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MARIANO ZUKERFELD

KNOWLEDGE IN THE AGE OF DIGITAL CAPITALISM

An Introduction to Cognitive Materialism

Knowledge in the Age of Digital Capitalism: An Introduction to Cognitive Materialism

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Translated from Spanish by Suzanna Wylie

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Introduction

I

The great classics that have studied *Capitalism*, those that have criticised it as well as those that have lauded it, have undertaken the task by privileging the most diverse range of variables. However, in the studies published up to the third quarter of the twentieth century, flows of *Knowledge* have had to settle for supporting roles in the drama of capitalism, when they haven't been sidelined and excluded from it altogether.

But if knowledge has received rough treatment at the hands of those who have applied themselves to studying the transformation of productive processes, even more brusque has been the treatment given to the frameworks of regulations around access to that knowledge: what we now, simplistically, call *Intellectual Property*. Ostracised and condemned to dwell in a marginal branch of law, it has had quite a different fate to that of physical private property.

In recent years, along with digital technologies, digital social media and other associated phenomena, authors have emerged who, approaching the question from different disciplines, have attempted to consider the role of knowledge

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and intellectual property within the dynamics of capitalism. Indeed, it has become clear that it is not possible to scientifically understand what happens to flows of digital information without understanding how they engage with diverse forms of knowledge (beliefs, ideologies, skills, norms etc.).

However, it has not been noted, apart from certain exceptions, that knowledge only exists materially, and that this very materiality is crucial when studying it. On the contrary, there is a tendency to understand knowledge as an 'immaterial' entity, which seriously limits the possibilities for its scientific analysis.

Without doubt, the efforts of various authors have produced valuable, although partial, contributions. And where they haven't provided sustenance they have at least contributed to stimulating the appetite. Notwithstanding, the social sciences still lack a systematic, multi-disciplinary, materialist and scientific conceptualisation of how knowledge works in the productive processes, and what its relationship is to the different stages of the capitalist totality. This book is an attempt to take a step in the direction of redressing that situation.

II

The foundations of this book are in my 2010 Doctoral thesis, *Capitalism and Knowledge: Cognitive Materialism, Intellectual Property and Informational Capitalism*. After my defence, I organised the text into three sprawling volumes (Zukerfeld 2010) and sent it to the most eminent publishers in Argentina to offer them the privilege of publishing it. Unanimously, the seasoned editors gave my manuscript the warmest of welcomes, opting to incinerate the rambling drafts. Despite being misunderstood by these arbiters of the analogue era and, more generally, by the academic elite, the trilogy won the popular acclaim of digital natives and sectors of the working class. More precisely, its thousands of pages were made use of with great delight by my daughter Laura (Bassa and Zukerfeld 2008) and her kindergarten friends to make collages and paper airplanes. Likewise, a carpenter of dubious competence benefitted greatly from volume II, which he used as a substitute leg for my sofa. Emboldened by these successes, I shared the manuscript on the web and ever since then I have been craftily serving it up to a captive audience comprised of my students.

In terms of the contents, the first volume primarily undertook the theoretical presentation of cognitive materialism. The second and third volumes were dedicated to applying this theory to two complementary fronts: on the one hand, the history of capitalism, characterising its three stages (mercantile, industrial, and informational), with particular attention to informational capitalism; and on the other hand, the evolution of a group of capitalist regulations of different types of knowledges, including principally those institutions that today we assemble under the expression intellectual property (encompassing copyright, patents, trademarks, industrial secrets, but also traditional knowledge,

geographical indications, right of publicity, sui generis laws, various types of licenses and many others).

Above and beyond logical order suggesting priority position for the presentation of the theoretical framework of this analysis, I am also convinced that as a result of the gap in the literature, development of the theory should be given priority. This book, therefore, consists of an updating and development of what was the first volume of *Capitalism and Knowledge*. To that end, I have corrected and expanded the first four chapters and eliminated some discussions pertaining to the literature on the knowledge economy and social studies of science and technology. Additionally, I have added chapters 5 and 6 which provide an account of two significant shortcomings of the original text: the absence of a theory of exploitation, and a theory of classes from the perspective of cognitive materialism.

III

There are those who say that the first thing that should be made clear in a text such as this, is who it is engaging in discussion with. In this sense, it is important to point out that this book dedicates practically no space to the time-honoured enemies of the critical, emancipatory, tradition. I do not dwell on attacks aimed at the handful of powers in whose hands are concentrated the resources of the world economy, financial capitalism, neoliberalism and its personnel (like the foot soldiers who are currently destroying my country), American imperialism, the International Monetary Fund (IMF), and other parasites living off human societies and nature. There are many excellent texts already dedicated to those matters and, without doubt, there will be many more to come.

Instead, here I will enter into a discussion with closer traditions with which I share concepts, ambitions, outlooks. Traditions I admire, but in which however, in some of their manifestations, I find aspects that I intend to criticise in the most emphatic way. These traditions are manifold, but there are three it is worth delineating here.

The first is Marxism, with which I share, among other things, the idea that the concept of capitalism is the key to embarking on the scientific study of our societies, that exploitation is a phenomenon inherent to capitalism and that the contradiction between what it describes as productive forces and social relations of production is central to understanding the transformation from one stage to another.

However, I will attempt to argue with those dogmatic aspects that transform what was an innovative *wissenschaft* into a conservative religion, which in many cases is completely incapable of dialogue with other traditions. I am as convinced that Marx was the most important thinker in the social sciences as I am that his work contains inescapable limitations. The fact that many Marxists are unable to perceive Marx's cognitive production, and their own, as products

historically conceived in a particular stage of capitalism is an incoherence that never fails to astound me. More specifically, I will debate the humanist aspects that various forms of Marxism are rooted in and, connected to this, I will point out the limits of the Marxist theory of exploitation, as a consequence of the problems inherent to the labour theory of value. More importantly, I will try to show that Marxism has neglected the analysis of the role of knowledge in capitalist productive processes.

Secondly, in relation to autonomist and post-structuralist authors, including those from the cognitive capitalism tendency, I share the vocation to highlight the discontinuity, the change of stage from industrial capitalism to what we call informational capitalism (and what these authors describe as societies of control, cognitive capitalism, semiocapitalism, etc.). Additionally, I hold with with the observation concerning the blurring of working time and free time that the current stage is characterised by, I vindicate the gesture of studying the relationship between knowledge and capitalism from a critical perspective and admire the search for new theoretical tools which with which to analyse this new stage.

Nevertheless, I have some important differences with this perspective. On the one hand, much of its indisputable publishing success has been based on concepts that, even though they seem attractive initially, are ultimately beautiful but of little use. On the other hand, many of these critical philosophical initiatives, when they engage with discussions about the capitalist economy, adopt concepts from orthodox economics in a completely naturalised and acritical way.

Thus, they ascend to their concepts upon the scaffolding provided by the dominant ideology. More generally, I do not share these approaches' rejection of the categories of totality, contradiction, negativity, and I believe that much of their blithe positivity makes them functional to the dominant ideology of informational capitalism. Finally, this tradition brandishes the banners of difference, otherness, multiplicity. However, in practice it is no more adept at dialogue with difference (in other words with those viewpoints that do not echo its mantras) than any other dogmatism. This intolerance in the face of plurality, debate, and constitutive contradictions, that for Marxism, scientism, or any religion can be explained (disagreeably but with coherence) by the belief that there is one truth, which they are in possession of, is completely unsustainable when observed in these 'philosophies of difference'.

Thirdly, with social scientists, that is, the producers of academic papers (in the fields of sociology, STS studies, philosophy, communication, economics, law, among others). I share the vocation to submit research findings to the judgement of independent reviewers, to accept the opinions of colleagues with other points of view, and produce results based on empirical evidence and systematic reasoning. In turn, I intend to incorporate specific contributions from each of these fields, which would be onerous to enumerate here.

However, I cannot avoid expressing the most energetic repudiation of the enthusiastic submission to the current norms of the academic world by these academic paper producers. The increasingly frequent choice to devote oneself to research, and within it to one area in particular, in virtue of securing a smooth career path, exercising intellectual dilettantism or travelling around the world with the excuse of anodyne conferences, has greatly impaired the potential of the social sciences to understand the world, let alone to change it. There is no tragedy in admitting that one lacks passion, love, or commitment towards the research object (there are even those who take pride in it). In that case, it would suffice to change the object, or activity. No one should deprive themselves of trying to do work they love, not even in the context of the unjust societies we live in; at the same time, no one should deprive others of that opportunity either. On the contrary, I have unfortunately seen time and again how some of the most original, serious, and committed researchers (who immerse themselves in texts and not in speculations about academic posts and funding), are relegated and even ejected from the academic world in favour of research bureaucrats. Bureaucrats who regurgitate vacuous papers, polluting the cognitive ecosphere, who, with dispassionate expertise, poach posts and funding on the basis of artificially bloated CVs.

Now, in terms of concrete individuals, the aspects I appropriate and those I criticise from each of these traditions cannot be cleanly disentangled from each other. They combine, in greater or lesser proportions, in the same human subjects, inhabiting them as dialectical contradictions. Furthermore, these contradictions inhabit the author of these lines and spill out into this book. Criticism, at least of the variety attempted here, is always the critique of contradictory totalities and is, simultaneously, self-criticism.

IV

This book is structured into six chapters. Chapter 1 opens with the following question: how do all goods and subjects relate to capitalism (understood as a totality that governs our societies)? I argue that, in the last instance, it is through two types of regulations: those shaped by physical property and those by intellectual property, which in general act simultaneously. This rests on the fact that goods and subjects are made up of variable combinations of two entities: physical matter and knowledge matter. A comparison is presented between these two entities in philosophical, physical, and economic terms. While physical matter is consumed in the process of its productive use, knowledge matter does not erode in this way; while the former can only be transformed, knowledge can be accumulated. However, knowledge matter does not exist as an immaterial entity (contrary to arguments sustained by numerous authors), but instead exists as an emergent property of physical matter. This

leads me to propose a materialist analysis of knowledge. Indeed, the particular characteristics of a physical bearer of any knowledge condition several of the ontological, economic and legal properties that such knowledge assumes.

In chapter 2, leaning in part on the first, cognitive materialism is located in relation to the gnoseological traditions. I advance this as a third position in confrontation with epistemology on the one hand, and Marxism and the sociology of knowledge on the other. In all cases the fundamental point in common that all the disciplines that have studied knowledge share, is that they understand it as a product of human subjects – individuals, collectives, etc. From the perspective of cognitive materialism I have encountered three shortcomings in the previous approaches: idealism, humanism and the lack of a definition of knowledge. Next, my approach is defined on the basis of its following features: materialist, emergentist, dialectical, non-humanist, scientific, cognitive. Both the question of what knowledge is (chapter 1), and the question of how to understand knowledge (chapter 2) lead to the need to study knowledge on the basis of its physical bearers.

Therefore, chapter 3 introduces one of cognitive materialism's central tools: the typology of knowledge based on its material bearers. Four kinds of bearers will be identified: biological, subjective, intersubjective, and objective. Biological knowledge includes the genetic, endocrinological and neural information flows of living beings. Subjective knowledge includes the explicit and implicit memories of an individual's mind. Intersubjective knowledge rests on 'social' groups. Five sub-types of the latter will be distinguished: linguistic, recognition, organisational, axiological and normative (regulations internalised by subjects and usually enacted by the law – physical property and intellectual property are the two main types of normative intersubjective knowledge). Objective knowledge encompasses technologies on the one hand, and information on the other.

Then the concept of cognitive material configuration is introduced to describe the totality of this variety of knowledge for a historically determined situation. By way of an example, the cognitive material configurations of the three periods of capitalism (mercantile, industrial and informational) have been characterised in a condensed fashion.

While chapter 3 is concerned with stocks of knowledges, presenting them as immovable entities, chapter 4 introduces the categories necessary to understand the dynamics in order to give an account of the flows of different types of knowledges. The principal concept in this sense is 'translation'. Among other concepts associated with translation, 'human attention' is introduced. But the type of translation our argument focuses on is that which we define as 'productive processes'. Within them, capitalist productive processes are focused on, and from there I go on to define the capitalist system. As part of this objective three concepts are encountered which merit a specific exploration: regulation, exploitation, and expropriation. It is to these three concepts, and to exploitation

in particular, that the lengthy chapter 5 is dedicated. Firstly the generic, ahistorical concepts of exploitation, expropriation and regulation are discussed. I assert that exploitation relates to the asymmetrical exchanges of physical matter and, above all, knowledge matter, that occur within productive processes and which result in one of the parties, the exploiter, obtaining a greater economic value than the other and that this is obtained at the expense of the latter. Expropriation, by contrast, entails the direct confiscation of physical matter – often with no compensation – that, decisively, occurs within the sphere of exchange and not that of production. Regulation, for its part, consists of the imposition of norms (legally sanctioned or by other means) that frame exploitation and expropriation. For each case, after the generalities, the capitalist particularities of each concept are discussed. In this way the central object of this chapter is arrived at: capitalist exploitation.

Capitalist exploitation means the appropriation (neither violent nor illegal) by the capitalists of surplus value that arises from the partially or completely unremunerated *knowledge* produced by or borne by other subjects. I will discuss three forms of capitalist exploitation: *exploitation through alienation*, *exploitation through reproduction*, and *exploitation through attention*. Naturally, the theory of exploitation is connected to a theory about stratification and classes that constitutes the focus of this book's final chapter.

Thus, chapter 6 puts forward a theory of social classes for different stages of capitalism. To that end, on the basis of the concepts elaborated over the previous chapters, an abstract schema of classes is defined, underpinned by the level of access to productive resources that different groups of actors enjoy. In that way, I characterise the capitalist class (encompassing capitalists per se, cognitive capitalists, physical capitalists, cognitive rentiers, and physical rentiers) and the working class (including cognitive workers, physical workers, excluded workers and self-employed workers). This schema is concretised in the analysis of classes in the mercantile, industrial, and informational stages of capitalism.[1]

V

This book was not originally written in English, but in Spanish, and as a result it is necessary to complement the invaluably meticulous work carried out by the translator with three clarifications. The first concerns the narration of this book, after the introduction, in the first person plural. This is a relatively strange choice for a text signed by an individual author in the English language. However, in Spanish it is quite a standard practice. Nevertheless, I do not wish to take refuge in linguistic customs, but instead to offer a logical justification. The first person plural in this book serves at least three distinguishable functions.

The first of the uses of 'we' includes the reader, for example when reference is made to the trajectory covered in the previous chapter. Thus, there is a first person plural that alludes to the productive process shared by the author, the bearer that is found between the book and the reader. The second use of 'we', which is in fact the most frequent, aims to acknowledge the collective nature of cognitive production. With this I am not alluding to a generality (of the sort that all production is done resting 'on the shoulders of giants'), I am rather referring to having chosen to produce social sciences in the framework of research teams, internal seminars, shared office space. This is not the only option possible, nor am I entirely certain that it is the best. But it is the modality I chose years ago, and this book is the product of these collective spaces and time. Therefore, many colleagues, students, teachers, friends and others have made significant contributions, sometimes taking an interest and offering suggestions, in general arguing, or even demonstrating a notable lack of interest. All this feedback has encouraged me to reformulate different areas of this proposal. More specifically, some of the 'we' employed in this book refers to fieldwork conducted collectively, or even co-authorships (such as the article that chapter 6 is based on).

On other occasions, however, by using the first person plural my aim is to absorb, not those already known to me, but instead the anonymous members of diverse academic and intellectual disciplines which I engage with. The 'we' in these cases refers to groups I partly include myself in, justifiably or otherwise, such as sociologists, economists, postmodern social scientists, philosophers, Marxists. In some of these cases, the intention of the text is to laugh at some impostures that not only correspond to these groups, but also some I recognise as my own. This leads me to the second clarification, one that concerns the general tone of the text. For the most part I have adopted a style that is currently not recommended either in the academic world or in essayist productions in English (although it is not in other languages either). I am alluding here to the practice of ridicule, irony, or satire, but not merely or especially aimed at intellectual adversaries, but first and foremost targeted at fellow travellers, those to whom this book is addressed, and especially, myself. The culture of informational capitalism, so-called 'postmodernity', has many frankly despicable aspects. However, if a virtue has presented itself in opposition to the solemn rigidity of industrial capitalism, it consists of the possibility of laughing at ourselves, the subjects who inhabit this dispiriting epoch. But, and this is the key, allowing ourselves the liberty of mockery or irony as forms of self-criticism does not suppose that the arguments we wield are weak or will be impaired as a result. On the contrary, being able to laugh at oneself is an unmistakeable sign of vitality. If anything unequivocally signals the fragility of an argument (or a political regime, or a personal relationship) it is the inability to digest or even nourish oneself on laughter. However, for readers who do not share this view and who may consider that some of these ironies

are excessive or disrespectful towards a particular field or author, I offer my apologies in advance.

The third and final clarification is that of translation. Cognitive materialism uses a typology of knowledges as one of its fundamental tools. Thus, as we shall see, there are four types of knowledges, defined on the basis of their material bearers. However, in English the term knowledge is almost always used in the singular. Here, in contrast, to give an account of this variety, we must effectively use the plural form: knowledges. This is not a purely terminological question. The use of knowledge in the singular is the progeny of a tradition discussed in chapter 2, epistemology. For this tradition, knowledge cannot be expressed in plural because it is associated with the idea of truth (specifically the truth-falsity *axis*), and the truth cannot be multiple.[2]

CHAPTER 1

Capitalism, Physical Property and Intellectual Property

1.1 The Two Arms of Capitalism…

The starting point of the reasoning presented here is lacking in originality, theoretical flair, and if scrutinised, even precision. We begin by observing any material entity integrated into a contemporary capitalist society. 'Any entity' means exactly that: public and private goods, means of consumption and production, tangible and intangible goods, natural and social products and, of course, commodities and non-commodities. Is there anything that can be said about each and all of those entities? Is there any common feature that underlies so much variety? Naturally, if there were, this feature would not be found in the things themselves, irrevocably heterogeneous as they are, but rather in the relationships that capitalist societies have established with them. But is it possible to unearth *a single* social relation in common between the chair that the reader's body is sat upon, that body itself, the shoes the reader is wearing, the streets those shoes tread, the paper this book is printed on, the tree that the paper was made from, and the ideas found here? Some would say 'yes', inspired by the reflections of brilliant modern thinkers: it is physical private property that governs all fates in the world of capital. 'No', another would respond, seduced by the loudspeakers of the much less brilliant postmodernists: the multiplicity of being cannot be reduced to a single relational principle. Then what? Is there a single social relation that binds any particular entity to the capitalist totality or is there no regulation capable of achieving that? In our opinion, the first opinion is mistaken, and the second is even wider of the mark.

There is no single type of social relation that connects all material entities with the capitalist totality – not because there is not *any at all* but in fact because there are always *two*. Now we have arrived at the first idea to be proposed here.

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Physical Property	Good	Intellectual Property
Private property	Car	Patents Trademarks
Private property	Table	Public domain
State-owned public property	Book by Borges in a public library	Copyright
Private property	Play by Shakespeare bought by an individual	Public domain

Table 1.1: The double regulation of goods in capitalism.
Source: Author's own elaboration.

Under capitalism each good finds itself subject to a double regulation. On the one hand is a set of institutions that can be roughly congregated around the pole of *Physical Property*. On the other hand are a bundle of diverse regulations magnetised by the expression *Intellectual Property*. Both types of regulation represent the two arms of capitalist machinery and both act *simultaneously*. Let us look at some examples that will help to clarify this idea.

Consider, for instance, a car. Our first impression is that its connection with capitalism is defined by physical property. This establishes that on the one hand is the legitimate owner of the vehicle, who can do with it whatever they please (use it, obtain profit with it, or dispose of it: *usus*, *fructus* or *abusus*) and that, on the other hand, there are non-owners who are excluded from access to this good. However, this image is not entirely correct because, above all, a bundle of intellectual property rights pertain to the car. Trademarks and patents, for example, mean that the legal owner of the physical private property has restricted use of some elements: they cannot reproduce the distinctive logo of the car manufacturing company for commercial ends, or commercially produce parts similar to those belonging to the vehicle, or copy the design of any of the parts either. This point is made more apparent in reference to a means of industrial production: a steam engine in eighteenth-century England, a conveyor belt in twentieth-century USA or an assembly line robot in twenty-first century China. Of course, access to these goods is still delimited by physical property, but the arm of intellectual property becomes more visible. Patents for the machinery and processes involved, the trade secrets associated with these productive processes and other similar rights surface as powerful barriers before the potential user of some of these technologies. The above examples should be sufficiently illustrative to convey that the relative weight, relevance, and conspicuousness of both regulations vary in each case according to diverse circumstances.

In order to develop this point, it is worth clarifying that the type of regulation we are generally summarising under the category 'physical property'

includes private property strictly defined, but also state-owned public property, cooperative property and other forms. Similarly it should be pointed out that the term 'intellectual property' subsumes both different rights pertaining to the private sphere[3] as well as the regulations related to the public domain. Hence, it is not uncommon that from the viewpoint of one of the regulations a good is 'public', while being considered 'private' from the perspective of the other. The table in the cafe where these lines are being written – a generic wooden table without any distinguishing features – illustrates one of the forms of this uncoupling. The intellectual property rights acting upon it, for example the design patents, may have expired, and so from this perspective it stands in the public domain. But the physical property rights, naturally, are still absolutely valid, as the owner of the cafe would soon make us aware if we were to attempt to make off with their table. In a more general way, this combination can be recognised in all goods whose intellectual property rights have expired due to their age, or that have failed to cross the threshold of patentability requirements due to their lack of originality. The reverse is also true of course. The typical example of this is a text subject to copyright that is stored in a public library. The physical property of the good is public, but the work found within it is protected nevertheless. Many more complex and polished examples could be imagined, but for the purposes of our argumentation here, the aforementioned will suffice.

