Among them he mentions (p. 26) Pieces and Labor (Pièces et main d'oeuvre – PMO), a group based in Grenoble, nearby the famous Micro and Nanotechnologies Innovation Campus Minatec Center (http://www.minatec.org/en). Their name, PMO, plays with GMO (Genetically Modified Organism), and tries to make the link with these organisms that are not welcome in France and broadly in Europe.

Dominique Vinck' position on the relevance of this link is not very engaged: "surely, some elements of the GMO story could be found in the nanotechnologies case, but, very probably, the controversies will be more numerous and diverse" (p. 96).

According to the sociologist, the social questions connected with nanotechnologies are very important for their development. Paradoxically, only 0,4% of the expenses are dedicated to the study problems of such as risk assessment (p. 86) and "social inscription of nanotechnologies in society" (p. 122).

One of the main critical issues and a big challenge in this book of sociology of technologies concerned the study of the actors. As other sociologists of sciences and techno–logies, in fact, Vinck tries (p. 121) to "follow the actors": State, industrials, researchers, social groups concerned, regulatory institutions. Actors and their nanotechnologies' definitions are strictly related, since the latter are strategic for the allocation of resources (research subvention), for the legislation, the standardisation and for social acceptance (p. 20). However, the book does not follow the logic of different definitions and the benefice of them for each actor. Moreover, Dominique Vinck tries to give some possible definitions at different parts of the book (p. 13, 22, 27, 28).

Vinck mentions the Precautionary principle (p. 92) that plays an important role in this controversy. We can regret his too simplistic way to present it, letting only place for the fears of researchers and people, or the opposition of industry against the "discouragement towards the progress". It could have been very easy to mention the European definition from the Commission on the Precautionary Principle, a consensual text very complete and operational.

Although some references are given to ethical committees (p. 127), the ethical controversy – which is important both in the discourses of pro or con actors and on the ontological level (that is the reality of these new entities and their impacts on human live and environment) – is very weak.

Moreover, another simplification in the book is about the participative democracy, which is presented as the solution (p. 105). This form of democracy is distinct from the direct and the representative democracy. Following Callon and collegues (2001), Vinck proposes participative democracy as an alternative to representative and delegative democracy. Most of the experiments in Participative Technological Assessment (PTA), however, are not considered as an alternative even though they seem to be more consistent with representative democracy on specific issues. The direct democracy as well is not a system where the delegation of legislative power tends to disappear as Vinck writes, but there is also a form of complementarity. The problem with the PTA example is precisely to find the way to institutionalize PTA results and devices and to find their place in the ordinary politics. Indeed, very often they are only "one shot" experience, without strong assessment and with loss of proposals for the counselling in Parliament or in the appropriate institutional bodies.

In political sciences and philosophy the trend is now focused on deliberative democracy. The high epistemic challenge, recognized by Vinck throughout his book, needs high level of reflection and not only participation. These forums are not the panacea as he describes them, but I think they need as much expertise, know-how and assessment as the research on nanotechnologies. These participative devices could offer good public spaces to confront the different actors, following and defending different definitions of nanotechnologies. Among the requirements of a deliberative democracy, in fact, the main point is the obligation to present arguments. In one of the more prominent theory of the argument (Toulmin, 1958), an argument is composed of different steps. The first one is precisely to agree on data and definitions. It would certainly be a way to continue Vinck's book.

References

Callon, M., Lascoumes, P. and Barthe, Y. (2001) *Agir dans un monde incertain*, Seuil, Paris.

Toulmin, S.E. (1958) *The Uses of Argument*, Cambridge University Press, Cambridge.

***

Giuseppina Pellegrino

The Politics of Proximity. Mobility and Immobility in Practice

2011, Ashgate Publishing, 157 pp.

Andrés Felipe Valderrama Pineda

(Technical University of Denmark)

The Politics of Proximity, edited by Giuseppina Pellegrino, is one of the most salient contributions to the field of mobility studies and to sociology in general published in the last few years. The main reason for this is that it takes up seriously the question "why do we move so much?" This question is pertinent at a moment in history when two contradictory developments are happening: on the one hand, we have now all the technological development necessary to reduce corporeal travel and at the same time remain connected; on the other hand, the same technologies could support the old dream of living in the countryside and still be part of the urbanity, being permanently connected. However, never in history humans have travelled so much, and never in history humans have crammed so much into dense and expensive cities. Why does this happen? Why do we pay so much money to live in cities and travel in them and between them so often? In short, why do we take so much pain to be in proximity? This is the question for the politics of proximity that the various authors of this excellent compilation take up and

discuss.

