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Fixed Man, Enhanced Man, Transformed Man

In the past, for a patient, any hospitalization would end in one of three ways: recovery, death or disability, also regarded as "little death". Such was the terrible destiny of a patient. Gradually, chronic diseases have slid into the first two options, thanks to the advent of medical diagnosis. The diagnosis surpassed the symptoms. An example is the definition of diabetes obtained through medical diagnosis: according to international norms, a person suffers from diabetes if his glycaemia is 700 mmol/L (126 mg/ dL) or more after 8 hours of fasting.

1.1. The Anthropocene

Paul J. Crutzen, winner of the Nobel Prize in Chemistry, coined the term "Anthropocene" to mark the epoch that started around 1800, in which men began altering the environment, starting with geology and biology. The changes are attributed to the actions of men upon themselves; hence, the term "Anthropos". One of these is the increase in life expectancy. Jacques Grinevald prefers the term "thermo-industrial society". This visible acceleration of history is at the origin of the new theories that we will tackle later on.

Man has always sought immortality, which remains a mere hypothesis. The industrialization of medicine will be carried out between two extremes:

– ethical medical practice and profit, the dreams of immortality and reality;

– public health policies and demagoguery.

It will also be carried out between:

– sciences and utopias;

– certain methods and sectarian or religious manipulations.

Currently, man-related technologies allow us to carry out three kinds of actions:

– the first is trying to "restore" patients after an accident or an age-related decreased performance. We will call these technologies "restorative technologies";

– the second has to do with an enhancement of performance. These technologies can be of different sorts: artificial intelligence, genetics, nanotechnologies, robotics, etc. It is possible to define, in each of these, a group that we will call "gerontechnology". Other ideas, which seemed to belong to sci-fi a few years ago, have now become a reality. These notions have, therefore, been recently brought up to date;

– finally, new technologies will be able to replace a deficient body, whether it is artificial hearts and pancreases starting to be implanted or exoskeletons that allow humans to walk again.

I prefer this distinction to the one often made between fixed man and enhanced man.

These new medical technologies follow on from the post-Pasteurian[1] trilogy based on the "hygiene-vaccines-antibiotics" triangle, which came to an end in the 1970s with the explosion of medical diagnosis. Between Pasteur's discovery and 1970, i.e. in less than 80 years, average life expectancy increased by 30 years. Hygiene was based on communication and education, and involved several myths. These must also be analyzed through communicational models in relation to health technologies. Philippe Breton, researcher at the CNRS, clearly highlighted the existence of these myths through his critique of Norbert Weiner's philosophy [BRE 99].

1 We refer to Louis Pasteur, who implemented vaccination.

The theory of the four humors was the keystone of medical philosophy for two centuries. According to this school of thought, it is first of all the blood produced by the liver and received by the heart that creates a sanguine, jovial and warm temperament. Then there is phlegm, also called lymph. Attached to the brain, it creates a phlegmatic temperament. The third humor is the yellow bile, also produced by the liver, which characterizes a choleric temperament, inclined to violence. The choleric temperament is said to give an impression of force and control. The last one is black bile, produced by the spleen, which is an expression of anxious or melancholic temperaments. These four humors correspond to the four elements: fire, air, earth, and water. These are ideas based on beliefs and ideologies which rely very little on scientific methods. So, nosography is the science that allows us to classify symptoms and pathologies. Doctors could avail themselves of "nosology" to treat.

For years, after the adoption of Pasteurian medicine, medicine was considered as a fight against agents external to humans. This point of view will only belong to a negligible part of the health field.

"The theme of a communication-centric society unknowingly takes on the responsibility for the utopic ideal of social change that had begun to express itself a century before. This idea of a communication utopia is therefore questionably positioned in the continuation of theories of political change which, in the 19th century, did not postulate either social exclusion or the reinforcement of the role played by the State, and which had started looking for other forms of social regulation […] that pivoted around technical progress and a new relation to machines, but also around another definition of Man and of the social bond" [BRE 97, p. 62]. This communication-centric society took off with diagnostic tools, such as radiography, born at the end of the 19th Century, and then chemistry, which makes blood tests possible. This technical progress and the notion of the external enemy helps us to forget that life takes each of us along the path of aging and death.

