Materiality in the digital age

Human beings connected to matter

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(Preliminary translation of an extract from the original book, reviewed by Keith Parker)

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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 challenges us to consider the results of going beyond structural logic in a rational approach to matter. This contemporary outlook on materiality refers to intangible phenomena which we should regard not as the disappearance of matter as such, but rather as working with a different kind of matter. Materiality is in the grip of invisible matter (digital), and social relationships are developed today under the influence of the numerous ways in which digital information can be produced via networks.

How matter is defined nowadays

The Latin word *materia* equates with the Greek word *ὕλε* (wood, stuff), and it is derived from the same root as *mater* (mother) (Ernout & Meillet, 1959). Matter is the common matrix where the many objects of the world are engendered. Ancient Greek philosophers equated it with nature. Matter evokes that which a thing is made of, which can be transformed by the human work, which is the medium of change. While Aristotle defined matter as "that of which each thing is made", Plato used metaphors as repository, childminder, or mother to define matter. Originally, the word "matter" (*ὕλε*) signified the firm, ligneous part of wood, the generative part, very different from bark and leaves. It is constantly changing also. This noun eventually came to refer 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 size and mass. The amount of stuff contained in a body depends on its density and its volume. People allude also 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

In the history of philosophy, the concept of matter moves on from a mystical understanding to a scientific one, but it also has its place in discussions on art. Thanks to Georg Wilhelm Friedrich Hegel, the philosophy of art detached itself more and more from material aspects as the 19th century progressed. Thanks to Albert Einstein in the 20th century, the concepts of matter and energy were joined together, mass being no more than an intense concentration of energy. The special 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.

Thus, the edifice of classical physics controlling our daily lives was considerably reshaped by the appearance at the microscopic scale of unexpected links between matter, space and time.

Matter and energy

Aristotle never discussed work in the modern sense of the word, any more than Galileo discussed 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 on 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 the material principle, action results from cooperation of two other principles, the *efficient* cause and the *final* cause, which, when applied to matter, determine it and give it shape.

The formulation of a suitable vocabulary was a crucial stage in developing the concept of energy in physics, a concept which was not firmly established until the middle of the 19th century. The concept of energy is basic for studying the phenomena of matter's transformation, such as chemistry and metallurgy, and mechanical transmission, which form the basis of the industrial revolution. Any change implies that a power takes action. So motion implies, as every change of state, to pass from potentiality to reality. Whereas today, in a contrary development, there are numerous technologies, digital interfaces, to pass from the real to the virtual.

Human intelligence has succeeded in explaining in turns light, attraction, electricity, the notion of pure energy, to the point where modern science is tempted to reduce the formerly sacrosanct matter to a simple manifestation of this energy, to consider its elementary particle (electron) as "a mere appearance... a localization of this energy in what is usually a very small space" (Huyghe, 1955).

What is materiality?

The definition of materiality calls on its close connection to matter and materials, contrasted to them, but also referring continually to them. Material would concern what can be felt, touched, while materiality would refer rather to emotion or a way of thinking. But if we look more 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 is of concern to philosophy as well as sociology, to engineering as well as art.

The question of materiality pervades the history of sciences and technology, the history of architecture, but the history of art also. Materiality questions the interactions between shape and matter; for architects light is a material in its own right. 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 a poetry of building and a philosophy of materiality which contemporary culture often disregarded, paying almost exclusively attention to the notion of space. The idea of space is becoming more clear today: we regard it rather as an environment of changing atmospheres, which encourages us to reflect on the 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, the affect and atmosphere of home. Materiality is a process, a flow and connections, as the authors have so well expressed it in the book *Digital Materialities* (Pink, Ardèvol & Lanzeni, 2016). This work is written by professionals from

widely varying fields, living in different continents. Thus Elisenda Ardèval is associate professor in social anthropology at University of Catalonia, Paul Dourish is an 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 the crossroads of research in design and in digital technology: they experiment a world where digital and material entities are entangled elements of the same processes. Their joint work show us how, by combining knowledge from different fields, we 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 to materiality leads us to consider the consequences of leaving aside the structural logic of a Cartesian approach to matter (coherence). This new materiality refers us to phenomena in the realm of the intangible which we need to consider, not so much as the disappearance of matter, but as the emergence of a matter which is "other". Materiality is in the grip of invisible matter (digital).