Now, although up to this point we have referred to the double regulation that weighs upon goods, this should not obscure the fact that this duo *also acts in the same way upon human subjects*. Do physical and intellectual property also govern humans, our bodies, our energies and minds? We would argue that they do, and in a variety of ways. Indeed, capitalism is juridically founded on the idea that each subject has exclusive property rights over their own body. As Locke, amongst others, indicates, it is from this initial property right that the possibility of conquering other properties stems. Actually, the subject is first affirmed as owner of their own body, and along with it their own labour, and only then can they appropriate the fruits of exercising this first property. Furthermore, each subject has the right to exclude others – the basic condition of ownership – from the use of that organism. The human body is a quite special physical private property for capitalism: it *cannot* be legally sold, but the conditions are generated in which it *must* be rented. As regards intellectual property, a counterintuitive phenomenon occurs: that which is housed within the body itself can be property of another owner. For example, numerous knowledges acquired in the performance of work can be owned by the employer, even though they are lodged within the individual mind of one worker or another. Thus, in addition to the double regulation, an idea begins to emerge which we will revisit: goods and human subjects are not so very distinct for capitalist regulations as they are for some social theories.

To backtrack a little, the idea that entities are subject to a double regulation can be traced all the way back to classical antiquity. Seneca, in a marginal passage of *De Beneficiis* (59 CE) says:

> In all the cases I have adduced, there are two owners of the same thing. How can that be? One of them owns the thing and the other owns the use of the thing. We say that some books are Cicero's; Dorus the bookseller says that the same books are his own, and both claims are true. One claims the books on the grounds that he wrote them, the other on the grounds that he bought them. And it is right to say that the books belong to both, for they *do* belong to both, just not in the same way. (Seneca 2011, 171).

Much later, in the capitalist world that had started to ruminate on the modern idea of copyright, the book was also the good, which stimulated reflections about the double property regulation. Kant in his *Metaphysik der Sitten* distinguished between the book as a corporeal artefact (*opus mechanicum*), associated with a real right, and the book as discourse (*praestatio operae*) associated with a personal right (Kant [1797] 1991, 107). Fichte's (2008) similar division should also be mentioned, which he elaborates in a 1793 article.[4] Shortly afterwards, not focusing on books but on artefacts, Jeremy Bentham established this distinction with crystal clarity in a footnote:

> Property is in fact of two kinds. In the instance of one of them, the creation is effected by interdicting to persons at large in most ways, or perhaps in any way, the use [and the] liberty of occupancy with regard to the thing itself, which is deemed the subject of the property in question. In the other instance, the creation is effected by interdicting to persons at large the liberty of occupancy not with regard to any one corporeal object in particular which thereby is constituted the person's *own*, but with regard to all corporeal objects whatsoever, when exercised in such a manner as to produce a certain effect. (Bentham [1795] 1954, 265)

Of course, these antecedents are no more than curious exceptions, tender green shoots in the winter of industrial capitalism; the double regulation of property only unfurls into full bloom in informational capitalism, the current stage.

In summary, some ideas can be distilled from what we have explored thus far:

1. Physical property and intellectual property act simultaneously upon entities and regulate different aspects of these.
2. Different ownership rights can coexist and converge on these entities.
3. These ownership rights can be, independently of each other, public or private.
4. The double regulation does not only apply to goods, but also to human subjects.

But, which of these aspects are governed by physical property and which fall under the aegis of intellectual property?

1.2 … and the Two Aspects of Goods: Physical Matter and Knowledge Matter

A simplified answer to that question could be: *physical property regulates access to physical matter, which entails what is usually called 'matter' and energy, while intellectual property regulates access to knowledge matter, which encompasses what is commonly labelled as knowledge, information, culture, communication, etc.*

This statement merits some clarifications that will occupy at least the rest of this chapter and the three that follow.

'What is all this business about matter and energy?', the reader could ask, in irritation, 'Isn't this a social sciences book?' Reading the introduction should have been sufficient to deduce that throughout this book a fair deal of pretentious verbiage about economic, sociological, philosophical and juridical matters is par for the course: but is it really necessary to dishonour the immaculate cognitive geography of the natural sciences as well? Unfortunately, it is, yes. However, while the outrages committed on other terrains will be extensive, those related to the latter will be brief, although more due to cowardice than wisdom.

Where does the discomfort come from that the sentence in italics generates? The discomfort actually seems to spring from two ideas, tacitly but assuredly included in the phrase that opens these paragraphs. On the one hand, the expression 'knowledge matter'. Is this not a contradiction in terms? Isn't knowledge anything but material? We would argue that this is, in fact, a misconception and over the following chapters we will try to demonstrate that knowledge is nothing but material.

On the other hand, that *physical matter and knowledge matter are the two aspects from which Being is composed in the eyes of capitalism; that everything can be conceived, in the last instance, by means of these elemental substances, and that they combine in a variable way in all the entities under the sun.* Let us situate this in a narrow historical context, although a brief clarification should be introduced beforehand. The word *matter* has at least two different meanings that are relevant for this book. On the one hand, it could refer to entities defined by having a mass. This is the meaning that many authors (particularly those coming from exact sciences) give to the term, and the one we are going to refer to at the beginning of the next section. This meaning will be indicated by quotation marks hereafter: 'matter'. On the other hand, matter can refer to a much broader set of entities: the group of entities that are material, that is, changeable, as we shall discuss in chapter 2. This

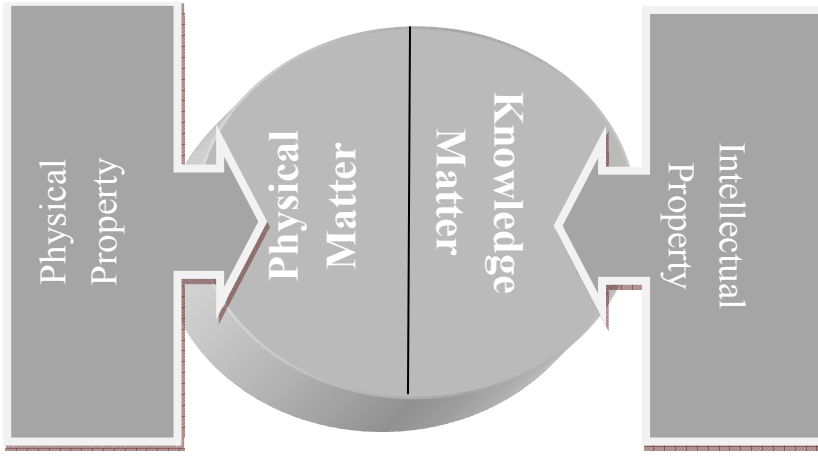

Fig. 1.1: Capitalist regulations and aspects of Being.
Source: Author's elaboration.

second meaning is the one that we will endorse, manifested in expressions like physical matter, knowledge matter, material or materialism. So, 'matter' (as a native category of scientists and philosophers who will be mentioned) is a subgroup of matter (as a concept of cognitive materialism), as should become clear by the end of chapter 2.[5]

1.3 Physical Matter: A Brief History of 'Matter' and Energy

As is fitting for a contribution to a tradition that strives to dress itself up with cheap erudition, the retrospective panorama presented here opens by swaggeringly mentioning Greek philosophers that we have merely studied a little, and ineptly at that. Among the pre-Socratics,[6] the Ionian thinkers (in opposition to the Pythagoreans and the Atomists) placed special emphasis on bestowing a material aspect on the unity of Being. Seeking a universal substance from which all things derive, Thales of Miletus found it in *water*, and Anaximenes, his neighbour, found it in *air*. It was *fire* that fulfilled this role in the philosophy of Heraclitus of Ephesus, but in a more complex way: it was the materialisation of *logos*, understood as the principle which gave equilibrium to a universe undergoing constant change.[7] As far as Anaximander is concerned, his conception that the essential is the indeterminate or the boundless, still maintains a rigorous relevance for post-structuralist philosophy, after a stopover in Simondon's concept of *individuation* ([1958] 2005, 339).

From among the atomists, Democritus of Abdera – and his mentor Leucippus – must be mentioned immediately. With him appears the idea of the atom and a decisive form of materialism. However, his philosophy is much richer than that

of the Eleatics with whom he engaged in dialogue. He conceives of Being as composed of two substances: what exists (*τοον*), which can always decompose down into the level of atoms – homogeneous and indivisible; and what does not exist *(τομηον),* that space between atoms – where they move, attract and repel each other. Notably, and here lies the materialist foundation, not only the body (*soma*) but also the soul (*psyché*) were conceived of as being made up of atoms, just that in the first case these were heavy, and in the latter they were light (Novack 1977, 118).[8] As is well known, these fundamental ideas were later developed by Epicurus and, to a certain extent, by Lucretius.[9]

However, it is from the Pythagoreans that the idea of distinguishing between diverse elements first emerges. In fact, the term element is imprecise: more accurately described these are the *stoicheia* – roots, foundations, syllables. Empedocles of Acragas advances the separation between earth, air, fire and water. This distinction was promptly assumed to be valid and lasted two millennia, thanks in particular to Aristotle's reformulation (Lang 1998) who, rejecting the materialists' concept of the void, added ether as the fifth essential substance, or more precisely, as a container of the other elements and the cosmos (for a more detailed description see Böhme and Böhme 1996). Naturally, divisions very similar to these appear in traditions far removed from Ancient Greece and its Christian heirs: they appear in Taoism, Chinese philosophy, Hinduism, and almost all cultures that have left a written legacy (Maartens 2007). But Aristotle's contribution to this history is not merely related to matter but also, following Plato to a certain extent, his establishing the *hylomorphic* doctrine. Matter, with its five foundations, is only determined through *form*. The former is the purely indeterminate, that which possesses receptivity as its decisive feature, while form is the active principle, the ultimate cause of being (Ferrater Mora 1964, Volume 3, 153). It is not difficult to appreciate the virtues that this conception offers – as against atomist materialism – upon being adopted by the monotheisms that would come to prevail. Thus, the Aristotelian synthesis with greater or fewer scholastic adornments, stood firm for centuries.

It is worth noting that the four elements and form can be easily related to the concepts of 'matter', 'energy' and 'information' (or knowledge matter). Earth, water, and air are associated with the three states of 'matter' (solid, liquid and gas) and fire can be similarly related to energy. Form, for its part, is nothing more than the objectification of different types of knowledge, as we shall see later on. However, the term energy wouldn't appear until well into the nineteenth century; the word matter (*hyle*) in Greece referred to that which was maintained in the transition from one form to another, and not necessarily to entities with mass, as the concept is understood today (in the first meaning mentioned above). Finally, form (*morphos*) bore no relationship with knowledge understood as *episteme*: it was an imposition extrinsic and independent to the matter, such that it made no sense to proclaim, as with the latter, its closeness to the truth. But, of course, in the twilight of the Middle Ages, while Thomism still consecrated Aristotelian physics, disagreements with it started to be perceived. Above all, these concerns

are expressed in the writings of Al-Biruni, Al-Khazini,[10] and other Arabic scientists (see Rashed 1996). Europe would also join in the heresy, although with considerably more timidity: Jean Buridan, Oresme, Albert of Saxony, Domingo Soto, and Juan Bautista Benedetti, among others, preceded Galileo. Thus, while the four elements – with or without ether as a complement – would maintain their influence on various metaphysical concepts, they would gradually lose ground under the dominion of modern science. Soon Newton and industrial capitalism would establish a world in which the ontology is that of *masses* and *forces*. Above all, bodies attract or repel each other on the basis of some relationship between their masses and distance. It is from these variables that forces are derived (note the difference with the later notion of energy), and the mission of physics would be to reduce the world to simple equations of attraction and replusion between bodies, as Helmholtz puts it.[11]

Thus, if Aristotle and the medieval world consecrated the vision of the pre-Socratic Ionians, modern science would depart from this to reappraise the ideas of the materialists of antiquity: atoms prevailed at the hands of Lavoisier, Dalton, Avogadro, Mendeleyev and others.[12] One of the important ideas in this conception is the *law of conservation of 'matter'*, intuited in the mid-eighteenth century by Lomonosov and specified later by Lavoisier: in a chemical reaction 'matter' is neither created nor destroyed but rather transformed, maintaining the total mass of the product. More generally, '*matter*' was the key concept until the nineteenth century.[13]

However, the development of what will later be described as the *Cognitive Material Configuration* (in chapters 3 and 4), meaning the development of flows of knowledge in the productive processes, contributes to the emergence in the nineteenth century of a new ontological component that would supplement 'matter': *energy*. Beyond the obvious relationship with the development of capitalism[14] there seems to have been, at least on this introductory and internalist territory, which we are traversing, three bases for this novel development.

Firstly, at the hands of Faraday, Hertz, and especially Maxwell, the concept of *field* arises. Along with it begins to take shape the concept of energy – and no longer of force or work: 'Field represents energy, matter represents mass'[15] (Einstein and Infeld 1938, 256). On the other hand, the discussions about whether heat – that wasn't homologous to a force or 'matter' – was a substance in and of itself or not, would result in a remarkable discovery. The studies of Mayer, Black, Rumford and Joule (who belonged to all professions except physics itself) demonstrated that heat is nothing but a form of energy, like mechanical energy is (Einstein and Infeld 1938, 38–47). Finally the laws of thermodynamics, associated with Carnot, Kelvin and Clausius, must be mentioned. These were also decisive to the development of the concept of energy. The first law postulates the conservation of energy, acting as a complement to the much older one related to 'matter'. In effect, in a closed system energy can be transformed, but not created or destroyed. The second law of thermodynamics, which has a variety of formulations, establishes the principle of *entropy* – energy that cannot be used to perform work, disorganisation of

a system, irreversibility of changes, *growing* uncertainty in closed systems. As is well known, this has enormous not only physical but philosophical consequences, some of which we will avail ourselves of shortly. In summary, towards the end of the nineteenth century we are presented with two key consolidated concepts: 'matter' and energy.

> Our two concepts of substance are, then, *matter* and *energy*. Both obey conservation laws: An isolated system cannot change either in mass or in total energy. Matter has weight but energy is weightless. We have therefore two different concepts and two conservation laws. (Einstein and Infeld 1938, 54)

Now, the crucial innovation that brings the twentieth century into this brief history is the theory of relativity. Our limited ability to understand it, resistant as we have been to the impression of books and varied pedagogies, does however allow some chinks of comprehension through which to glimpse a simple fact: the theory mathematically demonstrates the equivalence of all forms of 'matter' and energy, through the famous formula $E=mc^2$.

> From the relativity theory we know that matter represents vast stores of energy and that energy represents matter. (Einstein and Infeld 1938, 256)

With this as a point of departure, it seems reasonable to speak of what was called 'matter' and energy as a unitary entity. Scientists have done so,[16] and so we shall follow suit here.

Naturally, 'matter' and energy are perfectly distinguishable in many of their phenomenal manifestations. However, the point is that both share the same properties, just like, if the inaccuracy can be forgiven, water and steam. Both possess mass and energy (although in extremely dissimilar quantities). In turn, 'the two conservation laws of mass and energy are combined by the relativity theory into one, the conservation law of mass-energy.' (Einstein and Infeld 1938, 259–260). But beyond the opinion of science on the matter, what interests us here is that capitalist regulations are, in a manner of speaking, in agreement with them. Electrical energy does not have fewer property rights assigned to it than the cables that conduct it do; the water that falls during a storm and the bolts of lightning generated at the same time, are both equally public.[17] In sum, the shared properties of what scientists call 'matter' and energy allow us to subsume both under the expression *physical matter*[18] from here onwards.

1.4 Towards the Other Entity? Beyond Physical Matter

So far, an explanation has been provided detailing how the idea of physical matter was reached. But where does the other side of the coin appear from, the other flow which we have pompously called knowledge matter? In fact, without

realising it, the concept of Aristotelean *form* – that is partially associated with the meaning attributed to knowledge here – has been lost somewhere along the way. Physicists and chemists washed their hands of the matter during the eighteenth and nineteenth centuries, and up to the beginning of the twentieth century, and it has been left in the hands, somewhat less favourable to materialism, of philosophers and social scientists. Concerned with atoms, forces, masses, heat, energy and quantums, scientists relegated the question of Aristotelean form to the arena of religion, philosophy, or sociology. After all, this does not seem so illogical, being due to a tacit or explicit acceptance of a certain form of ontological dualism, a certain division of epistemological labour. However, halfway through the twentieth century,[19] particularly from the 1970s, certain perspectives began to gain *momentum* that, coming as they did from the hard sciences, consider that there is another entity, conceived of as distinct from physical matter. As is well known, after the Second World War the terrains of information sciences, cybernetics, computing and related disciplines started to develop. In this context Norbert Wiener bluntly asserts:

> Information is information, not matter or energy. No materialism, which does not admit this, can survive at the present day. (Wiener [1948] 1961, 132)

This emphatic assertion not only postulates the idea of a third entity denominated *in-formation*,[20] but also situates it within a materialist perspective that at the same time criticises various forms of Marxism which are incapable of considering the materiality of this new entity (Capurro and Hjørland 2003, 359). The theory of information, besides Wiener's contributions, is supported by the decisive interventions of Shannon (1948, Shannon and Weaver 1963) and Bateson (1972, 1979), among others. However, the term information is not used in all cases in a strictly analogical way[21] and, above all, it is invoked in a completely different sense to the one employed in this book. Leaving to one side the subject of the relationship between information and communication that interests Shannon – signals, noises, probabilities – and also setting aside the question of cybernetics that enthuses Wiener – command, order, control – and many other questions, we are left with the modest consensus that emerges in some corners of the physical and information sciences related to the existence of an entity that is not, strictly speaking, *only* 'matter' or 'energy', in other words, physical matter, and that, in fact, seems to have quite different properties.

In more or less the same period, the discovery of the structure of DNA and a whole series of other advances in the world of biological sciences led to theories of information widening beyond the world of physics, electronics and their embryonic developments at the time. Now it is the life sciences, in their-wide variety, that lean upon the theory of information.[22] Not only medicine and biotechnology, but also experimental psychology and its repercussions in the neurosciences.[23] Information is no longer a principle limited to certain

human creations, and becomes a crucial concept for understanding nature, and Being.

> Evidently nature can no longer be seen as matter and energy alone. Nor can all her secrets be unlocked with the keys of chemistry and physics, brilliantly successful as these two branches of science have been in our century … A third component is needed for any explanation of the world that claims to be complete. To the powerful theories of chemistry and physics must be added a late arrival: a theory of information. Nature must be interpreted as matter, energy, and information. (Campbell 1982, 16)
>
> The information content of amino acid sequences cannot increase until a genetic code with an adapter function has appeared. Nothing which even vaguely resembles a code exists in the physio-chemical world. (Yockey 1981, 13)

In brief, a broad range of scientists with a background in the natural and exact sciences currently adopt the distinction between physical matter and this other entity, principle, or concept that, in the majority of cases, they call 'information' (Wiener 1961; Miller 1978,[24] 1992; Karpatschof 2000; Kirschenmann 1970;[25] Campbell 1982; Umpleby 2007;[26] Gershenson 2007;[27] Madl and Yip 2007;[28] Gitt 2006; Maartens 2007[29]). Also, for social scientists, the theory of information began to appear as a base upon which different disciplines can be integrated. The approaches of complexity and systems theory, in diverse ways, believe in this potential and make use of it (among others, Parsons 1977; Luhmann 1995; Morin 2008; García Camarero 2001;[30] partially Simondon ([1958] 2005)).

Thus far we have attempted to demonstrate that the idea of bestowing entity, from a materialist perspective, on something that is neither 'matter' nor energy, is not original in the slightest. However, we have only appealed to the authority of some cited texts, without delving into the argumentation that sustains this idea. In turn, and at best, the suggestion has been made that this third entity is information, while above we alluded to the fact that in our schema 'matter' and energy, that is, physical matter, are complemented by knowledge matter. The next step in our reasoning consists of attempting, still on a very abstract level, to surmount these two limitations. We will have to replace information with knowledge matter, explain why this is done, and give a positive content to this last concept.

1.5 From Information to Knowledge Matter

A broad brushstrokes history of the term 'information' can be found in the studies of Rafael Capurro and Birger Hjørland (see, for example, Capurro and Hjørland 2003). As in other cases, success and tarnishing through overuse go hand-in-hand, and the triumph of the concept of information has burdened it

with the most diverse definitions (for an exhaustive list see Hofkirchner, 2013). A similar phenomenon took place with 'knowledge' as well, although in that case over centuries rather than decades. An article from a few years ago, with no claims of exhaustiveness, compiles 130 definitions for these two concepts (sourced from academic publications) and classifies them into 28 groups of opinions (Zins 2007). Repeatedly, the lack of scientific definitions of these terms has been noted.[31] It is easy to agree, as a consequence, that it is not possible, on any scientific basis, to assume a *single* point of view is valid, rejecting all the others a priori. Different definitions produce framings that shed light on certain problematics while relegating the rest to the shadows. As long as these concepts are used within coherent, systematic schemas, it seems reasonable to give each one the benefit of the doubt until in the end the papers, books, or programs of investigation show what the benefits of their use are. Only practical application and the subsequent destiny of such schemas will reveal how fruitful their initial definitions have been. Indeed, the only way of arriving at well-polished concepts is starting from provisory definitions, which must be whittled into shape or even replaced at an opportune moment. In this sense, we will proceed in the following way. At first a succinct explanation will be provided as to why we have recourse to the idea of knowledge rather than information. Then some elements will be provided which superficially delimit what we understand by knowledge in ontological terms. This task will be completed, in abstract terms, by the end of chapter 4. Once that milestone has been reached, a general vision of the perspective we intend to propose will become clear.

So, why knowledge and not information? Firstly, let's look at the modes in which information is defined. Some of them are extremely broad. They encompass, like the Aristotelean *morphus*, the organisation of all physical matter. Others, the majority, refer to the design/organisation/form of different living systems: information is merely an attribute of biological entities. Here, following in Shannon's footsteps, information is associated with the phenomenon of communication (independently of whether it is produced among humans or between unicellular organisms). But for some economists (e.g. Varian 1995, 1998; Shapiro and Varian 1999), information is something much more specific: everything that can be codified as digital signals. Both the more general uses and these more specific ones have, as we will try to show, great practical virtues for the categorisation of different productive processes. However, it is not possible to preserve a single word for both things. A concept is needed to designate that type of entity that complements physical matter and another to describe the small subset of flows of bits. Here a semantic incompatibility surfaces between the information sciences, systems theory, and economic approaches.

Secondly, and in relation to this subset, it should be made quite clear that we do not in any way reject the concept of information. In fact, it will be one of the central concepts of this book. However, this will be introduced in chapter 3, as a specific type of knowledge. In other words, the concept of knowledge that we

advance, subsumes the concept of information, along with various others. This connotes another peculiarity: for our purposes information will be a tightly circumscribed concept, with a much smaller scope than that used in the theory of information and more closely resembling that used in economics.