Abdel Omran [OMR 71] has defined three periods in medicine: one characterized by extremely deadly plagues [WER 99] and famines, one characterized by the drop in pandemics – when the "hygiene-vaccines-antibiotics" triangle was effective – and finally the new period characterized by degenerative or "societal" diseases. As a result, it would be possible to create a new man. These new diseases no longer have a single external cause listed by nosology. This way of diagnosing comes to an end at the moment

when thousands of new quantifiable forms of diagnosing appear. They no longer correspond to symptoms, but to hypothetical or future symptoms. Together with the appearance of these kinds of diagnoses, some technologies enable us to act directly on the different disabilities that human beings may be led to face. Hence, the birth of a new man: enhanced, android, bionic and even cyborg or hybrid.

1.2. A new man in the face of progress

The notion of progress is not self-evident. It is quite recent. As for the future, it is a process that establishes itself deceptively through keywords that we will group under the term "new man". So, a new man appears through the introduction of technologies performed on man that are described as follows. I have chosen to list these concepts alphabetically.

1.2.1. *Actroid (clones)*

The notion of cloning, so that we could have at our disposal a perfect double that can restart our life, had its hour of glory with the success of animal cloning. Currently, research is focusing more on Actroids, which are artificial "doubles" programmed on someone's appearance, expression, movement and even voice. Roboticists regard them as a solution for helping aged or disabled people.

1.2.2. *Android*

By Android, we mean anything with a human shape. The etymological definition includes anything that may look like a human. The use of this word presupposes that we are not referring to an actual human being.

1.2.3. *Bionic*

Bionic is a portmanteau formed from "biological" and "electronic". Bionics is the branch of science that investigates how a living being receives and processes signals to act. Its goal is to replicate this mechanism in machines and robots.

1.2.4. *Cyborg*

The term "Cyborg" designates a living organism made of organic matter and cybernetic elements (electrical circuits, mechanical systems). Cyborg is a portmanteau created from combining the words "cybernetic" and "organism".

1.2.5. *Enhanced man*

This concept defines those technologies that try to enhance human abilities beyond their natural biological evolution. In this context, the steps taken in terms of fixing, transforming and enhancing are notable. In contrast with this definition, there are also some rather old concepts, which are mainly the product of "sci-fi".

1.2.6. *Hybrid man*

The term hybrid man designates a new type of man, a mixture of two bodies combined into one. One of them is natural; the other is a product of technology. Experts are analyzing a point of reference that can vary from simple juxtaposition to perfect fusion. This term comes from classical Latin "ibrida", which means "bastard, mongrel". This implies, by analogy with agriculture, that the hybrid man cannot reproduce as such. He will only give birth to "simple" men, i.e. beings that do not possess all human qualities and functions.

The robot-based approach completely omits the evolutionary component of man that necessarily leads to death. Despite everything, the "robot" model remains the most prominent. On the other hand, "the immense set of degenerative diseases is hard to distinguish from the natural effects of aging, even if the age at which they develop varies in relation to the person" [PÉR 12, p. 51]. Deafness, cataracts, and mobility issues affect nearly everyone at a certain age. Prostheses have become a solution; hence, new technologies have been adapted to this situation.

1.2.7. *Hybris or hubris*

This is a very old perspective that dates back to the Greeks. It is a form of immoderate pretentiousness, an extreme kind of pride or arrogance made

possible by the possession of a piece of technology. This excessive pretentiousness often involves losing touch with reality. It is embodied in a form of overestimation of one's own competence or ability, particularly when the person displaying it is in a position of power. Certain types of technological equipment such as limb prostheses or pacemakers can now put men in positions of this kind. The example of the Paralympic runner who wanted to compete against Olympic runners illustrates this point.

