Materiality in the digital age

The human being connected to matter

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(a preliminary translation of an extract from the original book)

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Introduction

This work compares the development of materials (hybridization) to the digital evolution (hybridization of reality with digital elements) with the aim of reinventing another connection to materiality. It leads to pose a challenge about the result of surpassing structural logic in rational approach of matter. This contemporary outlook on materiality refers to intangible phenomena which we have to observe not as matter disappearance but as a work on a different matter. Materiality is in the grip of invisible matter (digital), and social relationships are developed today under the influence of numerous means of production for digital information via networks.

What is matter nowadays

Latin word *materia* equates Greek word *ὕλε* (wood, stuff), and it is made of the same root as *mater* (mother) (Ernout & Meillet, 1959). Matter is the common matrix where many objects of the world are engendered. Ancient Greek philosophers got it mixed up with nature. Matter evokes which a thing is made of, which the human work can turn into, which is the medium of change. According to Aristotle, matter is "of which it is made" for each thing. Plato uses metaphors as repository, childminder, or mother to define matter. Historically, matter was the strong ligneous part of wood, the generative part, very different from bark and leaves. It is constantly changing also. This substantive finally refers to all substrates.

Matter is all we touch and has body and shape. This is the stuff of which bodies are made, perceived by senses, and whose basic features are expanse and mass. The amount of stuff contained in a body depends on its density and its volume. People allude to divisibility, inertia, motion, disintegration, change of matter. There are some general classes:

- raw matter / organized matter;

- inanimate matter / living (or animated) matter;

- organic matter / inorganic matter;

- animal / vegetable / mineral matter

As considered in the story of philosophy, the notion of matter moves on from a mystic understanding to a scientific understanding, but it has also its place in talks on art. Thanks to Georg Wilhelm Friedrich Hegel, the philosophy of art was solicitous on its release of physical aspects during 19th Century. Thanks to Albert Einstein, the concepts of matter and energy match each other on 20th Century, mass being only an intense concentration of stuff. The theory of restricted relativity had joined space and time together in a same entity, the space-time (continuum). The basic equation of general relativity enables to confirm that matter, energy and space-time are three equivalent forms of a same reality.

So, the edifice of classical physics that controls our daily life is strongly reconsidered by outbreak of unexpected links between matter, space and time on a microscopic scale.

Matter and energy

Aristotle did never talk about work on a modern meaning, and Galileo did not really talk about energy. In Aristotle's Metaphysics, raw matter as universal stuff is the power of opposites (*dynamis*). Action (*energeia*) is the operation by means of which raw matter takes

the state of entelechy (*entelekeia*), or stuff becomes real being, in other words. This theory is closely linked to the four principles of Aristotle's Metaphysics. Indeed if power is identical to material principle, action results from cooperation of two other principles, the *efficient* cause and the *final* cause, which applying in matter determine it and give it shape.

The development of a suitable vocabulary was a crucial stage to get the physical concept of energy: this concept began only solidly built on the middle of 19th Century. The concept of energy is basic for studying the phenomena of matter's transformation, such as chemistry and metallurgy, and mechanic transmission, which form the basis of industrial revolution. Any change implies that a power takes action. So motion implies, as every change of state, to pass from potentiality to reality. On the contrary, there are today numerous technologies, digital interfaces, to pass from real to virtual.

The mind succeeds in explaining light, attraction, electricity, the notion of pure energy by turns, until modern science will be tempted to reduce the olden sacrosanct matter to be only an appearance of this energy, to take into account just a localization of this energy among its elementary particle (electron) , in a usually very small space (Huyghe, 1955).

What is materiality?

Materiality appears to be defined in close connection to matter and materials, in contrast to them, and it refers continuously to them. Material would be in the range of feeling, of sensitivity, while materiality would refer to emotion, way of thinking. But when we look closely at this concept, the word "materiality" seems to have several meanings. It is used in physical terms (mass) as well as in immaterial terms (intangible); in visible terms (thing) as well as in invisible (atmosphere). Materiality can be evoked in structural terms (assembly), even representative (information). It is within the realm of sensitivity as well as culture. Materiality comes under philosophy as well as sociology, under engineering as well as art.