The third point is a little more complex. It is frequent, among the varied theories concerned with information and knowledge, that either tacitly or explicitly a striking division is established. On the one hand, recourse is made to the idea of knowledge – situating it on the axis of truth-falsity or something similar, such as science-common sense – and it is referred to in relation to what occurs *with humans at the level of individual consciousness or social structure*. Meanwhile *for the biological and inanimate levels*, the concept of *information* is used – with its corresponding language of codes, probabilities, messages etc. However, in both cases, by one name or another, this entity that is not knowledge matter is being alluded to. Why must this distinction be made? On the one hand, it arises from the Greek tradition that situates knowledge on the axis of truth-falsity. This axis, however, has been criticised by the sociology of knowledge (Mannheim [1936] 1949; Stark [1958] 2010) and later by the sociology of science (starting from Bloor's strong programme [1976] 1991). In chapter 2 we will return to this point. But, on the other hand, in a more profound way, the distinction seems to be rooted in the *humanism of industrial capitalism*. This *methodological* humanism has also been the object of criticism from the most varied corners of the social sciences (three extreme cases which share only this argument: Latour 1993, 2005; Luhmann 1995; Sloterdijk 2009). However, its conceptual repercussions continue to be felt, with its legitimacy undented. Although this is a tangential point in our argument, it is unavoidable to insist that the idea that the human and the non-human merit different gnoseological treatment is far from being self-evident. In fact, it is worth wondering if the elective affinity (in the sense that Weber confers on Goethe's expression) between this methodologically humanist conception and industrial capitalism has not had its repercussions in the irreversible damage to our ecosystem that, doubtlessly, has effects which are difficult to describe as humanist. At best, this distinction is acceptable as an a priori for idealist perspectives. No one demands that the Christian worldview or certain forms of methodological individualism shift from the centre to the individual human subject. However, something different should be expected from the perspectives that cleave to materialism. To clarify, the third point consists of inverting the burden of proof of the humanist equation: we argue that there are no elements that justify conceiving a priori of a discontinuity between what is usually called 'knowledge' (the human individual and social) and what is commonly labelled as 'information' (the non-human, biological and inert). This point shall also be returned to in chapter 2.

In short, the term *knowledge matter* will be used here to refer to that entity that natural scientists differentiate from physical matter, shifting away from the truth-falsity axis and from the human/non-human distinction. Information

will be a subset within the world of knowledge matter (in the same way that calorific energy is a type of physical matter). The expression *knowledge matter*[32] attempts to convey one of the main claims of our theory: that knowledge only exists on a material basis, in a physical bearer. This claim will become clearer over the course of the next section and following chapters. However, it is necessary to specify what we understand by knowledge matter.

1.6 Knowledge Matter and Why it Matters: Towards a Materialist Perspective of Knowledge

What is this concept of knowledge about? What is the positive content that corresponds to the term within this theory? How does it differ from physical matter, or to pose the question more precisely, upon what basis can such a division be justifiably sustained? More importantly, how is this notion of knowledge related to a materialist theory? Over the following pages some rough, and still very abstract, ideas for an *analytical* definition will be offered, while in chapter 3 an exhaustive *nominal* definition will be provided. These ideas are presented as contrasting knowledge matter and physical matter.

The first and principal contrast, already discussed above, is of a legal or regulatory order: capitalism governs knowledge matter by means of intellectual property (and similar institutions), while physical matter is ruled by physical property. Let us take a determinate wheel, devised and constructed by a particular artisan, at some indeterminate time and place in the history of capitalism. The wheel, evidently, combines physical and knowledge matter. It might be the case that the artisan is the owner of the physical bearer (she can exclude third parties from it), but not of the knowledge matter (which may be in public domain).

Secondly, knowledge matter is an *emergent* form. *Emergence means that knowledge matter, even though it only exists on the basis of a material support, has properties that are not reducible to those of the physical matter that sustains it*. It is vital to point out that emergence is a feature of all material entities, not only knowledge: emergence is also observed in inert physical matter. However, *knowledge matter is associated with living beings*, that is, with the emergence of systems that reproduce and maintain themselves (autopoietic, according to Maturana and Varela 1984; Luhmann 2012). Life, in fact, constitutes a significant threshold separating different forms of being, placing on one side pure physical matter (atoms, molecules, etc.), and knowledge carriers on the other. Prior to the appearance of life on earth, there were only blind forces and inanimate masses: mute physical matter. After a certain moment, simple forms of knowledge emerged, carried by the first beings capable of reproducing themselves. Much later, with the advent of humanity, knowledge was objectified in artefacts and codified in varied symbols.

Thirdly, and in the same sense, physical *matter is finite, limited, cannot be created nor destroyed but only transformed* (as the aforementioned laws of conservation indicate). *Knowledge matter, by contrast, is born and expands, but can also die*. The idea of the wheel appeared at some specific moment and as we all know it has been disseminated or reinvented without major spatiotemporal limitations. However, there is nothing that guarantees its immortality, and the same applies to other knowledges that our mortal artisan has adopted.

Fourthly, *knowledge matter represents negative entropy* (Schrodinger 1944; Von Neuman 1966[33]), or negentropy (Brillouin 1953). Negentropy can be defined as a deficit of entropy in a subsystem which is dynamically ordered in relation to the chaos that surrounds it (Mahulikar and Herwig 2009). Put simply: it expresses the inverse of the tendency to disorganisation that governs physical matter. A wheel, and also the human who produces it, remain articulated and resist the physical forces of uncertainty and decomposition. It is the objectified knowledge in this rotating artefact that has given it a form that the laws of physical matter would have denied it. In turn, the artisan herself who materialised knowledge in the wheel depends, for the continuation of their own metabolism, on the concurrence of diverse cognitive flows.

Fifthly, we follow the lead of economists who often hold that *a feature of knowledge matter is that its consumption is non-rival*[34] (Romer 1993;[35] Stiglitz 1999; without using the term the idea is also in Samuelson 1954), *infinitely expansible* (David 1993) and has *zero subtractibility* (Ostrom and Hess 2006). What do these terms mean? Basically, that the consumption of a determined knowledge matter does not deplete the available quantity of that knowledge. The idea of the wheel can be used by additional artisans without the available quantity of that idea diminishing.[36] In the same sense, knowledge matter does not wear out with use.[37] Any given wheel can suffer wear-and-tear, or the mind and muscle of the artisan can be exhausted; in other words, the bearers of the idea of the wheel can be consumed. But the knowledge itself does not suffer from intensive use.[38] In turn, the *positive externalities* (Cornes and Sandler 1996) of knowledge matter also hinder, as Jefferson indicates, the material possibilities of excluding subjects from it, and from it alone.[39] In contrast, it is usually possible to operate an almost perfect exclusion from physical matter. It is difficult, for the artisan who uses the wheel, to prevent his or her neighbour from observing the knowledge carried by it. It is much easier to protect the physical aspect of the wheel. Thus, the exclusion in relation to knowledge operates through the exclusion regarding the physical matter with which it is bound up. How difficult or easy it is to exclude subjects from a determined knowledge depends upon the level of difficulty posed by exclusion from the material basis in question.

In sixth place, another common idea in economics is that the marginal costs[40] of knowledge matter or of some of the forms it takes, are *comparatively low either with regards to other goods or with regards to fixed costs*[41] (Bentham

1954;[42] Arrow 1962; Nelson 1959; Varian 1995). Reproducing the idea of the wheel is much easier than reproducing the wheel itself and, at the same time, the costs of producing the first wheel are much greater than those associated with the second. In the first case our artisan must elaborate a design, supply themselves with tools and calibrate them, make test models and correct faults. In the second, these expenses are reduced to the inputs in question. However, this formulation of neoclassical economics is not quite correct. It would seem that there are some goods that are made up of knowledge matter and others that are not. The former would have the properties described, while there would be others lacking them. Actually, as we have asserted, almost all entities – except the inert entities that have not received cognitive flows, such as the wind or a stone – combine, *in diverse measure*, different types of knowledge matter and different types of physical matter. The wheel as an artefact, the idea of a wheel in the mind of the artisan, and that same wheel described in a text all involve varied mixtures of these. The cost of the reproduction of the knowledges varies in each case, based on the proportions of this combination and the type of bearer that the knowledge is embedded in (Romer 1993). Let us set aside the example of the wheel and take up the idea of God or of money. When it is said that knowledge matter reproduces itself with low marginal costs, this is a reasonable claim for the knowledge codified in texts (the idea of God in the Bible, the monetary signs on notes or bank accounts), but it is completely unsustainable for the intersubjective form of that knowledge (the collective belief in God or the social faith in the contract that money implies). Indeed, reproducing knowledge carried intersubjectively is extremely costly, when not impossible,[43] as the inflation of atheism and the atheism of inflation show.

In summary, the reproduction costs of the *goods* in which knowledge has been materialised depend on the forms of physical matter with which they are entangled. Having stated that caveat, it can be said that, on the highest level of abstraction, knowledge matter has lower reproduction costs (or marginal costs) than physical matter, whose reproduction costs tend towards infinity (insofar as it cannot be produced or reproduced).

In seventh place is the asymmetry of the relationship between physical matter and knowledge: *although there is physical matter that is devoid of knowledge matter, knowledge only exists supported by some form of physical matter*. As already pointed out, knowledge matter does not exist as an independent entity, but only as an emergent property of knowledge matter. *Now, the key is that this, from the standpoint of knowledge matter, becomes a* ***Bearer***[44] *that moulds knowledge, bestowing particular properties on it*. Contrary to the belief in the Platonic *topus uranus* (inhabited by pure and perfect *eidos*, uncontaminated by contact with matter), here we argue that the idea of the wheel does not exist without a seat in subjective consciousness, the rotating artefact, a codified representation, or some other physical bearer. Indeed, the perishable form of a perennial content is a necessary evil. The destinies of knowledges which do not wear out

and the bearers that do, are tragically bound up with each other. In turn, it is evident that the particular features of the *bearer of any knowledge matter determine various properties that such knowledge assumes*. That the idea of the wheel exists subjectively as an individual mental representation, as an objectivisation in a determined artefact, or as a codification in a text, confers on that knowledge highly divergent possibilities of, for example, being disseminated, being considered useful, or falling into oblivion.

Next, providing that the above holds true, it seems conducive to utilise the physical *bearers* as *a tool with which to distinguish several classes of knowledge matter*.[45] Indeed, with regards to 'matter' (as entities with mass), the various levels on which it exists are well known: atoms, molecules, and cells, among others. The same applies to energy: thermal, electrical, nuclear etc. These are classifications between different levels (with hierarchies) or planes (without) but, in any case, all are classifications of a materialist variety. It is noteworthy that in terms of knowledge, this kind of typology[46] has not been elaborated more than tangentially and, more importantly, they have not become common sense. Of course, this is due to the fact that knowledge has tended to be conceived of in an idealist way, disconnected from the materiality of its existence. The Cartesian dichotomy, now superseded on so many planes, persists in relation to knowledge. But what are these planes or levels that knowledge exists on? For the time being, in relation to knowledge these are the *bearers*. Although in chapter 3 a detailed typology will be elaborated, here it will satisfy our purposes to preview this answer in order to introduce the comparison with physical matter.

In this sense, some forms that here we describe as knowledge (matter) resemble what is habitually understood by the term in the social sciences: the *subjective* and conscious knowledge of individuals. Without stretching the point too far it is also commonly accepted to consider knowledge to be what the neurosciences call implicit memory: non-declarative knowledge, akin to what economists call 'know how', sociologists of science and technology call 'tacit knowledge', and psychologists refer to as the 'unconscious'. A second bearer of knowledge, accepted from its inception in anthropology and sociology, and later recognised by economics (especially Evolutionary economics) is the *intersubjective*: referring to those knowledges that are situated, so to speak, beyond the particular human subject. Values, norms, languages, institutions, and beliefs would seem to dwell in this sphere. In turn, the impact of the theory of information on the biological sciences means that there are forms, that here we call knowledge, which exist at a smaller scale than the individual subject. This is a third type of bearer, belonging to the *biological* order: flows of data codified in various ways, e.g. genetically that inform all living beings.

Lastly, there are knowledges with an *objective* bearer in some inert entities. Wherever humans have intentionally translated their knowledge onto inanimate material, there is knowledge of this type. For now it matters little whether

Physical Matter	Knowledge Matter
Physical property	Intellectual property
Emergence	Emergence
Irremediably limited	Potentially infinitely accumulable
Entropy	Negentropy
Subtractability	Expansibility
Infinite reproduction costs	Comparatively low reproduction costs (varies according to bearer)
Can exist without knowledge matter	Cannot exist without a physical matter bearer
Levels or planes: Atoms, molecules, cells, organs, etc./ thermal, electrical, chemical, nuclear, etc.	Bearers: Biological, Subjective, Intersubjective, Objective.

Table 1.2: Physical Matter and Knowledge Matter.
Source: prepared by author.

these knowledges have been objectified in a wheel, a cave painting, or a computer. Thus, the human individual, the human collective, the biological human and non-human, and the inert entity that has been shaped by 'social' flows of knowledge, all these are forms of knowledge matter. In other words, knowledge matter exists in four bearers: *subjective, intersubjective, biological, and objective*.

Returning to the level of analysis of the goods (and subjects) with which this chapter opened, we must reiterate that these are combinations of variables, diverse proportions and heterogeneous qualities of physical matter and knowledge matter. But it is important to emphasise that the variability has significant consequences in relation to both the economic properties of the goods in question (for example, their reproduction costs as mentioned earlier) and to the regulations that principally affect these goods. In this last sense, let us cast our minds back to the idea that physical private property regulates access to the physical matter aspect of a good while so called intellectual property acts on knowledge matter. We can now add that the proportion of physical matter and knowledge matter is one of the variables that have an impact upon the differential weight that the different types of capitalist regulations have. Let us imagine that the wheel in our time-honoured example has physical material inputs, implying significant costs, and requires large energy resources to power them. We shall conjecture as well, that the knowledge that the artisan makes use of is found in the public domain and easily learnt. In this extreme case, it is evident that physical property will make itself felt more than intellectual property. Let us now suppose, and on the contrary, that we encounter a different wheel: one

that objectifies knowledge matter perfected and handed down over generations, with secrets guarded by families or craft guilds, and that the physical materials and energy needed to produce it are few and extremely cheap. In this case, although once again both regulations are present, intellectual property (or its historically situated equivalent) would weigh more heavily upon the object.

To close this chapter it is crucial to introduce a clarification about the *historicity* of the concepts and theories that have been put forward. Naturally, all concepts and theories are subject to historical development. Their origins, suitability, and limits are indissociable from the contexts in which they emerge and circulate. This simple idea is accepted by all authors regarding the currents and concepts of other disciplines, but is rarely adhered to in relation to their own. It is difficult to convince an economist that, to pluck an example from the air, the trisectoral division of the economy (into farming, industrial and service sectors) is not a natural and unalterable product but that it instead took shape in a determined period. It would be even more difficult still to hold a critical discussion with a Marxian (who would nod approvingly right up until the previous sentence) about the historicity of Marx's own categories. Having said that, here we would like to avoid committing that sin, as far as is possible.

Indeed, our approach in relation to distinguishing physical matter and knowledge matter (along with the other concepts presented over the course of this book) is as subject to the contemporary epoch (informational capitalism, as we shall see) as any other. Thus, *it is essential to bear in mind that what appears as a physical, philosophical, legal or economic ontology, is as transitory a historical product as any other*. It is not a question of plugging up one's ears to block out the seductive song of the sirens, but rather of heeding Odysseus' precaution: by binding oneself to the mast of historicity.

If the starting point of our reasoning has been forgotten, by now one could have the impression that our intention is to hypothesise that physical matter and knowledge matter are the two aspects that animate Being, that we are attempting to resolve the ahistorical mystery of ontology. Fortunately, due to both lack of skill and vocation we shrink from such a display of philosophical fencing. We have no well-formed opinion, nor does it seem relevant to know for certain, if Being is composed of physical matter and knowledge matter, of fire and water, or of an indeterminate multiplicity and events. *We do maintain, on the other hand, that there is a dialectical totality which we can agree to call capitalism. Suffice it here to hypothesise that it is (what in chapter 3 will be called) the cognitive material configuration of this stage of capitalism that is organised around this distinction between physical matter and knowledge matter and that, therefore, it can be profitably understood through it.* These capitalist regulations, conceive of physical matter and knowledge matter as two aspects of a Being, two aspects that, by definition, appear as natural and immutable. How fruitful our approach turns out to be is for the reader to decide once the end of this book has been reached.

This chapter opened with capitalist regulations and has finished by highlighting the characteristics of two aspects of entities. We touched on knowledge (matter) being one of them, that is to say that knowledge presented itself to us in an *ontological* way. However, knowledge has not been approached in a *gnoseological* way, which is of course the most usual. Thus, we have not entered into debate with the tradition that begins in epistemology and continues through Marxism and the sociology of knowledge. This is what will be attempted in the next chapter in order to be in a better position to introduce our perspective, cognitive materialism, in a systematic way.

CHAPTER 2

How to Know Knowledge? Introducing Cognitive Materialism

The ideas presented in the first chapter will have alerted the reader to the fact that we intend to give the concept of 'knowledge' a meaning which is quite distinct from the varied definitions it is often given in epistemology, Marxism, and the sociology of knowledge. In this sense, it is now advisable to situate our approach in relation to these traditions. Indeed, any reflection on the term knowledge should take into account the different approaches and strands of thought that have intersected with the concept. But far from tracing this historical trajectory in any detail, evaluating critiques and integrating the research presented here into the solid foundations of philosophy and the social sciences, the objective of making this comparison here merely lies in revealing the particularities of cognitive materialism.

2.1 Epistemology

Let us start from a completely naturalised idea in order to facilitate our presentation. The different disciplines that have studied knowledge share an understanding of it *as a product of human subjects* – individual, collective etc. But, is it that clear-cut? We will try to show that it is not, but for now we shall abide by this idea. As a consequence, the relationship between subject and knowledge can be useful, in order to assemble these diverse viewpoints around it (Mannheim [1936] 1949, 12, but above all see Cassirer 1906, 1907).

Now, beyond popular stories, myths and religions – which it might be worth lingering over – the first discipline that dedicated itself to thinking about the features of knowledge was philosophy, and within it what we today call epistemology (Mannheim [1936] 1949, 12).

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In all likelihood much to the horror of the diligent devotees of this philosophical branch, we suggest a crude simplification: that the traditions of philosophy, particularly epistemology, have as a fundamental characteristic the analysis of the subject-knowledge relationship in ideal terms. Of course, this idea is not at all original, having been formulated by Marx and Engels, for example in *The German Ideology* (see below). Perhaps it would be more interesting to add that one of the features of this epistemological idealism – and certainly of the so-called 'historical materialism' that engages in a critique of it – is that it locates all debates around the truth-falsity continuum. How is truthful knowledge produced? How can it be distinguished from false knowledge? What are the guarantees that the knowing subject is on the path to truth? Is it possible to gain access to the truth or even draw close to it? How can the falsity of a supposed knowledge be demonstrated? These have been, ultimately, the questions that have animated the debates since Classical Antiquity. Neither is it surprising, when epistemology remains semantically anchored in the Platonic notion of *episteme*, as immutable, truthful, transcendent knowledge (and in a good deal of the conceptions of it, inaccessible to the senses). Thus, the term that came to be used for the entire history of this tradition to designate knowledge – i.e. episteme – means that the idea of false knowledge is understood to be an oxymoron. But the point we would like to make here is more about the association between *epistemology and the truth-falsity axis than about the link between knowledge and truth*. This emphasis lacks significance in Plato's case and his distinction between two classes of doxa and episteme in book vii of *The Republic*. But it becomes increasingly important for subsequent epistemology. Popper's falsifiability – along with coterminous authors and debates – limits the potential of humanity – especially scientists – for gaining access to the pole of truth on the axis in question, but it does not alter the *axis itself* to which the joys and sorrows of knowledge are condemned. For Plato the *philosopher* could, under certain circumstances, reach the end of the race and cross the finishing line of truth (which was also the starting point, in their forgetfulness of the topus uranus); while for Popper, the *scientist* is condemned to assume the role of a self-aware Achilles who runs knowing that the tortoise and its truth, sooner or later, will inch further away. Science draws ever closer, but the elusive epistemic reptile unremittingly interposes a certain distance. Beyond these metaphors, it is evident that we are still talking about the same axis. Whoever reads through this book, whether they are philosopher or scientist will have no bearing on how far or how close to our objectives they get.[48]

Besides the location of knowledge along the truth-falsity axis, it is important to emphasise that the other distinctive feature of epistemology is its *idealism in the analysis of the relationship between subject and knowledge*. Even within the broad level of generality we are navigating in these paragraphs, perhaps it is possible to slightly reduce the level of imprecision. To that end, we will adopt a historical division that Karl Mannheim suggests, placing on one side the periods in which the epistemological question was directed towards the *objects of knowledge*, and

on the other the periods in which the knowing subject was examined. The former, the author claims, are typically rooted in the pre-modern era:

> In periods in which the objective worldview remains more or less unshaken, and in epochs which succeed in presenting one unambiguously perceivable world order, there exists the tendency to base the existence of the knowing human subject and his intellectual capacities on objective factors. Thus in the Middle Ages, which not only believed in an unambiguous world-order but which also thought that it knew the existential value to be attributed to every object in the hierarchy of things, there prevailed an explanation of the human capacities and thought which was based on the world of objects. (Mannheim [1936] 1949, 12)

The idea is clear. In a stable world, in which the good, the beautiful, and the truthful have not been rent asunder, in an ordered and balanced world, in a world that counts on the guarantee of omnipotent gods, ultimately there is no reason to doubt the objects of knowledge. Additionally, Mannheim holds that the shattering of medieval certainties regarding the order of the world of objects, connected to the ascent of modernity, drove epistemology to take refuge in the subject itself, shifting the emphasis of its investigations onto it.