"Google Glass" – glasses that allow us to simultaneously record and display images right before our eyes – is part of these "hybristic" developments.

This list is mentioned merely to create a debate, since we do not think that the above-mentioned forms of humans will develop. On the other hand, the bet on human evolution as enabled by technology is certainly going to be won.

1.3. Fundamental technologies

These technologies are mainly used for aged or non-autonomous people.

1.3.1. *Gerontechnology*

Many geriatricians are convinced that technology can compensate those deficiencies that affect people over a lifetime. When aging, our sight as well as our hearing decrease, but diseases and accidents can also lead to disabilities. These kinds of technologies are called gerontechnology. The two questions that crop up in relation to the development of these technologies are the following:

– how to turn the process of aging into a potential source of economic profit?

– what risks do they involve?

The development of these technologies is most likely to go separate ways and to require the presence of several actors with different profiles and competences. As is the case for drug therapy, useful technologies rely on whether or not they bring actual benefits.

Providers have to show that technologies help humans. However, the mere fact that it is not (and never will be) social security that buys tablets and mobile phones, but the people affected themselves, raises the problem of the quality of this offer.

1.3.2. *The robolution*

Robolution is a term coined by Bruno Bonell, who thinks that rather than universal robots, there will be a series of robots and intelligent units able to facilitate household life.

The term "robolution" is proposed to designate a series of robots and intelligent units. Among these, we should mention exoskeletons, which help carrying heavy weights or hemiplegic people, an interactive therapeutic baby seal for children or patients suffering from Alzheimer's disease, and service robots for disabled people. Following this logic, the Aldebaran Robotics society came up with an android robot, Nao, that has sold several thousand units since 2008. This kind of robot can tell stories, answer questions, etc. This approach goes hand in hand with the Internet of Things, while also remaining a potential competitor.

The impact of this robolution has been strengthened by the emergence of 3D printers. So, it is possible to fabricate prosthetic arms adaptable to each individual starting from a public and free project. As proof of how patients are involved in the advent of the industrialization of health, an association called E-Nable was set up to link people who have lost limbs with users of 3D printers able to customize the project.[2] "Maxence", a 6-year-old from Isère, was one of the first French people to benefit from this approach.

1.3.3. *Anthropotechnics*

"Anthropotechnics appears to be a many-sided service of human biological transformation for purposes including performance, identity quest, freedom, standardization, etc.".

2 The website of this association is http://enablingthefuture.org/.

This definition, proposed by Jérôme Goffette, refers to a list of technologies and approaches: aesthetic transformations, physical doping, mental doping, humor modulation, control over sexuality, cyborgization, atypical assisted reproductions, mechanical ventilation, walking assistance, implants to see, listen, or hear, etc.

1.3.4. *Nanorobotics or fog utility technology*

The nanobots proposed by Kurzweil are microbots, the first of which are emerging from their experimental stage. They are swallowable capsules that examine the digestive system. However, this term can also refer to robots that roam all over our blood system and cleanse our blood or repair tissues.

The foglets are nanobots that can lie side by side and create objects useful for humans.

1.3.5. *Diagnostic technology*

Diagnostic technologies saw their hour of glory with the advent of chronic diseases. It is the diagnosis that makes the diseases chronic, and some of them are asymptomatic. They have no single and identifiable external cause. They include cancer, cardiovascular diseases, neurodegenerative diseases such as Alzheimer's and Parkinson's and, more recently, bone diseases.

The DMS (Diagnostic Medical System) society, based in Montpellier, has developed a DXA osteodensitometry with 3D reconstruction, which will allow us to diagnose osteoporosis, a disease that leads to fractures for one woman in three and one man in five from their 50s onwards. These tools have often provided diagnoses that the medical staff did not know how to handle.