The question of materiality tackles the story of sciences and techniques, the story of architecture, but the story of arts too. Materiality asks interactions between shape and matter; light is a material in its own right in architecture. The founding principles of architecture are still discussed, taking preference sometimes over structure, or frame, sometimes over texture, woven surfaces, being torn between strong building (shelter) and atmosphere, environment.

Many architects of the 20th Century developed poetry of building and philosophy of materiality which contemporary culture often disregarded, paying almost exclusively attention to the notion of space. The idea of space takes shape today: we regard it rather as an environment of changing atmospheres which explains concern for materiality of duration, of time, of moment.

According to Whitehead, apprehension involves feeling and perception. All that exists is enjoying oneself, experience. Apprehension means that social / material, micro / macro, human, non-human, cognitive / emotional meet and merge (Whitehead, 1929). In fact when we evoke things and objects, we regard them as non-human entities that come to life through various circumstances, related to human beings or other things. Daily activities weave links with materiality, sensoriality, affect and atmosphere of home. Materiality is a process, a flow and connections, as the authors talk about it in the book *Digital Materialities* (Pink, Ardèvol & Lanzeni, 2016). This work is written by professionals from very various fields, living in different continents. Thus Elisenda Ardèval is associated professor in social anthropology at University of Catalonia, Paul Dourish is anthropologist and professor of Informatics at the University of California, Irvine; while Sarah Pink is professor of design and media ethnography at RMIT (*Royal Melbourne Institute of Technology*), in Australia. They are at

research crossroads in design and digital: they experiment a world where digital and material entities are entangled elements of the same processes. Their common work show us how knowledges combination increase our capacity to design the future while imagining new digital materialities.

This new vision of materiality inverts the usual approach which regards firstly the development of shape, then examines its dimensional and structural reality. A contemporary approach of materiality brings us to wonder about result of surpassing structural logic in Cartesian approach of matter (coherence). This new materiality refers to phenomena in the range of intangibility which we have to observe not as matter disappearance but as a work on "another" matter. Materiality is in the grip of invisible matter (digital).

The word "materiality" is very used in Anglo-Saxon world of finance and it corresponds to the idea of relevance concerning digital data. This concept is pervasive in the community of financial affairs, of world controllers: it supplies indicators to financial analysts in order to position themselves for the financial situation of company in a clear and reliable way. Formal obligation duties of company public relations create date inflation (accounting, business in progress, value creation, governance and sustainable development). This does not help understanding along. A very great amount of data can consequently lead to a loss of meaning because a few people are able to analyze them properly. So work around this concept of materiality involves selecting information in order to retain only essential and relevant of which. Many companies publish materiality matrix in their report of sustainable development. It depicts graphically results of their materiality analysis according to advices of *International Integrated Reporting Council* (IIRC) and *Global Reporting Initiative* (GRI) (...). This materiality is both general concept and legal concept. "Material information" can reasonably affect viewpoint of a fairly consistent group, named "stakeholders", who adopts a rational behaviour. However people have to be cautious with numbers because societal and social issues are often firstly qualitative: so this materiality is based on ability of digital tools to convey reality. It is decorrelated from physical matter and uses contemporary entities (digital tools, data, networks). It tries to make tangible what is not certainly tangible purposefully to rationality.

Materiality and social relationships

Every time a new materiality appears, it changes social, industrial and cultural relationships (Dagognet, 1985). Now we are daily surrounded by "products". Standardization and normalization are strengthened. New design and functionalism enable suitable, miscellaneous and complex shapes, while a social awareness of thing arises with ecology. These new dynamics, sometimes hardly compatible, influence design and sustainability of products. Modern anthropocentrism often put technical reason above reality. However people have to renounce transform reality into pure object of use and domination if they want to spare matter consumption for future generations.

In the digital age of industry 4.0, we praise dematerialized products (digital services) because they consume a little matter. But can we confirm they are really sustainable (ecologic)?

According to Karl Marx, the production way of material life conditions generally the process of social, political and intellectual life (Marx, 1845). Production of ideas and representations is the "language of real life": humans are originators of it. The things of "sensitive certainty" are only given by social development, industry, etc.