> …the conception of order in the world of objects which was guaranteed by the dominance of the church became problematical, and there remained no alternative but to turn about and to take the opposite road, and, with the subjects as the point of departure, to determine the nature and the value of the human cognitive act, attempting thereby to find an anchorage for objective existence in the knowing subject. (Mannheim [1936] 1949, 12)

Thus, from Classical Antiquity until the Medieval Age, the central focus of epistemology was knowledge itself, understood as a pure, abstract, ethereal entity. In other words, idealism understood knowledge as a form of being independent from the subject, a carrier of characteristic properties. Modernity, and especially the tradition that since empiricism and rationalism converged in Kant and led to transcendental idealism, changed this radically. The focus of epistemology becomes analysis of the knowledge-creating subject. What are the enabling conditions, that categories of understanding must possess,[49] what are the general features necessary for this subject to produce knowledge (remember: 'truthful knowledge')? Of course, the point is that now it is the subject who is considered in ideal terms. The subject whose knowing-potential is explored is either a universal, ahistorical, completely abstract subject, or an incarnation of the systematic thinker: the philosopher or the scientist. No analysis of materiality, of 'social' circumstances, of the empirical features of cognitive processes is invited to that particular philosophical banquet.

Certainly, for epistemology, even more distant than the question of the materiality of the knowing-subjects is the concern about the materiality of knowledge itself. This is due in part to the difficulty of wrestling with knowledge epistemologically and ontologically simultaneously: as a knowledge about the world and as a thing in the world. This is how Steve Fuller puts it:

> Philosophers generally think that knowledge is about things, but rarely is knowledge itself conceptualised as a thing. To make a 2500 year-old story short, the main reason why philosophers have shied away from thinking about knowledge as a thing turns on conceptual difficulties that are supposedly involved in treating knowledge as something both in the world and about the world. (Fuller 2005, 1)

In short, epistemology tends to either consider knowledge itself as a purely ideal entity, or to imagine the knowledge-producing subject as an ideal subject. Materiality continues to be viewed as a contaminating residue that should be filtered out in order to arrive at the knowledge of the essence of Being.

2.2 Marx and the Sociology of Knowledge

The reflections of this second important group start from the assertion of a fundamental concept whose clearest, if not the first, formulation comes from Marx. This is that the ideas and subjects that produce them are tightly bound up with the 'social'[50] context that surrounds them.

Evidently, this implies a departure from *one* of the idealist aspects of epistemology. The social circumstances in which these subjects are immersed, with different particularities he points out, must be analysed, in all the perspectives of this group. Schematically, there is agreement that: i) knowledge is a product of concrete, material, empirical, and contingent human subjects, and not of transcendental beings such as those of epistemology; ii) the subjects elaborate these knowledges while conditioned or determined by diverse, generally 'social', factors; iii) consequently, to study the features of knowledge these factors must be studied and elucidated. Two heterogeneous approaches are subsumed here. The first is proper to Marx. The second, closely related to the former, belongs to the sociology of knowledge.

2.2.1 Marx

The first clear formulations of Marxist materialism are found in *The German Ideology*, written with Engels in 1846, but which wouldn't see light until its publication well into the twentieth century.[51] However, the most general (and in a way, the bluntest) enunciation of the relationship between subjects and

knowledges for this approach can be found in a well-known passage from the *Contribution to the Critique of Political Economy*:

> In the social production of their existence, men inevitably enter into definite relations, which are independent of their will, namely relations of production appropriate to a given stage in the development of their material forces of production. The totality of these relations of production constitutes the economic structure of society, the real foundation, on which arises a legal and political superstructure and to which correspond definite forms of social consciousness. The mode of production of material life conditions the general process of social, political and intellectual life. It is not the consciousness of men that determines their existence, but their social existence that determines their consciousness. (Marx [1859] 1977, 20)

What does this paragraph (and those from *The German Ideology*) tell us? Firstly, the critique of philosophy, particularly German idealism, makes its appearance, that Marx never tires of repeating: we must set aside speculations and start from the concrete reality of human social subjects. Materialism derives from this, for this author: analysing the concrete conditions of the production and reproduction of real life, integration into the social relations of production and, only on the basis of these, studying the products of the mind. Secondly, it should be noted that Marx's emphasis is not on the materiality of individual subjects. If this were the case, we would be confronted by a psychological explanation: a subject experiences one or another personal situation, and this leads them to conceive this or that idea. But for Marx, and in the quote above this can be seen clearly, the problem is the integration of the subject in the web of 'social relations'. These, particularly those of production, are what determine 'social consciousness'.

A third relevant element for our synopsis is the resignification of the concept of *ideology*.

> The phantoms formed in the human brain are also, necessarily, sublimates of their material life-process, which is empirically verifiable and bound to material premises. Morality, religion, metaphysics, all the rest of ideology and their corresponding forms of consciousness, thus no longer retain the semblance of independence. They have no history, no development; but men, developing their material production and their material intercourse, alter, along with this their real existence, their thinking and the products of their thinking. Life is not determined by consciousness, but consciousness by life. In the first method of approach the starting-point is consciousness taken as the living individual; in the second method, which conforms to real life, it is the real living individuals themselves, and consciousness is considered solely as their consciousness. (Marx and Engels [1846] 1970, 47)

In Marx, terms such as representations, consciousness, and ideas, occupy the place of (a part of) what we call knowledge, and this is no coincidence. The former are part of ideology, of the beliefs distorted by material interests, while knowledge would be associated with science[52] and, in the last instance, with reason and truth (Naess 1956). As Tom Bottomore remarks:

> The theory of ideology is not present as a new epistemology, and Marx would not have developed the theory in the way he did if he had not already believed that the doctrines that he was attacking were false. His theory of knowledge was implicitly that of the natural sciences. (Bottomore 1956, 54)

All this is the source of bitter polemics but in any case, it is not a significant issue for our analysis. Here it suffices to point out that Marx *situates knowledge (in the broad sense in which we understand it) in relation to the materiality of the subjects that produce it. However, he does this only for that part of knowledge which he calls ideology.* In the paragraph cited above from Marx, an idea surfaces that would take on various different formulations later on: that of the historicity of ideas. This means not only that beliefs are a product of the material embodiment of human subjects, but also that the transformation of the modes of production, class struggle etc., cause these beliefs to be modified. The notion (that would gain popularity with Kuhn) that the legitimacy of ideas is a transient historical product is one that we also owe to Marx.

2.2.2 The Sociology of Knowledge

By sociology of knowledge we are referring to a perspective that took shape at the beginning of the twentieth century, in Germany and later on in the USA (Merton [1948] 1968, 511). Among its founding authors are Mannheim ([1936] 1949), Scheler ([1926] 1980), Merton ([1948] 1968), and a number of other illustrious contributors.[53] Both the perspectives of authors such as Schütz, Garfinkel, and Goffman (phenomenology, ethnomethodology, symbolic interactionism) and, especially, Berger and Luckman's well-known study ([1966] 1991), are the descendants of *Wissenssoziologie* through the branch of the sociology of common sense knowledge. Through the opposing branch – although it grows increasingly closer to its estranged sister – we have the version which came after the 1970s, the sociology of scientific knowledge, or simply, of science. Authors such as David Bloor, Harry Collins, and Bruno Latour, among many others,[54] engage in dialogue with this familial legacy.

Discussing the origins of the sociology of knowledge is inconceivable without mentioning its debt to and critique of Marx. The most important book in this tradition, *Ideology and Utopia*, reveals this with its very title. Indeed, Mannheim extends the principle of the 'existential determination of ideas'

(Mannheim [1936] 1949) *to all forms of what he calls knowledge*, i.e. to ideas, representations, and beliefs, regardless of whether they are true or false, scientific or common sense. As one commentator points out, comparing the sociology of knowledge with Marxism (which he refers to with some disdain as the 'doctrine of ideology'):

> We see here already the decisive difference between the doctrine of ideology and the sociology of knowledge. The former deals with a mode of thinking which is thrown off its proper course, the latter with all modes of thinking, and especially with those which form the intellectual framework of our whole world-view and which exist long before any falsifying interest-begotten tendency can assert itself. (Stark [1958] 2010, 48–49)

Perhaps the best synopsis of the programme of the sociology of knowledge, which distinguishes it from both epistemology and Marxism, is offered by Tom Bottomore in an article from 1956:

> All knowledge is a subject for sociological study. I use "knowledge" here, not in the philosopher's sense to denote "a subclass of true beliefs", but to denote any product of reflective thought, as distinct from intuition or immediate experience. Knowledge in this sense includes true and false beliefs, as well as beliefs which are neither true nor false … The sociology of knowledge, then, is the study of the relations between the constructs of reflective thought and social structure, that is, between such constructs and social groups (occupations, communities, etc., as well as social classes), institutions and total societies. (Bottomore 1956, 56)

The sociology of knowledge, in general, maintains its emphasis on the social – as opposed to individual – aspects in the determination of ideas. At least, this is how Mannheim sees it:

> The principal thesis of sociology of knowledge is that there are modes of thought which cannot be adequately understood as long as their social origins are obscured. It is indeed true that only the individual is capable of thinking. There is no such metaphysical entity as a group mind which thinks over and above the heads of individuals, or whose ideas the individual merely reproduces. Nevertheless it would be false to deduce from this that all the ideas and sentiments which motivate an individual have their origin in him alone, and can be adequately explained solely on the basis of his own life-experience. (Mannheim [1936] 1949, 2)

Nevertheless, this perspective carries along with it some risks of relativism, which in fact Mannheim is often accused of.[55] Marx situated, at best, the

possibility of knowledge (truth and science) in the material determination of the proletariat – as we now know Soviet science took this unsustainable idea quite far. But Mannheim's solution to the relativist threat and the problem of reflexivity[56] is hardly more satisfactory. He advances what he would call 'perspectivism' or 'relationalism': he holds that there is a 'class-less position' of the 'socially unattached intellectuals' (Mannheim, cited in Merton [1948] 1968, 561). Mannheim himself, naturally, belongs to this stratum. Once again, here we are not interested in how to resolve this problem, but rather in the fact that the debate about relativism would not be abandoned by the sociology of knowledge or by its progeny.

Indeed, both the branches of sociology that hierarchically structure quotidian existence (Schütz's 'life world', and branches of the sociology of science subsequent to the 1970s) maintain the central arguments of *Wissenssoziologie*, and sometimes advance no further than to reiterate them with some linguistic adornments. In other cases there have been developments, or elaborations. In this last sense, the propositions of David Bloor's 'Strong Programme' ([1976] 1998) and Harry Collins's 'Empirical Programme of Relativism (EPOR)' (1981, 1982) ultimately took the principles of the sociology of knowledge to the extreme.[57] The same is true of Latour, Callon, and Law's actor-network theory (vide. Latour 2005), although this perspective exceeds the programme of the sociology of knowledge. In turn, the different sociologies that analyse the everyday production of knowledges (the key reference text is Berger and Luckman 1991) tick a sometimes forgotten box. Both currents point out that *the issue is not that there are one or several social, independent, causal factors pre-dating the knowledge that they produce, but that the production and circulation of knowledges also constructs social relations*.[58]

In all these cases, the emphasis progressively shifts from theoretical constructions to fieldwork. In daily life or in the laboratory, with the mentally ill or with scientists, *the study of the routine nature of the production of knowledges by individual subjects became crucial*. 'Practices' and 'actors' plant their flags on every mountaintop. The authors cited above and their readers wonder, what could be more concrete than fieldwork and, especially, case studies? What more effective check on idealist speculations than the narration of reality such as it is presented in ethnography? Knowledge is studied '*in the making*', everything is process, instability, action, and should be captured thus. Capitalist relations and far-reaching theories, from which the sociology of knowledge originates, are – keeping up appearances or not – banished from the *mainstream* of the sociology of knowledge. In short, *the sociology of knowledge maintains the analysis of the relationship between subjects and the production of knowledge with reference to the social incorporation of the former*. But it broadens the analysis in various ways: i) It includes what is true and what is false, and also that about which it makes no sense to claim as truth-falsity. It partially sets aside the truth-falsity axis which in epistemology and Marxism has been preserved; ii) It expands the social factors considered ad infinitum: the social relations of production, the

labour process, and social classes would not only lose their prior protagonism but in the constructivist turn of the 1970s, would be completely forgotten and diluted. In contrast, institutions, culture, traditions, schools and thought, and above all 'networks' and the 'practices' of 'actors' would win broad approval; iii) In some cases the unilateral direction of the link between 'social relations' (to employ a neutral term) and knowledge went through a process of transformation, until it came to be understood as being bilateral.

2.3 Cognitive Materialism

In this section some shortcomings contained within the approaches reviewed over the last few pages will be indicated, and then the approach of cognitive materialism will be presented.

2.3.1 Limitations of the Previous Approaches

Unfortunately, from the standpoint of cognitive materialism, both Marxism and the sociology of knowledge have, despite their valuable contributions, some significant and interrelated limitations: *idealism, humanism and the absence of a definition of knowledge*.

Idealism? But, are not some of these perspectives the champions of materiality? Is it not the case that Marxists are materialists par excellence? And, do not the other theories take into consideration the economic and cultural contexts in which subjects' lives unfold, in a thousand and one different ways? Are they not inundated by fieldwork? Do they not produce tonnes of case studies that analyse each and every detail related to the 'concrete practices' of knowledge producers? This is precisely the problem. All of these approaches often *only* take into consideration the materiality of subjects and their social contexts. *But that is only the materiality of knowledge in the cases in which social subjects are acting as bearers*. If there were other forms in which knowledge could exist, any analysis circumscribed to the joys and hardships of humans and their social fabric would, evidently, impose narrow boundaries on a materialist approach. This leads us to cautiously wonder: have any of these theories considered the *possibility* that knowledge could exist as something independent of 'social' human subjects? The answer, sadly, is no. With some partial exceptions,[59] these dozens of theories have not paused to evaluate such a simple concern. Thus, the connection between humanism and the idealism with which it is inextricably linked can be observed. Humanist reductionism placed limits on materialist inclinations towards knowledge itself.

Instead, one could ask in a general way what the material resting-places are that knowledge wanders through? Or, more precisely, in which forms of physical matter does what we describe as knowledge matter reside? This question

shifts the focus completely. Even though it impels us, as a first customary gesture, to analyse the subjective (such as individual consciousness) or intersubjective bearers (such as the values of a given society), in other words those which Marxism and sociology examine, now we can approach them in an entirely different light. Furthermore, at a second instance, the materialist question urges us to analyse other bearers in which knowledge resides. Do we not find knowledges objectified in the inert bodies of technologies? Does the ink impregnated into a text not carry codified knowledge?

The criticism about lack of attention paid to the materiality of knowledge has been proffered by very few authors from philosophical or sociological backgrounds. One of those who have ventured to do this is Steve Fuller. Although his target is philosophy, his argument can be easily extended to the different forms of sociology of knowledge.

> …epistemologists have ignored knowledge's diverse material containers, such as books, brains, databanks, and communication network, despite the different costs involved in getting access to the knowledge they contain. In fact, rather than making this point a matter for empirical disputation, epistemologists usually presume that only that which can be conserved as it is conveyed through diverse containers — that is, "content" — can have genuine epistemic import. (Fuller 2005, 3)

There will be an opportunity to discuss all these details in the next chapter, but for now we have enough evidence to suggest that Marxism and the sociology of knowledge are, at best, materialist with regards to the diverse factors that affect human knowledge-producing subjects, whether these are individual or social. However, they remain idealist in relation to knowledge itself.

On the other hand we have the problem of a definition. It is noteworthy that in the cases in which knowledge is subjected to a treatment that distances it from the truth-falsity axis, when it begins to be treated as a thing, in other words when it is dealt with in a less idealist way, in this same operation it loses all specificity, all definition regarding what knowledge is and what its attributes are as a thing. This is the case for the sociology of knowledge and social studies of science and technology. Indeed, in these approaches knowledge is no longer considered in terms of the truth-falsity axis, but in general there are no clear definitions with respect to what its content is, what its features are. A distancing is undertaken, with good intentions, from the erroneous certainties of epistemology and Marxism that associate knowledge with truth. But this usually lapses into a striking uncertainty regarding how to give a positive content, a clear physiognomy, to knowledge.[60]

However, this criticism should be attenuated with two extremely important caveats. The first is that the limitations of the approaches mentioned do not imply that they are lacking in importance, or are useless. The distinction

regarding scientific and non-scientific knowledge which epistemology has been concerned with, and the analysis of the mechanisms through which certain knowledges are legitimised while others are silenced, which has aroused the interest of the social sciences, are of enormous value for the construction of more just, egalitarian, and free societies.

The second is that in social studies of science and technology, and in innovation and knowledge economics, there are numerous pertinent contributions on these questions, capable of being valuable inputs for a materialist understanding of knowledge. Indeed, although knowledge matter is not always defined from an ontological viewpoint (let alone discussing materialism as a theoretical framework), in many cases its different forms of material existence are analysed, different types of knowledge are distinguished and their properties are examined, in ways which, to a greater or lesser extent, are beyond humanism and idealism. In previous studies three bodies of literature that assume this perspective have been identified. There are at least three conceptual families that have offered opinions about the properties of knowledge, rather than the human subjects connected to it. These will now be mentioned in ascending order of proximity to our approach.

The first of these groups revolves around the concept of *public goods* and similar concepts. Focusing on the properties of *rivalry/subtractibility and excludability*, various positions have been developed in the sphere of economics regarding how to classify knowledge (Ostrom and Hess 2006; Kaul and Mendoza 2003; Romer 1993).[61]

The second group refers to the concept of *tacit knowledge*, and especially to the discussion about its opposition to *codified knowledge*. This includes original contributions from Michael Polanyi (1958, 1967) and interpretations and developments of the concept across three fields: management literature (particularly Nonaka and Takeuchi 1995); evolutionary and neo-Schumpeterian economics (Nelson and Winter 1982; Cowan, David and Foray 2000, among others) and the sociology of scientific knowledge, mainly through the works of Harry Collins (1974, 2010). Additionally, the neurosciences and their antecedents in experimental psychology have made valuable contributions (Damasio 1995; Schacter 1987 and Kandel 2006).[62]

The third group includes authors who have introduced typologies of knowledge: in other words, demarcations between different types of knowledge. In disciplinary terms, the origins of these classifications can mostly be traced back to economics, although there have also been worthwhile interventions from the world of management (Lundvall 2000; Machlup 1962; Mokyr 2002; Spender 1996; Blackler 1995 and Chartrand 2007).[63]

So although in this concise book there is no space to discuss these bodies of literature, it is important to indicate that the systematisation of cognitive materialism presented below (and in a good measure the features of knowledge matter presented in chapter 1 and the typology in chapter 3) is based upon them.

2.3.2 Characterisation of Cognitive Materialism

The systematic exposition of our approach can be organised around its basic characteristics. It is a *materialist, emergentist, dialectical, non-humanist, scientific, and cognitive* approach. Although some of these features have already been mentioned, here they will be set out together. Warning: the following pages contain explicit scenes of philosophy and we recommend that impressionable readers jump straight to chapter 3.

Materialist

Cognitive materialism holds the basic assumption of every materialist philosophy: all and only material objects are real.[64] Material objects (entities) are defined by the fact that they are *changeable* (Bunge 1981, 20), as opposed to immaterial or conceptual objects. This approach seeks to distinguish material objects from Plato's worlds of ideas, Christian philosophy and others in which ideas are immutable, motionless, and not subject to change, while for Bunge matter is the set of material objects. Of course, this assertion of materialism refers to all entities, not only to humans or their social relations.[65] Crucially, material entities are not necessarily physical entities.[66]

Now, according to cognitive materialism, matter comes in three forms: 'matter' (the set of entities that have mass and volume), energy and knowledge. 'Matter' and energy are the physical entities *or physical matter*[67]. Knowledge, which only exists in a material bearer, is a non-physical but material entity, therefore, always *knowledge matter*. Therefore *there is no knowledge that exists as an immaterial entity, only as an emergent level of physical matter. This, from the point of view of knowledge, becomes a bearer.*

To return to the example provided in the previous chapter, the artisan's knowledges are far from existing *immaterially*: they are memory traces, flows of neural, endocrine, or genetic information, subjective consciousness, and many other elements that are embedded in the artisan's material corporeality. Some of them may be translated to the wheel, or a text which describes how to make the wheel, or to a neighbour desirous of learning how to copy the artefact in question, but in all cases the knowledges will be received by material bases, which are varied but indispensable. The same applies to software, works of art, so-called 'human capital', and other entities that academic and media narratives currently in vogue describe as *immaterial*.

Therefore, the discourses that revolve around the immateriality of some knowledge forms (from Negroponte to Negri) may be better or worse, more or less suggestive, but in our view are not materialist in any way. These postmodernist discourses, despite originating from disparate positions on the ideological spectrum, have a number of errors in common. The main one is the assumption that the diminutive, invisible, or intangible, implies lack of

materiality: typically, that the knowledges codified as digital information are immaterial.[68] This, however, is unsustainable. The way in which human senses, especially sight, do or do not perceive any entity does not tell us much about its materiality. Are organ systems material, while electrons are not? Are energy or magnetic fields not material? For example, when Negroponte, in a famous text (1995), remarks that the passage from the world of atoms to the world of bits entails the transition from matter to immateriality, he forgets that these bits have a very specific materiality, as Cafassi (1998)[69] opportunely argues. Indeed, it is *precisely the material characteristics* of bits (being electrical signals) that confer to them their fundamental economic properties (they can be cloned with costs close to zero).[70]

A second similar error consists of denying the materiality of those knowledges that can easily switch bearers. It is believed that ideas that can be translated from a brain to a book, and from there to a third bearer, or data that travels from a server to a computer network and from there to a hard drive, are incorporeal phantoms. The evident mistake consists of failing to take into consideration that all these translations entail passing through different forms of materiality. Whether they are few or many, it is vital to understand what these bearers are, as will be elaborated later on. The authors who gesture towards this volatility of knowledge, this circulation through different bearers, discover nothing less than the fact that there are certain forms of knowledge that shrink from material monogamy. From this they deduce, paradoxically, that these knowledges lack a material character; in other words, they deem them to be celibate. But on the contrary, what really occurs are forms of polygamy and diverse promiscuity. The analysis of material bearers is equally or more important in cases in which a life-long partnership is established (because the translation, as we shall see, entails changes of ownership, economic properties, and power). But this is a fact that slips unobserved by the champions of immateriality, who perceive Platonic, puritan chastity where there is nothing less than Dionysian orgies.