Most often, it is, therefore, the diagnosis that makes the disease chronic.

Chlamydia is one of these diseases. In Ireland, for instance, a study showed that 80% of women and 50% of men infected with Chlamydia show no symptoms. Chlamydia is an infection caused by the Chlamydia trachomatis bacterium. It even seems that we can be infected more than once in our lifetime. It is an asymptomatic disease. People get infected without realizing it, since the disease has no symptoms, and can, therefore, in turn transmit the disease.

If symptoms are detected, they appear 2 to 5 weeks after the transmission. They are as follows: vaginal discharges or bleeding after sexual intercourse and between vaginal menstruations, discharge from the penis or the anus, stinging or burning when urinating, pains in the lower abdomen or during intercourse. The advice is to see a GP.

Chlamydia, when untreated, can have dire consequences on women's health: infertility, ectopic pregnancy (in the Fallopian tubes), and chronic pains in the lower abdomen. In men, it can lead to chronic prostate infection (prostatitis), one strain of which is caused by this bacterium. It also increases the risk of catching or transmitting HIV, as well as the risk of developing cancer.

There is no vaccine against chlamydia and only "sexual protection" remains effective against it. Condoms are, therefore, the best kind of protection. Pfizer's Azithromycin can treat chlamydia effectively.

This bacterium is sexually transmitted but it can also spread "orally", although in this case the risk of transmission is lower.

Box 1.1. *Chlamydia, a diagnostic kind of disease*

Sarcopenia (a weakening of the muscles), described in 1989 by Irwen Rosenberg, is another example of the impact of medical diagnosis. It inevitably leads to death but it represents the great progress made by medical diagnosis, since the diagnosis allows us to follow its development.

1.3.6. *Genetics*

Genetics is certainly the kind of technology that will pave the way for the industrialization of health. Genetic diseases are linked to the malfunctioning of a gene and to other factors that are more or less known. If they are hereditary diseases, the transmission takes place whenever a part of the parent's genome is transmitted to the infant during sexual reproduction.

However, external factors such as radioactivity or chemicals can lead to the same situation. A genetic disease can be described as an anomaly or, in scientific terms, the mutation of a gene or of an allele. This situation will result in the production of an abnormal protein. This protein can lead to different consequences in relation to diseases that can appear at birth or later on, it can lead to the development of cancer, etc. Genetics on its own has shown its limitations and researchers have joined it with epigenetics.

Organizations such as Orphanet[3], the portal for rare diseases and orphan drugs, or the *Online Mendelian Inheritance in Man* (OMIM) of Baltimore's Johns Hopkins University, catalog genetic diseases and the genes associated with them. This list is more or less updated on important medical portals and even on Wikipedia.

In 2012, experts estimated the number of known genetic diseases at 10,000, and reportedly discover five new ones each week.

1.4. Debates on technologies and men

These debates have appeared in response to certain movements promoting new kind of man greatly enhanced by technologies. The creation of such a paradigm omits, and sometimes effaces, the natural evolution that leads to death.

1.4.1. *Transhumanism*

Transhumanism is a philosophical doctrine that defines itself as a cultural and intellectual movement. It analyzes, advocates and encourages the use of certain technologies to enhance the human condition, both physically and mentally, beyond the constraints of natural biological evolution.

Transhumanism is governed by an international association, the WTA (World Transhumanist Association), founded in 1998 by philosophers Nick Bostrom and David Pearce. Transhumanism has branches in numerous countries. The association called >H has recently adopted the abbreviated form H+. The former website of the association suddenly shut down in 2009. Currently it is possible to find information on the "humanity plus" website. It

3 Its website is http://www.orpha.net.

is very interesting to note that several countries have developed research centers and even founded universities in relation to this topic, whereas others have dismissed these approaches.

1.4.2. *Replacement anthropotechnics*

These new notions of man lead researchers to question the boundary between replacement and enhancement; whether because the idea itself of transformation is out of the question, or because it is considered unethical, or again because it is seen as something that can potentially be reduced to either possibility (replacement or enhancement).