The word "materiality" is much 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 to allow them to take a position in a clear and reliable way on the financial situation of a company. The framework of formal requirements to communicate imposed upon companies today has generated an inflation of data (accounting, business in progress, value creation, governance and sustainable development) which does not help understanding. A very great amount of data can consequently lead to a loss of meaning because few people are able to analyze them properly. Hence, work on materiality, in this sense of the word, involves a degree of selectivity, choosing only information which is essential and relevant. Many companies publish a materiality matrix in their report of sustainable development. It depicts graphically the results of their materiality analysis as recommended by *International Integrated Reporting Council* (IIRC) and *Global Reporting Initiative* (GRI) (...). This materiality is both a general concept and a legal one. A "material information" is considered to be one which can reasonably expected to influence the viewpoint of an involved and consistent group of people, behaving rationally, and referred to as "stakeholders". However people have to be cautious with numbers because societal and social issues are often primarily qualitative: so this materiality is based on the ability of digital tools to convey reality. It is detached from physical reality, it uses contemporary entities (digital tools, data, networks) in an attempt to make tangible what is not necessarily so, in order to permit rational action.

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 tailor-made solutions, various and complex forms, while the emergence of ecology has promoted an awareness of the social implications of objects. These new dynamics, sometimes difficult to reconcile, influence the design and sustainability of products. Modern human's self-centered attitude has often preferred technical solutions to facing up to reality. But we must abandon our propensity for considering reality as a mere object for use and domination, if we are to reduce our consumption of matter for the sake of future generations.

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

Karl Marx considered that the methods of production of our material existence condition the process of social, political and intellectual life (Marx, 1845). Production of ideas and representations is the "language of real life": human beings are its originators. The things of "sensitive certainty" are only given by social development, industry, etc.

Thus with Marx a new materiality emerged, of social relationships, exchanges and representations. He sought to develop a materialism of representation by studying exchange phenomena, the question of value formation, as well as a concern for social consciousness. His thought paved the way for an unprecedented theory of knowledge, provoking even a redefinition of the concept of matter. This materiality of social relationships and cultural frameworks is today heavily influenced by the multiplicity of the means of producing and diffusing digital information via networks. But does not the conquest of self-sufficiency via internet encourage ultimately the standardization of exchanges?

Delivering intelligence to matter

Matter is something which exists independently of humans, and can receive the mark of their mind to make a thing. For Descartes, mind is the subject of knowledge, the intelligent 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. Thus cultural life rests on material resources and is increasingly interwoven with them.

Since the origins of humankind, materials have worked with people, who exploited first their hardness or their malleability, then their imperishability. Today we endow them with new qualities of the order of intelligence: 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 humankind no longer constructs simply with a given matter, but materializes his own components, the fruit of his various technologies. Cross-sectoring and cross-fertilization through techno-sciences lead to the hybridization of materials for which we model the 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 a synonym for information.

At the same time, an object becomes smart, dual, both physical and virtual. It has the ability to memorize, to communicate, act and make decisions, and it acts in its environment just like a human being.

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

Towards a new materiality in the grip of the digital

Matter answers, firstly, to an intuitive perception of concrete reality which, presenting various aspects, has a tangible, lasting nature and dimension. Matter in its elementary state is a substance endowed with essential properties, primary qualities. The word "matter" can

signify, on the one hand, something concrete which seems to make up specific things in a lasting manner, or on the other hand, the idea of a substance composing the world as a unity. We use materials to delimit space, to protect ourselves. The shape of matter is intertwined with the development of human existence. When we touch reality with our fingertips, we feel we are alive. Techno-sciences, and more particularly digital technologies, enable us to copy 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 3D laser scanning and additive manufacturing. Can we comprehend reality with digital media?

Denial of materiality is at the heart of rhetoric about virtuality; hence our contemporary concern with how to comprehend matter in an increasingly virtual world. Can humankind move beyond the dichotomy of material world and digital world? The perceptual being is made up of the body together with the space which surrounds it. He sees objects as entities which are made alive through the different circumstances of his life. Materiality is a process, a flow and connections. Reality is multiple, relational, shifting. The digital, on the other hand, is by its very nature a representational system. People suggest an approach to open new ways of knowing the world, by regarding data media as part of this world. The digital could open doors to intuitive transparency, to generalized intelligence.