So far we have differentiated cognitive materialism from non-materialist approaches. However, other forms of materialism should now be mentioned, which share some points of view with ours, and which have been gaining visibility in recent years. Among them, on the one hand, are the various forms of new materialism, and on the other hand, cultural materialism. Although a detailed analysis of both would cause us to stray too far from the thread of this book's argument, a brief comment can be offered. New materialism (Coole and Frost 2010) includes numerous perspectives that are difficult to summarise. However, in general they have an essayist, not scientific, vocation (definitions and operationalisations are not even attempted). Despite sharing an emphasis on the non-human, they keep (similarly to Latour, as indicated in an endnote) their focus on the concept of agency. Therefore, they are far from locating knowledge as a central core. Furthermore, in the majority of cases, the analysis of capitalism is not their objective.

Cultural materialism, for its part, is highly relevant to the series that this book is published as part of. Through various studies, mainly by Fuchs (for example, 2015), following Raymond Williams, an approach is offered that coincides with ours in terms of being designed to analyse capitalism (exploitation, classes), recuperating dialectics, and bringing into a dialogue another material entity (culture or communication in their case, knowledge in ours) with physical entities, although not in a binary way. However, we have at least two differences with this approach. The first relates to the cultural materialist standpoint being humanist. The second touches on the limitations of the concept of culture. Our argument in a nutshell would be that the notion of 'culture' (as used in that literature) is itself a product of *industrial capitalism* and, therefore, might not be the most appropriate for dealing with different stages of capitalism, let alone other modes of production. More precisely, culture represents one of the poles of the legal dichotomisation between the instrumental and the non-instrumental that industrial capitalism performed. Thus, we tend to believe that it is not a concept capable of dealing with the totality.

Emergentist

It is not unusual to split materialist philosophies between emergentist and physicalist (or reductionist). Cognitive materialism is, to some extent, a kind of the former which claims that matter organises itself in systems with emergent properties. This means, first and foremost, that *the properties of a certain level cannot be reduced to the properties of another level*. In this vein:

> The material unity of the world means that the motion of matter results in a natural hierarchy of relatively autonomous forms of movement of matter where each level has new, emergent qualities that can't be reduced to lower levels or an assumed "materia prima". (Fuchs 2003, 197)

Of course, this does not mean that the levels are unrelated. Furthermore, it is important to underline that in cognitive materialism the levels or planes are not necessarily organised hierarchically.

All matter, that is, physical and knowledge matter, is emergent. Emergence is related to the self-organisation of matter (Fuchs 2003), but it is not identical in physical and knowledge matter. Indeed, while physical matter emerges from itself, knowledge matter emerges from physical matter. Thus, the origins of knowledge matter are associated not only with self-organisation, but also with autopoietic systems, i.e. living beings (Maturana and Varela 1984; Luhmann 2012; Hofkirchner 2013). However, it is crucial for our perspective to emphasise that knowledge matter may exist in objective, inert bearers produced by those autopoietic systems. Imagine the artisan trying to produce a wheel she has devised. Naturally, the artisan carries emergent knowledges – of a diverse

nature – and is herself an autopoietic system. But the wheel she constructs, having no potential to reproduce and perpetuate itself, is also a carrier of knowledges that have been objectified in it. As a consequence it has emergent properties, properties that did not exist in the knowledgeless physical matter that it is made of, for example the feature of rotating on an axle.

In order to frame an emergentist and materialist perspective into a dialectic framework, it is important to recall that the Hegelian 'law of the transformation of quantity into quality' is the ultimate antecedent of the modern notion of emergence (Hodgson 2000; Fuchs 2003).

However, to give greater precision to what should be understood by emergence (and what should not), it is necessary to understand the dialectical character of cognitive materialism.

Dialectical

So, what is the relationship between an emergentist materialism (that is usually associated with evolutionary theory and systems theory, sciences of complexity) and the dialectic? The question should be elucidated because, in fact, some authors oppose dialectical and emergentist materialisms (Charbonnat, 2007). However, it is our belief that emergentism can fruitfully be interpreted on the basis of Hegelian dialectic (Levins and Lewontin 1985; Wan 2013; Fuchs 2003). Our reading of Hegelian dialectics should therefore be explained. 'Oh, not the whole thesis, antithesis, synthesis thing again', the reader may groan. However, these are in no way categories from Hegel's dialectic. In that case, what is it?

The rushed synopsis that follows has the double demerit of being vexingly elementary for those who are acquainted with Hegelian dialectics, and completely obscure, or even irritating, for those who are not at all familiar with it, or those who renounce it altogether. Unfortunately, there is no better alternative available, and in spite of these drawbacks, this brief presentation seems to be preferable to either eliding or overly expanding it.[71] The presentation is organised around three key points: firstly, the moments of the dialectic, including the role of negation; secondly, the relationship between the whole and its parts; and thirdly, some clarifications about the relationship between contingency and necessity, around the notions of irreversibility and retroactivity.

So, the first point to discuss refers to three moments, three states of being that are repeated successively and infinitely, and the negativity that binds them. This is why the only thing that is eternal in the dialectical process is change, movement.[72] In visual terms, this development can be described with a spiral: the development of being passes through the same moment an infinite number of times, but it does so on different levels. Thus, the third moment that a given dialectical movement culminates in, transforms into the first moment of the movement that follows it.

Contrary to the widespread belief that the categories of thesis, antithesis, and synthesis represent the *sine qua non* of Hegelian thought, it is vital to make clear that the three moments of the dialectic are the following. The first, the abstract universal, is that in which the totality presents itself in a confused and undifferentiated way. It is the moment of immediacy, where the contradictions have not yet revealed themselves; they have not 'arisen'. The unity here is given from the position of the external observer: it is a unity 'in itself', but internally is not clearly recognised as such. The second moment, the concrete particular, is that of splitting. The dichotomies confront the parts of the whole. The being divides itself into counterposed individualities that assert themselves through negation of the other. These individualities produce an initial form of self-consciousness: they constitute subjective unities, 'for themselves'. The third moment, the concrete universal, represents the sublation ('*aufhebung*'), the negation of the division and reunion of that which was separated, but now under a *mediated* unity. For the avoidance of doubt, it is worth reiterating that dialectical movement does not end at the concrete universal; it is converted into the abstract universal of a new movement and so on, ad infinitum. The constitutive negativity, the inherent contradiction of being is the driving force of this movement. To some extent, a dialectical *relationship* between two entities may be summarised around three principles. '(1) mutual exclusion as opposites (2) depending on each other (3) in an asymmetrical relation.' (Hofkirchner[73] 2013, 155).[74]

The second point necessary to mention is the relationship between the whole and its parts that the dialectic proposes. To elucidate this point we shall make use of some simple ideas outlined by Levins and Lewontin. The first two refer to the idea of *totality*:

> The first principle of a dialectical view, then, is that a whole is a relation of heterogeneous parts that have no prior independent existence as parts. The second principle, which flows from the first, is that, in general, the properties of parts have no prior alienated existence but are acquired by being parts of a particular whole.[75] (Levins and Lewontin 1985, 273)

Thus, in the dialectical idea of totality, the totality imparts meaning to the parts. This goes further than the simple principle of emergence: it does not just mean that the emergent levels have properties which do not exist in previous levels, but that, once the emergent levels surface, some properties of the previous levels are actually reliant upon them. To put it simply, there is a dual directionality of emergence.[76] Thirdly, the relationship between the whole and its parts is indissociable from their rejection of the split between subject and object.

> A third dialectical principle, then, is that the interpenetration of parts and wholes is a consequence of the interchangeability of subject and object, of cause and effect. (Levins and Lewontin 1985, 274)

Thus, from a dialectical standpoint, the perspectives of subject and object are interchangeable. This is extremely important as it helps to sustain the non-humanist dialectical approach developed below. It is not the case that the subject constructs the object, that there is an active and a passive entity, a cause and effect, but that dialectical development includes that which in determined historical situations we designate as subjects and objects.

Now, one of the most frequent criticisms of the dialectic consists of dismissing it as evolutionist, determinist, historicist or, especially, teleological. This is not a preposterous accusation: some readings of Hegel, and certainly some forms of Marxism (that undoubtedly have led to political failure, if not horror), have adopted this approach. In fact, the idea of three moments that succeed each other and the figure of the spiral that we have employed could be interpreted in this way. Conversely, many of those who aim to rescue the dialectic (similarly to those who would like to bury it) lay emphasis on the perpetual movement it suggests, the constitutive instability of being, the ceaselessness of the dialectical process etc. Indeed, the dialectic accepts the circumstantial character of all fixity.

Which of these positions is correct? Does the dialectic imply contingency or determination? Freedom or foreclosure? This brings us to the third and final point: the connection between the dialectic and the notions of contingency and necessity. In our opinion both poles are integrated into the dialectic by means of the features of *irreversibility* and *retroactivity*.

The dialectical process does not imply determination or foreclosure, but rather contingency and opening *in the present tense*. But this does not mean absolute indetermination. The key lies in the irreversibility that dialectical mediation gives rise to. Once a contradiction has arisen, there is no possible return to the pre-existing condition. This means that each dialectical figure is distinct from those preceding it, but not that it proceeds along a predetermined path, or the best possible ex ante etc. (Žižek 2012, 145). The dialectic entails indeterminacy and contingency, but at the same time something similar to what innovation economists call *path dependence* (David, 1985) in the face of bifurcations: choices made for contingent reasons at a given moment limit the options available later on; history progressively carves out paths which, once trodden, are difficult (if not impossible) to retrace. Expressed in more precise Hegelian terms, once the mediations have manifested themselves, immediacy cannot be regained.

On the other hand, when looking *backwards* from this point in the dialectical process, this sum of irreversible contingencies assumes a definite sense. Hegel condenses this dialectical constitution of the past in the famous and beautiful phrase, 'The owl of Minerva begins its flight only when the shadows of night are gathering' (Hegel [1821] 1991). Thus, only in the twilight (in the sense of the last possible moment: the present) of a society, a life, or a system can its reality, its meaning, be described (the owl of Minerva represents wisdom), in hindsight. The unfolding of the day is contingent, free, indeterminate, but the

night infuses it with meaning in which its symmetries, harmonies, and rituals stand out.[77] Here we can see clearly the relationship between part and whole: the totality that is constituted at dusk is that which confers meaning to the parts as parts. It must be emphasised that this twilight is constantly drawing in: the past must be reinterpreted time and time again. The present reconfigures the past, as emergent levels reconfigure the preceding levels. This leads us from Hegel's owl to Marx's ape, as Žižek remarks:

> This is how one should read Marx's aforementioned thesis about the anatomy of man as a key to the anatomy of ape: it is a profoundly materialist thesis in that it does not involve any teleology (which would propose that man is "in germ" already present in ape; that the ape immanently tends towards man). It is precisely because the passage from ape to man is radically contingent and unpredictable, because there is no inherent "progress" involved, that one can only retroactively determine or discern the conditions (not "sufficient reasons") for man in the ape. (Žižek 2012, 172)

Cognitive materialism, in sum, adopts a dialectical perspective that includes, at least, the three moments bound by the contradiction inherent to being, the relationships between the whole and its parts, and the relationship between contingency and necessity that emerges from the notions of irreversibility and retroactivity.

Non-humanist

The bulk of the social theories that were born during industrial capitalism (those from sociology, political science, economics, Marxism) were based on the concept of 'action', which invariably anchors this tradition to anthropocentric perspectives. The concepts of 'social relations', 'labour', and 'rational choice', are nothing less, in the last instance, than categories derived from the former. The same applies to the concepts of 'social actor', 'agent' etc. The concept of action unequivocally places the human subject as the beginning and end of 'social science'. The same notion of society and the social is closely associated with this concept of action in these theories of industrialism. However, those theories are exposed as limited when thinking about the capitalist totality from the current stage, informational capitalism. Actually, there is a common core of ideas held by authors as diverse as Latour,[78] Deleuze, Haraway, Sloterdijk, Luhmann, Dawkins and others (including the pre-Socratics and numerous non-Western philosophers) regarding the theoretical and political limitations of humanism. Not only in relation to the ecological disasters of capitalism or the emergence of entities that resist binary categorisation as subject or objects, but also with regards to humanist theoretical perspectives, from both left and right, which have led to the worst atrocities suffered by humans. An explanation of political barbarity is incomplete if humanist thinkers are exonerated

from having lost sight of the category of totality, of having maintained the division between subjects and objects, and having treated the non-human with the logic of sense-certainty (in the Hegelian sense).

In this context, we have the strong impression that the economic, legal, ontological and epistemological significance of non-human entities should not be left to postmodern perspectives, on one extreme, or functionalist and evolutionist perspectives on the other, which are undialectical in all cases. In contrast, cognitive materialism reclaims the possibilities of a non-humanist dialectic. In other words, it applies the principle of *general symmetry* (as it is known in Science Technology and Society studies) to the analysis of capitalism. Thus, the coming chapters will try to show how the utilisation of categories from a non-humanist perspective (starting from the idea that knowledge exists in non-human bearers, the analysis of productive processes in terms of flows of physical and knowledge matter rather than dead and living labour, the analysis of forms of capitalist exploitation that do not necessarily include 'labour' in the usual sense of the term etc.), could be advantageous for a approach which is both dialectical and scientific.

Now, it is crucial to assert that the adoption of a perspective which does not start from or prioritise the study of humans is not a free choice in the philosophical supermarket, as it may seem to the reader from the paragraph above. It does not arise from an evaluation of the merits or limitations of the humanist and non-humanist approaches. In fact, the non-humanism of cognitive materialism *is a consequence* of taking knowledge as a central concept, and searching for the material bearers through which it circulates. And the centrality of knowledge matter, in turn, arises from our initial question about the relationships between entities and capitalism as a totality. A particular knowledge can be owned by a company, being carried by an individual mind (a subjective, human bearer) or by a piece of paper (an objective, non-human bearer). It would simply be empirically wrong to restrict the analysis to humans. Thus, in the last instance, the non-humanist approach is a result of the need to understand the relation between the capitalist totality and the entities that it is composed of.

However, non-humanist does not equal anti-humanist. Cognitive materialism starts by analysing flows and stocks of physical matter and knowledge matter. This leads us in many, in the majority of, cases to study humans, their 'actions', their 'work', their 'social relations' etc. But this is done after our crucial mediation, this change of perspective. In other words, the study of human subjects is not a priori but a consequence of the analysis. Neither is this an approach that considers humans and non-humans on equal footing, in ethical terms. On the contrary: in order to be able to create emancipatory social relationships, we believe it is necessary to understand how capitalism acts as a totality upon humans and non-humans.

Returning to the comparison with other standpoints discussed over the course of this chapter, it should be noted that cognitive materialism also implies

radicalising the dual directionality of the subject-knowledge connection. As mentioned above, some tendencies in the sociology of knowledge – although also in structuralism in its diverse manifestations – assert that it is not enough to grasp the fact that subjects produce knowledge: knowledge flows also produce subjects. However, generally for these perspectives the flows of knowledge under consideration are purely human: subjective or intersubjective. In our point of view, this must be expanded: flows of genetic and neural information, knowledge objectified as technologies (such as buildings and machines) or as information (such as software and music), also participate in the production of subjects. The relationship between subject and knowledge is radically bivalent – which, clearly, associates it with what has just been elaborated as regards the dialectic.

Scientific

Cognitive materialism attempts to be scientific in a quite modest sense, which can be encapsulated into four principles. First, an attempt is made to define the concepts used, in the least bad way possible. In contradistinction to the postmodern gesture, which hides its imprecision with literary (often beautiful) ornamentation, we will endeavour to offer a systematic theory. In this sense, and second, cognitive materialism does not seek to be essayist or proclamative in style, but rather to be a contribution to scientific research. Third, the abstractions used (which we do not abjure, as the banal empiricism which dominates vast swathes of the academic world does) must be capable of being operationalised, and thus, of engaging with empirical material, with quantitative and qualitative sources, both primary and secondary. Despite the space restrictions inherent to this concise book limiting any demonstration of this operationalizing, it is essential to be cognisant of its necessity.[79] Fourth, this approach could be mistaken in some, or indeed all, of its concepts. What is asserted here will need to be rectified in the near future, to a greater or lesser extent. The arguments, silences, and happenstances of debate will determine the rhythm of this metamorphosis. There should be no acritical religious beliefs here (such as those that the slaves of their own trajectories practice, those who before the death of God pray to the philosophers that have killed Him, or the cloistered monks of Marx's labour theory of value).

Cognitive

Cognitive materialism holds that knowledge is the fundamental concept to understand how capitalism works. In this vein, we will employ the idea of knowledge we started to develop in chapters 1 and 2 to give an account of different stages of capitalism, define capitalist regulations, develop a theory of capitalist accumulation (particularly of capitalist exploitation), advance a schema of classes under capitalism and so forth.

Although from the 1970s there has been a lot of hype regarding knowledge, the concept has been put to use mainly with idealistic meanings, has not been defined clearly enough and has mostly been framed by humanist perspectives, as discussed above. Strictly related to these shortcomings, but much more importantly, knowledge appears as a concept derived from 'action', 'social relations' or 'labour', rather than as *the* basic building block of a theory. By contrast, from a cognitive materialist standpoint, knowledge matter is the ultimate bedrock upon which the other concepts are built.

So far the word *knowledge* has been accompanied in almost every instance by the word *matter,* in the phrase *knowledge matter*. This was due to the necessity of contrasting knowledge matter with physical matter while at the same time emphasizing that knowledge is nothing but a material entity. However, as our perspectives on knowledge and materialism have been sufficiently defined, it is not necessary to continue taxing the reader with extra words. Thus, from now on we will employ the words *knowledge* or *knowledges* alone, resorting to the expression knowledge matter sparingly, when direct comparisons with physical matter arise.

In this chapter, which partly leans on the first, cognitive materialism has been located in relation to gnoseological traditions. It is proposed as a third position confronting epistemology, on the one hand, and Marxism and the sociology of knowledge, on the other. In all cases what is fundamental is that the disciplines that have studied knowledge share the practice of having understood it as a product of human – individual, collective etc. – subjects.

The bulk of the epistemological tradition is idealist, in two senses. Firstly, in locating these discussions around the truth-falsity axis – specifically, for the association between epistemology and the truth-falsity axis rather than for the link between knowledge and truth. Secondly, the subject whose possibilities of knowing are explored is either a universal, ahistorical, completely abstract subject, or an embodiment of the systematic thinker: the philosopher or the scientist.

The tradition of Marxism and the sociology of knowledge, in contrast, gravitates around three ideas: i) knowledge is a product of material, concrete, empirical and contingent human subjects, and not of transcendental beings like those of epistemology, ii) subjects elaborating those knowledges are conditioned or determined by diverse factors, in general *social* in nature, iii) as a consequence, in order to study the characteristics of knowledge, these factors should be elucidated and studied.

From the perspective of cognitive materialism three limitations of these previous approaches can be found: idealism, humanism, and the lack of a definition of knowledge. Ergo, the next step was to define our approach on the basis of its features as follows: materialist, emergentist, dialectical, non-humanist, scientific, and cognitive.

With these elements in place, we shall be better able to elaborate a materialist typology of knowledge.

CHAPTER 3

The Typology of Knowledge

As has already been suggested, there are four bearers in which knowledge exists, four levels of materiality in which knowledge can be situated. These are: *objective, biological, subjective* and *intersubjective*.[80] Before these are introduced individually, a few clarifications are necessary.

The first concerns the division in general. It is immediately evident that the first level is the only one in which knowledge exists outside of living beings. For the remaining three, the subjective and intersubjective levels inevitably relate to humans. The biological level, in turn, incorporates other types of living beings. Once this separation between objective knowledges on the one hand, and biological, subjective and intersubjective knowledges on the other hand, is established, an objection could be raised. Would it not be more correct to indicate that there are only two types of material bearers, instead of four? Would it not be more precise, from a materialist perspective such as is proposed here, to show that there are objectified knowledges on the one hand, and that all the other forms have a living being as their bearer?

The error in this argument is that it confuses the *materialist* approach here with *reductionism* (or monism, in Searle's terms, 2004, 48[81]). The former is concerned with the properties of the knowledge bearing material, while the latter reduces all its properties to those of the *ultimate* bearers. The former is based on the idea of emergent properties, while the latter rejects them. Indeed, as discussed in chapters 1 and 2, here the idea is accepted that there are emergent levels of organisation of matter. Here, we follow those who point out that *not all properties at each level can be explained by the properties of other levels* (Morin 2008; Maturana and Varela 1984; Luhmann 1995; Polanyi 1967). This idea is actually incorporated into common sense ideas about physical matter. Nobody questions whether analysing cells is a materialist task nor suggests a need to break them down into molecules, atoms, or subatomic particles. Or rather, the analysis of the micro and macro cellular levels (e.g. molecules and tissues) is

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complementary to analysing the cellular level. Meaning, whatever the ultimate material unit may be, all the sciences agree that matter is organised on levels with properties which are not reducible to the previous ones, even though they are physically supported by them. It goes without saying that between the levels there are relationships, exchanges, and transformations that, in the case of knowledge, we shall call translations.

It is in this sense that we can speak about the materiality of the three levels of knowledge that flow through living beings. Evidently, the biological level operates under its own logic, but it is also clear that the subjective level, that of the human individual, has characteristics that surpass the sum of its biological components. But it is the third level, that of intersubjective knowledge, whose existence proves difficult to accept for some theoretical approaches. Suffice it to say that our approach is constructed on the foundations of the traditions of sociology (for example Durkheim [1895] 1986; Luhmann 1995), anthropology (eg. Lévi-Strauss 1963), linguistics (e.g. Saussure [1916] 2011), some schools of psychology (e.g. Jung [1934] 1981; Vygotsky [1934] 1986), philosophy (e.g. Castoriadis [1975] 1997, Deleuze and Guattari [1972] 1983), and Marxism (excising the reductionist element that we do not share in any measure, for example Lukács [1922] 1971). *All of these traditions accept the existence of a level of intersubjective realities that are not reducible to the individual, much less to the biological*. Despite this, the objection could be sustained. The existence of 'intersubjective realities' could be accepted, but how can a material status be conferred on them? How can it be accepted that intersubjectivity constitutes a bearer, according to the definition in chapter 1? *It must be remembered that this is a bearer for which the properties of the knowledge are not entirely reducible to those of the other levels, although they do interact with them*. Just as subjective phenomena – for example, consciousness and free will (Searle 2004) – cannot be explained fully by reference to the biological brain, intersubjective knowledges – e.g. language and social norms – cannot be understood by simply reducing them to the knowledge held in the minds of individual subjects. This is not to say that we are dealing with metaphysical entities. The mind emerges from the individual brain. And intersubjective knowledge emerges from the connections between collective minds (Collins 2010). Knowledges are located there, *in the last instance*, as organ systems are supported by atoms. And, of course, there is a relationship between all these levels. It is precisely for that reason that we refuse to deal with different forms of knowledge in isolation from each other.