According to philosopher Jérôme Goffette, current medicine is a form of anthropotechnics that attempts to meet the two needs of replacement and enhancement. Therefore, this difference would not exist for different reasons. He goes even further and writes that "several contemporary 'medical' practices have dismissed treatment and the fight against diseases in order to 'enhance' man". Let us point out, however, that doctors distinguish between the two approaches in their practices. In spite of everything, the philosopher sees two breaking points taking shape: the first in relation to the cry for help against death and suffering, and the second in relation to the medical duty to assist. Second argument: we should then have a clear notion of normality. Finally, it is impossible to make a precise distinction between replacement and enhancement technologies and, besides, over the course of history, there has always been a shift from replacement technology towards enhancement technology.

The debate about this new man refers to the notion of "assisted man", which involves the risk that people may no longer be able to carry out the tasks they are expected to.

1.4.3. *Algeny*

Algeny is a term used and proposed by Jeremy Rifkin, who sees a new form of humanity in these new technologies: a sort of biological plasticity that might lead mankind towards a new era.

1.5. World, *mondialisation*[4] and health

If the idea of industrialization is often linked to that of an assembly-line work, we have to point out that this last element has gained all of its strength in the process of *mondialisation*. Before tackling this latter development, we deem it necessary to think about the meaning and use of the word "world". It is actually a catch-all term, with the potential to hide our contradictions as well as our ambiguities. It becomes important to analyze its framework in relation to the health industry.

1.5.1. *A tool for measuring speed*

The first connotation of the term – in the sense "around the world" – turns it into a tool for measuring distance and speed, as such books as Jules Verne's *Around the World in Eighty Days* reveal. This inevitably leads us to the notion of rapidity of information diffusion. Thanks to networks, a piece of information can be propagated around the world in record time.

It is, therefore, possible, at least at a first stage, to conceive a *mondialisation* of the offer of treatment that allows patients to be treated more promptly.

A second approach consists of the dynamic view of human beings and dispositions, characterized by unstable equilibria and elements of the dynamics of diffusion. The asymptomatic carrier defined by Robert Koch illustrates this point. Microorganisms are inside the human being, but they are not active yet.

1.5.2. *A better world*

The term "world" is also used to mean "the other world", a better world. The myths about IT according to which – as Jacques Perriault underlines – there is a positive *mondialisation* certainly rely on this statement. Shouldn't modern medicine lead to a better world? In this case, epistemology and the history of health have described a healthy being that is simultaneously an

4 The differences between *mondialisation*, *mondialité* and *globalization* will be pointed out in the next few sections, where a definition for each of these terms will also be provided. *Mondialisation* and *mondialité* have not been translated since English lacks any suitable equivalent able to convey the same meaning.

ideal and a purpose of medicine. This ontological approach is characterized by an increase in the size of the ontologies. Therefore, the same biochemical diagnosis – the amount of sugar – has led to the description of two very different diseases: type 1 and type 2 diabetes. This ontological evolution also presents itself in terms of multiplication. Therefore, there are several hundred medical ontologies with specific uses.

1.5.3. *A world outside humans*

The world is defined as "that which is not part of oneself", which consequently corresponds to everyone else. To go into town means to go out into the world; this is how the world defines simultaneously wholeness and difference. The world is, therefore, considered a boundary as well as a frontier. It should tend to be widening with the development of technological progress. This is the theory developed by François Perroux: "Science, technology, and industry widen the circle of contacts and the circle of communications between beings and their groups" [PER 60, p. 68]. We should not forget that our modern technologies will change the world. Just think of what would become of wheelchair access policies if exoskeletons, intelligent prostheses and robots were to become widespread. This domination of "the automated man" is characterized by mechanical therapeutic actions. Mechanics, together with electronics, acts to fight diseases or disabilities or to eliminate their effects.