Therefore through Marx a new materiality emerged, the one of social relationships, exchanges and representations. He tried to draw up a materialism of representation by studying exchange

phenomena, question of value formation, as well as concern of social consciousness. His thought paved the way for an unprecedented theory of knowledge, encouraging even to the redefinition of matter concept. This materiality of social relationships and cultural frameworks is today under the influence of numerous means of production and broadcast of digital information via networks. But does not the conquest of self-sufficiency via internet encourage to standardization of exchanges after all?

Delivering intelligence to matter

Matter is which exists independently of humans, and can receive the mark of their mind to make a thing using it. According to Descartes, mind is the subject of knowledge, the clever principle. Human thought involves being able to process objective structures and make them complex. More and more, we transmit to matter our own functions like memory, data storage, artificial intelligence. We deliver even our sensitivity to it, by using sensors able to record our living data. Our materials foster communication, conduction, preservation of signs as well as inscription by electromagnetic coding. Then cultural life leans on material resources and their interweaving grows.

Since the origins of humankind, materials keep collaborate with human being. People operated firstly their hardness or their malleability, then their imperishability. Today we attribute to them new qualities in the range of cleverness: sensitivity, memorization. We design new, flexible and interactive materials whose action spreads well beyond their own physical boundaries, mixing stuff and intangible (digital) services.

The technological paradox of the 21st Century is that humans do not square only with matter, but they materialize their own components, pervaded by technologies. Cross-sectoring and cross-fertilization through techno-sciences lead to hybridization of materials of which we model links between functions and structures, to make them fit in complex systems. So we observe that new materials are predetermined by a complex combination of digital data. Material becomes synonym of information.

At the same breath, object becomes smart, dual, namely physical and virtual. It equips itself with ability of memorization, communication, action, decision; it is active in its environment just like humans.

What will be human being immersed in a world of objects with physical and virtual duality?

Towards a new materiality in the grip of digital

Matter corresponds with feeling of tangible reality which oftentimes has a tangible, lasting and extensive nature. Matter in elementary state is a substance fitted with essential properties or main qualities. The word “matter” wavers between designation of something concrete which seems to make up things lastly, and an idea of substance regarded as forming unitarily the world. We use materials to delimit space, to protect ourselves. The shape of matter recorded itself in the future of human time. When we touch reality with our fingertips we feel to be alive. Techno-sciences, and more particularly digital technologies, enable us to copy the reality. We reproduce information on digital media, we copy matter using biotechnologies or by simulating features observed in a natural state (mimicry). We copy the shape of things with scanner laser 3D and additive manufacturing. Can we comprehend reality with digital media?

Denial of materiality is at the heart of rhetoric about virtuality: thus the contemporary human being wonders how comprehending the matter in a more and more virtual world? Can he surpass the dichotomy of material world and digital world? Perceptual being is made up of

body augmented by surrounding space. He sees objects as entities which are made alive through different circumstances of his life. Materiality is a process, a flow and connections. Reality is multiple, relational, shifting. The essence of the digital is that is a representational system. People suggest an approach to open new ways of knowing the world, by regarding data media as part of this world. Digital could open a few doors to intuitive transparency, to prevailing intelligence.