Let us now criticise the position on the opposite side of the spectrum from reductionism, which imagines an absolute autonomy of levels. This, for example, could be the case for sociologists who repudiate the importance of studying the functioning of the biological brain in order to account for intersubjective phenomena (or Lacanian psychoanalysts who dismiss contributions from the neurosciences). In spite of the limitations of current advances, it is

clear that each level of knowledge is not self-sufficient. The beautifully tragic story of Phineas Gage with which Antonio Damasio opens his *Descartes' Error* illustrates this (Damasio 1995, chapter 1). From this narrative, it can be comprehended that lesions to specific parts of nervous systems can cause damage to the observance of social norms – in other words, intersubjective knowledge – without altering motor skills or intellectual faculties.[82] However, it is perfectly understandable that the idea of the existence of knowledges at the biological level generates resistance from social scientists. Sociologists who do not hesitate to accept the existence of knowledge at the intersubjective level, and economists who accept technology as an embodied knowledge maintain a distrust, which is the offspring of methodological humanism, of the idea that there could be knowledges in the flows of biological information. In contrast, it is equally understandable that for a 'hard' scientist amenable to reductionism, intersubjective and objective knowledges don a metaphysical character similar to that which knowledges in biological bearers have for economists and sociologists. Inviting dialogue between these perspectives, although it may not be possible to reach shared conclusions, is one of the objectives of the proposal presented here.

The last comment is the following. Within each of the levels of knowledge, various subcategories can be presented. Here one subclassification will be developed that has proved useful in previous studies, but plenty of other alternatives are perfectly valid. In our view, while the materiality of the bearers should be identified as a starting point, any subdivision made within each type of knowledge is welcome and we believe that is dependent on the empirical material that must be dealt with, the available data, intentions of the research etc. What follows, therefore, is a proposal relatively limited by the object of this book, but completely malleable for the purposes of further exploration. Next, the four types of knowledge are explored.

3.1 Objectified Knowledge (OK)

Knowledges carried by an objective bearer are those that are crystallised outside of living beings, materialised in the most varied *goods*.[83] A distinction must immediately be made between two forms of objectified knowledge. Firstly, technologies; and secondly, information.

3.1.1 OK Technologies and their Different Types

In informational capitalism the use of the term 'technology' in academic discourse (although this is also true of political and media discourse) is frequently a source of misunderstandings. The pertinent confusions are of at least two

kinds. On the one hand, interlocutors attribute extremely heterogeneous meanings to the concept, which each assumes to be valid. For example, technology could be synonymous with artefact for some, while for others it could refer to applied science. In particular, the currently fashionable idea that 'technology is everything' is especially damaging for a discipline that seeks to scientifically understand the relations between technology and society. Claiming that 'technology is not just the thing itself' is very well regarded in conference papers and journal articles. We are told that 'it is also the overarching set of practices, the social fabric, which resignifies the technological object'. Thus, practices, traditions, cultures, social actors and more elements are progressively stacked up on top of each other which, it must be underlined, are not alleged to be *related* to technology (which would be perfectly reasonable) but rather that they *are technology*. As a consequence of this programmed voraciousness, the concept of technology loses all practical utility, all its analytical incisiveness and empirical precision. The author receives laudations or citations, while the idea that 'technology is everything' is seasoned with words like 'networks', 'contingency' and, especially, criticisms of the bogeyman figure of 'technological determinism' (whose arguments are defeated upon diluting the concept of technology into the ill-defined mire of 'the social'). The fieldwork that this 'technology is everything' conception permits cannot soar beyond the precarious genre of object-distorted-to-fit case studies. But the empirical sterility does not at all diminish the sophistication of the enunciation, or the benefits of this approach for furnishing prefabricated theses. Furthermore, it excites the febrile mind of a postmodern public that takes pleasure in unnecessary complexity and, above all, delights in savouring the snake oil of impostured passions.

However, beyond the disparate uses of the concept of technology, the other common source of confusion is synecdoche. In effect, the part is confused with the whole. Therefore, it is very common to find the term 'technology' referring to 'digital technologies'. Indeed, the 'technology' sections of newspapers are concerned with nothing else but the technologies that process, transmit, or store digital information. The same occurs, for example, with the abundance of opinions, recipes, courses, and consultancies concerned with 'educational technology'. In none of these are desks, blackboards, chairs, pens etc. mentioned, but only a tiny fraction of the world of technologies – the digital. One version of this confusion, which is attenuated but endemic in academia, lies in confusing information technologies (IT), or information and communication technologies (ICT), with digital technologies. However, IT or ICT extends far beyond digital technologies: they include the telegraph, analogue telephones, books, abacuses etc. These superpositions, in addition to hindering dialogue, have other negative consequences. In effect, they obscure non-digital technologies, which are thus denied priority or even existence. Additionally, they prevent us from grasping what is specific about digital technologies, that which distinguishes them from the vast continent of technologies in general, and it even

means that they are confined to the thoroughly mapped territory of information technology.

But, let us start from the beginning. For cognitive materialism, technologies are *those knowledges which are concretised in the form that a determined good assumes with an instrumental purpose* (and that, in general, function as a means to produce other goods or services[84]), following Machlup, Mokyr, Chartrand and other authors.[85] For example, there are technological knowledges in computers that are used to design cars, the assembly lines that the cars are produced on, the cars themselves, and even the keys that turn on the ignition. Despite the diverse complexity of the knowledges that they bear, these four types of goods are utilised as means: to design and produce vehicles, to transport people, or to start the car.

It is necessary to differentiate technologies (that are pure knowledge) from the goods they are objectivified in (the key, the computer, the car, and the assembly line belt), that are best described as *artefacts* (and combine physical matter with technological knowledge, among other elements). In turn, it is important to clarify that the definition of technologies as objectified knowledges is by no means an understanding that they are *mere functionality or that the original functionality is preserved in the evolution of the artefact*. As is currently acknowledged, artefacts bear other knowledges that are not what here we categorise as technologies: they reflect all kinds of values and beliefs, and even norms (Heidegger [1953] 1977; Habermas 1970, in part Foucault [1975] 1995, but especially, Feenberg 1991, 2000). They can both regulate behaviours and be resignified by their users (Winner 1987; Bijker, Hughes, and Pinch 1987). The rejection of the notion of efficiency as the only element necessary to understand the diffusion and stabilisation of technologies is widespread, even in economics (David 1985). The diverse approaches taken by the authors cited above nevertheless share a rejection both of the idea that technology is completely neutral, as well as the idea that the knowledges materialised in the act of creating the artefact irrevocably determine their subsequent uses. While in broad agreement with this, our approach has a distinctive characteristic: instead of situating the debates about stabilisation and standardisation of technologies around the actions of 'social actors' or 'economic agents', the emphasis is on contemplating the relationship between technologies and the flows of all the other types of knowledge which are taxonomised here. Thus, the argument presented here is that technologies can only be understood as a part of the tapestry of historically situated knowledge, that towards the end of this chapter will be described as cognitive material configurations: nodes of diverse technologies, techniques, ideologies, organisational modes, laws, gods, texts, and other forms of knowledge.[86]

So, it is evident that technologies are extremely varied. It is useful to distinguish between two types. Referring back to the four examples given above, evidently the car and the assembly line belt are similar: they are machines; they

put physical matter into motion. But the ignition key and the computer have an equally close, although less obvious, resemblance: the primary role of both is to support a certain form of codified knowledge, of information. It could be argued then, that there are two types of technology: physical technologies, and information technologies.

Physical technologies are those which, it is worth repeating, *transport, process, manipulate, store or transduce* (see chapter 4) *flows of physical matter*. Examples are abundant and it is not necessary to resort to complex technologies like the assembly line or the car. Most of the goods that surround us are 'matter' or energy technologies: the coffee pot, the coffee cup, the table we place them on, the floor this is resting on in turn, the water pipes that run under the flooring, the hydraulic pumps that force water through the pipes etc.

Information technologies, for their part, store, process, reproduce, transmit or convert (see chapter 4) *information*. Although they may seem quite dissimilar, the key and the computer share the characteristic of storing certain codified knowledge, certain types, although very dissimilar, of information.[87] The latter, in addition, can perform other tasks with it, such as processing or copying. Thus, there are some information technologies that perform a single function, and those that perform various. These technologies, the usual victims of a reductionist approach, as mentioned above, are actually very diverse. Among those that store information, besides those mentioned, we could list paper, vinyl records, or USB drives. The Gutenberg printing press or an old tape cassette recorder *reproduce* information; the telegraph or fibre optic cables *transmit* it. Sensors, such as thermometers and other measuring instruments *convert* physical matter into information. Conversely, the mechanical arms of an industrial robot, called actuators, convert information into physical matter. It is highly important to note that information technologies are not limited to operating with linguistic symbols: images and sounds are also within their range of capabilities.[88]

To understand the functioning of the current stage of capitalism we must venture one step further, and separate the technologies of analogue information (Gutenberg's press, the vinyl record) from the technologies of digital information, or more simply, *digital technologies* (a USB stick, a mobile phone). The importance of this distinction is two-fold. On the one hand, the economic properties of digital technologies, ruled by Moore's Law (see below), differ from those of any other type of technology.[89] But on the other hand, it should be borne in mind that some digital technologies have the special feature of *being able to integrate all the functions particular to this type of technology in their artefacts*. Computers, and all devices resembling them, tend more and more to store, process, reproduce, transmit *and* convert digital information. This distinctive feature, completely alien to analogue technologies, is related to the fact that digital information acts as a sort of *general equivalent*.

Nonetheless, while being of great importance, the distinction between physical and information technologies is not sufficient. Anyone who observes the wide variety demonstrated by the examples given so far will tend to interject a division prior to the one suggested above, a division that distances the key from the computer and the coffee cup from the hydraulic pump, in other words a division that separates technologies on the basis of another variable. Intuitively, it can be seen that some of these technologies are very simple and composed of a single piece. Meanwhile, others gather together thousands of small units and combine them into sophisticated forms. This distinction has been circumscribed and bifurcated into the concepts of *tools* and *machines*. How best to define the frontier between them remains a matter for debate. For our purposes, it is only necessary to define the terms and explain how they will be put to use in this text, it is not beholden to us here to resolve prolonged disputes. Suffice it to say that the definition employed here takes as its starting point the criticism and reappraisal of the distinctions Marx ([1873] 1990, Volume I, Chapter XIII), and also Mumford (1934, chapter 1) make between machines and tools. Above all, these distinctions are combined with the separation between physical matter and knowledge matter that characterises the theoretical framework of cognitive materialism.

Our proposal is very simple: three kinds of artefacts should be distinguished:

i) Raw materials: forms of 'matter' or energy that are transformed completely in the productive process that awaits them. Paper that has been produced to be later printed on, and steel rods that are embedded in concrete during construction, are two examples.
ii) Tools: work tools that survive a determined productive process and are characterised by being put into motion by biological energy (human or animal). Of course, tools vary in their level of complexity. Some (like a walking-cane, for example) consist of a single object and we call them simple tools: one object that intermediates between the source that inputs energy and directionality and the object which is the recipient of the work. Others (like a piano) combine hundreds of parts. They are complex tools: they comprise many simple tools that are interposed between the energy source and the object of their action.
iii) Machines: simple or complex tools driven by a non-biological energy source.[90] Whether the source is water, wind, coal, oil, or electricity is a secondary question, as is the level of complexity of the machine. The important point is that the fallible biological forces give way to other more systematic and powerful ones. The mill and the computer, the sundial and the assembly line belt are, for our purposes, machines.[91]

Now, finally it is possible to combine the two types of technologies presented above with raw materials, tools and machines in Table 3.1 below. This is significant

		Artefacts			
		Raw materials	**Tools**		**Machines**
			Simple	**Complex**	
Knowledges	*Physical Technologies*	Iron rod	Spade Glass	Spinning Wheel	Mill, Steam Engine, Conveyor Belt
	Information Technologies	Paper	Abacus Book Thermometer	Mechanical printing press Semaphore Telegraph	Sun dial Telegraph **Digital Technologies**

Table 3.1: Technologies and Artefacts.
Source: Author's own elaboration.

because, in general, *authors that discuss tools and machines do this only thinking about physical technologies.* However, it is easy to find varied examples of artefacts that carry information technologies. They all have their place but digital technologies are possibly the most relevant to our purposes here. Among other reflections that can be made by studying the table, one that stands out is that the technologies of information represent an infinitely broader group with a longer history than digital technologies. Mixing them up, as media discourse usually does, is a grave mistake which it would be wise to avoid.

In terms of regulation (what further on will be called normative intersubjective knowledge), technologies can be appropriated by means of different kinds of patents, utility models, industrial designs, *sui generis* protection of chips and other resources. It may also be the case that from their inception or after a certain length of time has elapsed, the technological knowledges find themselves in the public domain, or are awarded compulsory licenses by the state that suspend ownership rights.

But, as indicated above, technologies are only one of the forms in which knowledge can exist in an objective way.

3.1.2. Codified OK

Knowledges that are materialised through a certain kind of codification in the content of an objective bearer are designated as information. In the key – that as explained above, contains an information technology – the unique arrangement of notches that it supports constitute information, a set of codified knowledges. Of course, the same is true for any written text, the grooves of a vinyl record, the instructions contained within a software program. The definition just given has implicit differences with some of the usual approaches. These

differences are derived from the materialist character of our approach. In effect, various authors (among them Collins 2010 and Chartrand 2007) only recognise information when codes are emitted and interpreted by humans. Here, in accordance with the materialist perspective laid out in chapter 2, this distinction is inadequate, and it is not necessary to include humans in the definition. The key is in objective codification. For example, the notches on the key and the symbols of a computer program are destined to be received by the lock or by other programs.[92] However, for our purposes verbal exchange is not considered to be information. This is a form of subjective or intersubjective linguistic knowledge, as shall be seen further on. Only codified knowledges that are *fixed in an objective medium* that can circulate after the moment of their production are considered to be information. Thus, a conversation becomes information if it is recorded in an audio file, for example.

This brings us to the third point already anticipated above. Contrary to the emphasis on associating information or codified knowledge with oral verbal language and particularly with texts (common in the economics of knowledge and the STS field), here stress is laid on language, of whichever variety, being only one of the forms of knowledge that can be codified objectively. Audiovisual recordings (and, in the future, tactile or whatever other type becomes possible) are highly significant. Therefore, the bulk of information that circulates in the world takes the form of images or sound, and not texts (Grantz and Reisel 2009).

(Objective) information can be of two types: analogue and digital. The former is associated with continuous physical magnitudes and relies on capturing the entirety of the signal. In practice, we can find analogue information[93] in the symbolic content of books, paintings, vinyl records, old telephones etc. Digital information (DI), that in the current stage of capitalism is hegemonic in the sphere of information, can be defined as *all forms of knowledge codified in binary form through on-off electrical signals. Each unit of information is a bit* (Cafassi 1998). Some features of DI should be mentioned. Put simplistically, rather than being analogue, digital information is the result of sampling: only some points are chosen of the magnitude that is captured.[94] Although this may seem to be a defect, it is in fact a remarkable virtue. The lightness of digital information allows it to be reproduced and transmitted in much more economical ways than analogue information. Therefore, a distinctive feature of DI is that it has marginal production costs close to zero (Varian 1995; Cafassi 1998; Moulier Boutang 2004; Rullani 1999). In other words, the special characteristic of digital codification as a bearer is that it enables the knowledge that has been translated into it to be cloned with negligible reproduction costs. This characteristic, the importance of which is difficult to overstate, is called the *replicability* of DI. On the other hand, bits have a striking property: one is exactly the same as another. One bit of an audio file, and one from an image, one from a text, and one from a software program, are all perfectly identical (Cafassi 1998).

In contrast, the analogue units that make up audios, images, and texts are insuperably heterogeneous. This implies a decisive feature: all types of digital information can be easily translated from one to the other, and the same digital technologies, as we shall see, can operate with its diverse forms.

Among the many examples of digital information, the majority have analogue relatives: images, texts, data. However, there is a very particular form of digital information, with no analogue ancestor: software, that is, computer programs. Where is its particularity derived from? Its origin is that its materiality is that of a text, but its activity is that of a machine. To paraphrase Austin and Foucault, software programs are 'bits that do things'.[95]

In general, digital information is a crucial concept in order to understand the functioning of the current stage, informational capitalism, but to repeat, its significance can only be grasped by observing its connections with other flows of knowledge, which is to say in the framework of the totality that it is integrated into.

Finally, when the terms information (on its own), analogue information, or digital information are used here, they refer to knowledge with an *objective* bearer, meaning those which are embedded in *inert beings*. However, it is immediately noticeable that among the knowledges with a biological bearer there are also knowledges codified as 'information'. This will be referred to as 'biological information', given that the corresponding bearers are living beings. Naturally, the sheer diversity of these bearers confers extremely diverse properties to these two forms of codified knowledge.[96]

The knowledges codified as information are regulated by copyrights and, in some cases, by sui generis protections of databases. Information (the 'work' in which it results, in legal terms) can also be in the public domain after the lapse of the monopoly that the law awards to its owner, or have a license that limits the exclusions that the law confers on it (like Creative Commons or similar arrangements).

3.2 Biological Knowledge (BK)

Knowledges with a biological bearer are flows of codified knowledge that circulate as biological information:[97] genetic,[98] neural,[99] or endochrine,[100] in all living beings. We will distinguish between *natural or organic* flows (such as the genetic information carried by a seed coming from a natural fruit), and *post-organic*[101] flows (such as the information carried by a seed which is the result of genetic engineering). It should be clear that in all these cases, the codes of the knowledges with a biological bearer are of a natural (or divine) origin. Human intervention – in the post-organic flows – only acts upon the content, but not on the form. This distinguishes the varieties of biological knowledge from the rest, for which not only the content, but also the codes themselves are human, and 'social', creations.[102]

Although still little is known about the relationship between these and other knowledges, it is not only evident that a link exists, but that genetics and the neurosciences, among other disciplines, are advancing in strides towards hypotheses related to the content of such a link. Thus, the inclusion of knowledges with a biological bearer in our typology is done, above and beyond the intention to fulfil the requirement of exhaustivity,[103] with the hope of offering a basis from which to understand the translations between different flows of knowledge that will potentially characterise the twenty-first century. The emphasis on the need to integrate (as a part of the totality) the knowledges with a biological bearer is an attempt to avert both biological determinisms, which attribute excessive significance to this type of knowledge, and sociological speculations, in which the confused dogma that 'everything is social' negates any explanation. Integrating biological knowledge with the other types in the same typology helps us to analyse the translations from one type of knowledge to another, without the need to resort to reductionisms.

The following two examples of the relationships between biological knowledge and other types illustrate our point. Firstly, the link between genetic biological information, and digital technologies and digital information. Secondly, that between neural biological information and subjective knowledge. The association between the transformations that occur on the terrain of knowledge with a biological bearer and those that take place on the terrain of technology and digital information has been noted by several researchers (Kelly 1995; Castells 1996; Sibilia 2005; Rifkin 1998; Sulston 2005). The link has been going through a process of construction since the mid-twentieth century, when Wiener's theory of information prepared the ground for DNA being conceived of as a carrier of information (Rifkin 1998). In the 1960s, for the characterisation of living organisms, the importance of knowledge with a biological bearer – generically named information – had already been well established (Simpson and Beck 1965, 145). This association expanded remarkably in the 1970s when the development of computing fed into the mass diffusion of the concept that information was a decisive element needed to define living beings (Thorpe 1977, 2). Of course, in the 1980s and 1990s, when digitalisation conquered the world, and genetic engineering revealed its potential, the conception of life as biological information firmly planted its flag on every summit.[104]

In this way we have arrived at the point at which knowledge with a biological bearer is no longer conceived of merely as biological information, but also as translatable into digital information and digital technologies (Freeman 1999, 10; Keller 1996, 118). The clearest in tracing the affinity between both types of knowledge is Richard Dawkins, radical neo-Darwinist, staunch enemy of all religions, and author of several best-sellers.[105]

> If you want to understand life, don't think about vibrant, throbbing gels and oozes, think about information technology. […] There is very little difference, in principle, between a two-state binary information

> technology like ours, and a four-state information technology like that of the living cell. (Dawkins 1986, 112–115)

Several years later, Dawkins reiterates this argument and, in fact, considers that the *translation* – he uses the term in the sense that is employed in the next chapter – between the organic BKs and the digital information OKs constitutes the greatest revolution in the history of human understanding:

> What has happened is that genetics has become a branch of information technology. It is pure information. It's digital information. It's precisely the kind of information that can be translated digit for digit, byte for byte, into any other kind of information and then translated back again. This is a major revolution. I suppose it's probably "the" major revolution in the whole history of our understanding of ourselves. It's something that would have boggled the mind of Darwin, and Darwin would have loved it, I'm absolutely sure. (Richard Dawkins, in Dawkins and Venter 2008)

Someone else that concurs with Dawkins is the businessman and scientist Craig Venter, president of the patent-seeking team that also managed to decode the human genome a little after the Human Genome Project.[106] Venter tells us that the current challenge is translation in the opposite direction: transforming digital designs into biological realities.

> Now, for the first time, we can go in the other direction. With synthetic genomics and synthetic biology, we are starting with that purely digital world. We take the sequence out of the computer and we chemically from four raw chemicals that come in bottles, we can reconstruct a chromosome in the laboratory, based on either design, copying what was in the digital world, or coming up with new digital versions. (Craig Venter, in Dawkins and Venter 2008)

In summary, genetics and modern biotechnology have been associated with digitalisation via two paths. Firstly, the idea of code, a set of instructions that are converted into physical matter is shared by both tendencies. The code of the nitrogenous bases is converted into amino acids; computers' binary code into electrical signals.[107] Secondly, decoding the genomes of different species was carried out inseparably from the use of digital technologies as a means of production. This does not only mean that the storage of monstrous quantities of information required the capacity of modern hardware, but also that without the appropriate computing programs to automise the decoding process, the task would have been impossible. But beyond the deciphering of the organic knowledge, computers are crucial to the elaboration of post-organic knowledge, as the last quote above from Venter, indicates.