1.6. *Mondialisation*, globalization and *mondialité*

Globalization and *mondialité* are the two main words used in relation to the dynamics of industrialization.

Mondialisation versus globalization

According to Marc Augé:

> "The term *mondialisation* refers to two kinds of realities: on one hand, what we call globalization, which corresponds to the spreading of the so-called liberal market and of ICT networks all over the world; on the other hand, what we may call planetary awareness or planetarization, which itself consists of two aspects".

Studying modern medicine certainly involves the study of these technological networks. They are even the most tangible representations of this *mondialisation*. Planetary awareness, in this case, is twofold. The first component can be qualified as ecological:

> "Every day we are aware of living on the same fragile and threatened planet, infinitely small in an infinitely large universe".

Health conditions vary from one geographical area to another, but medical technologies are spreading globally and becoming reliant on technologies, if only on testing technologies and medical imaging. Therefore, this allows a Frenchman or a German to have their teeth fixed in Hungary. Thus, we will have to imagine the breakdown of these technological tools and find a solution to this situation. The second form of awareness is social:

> "We are also aware of the ever-growing gap between the richest and the poorest, and of the parallel gap between knowledge and ignorance".

What to think of this planetary ecological or social awareness that is never put into action? The difference in the price of medications, even despite industrial production, illustrates this point. The result is that:

> "The term 'globalization' refers to the existence of a global liberal market – or deemed such – and of a worldwide technological network, to which, however, a large number of people have no access yet. The global world is then a network-centric world, a system defined by spatial and also economic, technological, and political parameters" [AUG 08, p. 41].

The key factor of this globalization is the necessary conformity to the least expensive or best-performing technical solutions. These have the advantage of allowing access to healthcare in the poorest countries. Still, industrialists have to agree to lower the prices of medications and supply for low-income countries.

1.6.1. *The notion of mondialité*

In relation to this conjunction of globalization and *mondialisation*, Philippe Zarifian chooses the term *mondialité*. "*Mondialité* can be defined

straight away and quite simply as the human sense of belonging to the same world if, by 'world', we mean the planet Earth". He finds it strange that this sense of belonging is seldom mentioned by humans [ZAR 04, p. 7].

This notion of belonging to a world, which Zarifian at first qualifies as the entirety of our planet, introduces a new problem, if we take into account the presence of "sub-worlds" or of the world communities to which an individual belongs. Why shouldn't a man or a woman from a certain country benefit from the medical progress carried out by another? Will those who are excluded from healthcare systems be left out on a merely financial basis, or will industrialization lower the costs to such an extent that all forms of medicine will be available to everyone? This approach leads us to believe that, with the advent of this industrialization, the development of a form of medical tourism is inevitable. The *santacteur* we previously mentioned will find out where that is taking place and travel there.

Another medical approach to this concept has to do with the global diffusion of viruses and bacteria like H1N1 influenza or Severe Acute Respiratory Syndrome (SARS). SARS is an infectious pulmonary disease (pneumonia) caused by the SARS-CoV[5] virus, which literally took off with one of the sources in Hong Kong to infect people from France to Canada. On the other hand, a recent and geographically closer virus, the MERS-CoV[6], has spread to a lesser extent in the Persian Gulf countries ever since its appearance.

1.7. Globalization, internationalization, localization

At this stage, it seems important to focus on the case of technicians and engineers. Software building experts propose three approaches.

1.7.1. *Some additional definitions*

Globalization consists of creating a "global experience" of software, which, therefore, becomes the point of reference. This process has been widely used by companies such as Microsoft. It is often based on education and information diffused effectively, discretely, indirectly and targeted in relation to the use of the product.

5 Severe Acute Respiratory Syndrome Corona Virus.
6 Middle East Respiratory Syndrome Corona Virus.

In the medical field, globalization was essentially controlled by the WHO, which diffused information about risks. The industrialization of health will definitely lead to the appearance of companies acting this way.