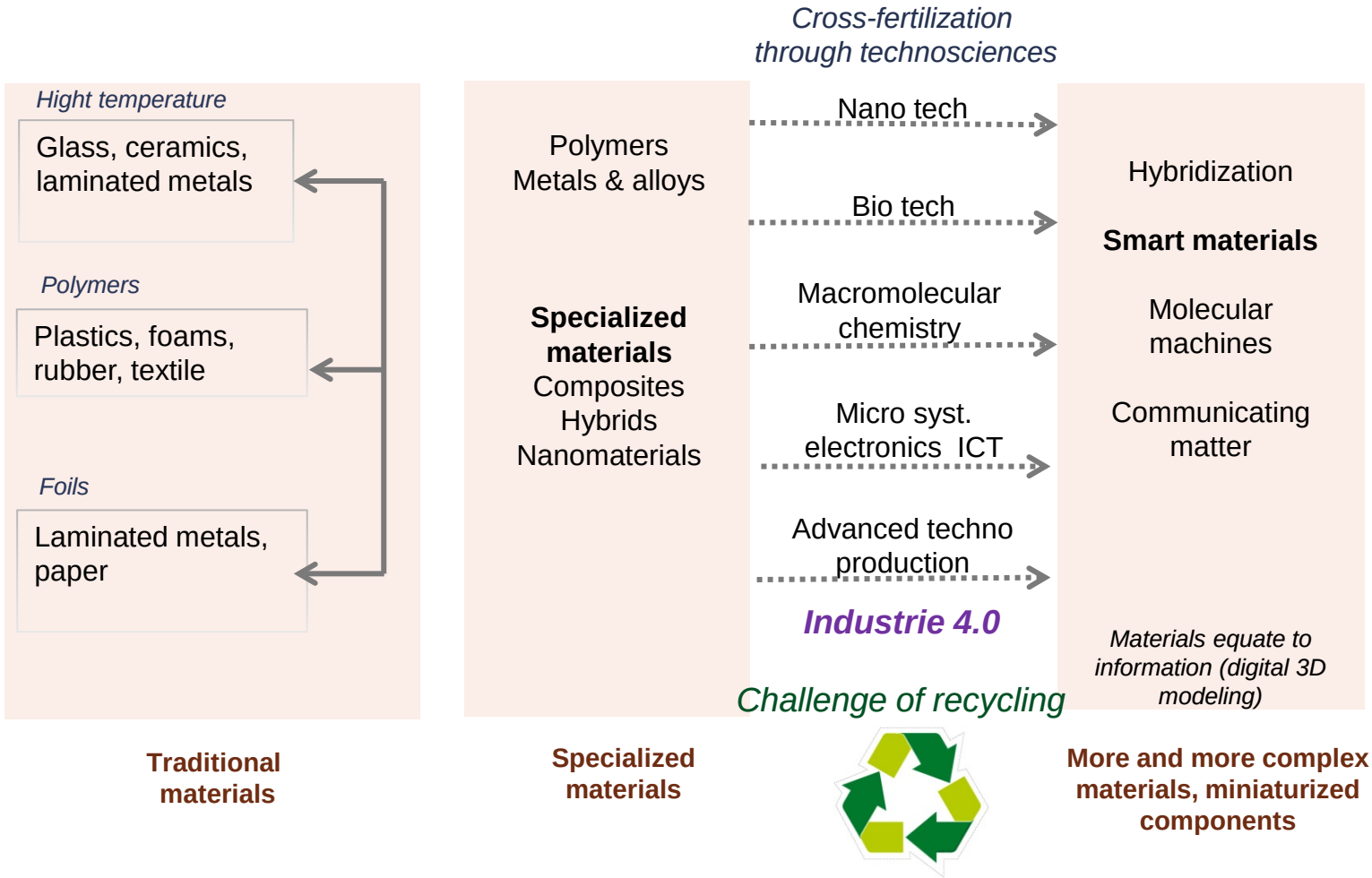
But could we make a difference between corporeal and digital materiality?

Information is both a product and a constituent component of social life. Digital technologies modify our perception of time and space, entangling them in a kind of interlacing. We are like in a reticulation of knowledge which blurs our original human perception.

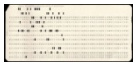
Could we really talk about human communication concerning digital?

MATERIALS DEVELOPMENT

TOWARDS A BLENDING OF INTELLECTION AND REALITY



DIGITAL TRANSFORMATION
TOWARDS SURROUNDING INTELLIGENCE



Punch card
1890

Invention of the word ***informatics***
1962

TCP/IP protocol , word ***internet***
1982

1st **browser** Nexus, HTTP protocol
1990

virtualization servers & storage
2008

Hyper-convergence IT Infrastructures Big data **Virtualization** network (SDN)

Performance couple human/machine

Informatics conquering business: information processing

1960

New strategy of business

PC goes into business; Self-sufficiency of users thanks to teleprocessing (cross-matching norms)

1970

Assimilation by general public

Exchange of data (pictures and sounds)

1990

cyberespace

Integration of people in a world system of communication

,

(nobody is an island)

2000

Intuitive transparency

A world of ideas and knowledge
Hyper-functional smartphone; connected things, artificial intelligence

2010

centralization (mainframes)	communication (networks)	sharing, mobility (internet)	ubiquity (web 2.0)	surrounding intelligence (virtualization)

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