Regarding neural biological information, it is useful to analyse its relationship with the subjective level. Empirical developments in cognitive psychology since the 1960s offer clear signposts about this link. Indeed, among others, Brenda Milner's research into the 'HM case' showed that the two types of memories that will be alluded to in the following section (explicit and implicit) have clear, discernible, and – most remarkably – largely autonomous cerebral bases. It is currently understood that memories (which are mental phenomena, in other words, subjective knowledge) are clearly associated with cerebral phenomena (that is, with a biological bearer). Thus, the neurosciences distinguish two types of memory based on the duration of the synaptic changes. On the one hand, *short-term memory* (that arises from the simple transitory excitation of the synapses of the prefrontal cortex) and *long-term memory* (that arises from a *fixed* reinforcement of the synapses due to the activation of genes and the subsequent synthesis of proteins). While short-term memory, or working memory, depends on the prefrontal cortex, long-term memories are stored in different regions, as we shall see.

In fact, neurobiological bases have been found for two types of long-term memory (as several authors who studied the problem of the subjective level had already intuited). The neurosciences designate them explicit (or declarative), and implicit (or procedural) memories (Schacter 1987; Squire 1987). In the following section each of these terms referring to mental phenomena will be explored but for now it is their biological aspect that is of interest. In the explicit memory circuit, short-term memories about people, objects, places, and events are stored in the prefrontal cortex to later pass through the hippocampus and finally be stored in different regions of the cortex, constituting long-term memories. Implicit memory, related to skills and habits, by contrast, is stored in the cerebellum, the corpus striatum, and the amygdala. In reality, from a biological standpoint, 'implicit memory is not a single memory system but a collection of processes involving several different brain systems that lie deep within the cerebral cortex' (Kandel 2006, 81).

With regards to intellectual property regulations, organic biological knowledges can be partially overseen by plant breeders' rights but, most often, they are public access. Post-organic knowledges can be protected in many countries by biotechnology patents. The ethnobotanic knowledges of diverse communities are protected by a new collective right called traditional knowledge.

3.3 Subjective Knowledge (SK)

The existence of knowledge with a subjective bearer is easy to accept. In fact, this category alone is included in *all* the theories of knowledge and, furthermore, it is this knowledge that the majority of the theories consider to be the *only* form of knowledge. The SKs are those knowledges for which the bearer is human subjectivity. As pointed out above, here we are referring to the knowledges that

are situated in the individual *mind*, as opposed to the *brain*, which is found on the biological level. Searle (2004, 301–304) suggests that the mind has free will as its defining characteristic, meaning that one of the features of the subjective level, absent from the biological, is more or less conscious choice between a variety of alternatives.

Stocks of subjective knowledges are known as *memories*. Although at first glance this may seem strange, the entire mental life of an individual subject, except the fleeting moment in which we live, stems from the memory.[108]

From at least since William James onwards, numerous authors have differentiated between two types of subjective knowledge, two types of memory. Psychologists like James or Freud, philosophers such as Michael Polanyi or Gilbert Ryle, economists such as Foray and Lundvall, and many more from a range of disciplines, agree on the opposition of two poles: consciousness, verbal expression on the one hand, and on the other the unconscious and non-verbalised knowledge.

Perhaps the simplest manner of distinguishing both types of subjective knowledge is as follows. Those knowledges with a subjective bearer which we can access via a conscious recollection of memories are explicit knowledges (*explicit or declarative memories*): a date, a name, a way of performing a movement. In contrast, those which are activated unconsciously and unintentionally are implicit knowledges (*implicit or procedural memories*): knowledge which enables us to ride a bicycle, speak a language fluently, or recognise a face.[109]

A specific form of implicit knowledge is technique. In other writings we have defined *technique* as a 'form of procedural subjective knowledge acquired in an instrumental way and performed implicitly' (Zukerfeld 2007, 36). Techniques are knowledges which are concretised in an action – bodily or intellectual – and from this is derived their 'procedural' character. Likewise, not only do they have the characteristic that they are stored in implicit memory, but also that they have usually been acquired (they are not natural) with instrumental – not consummatory or recreational – purposes. Therefore not all implicit knowledges are techniques. For example, the ability to regulate body temperature, walk, or talk are not, generally speaking, techniques.

Several authors link, or even use synonymously, the terms 'technique' and 'technology'. In some cases, they are linked with 'science'. Suffice to say that these approaches, which nevertheless can be useful for many purposes, do not adopt a materialist perspective towards knowledge. In other words, they do not consider that the bearer of a particular knowledge is the fundamental variable necessary to typologise it; instead they tend to prioritise complexity, abstraction, or usefulness of those knowledges. Here, in contrast, the most basic difference between technology and technique lies in the bearer. In one case, this may be objectivised knowledge, in another, subjective knowledge. Their relationship with science or truth holds no significance when defining them. However, both types bear the stamp of instrumentality.

Author	Explicit Knowledges	Implicit Knowledges
James [1890] (2007)	Knowledge-about	Knowledge of acquaintance
Freud [1915] (1996)	Conscious	Unconscious
Ryle (1949)	Knowing that	Knowing how
Polanyi (1958, 1967)	Explicit knowing	Tacit knowing
Mokyr (2002)	Propositional knowledge	Practical or Prescriptive knowledge
Schacter (1987)	Explicit memory	Implicit memory
Blackler (1995)	'Embrained' knowledge	'Embodied' knowledge
Foray and Lundvall (1996)	Know what	Know how
Spender (1996)	Conscious	Automatic

Table 3.2: Knowledge with explicit and implicit subjective bearers under different names.
Source: Author's own elaboration.

Returning to explicit and implicit knowledge, there is evidently a significant interchange between them. The process of learning techniques often facilitates the passage from the former to the latter. While the apprentice's clumsy hands await the conscious recollection of instructions related to how to perform, those of a skilled master receive fluent, unconscious and automatic orders. Anyone who has learned to play a musical instrument or drive a car will be familiar with this passage from the forced and deliberate fumbling through the steps of a procedure to their eventual smooth and automatic flow.

Capitalist regulations protect knowledge with a subjective bearer through trade secrets, confidentiality agreements, aspects of certain laws that deem an industrial invention to be a possession of the employer, and other related mechanisms. In some cases, subjective knowledge can be protected by patents, and in others as traditional knowledge. Likewise, professional qualifications (awarded by labour unions, the state, companies, or other organisations) are highly relevant to the regulation of subjective knowledge. Of course, these subjective knowledges may also be in the public domain.

3.4 Intersubjective Knowledge (IK)

Knowledge with an intersubjective bearer is hugely important but difficult to pin down empirically. There are several kinds. All varieties share the characteristic of being impossible to be understood on the basis of biological or subjective phenomena, and not being objectified outside of human beings. In this

sense, they are forms of knowledge that can, partly, be related to what Durkheim calls 'social facts' (Durkheim [1895] 1982, chapter 1)[110], and Luhmann's concept of 'communication' (Luhmann 1995, 2012)[111], or even the ideas of experimental scientists (Pentland 2007; Huberman 1995)[112]. Knowledges with an intersubjective bearer are embedded in the collective, intersubjective or, to use the more common but imprecise term, 'social' aspects of humanity.[113] They lie in the connections that pre-exist the human subjects and have a life which is relatively independent from any particular individual. As has been repeatedly stated here, there are various types of intersubjective knowledge, each displaying distinctive properties. In our opinion it is necessary to consider five types: *linguistic, recognition, organisational, axiological*, and *normative*.[114]

Before venturing into an analysis of each one, it is worthwhile commenting that all of them tend to display shared economic characteristics, which can be described as 'increasing returns to scale' or 'network externalities'. To put this simply, these terms refer to the usefulness of these knowledges increasing as their diffusion spreads, and that this evolves geometrically. This idea is usually known in the sphere of economics as 'Metcalfe's Law'. Hal Varian explains it thus:

> Metcalfe's Law is more a common sense rule than a law, but it arises in a relatively natural way. If there are n people in a network, and the value of the network for each of them is proportional to the number of other users, then the total value of the network (for its users) is proportional to $n \times (n - 1) = n^2 - n$. (Shapiro and Varian 1999, 175)

Let's take an example from the first type of intersubjective knowledge that will be explored next: languages. Making the assumption – perhaps unfair, but practical – that the number of connections possible between the speakers of a given language is proportional to the usefulness or total value of the language, and supposing that this language is spoken by four people, the number of possible exchanges is 12 ($= 4^2 - 4$; each subject can speak or listen to the other three). However, the internalisation of this intersubjective knowledge by an additional speaker provokes three consequences: (i) it increases the usefulness of the knowledge in question; (ii) it does this geometrically (one more speaking unit generates an increase of 8 units in the usefulness of the network: $5^2 - 5 = 20$; $20 - 12 = 8$); (iii) the additional speaker, adding usefulness or value to the network, creates, as an *externality,* an additional attraction for others to learn the language. Leaving to one side the numerical definition, the general feature that the more a knowledge is propagated, the more it is worth, can be observed for other forms of intersubjective knowledge, although it would be onerous to discuss it here without having explored each type in turn.

However, it is important to underline that this economic property is not necessarily present for knowledges that have other bearers. It is often said that 'knowledge', that is to say all knowledge, possesses these features of increasing

returns to scale and positive network externalities. This is a simple example of the mistakes that a non-materialist approach leads to: the fact that the properties of a knowledge depend on its bearer is not taken into account. Indeed, it is clear that for knowledge with a biological bearer, generally speaking, no such thing occurs: a gene is not more useful or valuable because another individual does or does not possess it. In the case of subjective knowledge, specifically techniques, there are not *necessarily* any network externalities either. In some cases they could arise – learning to play football requires other players, and each additional player, to a certain extent, is beneficial to the others' knowledge, but in most situations whether or not more skill-bearers are added is irrelevant to the performance of the subjective knowledge in question – the technique of the artisan is exercised equally well or badly regardless of the number of others that have mastered it. Furthermore, if we move into the specific terrain of economics, leaving to one side the usefulness of said knowledges and concentrating instead on their market value, the dissemination of a technique produces a fall in the price that the artisan can charge for her product or in the probability the football player has of being lauded as a great striker. Finally, the case of knowledge with an objective bearer is interesting. This is where Metcalfe's Law originated (Bob Metcalfe invented Ethernet) and is the source of the standard examples given in economics textbooks: telephones, faxes, to a lesser extent DVD players and so on. However, only some technologies have this property. Cars and lathes, which more closely resemble the knowledges of our artisan, don't share it. In fact, it only applies to what we have described as information technologies – and even then, not to them all. Neither an abacus, a calculator, nor an un-networked computer has this property. It barely arises in the subgroup of information technologies that *transmit* information.

But, if knowledges with an intersubjective bearer always have network externalities while technologies only have them in some cases, why is it the case that the latter are chosen as examples of this particular economic phenomenon? For a very simple reason: technologies operate within the *price system* while knowledges with an intersubjective bearer, in general, do not. Knowledges with an intersubjective bearer are tricky to measure and consequently, to integrate into economists' analyses. However, this does not reduce their importance to the functioning of capitalism. The methodological difficulties of quantifying them should not impede us from discussing their relevance, or investigating their properties.

3.4.1 Linguistic IK

As has just been mentioned, another type of intersubjective knowledge is *linguistic*. This refers not only to the collective human ability to encode and decode knowledge, but above all to the ability to create codes. In other words, even though a bacterium, much as a human collective, can decode information,

only the latter can create forms of coding and decoding, can invent codes. This ability to encode and decode is categorised as an IK and not a SK because we consider it to be a knowledge that is embedded in the human species being and not in subjective individuality.

Needless to say, the study of these types of knowledge from the perspective of their intersubjective character has been undertaken by various schools of linguistics (Vygotsky [1934] 1986; Saussure 1983; Bakhtin and Voloshinov [1930] 1998; Voloshinov [1929] 1973) and other disciplines (Castoriadis [1975] 1997; Virno 2015; Habermas 1984). The following quote could reasonably be claimed to summarise the views of these authors:[115]

> The word (and in a general way the sign) is inter-individual. Everything said, everything expressed, is situated outside of the soul, outside of the speaker, it does not belong to him exclusively. We would not contemplate abandoning the word to a lone speaker. The author (speaker) has imprescriptible rights to the word, as the listener has his rights, and all those whose voices resound in a word have their rights. (Bakhtin, cited in Lazzaratto 2006, 157)

These authors and the definition given relate to so-called 'natural languages' – emerging from the biological capacities of our species and from historical intersubjectivity, like English or Greek.[116] However, one of the multiple features of industrial capitalism is the mass development of 'artificial languages'. These are consciously and systematically planned, like Esperanto, Braille and others. In turn, a specific type of artificial language is 'formal languages' (Crystal 2003; Houde, Kayser and Koenig Oliver 2003). These assume a maximum degree of abstraction, rationalisation and instrumentality. Formal languages completely eliminate the ambiguities, polysemies, redundancies, and temporal variations which characterise other types of languages. Of course, logic and mathematics are formal languages par excellence. As a consequence, although Spanish and the language of music, for example, are currently forms of linguistic intersubjective knowledge, their origins have a notable difference. The first, as with all natural languages, was *also* elaborated in an intersubjective manner. In contrast, artificial languages – that of Western music among them – proceed from a series of rationally and intentionally conceived rules, as knowledges with a subjective bearer. Only later, in the second instance, do they find a resting-place in intersubjectivity. In any case, we should not confine languages to a determinate category. In natural languages there are also determined rational and intentional interventions (such as the Oxford English Dictionaries) while within formal languages there are ambiguities, disputes over meaning etc.

It is important to differentiate between the subjective and intersubjective aspects of language. Saussure's distinction ([1916] (2011) is a practical one in this sense. Here we use the term language in a sense similar to that of Saussure's 'langue'. This refers to linguistic intersubjective knowledge. By contrast,

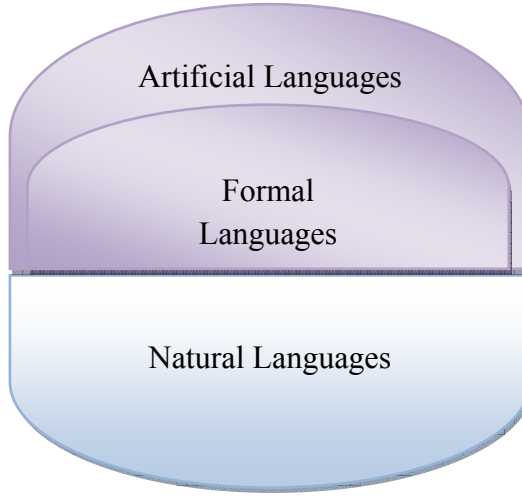

Fig. 3.1: Classification of language types.
Source: Author's own elaboration based on Crystal 2003.

he uses the term 'parole' to refer to the individual use of language, to subjective, implicit and explicit, knowledge. Of course, langue and parole are intertwined in a dialectical process – although we would add that, strictly speaking, they have the same relationship with the other types of knowledge as well.

Beyond the flows of different types of linguistic intersubjective knowledges, in previous studies we have analysed the relationship between signifiers and signified (again, in Saussure's sense, [1916] 2011) through the different stages of capitalism, as well as their quantitative dispersal over time. The signifier refers to the word, the chain of phonemes, the form. The signified refers to the concept, the idea that is evoked, the content. Therefore, in our view it is useful to investigate the origin of key determined concepts and the frequency with which they appear, the variations of signified that a signifier can undergo, the tension between different signifieds that can arise at a determined moment, the anachronistic uses of signifiers and signifieds etc. Naturally, this procedure aspires to link this type of knowledge with others, for example, with what are described as ideologies. For example, in previous research we have examined the idea that while during the pre-industrial period the signifier 'individual' designated the indivisible character of the subject, in industrial capitalism it started to assume the signified of an autonomous and self-sufficient subject. Likewise, while the signifier 'inventor' during mercantile capitalism referred to a particular type of importer, someone that brings knowledges into the kingdom that were previously unknown to it, during industrial capitalism the term starts to designate a person who sees themselves as a creator *ex nihilo*

(Zukerfeld 2011b). In turn, the sudden expansion of the signifiers 'intellectual property' or 'network' in informational capitalism can be relatively easily measured, and help us to understand some features of the current stage (Zukerfeld 2010, Volume II, Chapter 10).

Under capitalism, linguistic knowledge is not directly regulated by intellectual property rights. As with the majority of intersubjective knowledge, this is due to the aforementioned Metcalfe's Law: in general, dissemination benefits those who possess the knowledge, including in economic terms. Thus, natural languages have no owner. However, there are two kinds of regulations that should be mentioned. On the one hand, the regulation of what is permitted or prohibited in each language, the linguistic rules and corresponding accreditations. For example, in Spanish, the Real Academia Española determining which terms are permissible is indissociable from the wielding of power over other varieties of the Spanish language. Likewise, the regulation of English language certificates by various institutions, for example Cambridge University or TOEFL, intervenes decisively in the capitalist dynamic. On the other hand, in computing, the coded version of some languages (not Linguistic IKs, but a derivative of them) is subject to copyright.

3.4.2 Recognition IK

The second category of IK is Re-cognition. The word may seem strange. However, it is the least worst option we have been able to find to describe this type of intersubjective knowledge. Generically, we understand that recognition refers to *the forms that the connections assume through which the subject is integrated into human groups or collectives, is recognised by other subjects and through which she recognises herself*. Recognition refers, therefore, to the triple operation of recognising others, being recognised, and self-recognition, through a series of bonds or connections.

Of course, this idea is influenced, at a more abstract level, by the Hegelian *Anerkennung*, especially by Ricoeur's reading of it (2005, 171–263). In the sphere of sociology, Durkheim's forms of 'solidarity' ([1893] 1993) and Weber's concept of 'social relation' ([1922] 1968, 21) yield some retrievable elements: both concepts speak, in their own way, of different types of connections between subjects, which here will be designated as recognition. Finally, the simplest and most compact definition of the notion of recognition emerges from comparing it with Bourdieu's idea of 'social capital'.[117]

> … the aggregate of actual or potential resources which are linked to possession of a durable network of more or less institutionalised relationships of mutual acquaintance and *recognition* (Bourdieu 1985, 248, emphasis added)

The types of recognition are therefore varieties of this 'network of relationships of mutual acquaintance'. But in the sense that recognition is mobilised here, it does not only cover these tapestries of relationships as something extrinsic to the subject, but actually includes her, bestowing on her an identity, a 'knowing oneself likewise in its other', according to the Hegelian formulation (Ricoeur 2005, 182).

Now to bring all these references together. The forms of recognition can be conceptualised as being on a continuum ranging from the micro to the macro. From the most modest and singular subject up to the widest social collective, recognition can be found on all levels. How does a particular determined subject recognise their self? On the micro level, only since the advent of the industrial period has the subject been recognised as an *individual* (in the sense of being autonomous, along with the evolution of the linguistic knowledges mentioned previously). By contrast, under informational capitalism, the changes in the dominant modes of recognition have created a situation in which it is more reasonable to speak of *dividuals* (subjects who know themselves to be incomplete, and dependent on reticular connections), as Deleuze (1992) suggests.

However, it is on the macro level that recognition becomes particularly relevant to us. There are two historically situated modalities that have been well studied by sociology: *community*, characteristic of the preindustrial period, and *society*, typical of industrial capitalism. Of course, recognition at the micro and macro levels is indissociable. For example, as various authors have indicated (R. Williams 1978, 11–20; Bauman 2000), the constitution of the 'individual' and 'society' are produced in tandem in industrial civilisation. In previous studies we have attempted to show, following Castells (1996), that recognition in informational capitalism, tends to organise itself primarily into *networks* (Zukerfeld 2010, Volume II). Thus, on a broader level, recognition refers to this kind of linked aggregates, webs of belonging and identity.[118] The forms of macro recognition (community, society, and networks) co-exist and overlap beyond the historically situated dominance of one or the other. Similarly, the above is not an exhaustive list of forms of recognition; for example, on the macro level are also ethnic, national, and religious identities, which can be highly significant.

Naturally, between the forms of macro and micro recognition a range of possible webs with varied significance exists: professional networks, networks of Facebook contacts, social classes etc. In the case of industrial capitalism, the impacts of which continue to be felt, between the individual and society the ensemble of institutions organised around *work* intervene as mediators. From the association of personal identity with one's work ('I am a teacher', 'I am a taxi driver'), to the membership of union collectives, recognition connected to work played a crucial role in that stage and, to a certain extent, continues to do so. In turn, the micro and macro forms of recognition are intrinsically related, for example through the ideal character type of each period. While the ideal

type of subject of the *community* was the *martyr* and that of the individual/society was the hero (the *self-made man*, but also the revolutionary individual), for informational capitalism, the era of the *networks*, the *dividual* in whom the values of the era are congealed is the *celebrity*, or simply, the famous-for-being-famous (Bauman 2005).[119]

In materialist terms, the celebrity is the ideal typical subject of informational capitalism for a simple reason: in a world in which flows of digital information are superabundant, human attention becomes a scarce and valuable resource (as we shall see in chapter 4). The celebrity is nothing more than the centralising focus of attention. Thus, the typical subject is not merely integrated into a network of relationships, but is the node through which flows of attention must pass.[120] This leads us to one of the special characteristics of recognition: it is the IK most susceptible to capitalist regulation. One of the forms through which this occurs is the right to trademarks. This is nothing less than a crystallisation of the recognition that a company or a subject has achieved. Some associated rights are geographical and source-of-origin certifications that, above all, also protect reputation. In a complementary, and increasing, fashion (particularly associated with celebrities), rights and contracts arise which are related to public image, for example the right of publicity.

3.4. Organisational IK

Ever since Adam Smith's description of a pin factory ([1776] 1904), it has been widely accepted that the organisation of productive processes involves knowledge that cannot be found in individual workers, nor in the mere sum of their actions. In the functioning of a company's productive activity a form of knowledge is revealed which is external to each subject that participates in it. Associated with the division and connection between the tasks carried out, a collective knowledge that is usually maintained even when the workers of the productive process are changed: an *organisational knowledge* that is both mute and powerful. Although this type of knowledge also appears in extra-economic activities – like an orchestra or a football team – it is in the economy where it has been most assiduously studied (for an account of these 'organisation effects' see Coriat 1990, chapter 3). After Smith, it was Marx who, with the concept of 'co-operation', turned his attention to this impact of organisation as a productive force:

> The form of labour in which many, in the same place and in a team, work in a planned way in the same process of production or in different but connected processes of production, is called co-operation (…) This does not only involve an increase of the individual productive force, as a result of co-operation, but the creation of a productive force that in-itself and for-itself is necessarily a mass force (Marx [1873] 1990, 395–396).