Internationalization consists of creating a framework which is as neutral as possible and adapting it to each local situation. This approach has been used for the websites of multinational companies.

Localization consists in building an interface with versions that can be adapted to different cultures. Educational software publishers have focused on this kind of approach. Since each country has its own specific notions of education, software can seem to vary widely from one area to the other but it is actually built on the same foundations.

The problem consists in understanding the kind of shape that the industrialized medicine of the future will take. We will not consider this debate any longer, which we would not consider too productive given the current developments in terms of health. Let us remark right away that such systems as radiography, CT scans, and MRI are related to globalization.

1.7.2. *Types of mondialisation*

What does ICT contribute when faced with the pressure of *mondialisation*? Two answers seem possible: the destructive creation that begets a new form of more industrial society and, on the other hand, a compulsory connection to networks.

At the time of Jean Voge [VOG 63] and Abraham Moles [MOL 71], cycles constituted the only model. Economists were discussing Kondratiev waves (1992) of destructive creation. Is *mondialisation* the enemy to fight, the danger or the threat that challenges this model? The answer can only be affirmative when we consider the list of works published on this topic. On the other hand, no sign or reading leads us to think that the object of our study generates a kind of particular *mondialisation* that has the potential to create a new society. This approach will constitute the basis for our conclusion. We will try to determine the features of this society in which medicine will be more industrial.

Logically, we should pay attention to the other kinds of cycles defined by economists, such as the Kitchin cycle (3–4 years), the Juglar cycle (8–10

years), the Kuznets cycle (15–25 years) and the Kondratiev wave (40–60 years). It is possible to claim that the numerous experiments conducted in terms of telemedicine and e-health fall within a Kitchin cycle and consequently do not lead to lasting solutions. The Juglar cycle is now the renewal cycle of large healthcare equipment. We should point out that this has become 7 years shorter, which corresponds to the period needed to pay off the heavy equipment necessary for radiography, CT scans or MRI.

With MRI and the explosion of diagnostic methods, we can see, as far as our topic is concerned, the emergence of a new Kondratiev wave. It is the end of the "penicillin era". The problem we face at this stage consists of the link between the era of degenerative diseases, determined by Abdel Omran, and the rise of diagnostic technologies.

1.7.3. *Technosciences*

Alain Gras [GRA 97] considers *mondialisation* as an obligation to get connected. Technosciences constantly require the individual to get connected to an increasing number of technological networks, under which other, kinds of networks sometimes lie hidden. The individual is incorporated in infrastructures, which, however, have a flaw. Technical choices are made in mysterious and often unknown places. Sometimes it is a matter of safeguarding the structure of the project. In other cases, we have to do with a form of power obsession stemming from certain people. Finally, we have to do with new forms of power: a power upon the body that we will call "biopower". The individual is condemned to connect to the network, otherwise he will be condemned [GRA 97]. In other words, in order to benefit from medical progress, connection will become essential to data results of every kind, which come from publications as numerous as they are contradictory.

1.7.4. *Evidence-based medicine*

Current medical teaching uses the concept of Evidence Based Medicine (EBM), namely medicine based on proofs. These proofs are certainly a product of the *mondialisation* of medicine and are published in renowned journals. This approach requires four points of verification for any kind of medical action: the existence of experimental data, the building of theoretical

support, a statistical proof and the presence of an authority that validates all of these.

EBM, as it is being practiced now, has four consequences. The first is the confusion between risk factors, data and the disease, which is certainly the most insidious and veiled. The second consists in a rapid shift from the correlations found through studies to actual causal links. The result is that medicine will treat patients who are not ill and, conversely, that doctors can overlook patients in need. Finally, the success of a drug-based and technical solution is favored. This can potentially entail overmedication, overtreatment and unnecessary operations, all actions that healthcare professionals perform in good faith. Lastly, this approach overestimates figures and underestimates clinical observation.