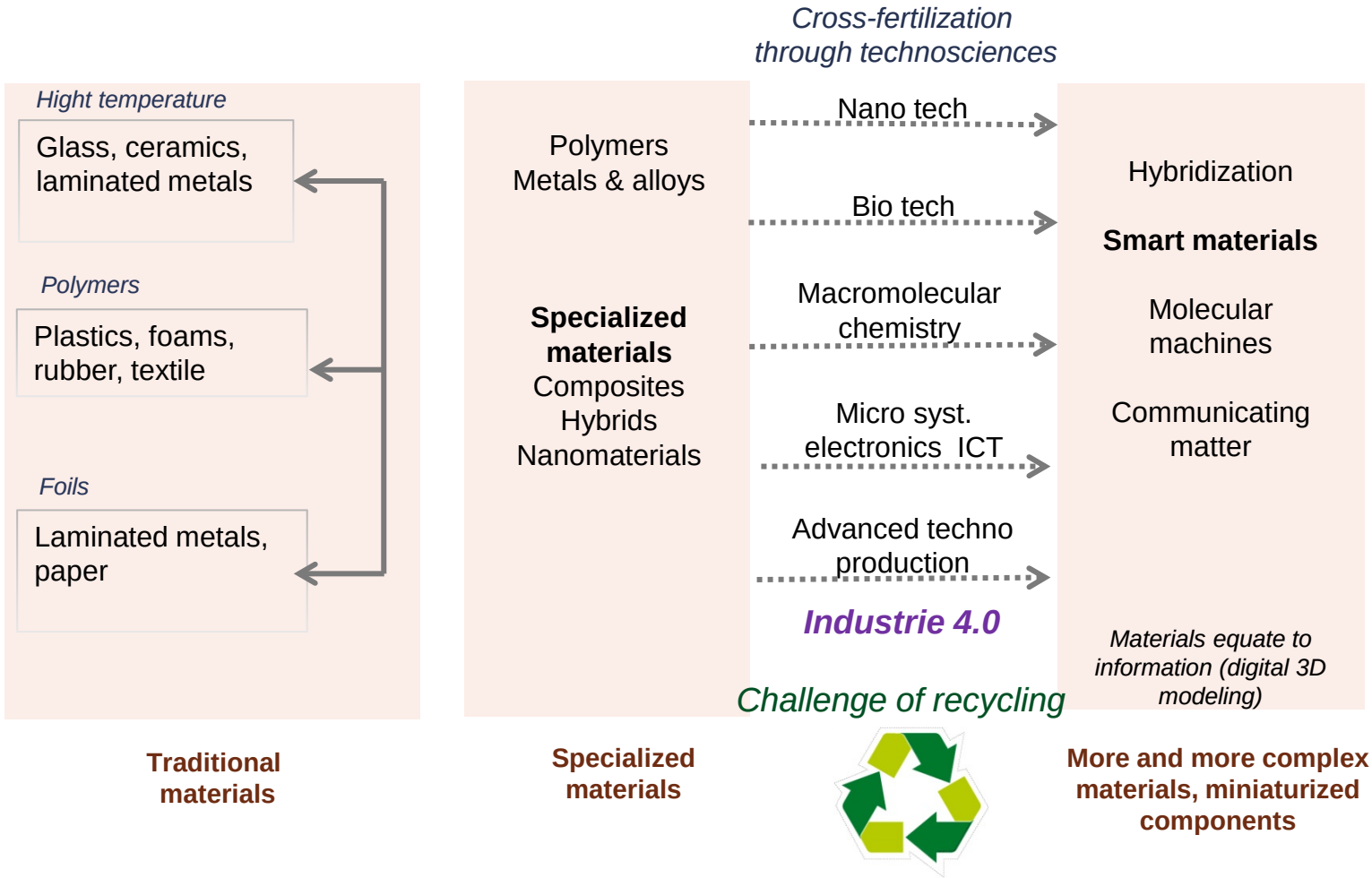
But could we make a difference between corporeal and digital materiality?

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, as it were, caught in a net of knowledge which blurs our original human perception.

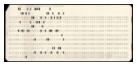
Can we really talk about human communication with the digital?

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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