The short and concise foreword by John Urry sets the stage for the book, while Giuseppina Pellegrino's accomplished introduction presents the main questions to be addressed in the book and its contributions. The main contributions are four: first, to take up and discuss "the inescapably political character of proximity"; second, the need to move ahead with (apply and discuss) John Urry's principles for a sociology of mobility and a mobile sociology; third, to perform analyses that take into account the "sociotechnical constitution of our everyday life"; and fourth, to focus on "practice as the situated and material locus of proximity and mobility".

Three parts constitute the body of the edited volume. The first is dedicated to the theoretical discussion of proximity and mobility. The other two present empirical contributions dealing with diverse methods: the second part focuses on issues of identity; the third on global firms and urban landscapes. For space reasons I will not discuss here all the contributions, but I will focus on some aspects that caught my attention.

Marchetti's contribution is a brilliant summary of Urry's theories and a useful discussion on the role of physical and social space. Engelbrekt presents the notion of attainable reach as a useful tool to discuss the politics of proximity. Lamentably, neither of these two excellent theoretical contributions is taken up in the empirical cases, nor in a much-missed summary conclusion to the book.

Buscema's ambitious attempt to bring together Marxists theories, Foucaultdian bio-politics and a superficial reference to social movements in Mexico is incomplete and even dangerous. It misses the opportunity to discuss one of the most salient aspects of the politics of mobility/immobility at a global scale: that for many communities and groups immobility is the result of confinement and aggression. They have not chosen to be immobile, but have been forced to do so because they are allowed to move only under certain conditions.

Gerharz elaborates how some of the inhabitants of Jaffna, in Sri Lanka, became immobile and disconnected during the war. She describes and discusses the various identity clashes occurring when a ceasefire was enforced and emigrants from the city could return after years of exile in various countries of North America and Europe. Unfortunately, she – as a Western anthropologist – chooses to be "stranged" by the way local traditional persons could not understand the Western customs appropriated by the emigrants. Gerharz missed the opportunity to discuss some of the Western perversions, though she reports some allusions to them, as for instance in the following remarkable description by a professor in Jaffna: "Before the ceasefire, Jaffna was a closed prison. Now it has become an open market". Shuffling the adjectives could provokingly inspire more symmetry:

open prison, closed market!

In stark contrast to the sufferings of people from Jaffna, in another contribution Gherardi discusses how middle and top managers suffer or enjoy the hyper-mobility required in their jobs. She ably shows how top managers regard their hyper-mobility as a resource and source of enjoyment, because they are able to establish homes in many places. Meanwhile, middle managers – who are also compelled to travel or re-settle, but have fewer resources – suffer the dislocations of multi-territoriality.

I would have loved to see the managers and the inhabitants of Jaffna treated in the same way as sources of knowledge. In the book, however, the latters are "stranged" while the formers are not. As mobilities studies grow in number of case studies and theoretical sophistication, it would be desirable the complete abandonment of the old Eurocentric mania of treating Western and non-Western peoples as ontologically different.

Finally, Paola Jirón's compelling analysis of mobility practices in Santiago de Chile is worthy of note. This is because it neatly deploys the mobility/proximity analytical spirit to show how people can be "confined in their mobility experiences" (and thus making the point that Buscema misses). These experiences are constituted by a set of choices in which socio-economic aspects play a role. However, the very soul of this contribution is to illustrate how those abstract and sometimes quantifiable social and economic aspects, become bounded in particular experiences of mobility along fixed routines. Just like in Jaffna during the war in Sri Lanka, in Chile Roberto, Francisco, Catalina and Rodrigo – the protagonists of Jirón's empirical account – are trapped in the open prisons of their mobile routines.

TECNOSCIENZA

Italian Journal of Science & Technology Studies

Vol. 3, Nr. 1, June 2012

Cover *Ospedale a mare,* by Andrea Napolitano

Essays / Saggi

Cartographies / Cartografie

Scenarios / Scenari

Book Reviews