The industrialization of health will have to involve EBM, but under no circumstances will this be the only basis it will rely on.

1.7.5. *The shortage system*

Medicine often works in "shortage management" mode, which is at the core of technical progress. *Mondialisation* has added a new dimension.

The possibility of performing transplants to treat patients has to be faced with the limited number of donors. It has given rise to the development of new medications able to widen the field of possible transplants. These same limits drive the development of artificial organs: initially external machines such as dialysis units, with the hope of turning them into intra-corporal devices, like artificial hearts.

The shift from a mundialized production to local needs causes problems. The *mondialisation* of pharmaceutical production is an example we may use as a starting point to understand the risks entailed within the process of *mondialisation*.

The report we have drawn up is standard in the industrial field, but raises problems in the health industry, where we must prevent patients from lacking the availability of medication. We have to note that presently around 60–80% of all active substances destined for the dispensaries of pharmacies pass through the hands of wholesalers and distributors. As for shortages, the figures

announced by the Academy of Pharmacy are as follows. Every day there is a 5% shortage of all medications ordered, and 50% of the shortages last more than 4 days. The table below is in line with the position of the Academy of Pharmacy [ACA 13].

Type of shortage	*Solutions*
Situations of shortage or discontinuation in the production of certain active substances still useful in terms of public health	To draw a list of the active substances that have become of public domain, the shortage of which could lead to public health problems To make European authorities regularly inventory shortage risks and relocation needs
Shortages due to the lack of quality of imported raw substances	To set up a European index of these substances and to make it public to those authorized to launch them on the market To exchange on a European level, the results of the inspections conducted in non-member countries, and to find ways to carry them out
Drug shortages due to the discontinuation in the production of certain low-return pharmaceutical substances	To implement a way of notifying the authorities To revalue prices in order to favor the production To organize a way of transferring the production on to a public pharmaceutical organization
Drug stock shortages linked to production-related quality flaws and to the policy conducted in terms of production – especially of certain kinds of medications – or industrial stock management	To shift from an information-centric culture to a dialogue-based one To introduce risk assessment methods To guarantee supply by bettering stock and production management
Supply shortages linked to the distribution network	To reconsider the pertinence of stock management rules To monitor the distributors' re-exports

Difficulties related to the public tender system (hospitals)	To reflect on public powers in order to avoid the appearance of excessive invitations to tender To integrate clauses concerning total quality management and supply security into the criteria regulating invitations to tender
Shortage of specific drugs (orphan, pediatric, radiopharmaceutical drugs)	To think specifically about the management of orphan diseases that require active ingredients of pharmaceutical standard and to encourage the European production of these ingredients To provide hospital pharmacies with raw substances of pharmaceutical standards To start thinking about the future of the production of radioisotopes for medical purposes
Specific pharmacy-related difficulties	To implement access to information concerning shortages and availability To set up exchange systems

Table 1.1. *Causes of shortages (medications)*

1.7.6. *Life Meccano*

This approach was suggested in the 1990s. It is mainly known thanks to François Jacob's speech delivered for his reception at the French Academy.

> "All the creatures that inhabit this earth, whatever their environment, size, or means of subsistence – snail, lobster, fly, giraffe or human being – all turn out to be made from molecules that are more or less identical.
>
> And likewise, from yeast to humans, there are groups of closely related molecules that serve to assure universal life functions, such as cell division or signaling between the cell membrane and the nucleus (…). It appears, then, that all life

> forms are constructed with the same modules, distributed in different ways".

This sentence propels science into the search for these life "atoms". It would therefore be sufficient to link diseases to the presence of this or that element.

"The living world is a sort of combinatorial system composed of a finite number of parts, like the product of a gigantic Meccano set; it is the result of a ceaseless process of evolutionary tinkering." Here lie the foundations of a whole theory of "human programming", based on the same principles of computer programming.

Nowadays, this mechanistic notion of medicine seems too simplistic.