From another angle, and much later, the notion from evolutionary economics of 'routines' (Nelson and Winter 1982, 134) refers to this form of knowledge that is embedded in organisational intersubjectivity. Of course, organisational knowledge has also been studied by management literature (Dixon 2001; Davenport and Prusak 2000; Baumard 1999; Blackler 1995). If we restrict ourselves to the limited idea of organisational knowledge in relation to labour processes, two pertinent observations can be made.

The first relates to how different organisational modes (intersubjective knowledges) interact with other forms of knowledge: they become entwined with technologies (objective knowledges), in artefacts, and with the subjects that internalise them (subjective knowledges). Indeed, in some historical circumstances (such as manufacturing) organisational knowledges remain as they are in intersubjectivity alone, and exercise a powerful influence without the assistance of objectifications or subjectivisations. In other modes, organisational knowledges are *also* translated into other bearers. For example, in a medieval craft guild, the organisation of the productive process relied heavily on the subjectivity of the master craftsman who held all the knowledge which would be set in motion during the intersubjective process. By contrast, in Fordism, the organisation of the productive process is aided by assembly lines and other machinery that *objectify* it. In any case, with greater or lesser support from other types of knowledge, productive organisation must pass through intersubjectivity.

Secondly, there is evidently one particular variety of organisational knowledge that predominates each different period of capitalism, although they also combine. In the pre-industrial period concepts such as 'artisanship', 'manufacturing', 'simple co-operation' are often used. With regards to industrial capitalism, notions such as 'mechanisation', 'Taylorism', and 'Fordism' (Coriat 1979), describe different organisational knowledges. In informational capitalism, there are two typical modalities, the 'network company' (Castells 1996) or 'Toyotism' (Coriat 1990), and 'collaborative production' or 'P2P' (Bauwens 2006). Organisational IKs are not subject to capitalist regulations as such. Their objectification in machinery (like assembly line belts) or software can make them viable for regulation. In addition, laws and employment contracts (for working hours) and even contracts with so-called social networking sites, generally speaking place the fruits of organisational knowledge in the hands of companies.

3.4.4 Axiological IK

In fourth place we have axiological knowledge. Although the term refers to values in particular, this type of knowledge denotes all forms of intersubjective belief. This, of course, includes right and wrong, what is valued positively and what is judged to be negative, but it extends much further to include any kind of representation: world visions of a religious order, political ideas, scientific paradigms,

or common sense knowledge are included indiscriminately. Evidently, this refers to an infinite variety of units of analysis. Quotidian and transcendental beliefs, either openly manifested or held unconsciously, so long as they are deployed intersubjectively are all axiological knowledges.

A theoretical source which helps to conceptualise this type of knowledge is, undoubtedly, Parsons' idea of 'culture'[121] (in his trisystemic model and later in the model known as AGIL; see Parsons 1977). More specifically, another reference that informs the idea of axiological knowledge is Wittgenstein's (somewhat opaque) concept of 'forms of life' (Wittgenstein 1953, 226). Rather than relating to articulable beliefs, this is an idea about the ineffable foundations of social activity, the implicit fabric of intersubjectivity. Jung's 'archetypes' ([1934] 1981) must also be mentioned here, and with greater emphasis, the concept of the 'social imaginary' from Castoriadis.[122] These concepts explain that axiological IKs are not only not natural, but neither are they necessarily rational (Castoriadis [1975] 1997).[123]

Of course, these beliefs represent a vast spectrum, and to study them empirically (that, it is worth reminding ourselves, is an essential task for cognitive materialism), it would be necessary to realise operationalisations according to the specific object of study. For example, in a national survey our research team designed, different flows of knowledge in secondary schools were studied, teachers and students were interviewed about what values they prioritised, and we also proposed an axiological dilemma in which the interviewees had to chose between an Apollonian course of conduct (effort, delayed gratification), and a Dionysian path (entertainment, immediate gratification). This, in conjunction with the other types of knowledge, allows us to distinguish tensions between divergent values that affect the school dynamic (Zukerfeld and Benítez Larghi 2015). However, in the study of historical capitalist development, we are primarily interested in other axiological knowledges. Indeed, for the capitalist dynamic, the axiological knowledges that fulfil the following three conditions are especially important: (i) being intimately linked to the development of the dynamic of the (capitalist) totality of each period. Meaning, they must be beliefs and values essential to the harmonious functioning of the productive processes and regulations of each period; (ii) being linked to the flows of other types of knowledge (entwined with particular subjects, technologies, information etc.); (iii) existing in a naturalised way, accepted immediately by the intersubjective collectives that bear them. The types of knowledge that share these three characteristics will here be called 'ideologies'. For example, the idea of 'God', of 'reason', of 'property', the belief that a whole set of symbols which we call 'money' is exchangeable for goods and services, the belief that human subjects are bearers of 'human rights', among other ideas inhabited, or inhabit, this intersubjective substratum in some spatio-temporally delimited contexts.

Here ideology closely resembles the sense that Žižek bestows on it. To take a simple example: the relationship between a King and his subjects. The King

only has subjects if they intersubjectively believe that the King is the King and that they are his subjects. We are confronted here with a series of beliefs that prop up a determined social order for the very fact of being collectively internalised. The King is King because his subjects do not question the social foundations of his power. This is the nucleus of ideological reality:

> "ideological" is a social reality whose very existence implies the non-knowledge of its participants as to its essence … (Žižek 1989, 15–16)

However, the above quote is insufficiently clear and must be distinguished from the Marxist notion of ideology. For Marx, ideology is 'false consciousness' and will vanish when the 'truth' is revealed (the role of the revolutionary party or some other source of certainties). In our view, on the contrary, ideology exists *materially* in the intersubjective tapestry: the capitalist totality – or whichever other type – depends on it for its continuation. But above all, ideology is not necessarily false.

> The lesson that must be drawn from this as regards the social sphere is above all that belief, far from being a "personal", purely mental, state, is always materialized in our actual social activity: belief sustains the fantasy that regulates social activity. (Žižek 1989, 64)
>
> An ideology, therefore, is not necessarily "false": as regards its positive content, it may be "true", quite precise, given that what really matters is not the affirmed content as such, but the mode in which this content relates to the subjective position supposed by the process of enunciation itself. (Žižek 1994, 46–47)

There are two points to add to Žižek's perspective. On the one hand, the point is not so much that ideology can be 'true', but that actually, as pointed out in chapter 2, it makes no sense to situate it on the truth-falsity axis. The interest lies in how it is articulated with the functioning of the social totality into which it is inscribed. Are the dominant beliefs necessary to sustain a determined distribution of resources, whether they be power, wealth, or other forms of knowledge? In the event that they are, we are confronted by an ideological reality. In contradistinction to a concept of ideology as an 'interested lie' (which could be useful in another type of study), here the emphasis is on the axiological intersubjective knowledges that are not *only or necessarily* part of any conscious conspiracy, or emitted by a tightly restricted group that deliberately disseminates them for their own self-interest. Some ideologies may have this origin, while others do not.

This could be clarified by a second remark about Žižek's position. Ideologies, in the most conspiratorial sense of the term, refer to the level of subjective knowledge, that is, to a set of subjectivities that produces a series of declarative

knowledges and attempts to spread them widely by means of their translation into various bearers. By contrast, what interest us here are ideologies as intersubjective beliefs only, when they have reached intersubjectivity, whether or not they stem from there.[124]

Other common ideas in the social sciences can be fruitfully categorised as forms of axiological knowledge, although discussing them would mean taking an overly circuitous detour from the aims of this book.[125] It is worth reiterating that axiological knowledges are intrinsically linked to other types of knowledge and, particularly, to other intersubjective forms. Performing an analytical separation is not to disavow that in practice the flows of different types of knowledge are indivisible. To return to an example mentioned various times already, the fact that individuality becomes a key value in industrial capitalism (e.g. through the idea of the self-made man), is inseparable from the recognition that specific subjects have divided themselves off as autonomous entities from the collective mass, from the changes to the meaning of the term 'individual' (now an autonomous subject who is self-sufficient when it comes to knowing and acting upon the world), from regulations (normative knowledge) like *enclosures* (which separate a particular subject from his land), and other forms of association between the particular subject and property. In general, values are not the object of exclusive regulations through some form of intellectual property. However, it is widely known that states act in all capitalist societies to promote some values, to the detriment of others. Furthermore, in many contexts, some axiologies are explicitly prohibited. Even if there are other agents (corporations, religious institutions, social classes) that also participate in the dispute over regulating axiology, the state is the only one which wields the power to impose some of those values by direct, or even monopolistic, means.

3.4.5 Normative (or Regulatory) Intersubjective Knowledge

Normative or regulatory knowledge concerns the intersubjective internalisation of certain patterns of behaviour that are supported by a diverse range of sanctions. It concerns the different kinds of norms (laws, decrees, acts, ordinances, treaties etc.), judicial rulings, and institutions, insofar as they are embodied in the collective fabric of relationships. That is, decrees, laws and acts constitute the means of analysis to give an account of the extent to which certain regulations have impinged upon intersubjectivity.[126]

Once again, we are faced with a vast assemblage of knowledge. Modest municipal ordinances coexist with penal legislation accepted by all cultures, with a broad spectrum of regulations in between. *However, some norms are of particular interest to us. These are the ones that form the backbone of capitalism, that regulate the relationships between subjects and resources*. At this point we

can cast our minds back, with a number of mediations, to speak of what at the beginning of this book we, slightly gratingly, called 'physical property' and 'intellectual property'. We have arrived at the moment in which finer grained detail about our approach can be provided.

The first thing to point out, which springs from everything discussed so far but is not usually taken into consideration, is that regulations and norms in general, and in particular what Marxists call the 'social relations of production', are nothing more than a particular type of intersubjective knowledge. *That which regulates access to multiple combinations of physical and knowledge matter is a type of knowledge matter*. Thus, regulations have the economic properties of knowledge in general, and those of knowledge with an intersubjective bearer in particular.

Secondly, it is vital to develop the idea that the concepts of physical and intellectual property are simplifications or, rather, two common types of a broader phenomenon, which is the *regulation of access*. Therefore, when at the beginning of this book the suggestion was made that the link between capitalism and all entities is a given because it embraces them with two types of regulations, they were referred to as physical and intellectual property with deliberate imprecision. Actually, it can now be confidently revealed, capitalism regulates *access* to the knowledge and physical aspects of these entities. This regulation can adopt various forms. Property, in a strict sense, refers to only one of them, which we can describe as exclusive.

It can be argued that different forms of property – in a strict sense – become increasingly historically limited in their capacity to account for the relationships between subjects and resources. The concept of property usually refers to the dichotomisation between subjects who have the ability to exclude others from a resource (property owners), and subjects unable to gain access to that resource (non property owners). However, there are many goods, among so-called 'natural resources' and informational goods (essentially composed of digital information), for which exclusion is not desirable or has not been accomplished. While the quantity or economic importance of these goods that cannot be conceptualised with the traditional notion of property is on the increase, the limitations of this concept become evident (Ostrom and Hess 2006; Rifkin 2000; Bell 1973). The term *access* (Rifkin 2000) on the other hand, enables us to tackle the various ways in which subjects enter into relationships with resources, *integrating but transcending different forms of property*.

Reappraising some elements of the theories about public goods and ideas from other authors,[127] below are presented various types of access utilised in previous studies which may be of some use for other investigations. How to classify types of access? Here it will be done on the basis of two variables. On the one hand is the distinction regarding the regulated object: between physical and knowledge matter, as proposed in chapter 1. Thus, the idea is reaffirmed that the primary question regarding concrete resources should

be about their *dual registration*. How is their physical aspect regulated? How are the knowledges embedded in it regulated? Access to these two entities is subject to disparate regulations which coexist in the same goods, as we have already seen.[128]

It is the second variable, related to the regulations themselves, which leads us to specify what was described in chapter 1. The dichotomy property-not property is inadequate. The crux of the matter lies in the fact that there are different forms of access that do not necessarily imply ownership of the good. Among the intermediate conditions can be found, for example, public access – mentioned in passing in chapter 1. There we hurriedly differentiated between public and private. This is not mistaken: *ranging from the minimum to the maximum level of exclusion, the categories of public and private are useful*. However, it is possible to be more specific. Leaving to one side the debates related to what is private and how from Blackstone's formulation ('the despotic dominion of the individual') we have moved to doctrines in which rights are limited (Anderson and McChesney 2003). It is in fact the idea of *public* which demands urgent updating. That is due to the idea that public and state-owned coinciding perfectly (common under industrial capitalism and especially in the post-war period) has become unsustainable.[129] Especially for efforts to understand the present stage of capitalism, informational capitalism, it is vital to highlight the significance of a *public* or *quasi-public non-state sphere.* Besides, in recent years a certain consensus has developed in economics related to the distinction between open access and common property.[130] Generally speaking, both permit some public access. Unlike private access, for both of these there are often large communities who share access to certain resources. However, while open access lacks all limitation and exclusion, in the case of common property inclusion arises from membership of a determined group (nation, club, library)[131] and, potentially, non-members are excluded.[132] Thus, an intermediate zone emerges with non-exclusive modes of access that should be considered, both as regards physical and knowledge matter.

A few clarifications may be required here. The table presents a typologisation of *norms* (in other words, knowledge). It is important to distinguish them from a similar conceptualisation introduced in chapter 6, in which relationships between *subjects* and *resources* are differentiated. Moreover, the examples of regulation included are by no means exhaustive: other regulations could be included. Finally, the terms employed in the table correspond to currently valid concepts, for informational capitalism, and should not be automatically extrapolated to preceding stages. Following Marx's methodological suggestion, we are studying human anatomy, as a key to later understanding the ape's. This does not only imply the obvious – that the term 'GPL licenses' lacks any analytical utility for merchant capitalism – but also the rather less obvious idea that 'intellectual property' was not a regulation *as we understand it today* until half a century ago.[133]

				Physical Matter	Knowledge Matter
Degree of exclusion	Low High	Exclusive ('Private')		Physical Private Property	Intellectual Property
		Non exclusive ('Public')	Common	State Property Cooperative Property Communitary Property (Common Pool)	GPL licences, Creative Commons licences, Compulsory State licences
			Open	Open Access	Public Domain

Table 3.3: A typology of access: normative knowledges as regulations of matter/energy and knowledge.
Source: Author's own elaboration based on Ostrom 1990, 2009; Ostrom and Hess 2006; Eggertsson 2003; Vercelli 2009; Zukerfeld 2005b, 2008b.

To recap, the types of access are classifications of the most important forms of normative knowledge: they regulate the relationships between subjects on the one hand, and physical and knowledge matter, on the other. Their concrete configuration is an essential element to understand historical stages, as shall be discussed next. With regard to access to the norms themselves, there are no regulations which exclude access to them, but there is however, a concentration within the state, by definition, of the monopoly of creation and administration of juridically valid norms.

3.5 Cognitive Material Configuration

The table below summarises the typology of knowledge on the basis of the material bearers.

With this typology now complete we can suggest how to use it. Taken as a totality and applied to a concrete reality we have a cognitive material configuration (CMC). This means *the entirety of the stocks of diverse classes of knowledge (based on their bearers) for a given dialectical totality*. This totality may be highly variable. It may be a social meeting, a productive process in a school or a business, or stages of capitalism.

Therefore, the concept of CMC shares some aspects with the concept of system, such as that within a CMC there may be others, and the idea that it configures a totality in which its elements perform multiple complex reciprocal influences.

In turn, the CMC is not a static, self-satisfied totality but rather a *dialectical totality in which contradictions between different types and sub-types of knowledge*

Type	Subtypes	
Biological Knowledges (BK)	Organic	
	Post-organic	
Subjective Knowledges (SK)	Implicit	Techniques
		Others
	Explicit	
Intersubjective Knowledges (IK)	Linguistic	
	Recognition	
	Organizational	
	Axiological	Ideologies
		Others
	Normative or Regulatory	Access to physical and knowledge matter (Physical, Intellectual property and others)
		Others
Objective Knowledges (OK)	Technologies	Physical
		Information
	Codified or Information	Analogue Information
		Digital Information

Table 3.4: Summary of the typology of knowledges on the basis of their bearers. Source: Rearrangement based on Zukerfeld 2007, 2010.

are constitutive and constant. For example, there are tensions between subjective knowledges and axiological intersubjective knowledges when a subject spurns a value held by the society she is a member of, or between subjective and codified objective knowledges when the subject wishes to express in writing something that has her knotted up inside, but cannot find the words, or between organisational intersubjective and technological objective knowledges when a group of artefacts are not compatible with the organisational mechanism in a productive process (as with the case of digital technologies in schools). In sum, there are a multiplicity of tensions, of a greater or lesser scale and seriousness, between different classes of knowledge. Some demand an immediate resolution, as they threaten the totality which they integrate. Others coexist without being transmitted to the rest of the totality.

However, from the viewpoint of the study of capitalist transformation, there is one particularly important contradiction, that which arises between some normative or regulatory knowledges and the totality of the CMC, that is, the productive totality: the regulation of access to the two entities (physical and

knowledge matter) that have been studied in relation to the totality of productive processes. To a large extent, the ideas presented here could be understood as a revision of the relation between the productive forces and the social relations of production elaborated by Marx. Indeed, the link between the CMC and one of its components (normative knowledge) is in fact related to a particular interpretation of the famous Marxian relationship between those two concepts. Actually, *the CMC is not dissimilar to the 'degree of the development of the productive forces'*.

In contrast to the term 'force', so favoured by Marx, in the approach detailed here the productive capacities that our species has historically wielded are composed entirely of knowledge matter. If the objection is raised that energy contributes to production, we could not agree more, but with the proviso that it is knowledge that channels this energy into producing use values, rather than being blind forces of nature – as will be discussed in chapter 5. But it is of much greater importance to state that even if all knowledges function as productive forces, it is normative intersubjective knowledge, the forms of access in particular, that have an affinity with the social relations of production. This expression of both Marxist concepts in cognitive terms leads us to reject the idea that the productive forces and the social relations of production are two autonomous entities, and that consequently one could determine or condition the other. Not only are we opposed to unsustainable economic determinisms (of the base-superstructure type), but also, especially, to the positivist and anti-Hegelian approach that they are underpinned by. If it is considered desirable to retain the Marxist vocabulary, something not undertaken here more than very occasionally, one must start from the fact that the famous contradiction between the productive forces and the social relations of production is the second moment of the Hegelian dialectical totality, in which the productive forces (the CMC) enter into contradiction *with themselves, with a particular manifestation of themselves, which is what* social relations of production *constitute*.[134]

Finally, the periods in which the contradiction between the entirety of the cognitive material configuration and normative knowledge is at its most intense are those moments when capitalism sheds its skin. This occurs through profound transformations to the norms regarding access to physical and knowledge matter, that adapt, although not automatically or even necessarily effectively or predictably, to new productive processes. In other words, the dramatic metamorphosis of normative intersubjective knowledge is a clear indicator (not the only one, of course) of a transition from one stage of capitalism to another. This is what occurred at the dawn of merchant, industrial, and informational capitalism.

While there may be nothing novel in pointing out this association with regards to physical private property, here it is worth stressing two points. Firstly, the transformation occurred, in each transition, to knowledge also, that is to say, to the ensemble of institutions which today we call intellectual property.

Secondly, the changes affect the regulation of access, which exceeds the dichotomy between property and not property.[135]

3.6 The Cognitive Material Configuration of Merchant, Industrial and Informational Capitalism

In this section we propose to illustrate the use of the concept of CMC through a characterisation of three historical periods which will be referred to throughout the course of this book. Despite the evident limitations imposed by this brief and schematic characterisation, it should suffice to suggest a systematic, non-reductionist, way of defining historical periods. The first characterisation concerns the pre-industrial period. This includes mercantile capitalism, which ranges approximately from the mid-fifteenth century to the end of the eighteenth, but also subsumes features from previous stages where there are continuities. The second moment is industrial capitalism, which covers the period from towards the end of the eighteenth century up to the third quarter of the twentieth century. Finally, a summary of the present stage, informational capitalism, is presented whose beginnings can be approximately dated from the 1970s and which continues up to today.

In each case some comments are offered about physical matter (that is, 'matter' and energy) in order to then concentrate on the different types of knowledge, without pretending to be exhaustive.[136]

3.6.1 The Cognitive Material Configuration of the Pre-industrial Period

Here 'matter' is of a natural character: scarcely removed from its original context. It should be mentioned that during this period the process of expropriating 'matter' principally from the continent that is now called America, offered significant material flows for the gestation of mercantile capitalism. The muscles, or the combined force of humans, horses, and oxen constituted a major *energy* source for the period. Unlike the future machines of the industrial revolution, these biological beings generate energy from renewable organic 'matter'. Although from the standpoint of the present the total consumption of energy seems negligible, the energy intensity, that it is to say the consumption per unit of production, was much higher than that of any subsequent period.

With regards to *subjective knowledges*, they were traditional knowledges, relatively stable over time. Their reproduction was first and foremost face to face, individualised, and framed within contexts of close familiarity: blood relations, guilds or communities. The SKs – their bearers, of course – were highly limited in terms of spatial mobility, due to physical barriers and, in due course,

the power of feudal regulations and their inertia even when these regulations began to be relaxed during merchant capitalism. Finally, limited contact with codified knowledges and the absence of specific institutions to transmit those knowledges widely, limited their dissemination. Of course, all this is indissociable from the strategies of regulation and exploitation of those knowledges by their carriers.

As regards *objective knowledges*, firstly we have technologies: in this period *simple tools that objectify physical technologies* predominate. Hammers, spades, needles and scissors occupy the hands of agricultural workers and artisans. Secondly, and to a much lesser extent, some *complex physical tools* appear, such as the spinning wheel, lathes, and shuttles. In the sphere of information technologies, of course, the printing press appears, also a complex tool that constitutes one of the landmarks of the period. *Machines* have an extremely limited importance. Watermills and windmills are quantitatively significant, but the development of ships that enable the crossing of the Atlantic and consequently expropriations and exploitations in the colonies, are decisive.

For their part, *codified* objective knowledges – information – possess the following characteristics. They were divorced from the production of goods for various motives: (i) the reduced diffusion of reading and writing techniques (ii) high costs of books in the period leading up to the mass diffusion of the printing press (iii) intersubjective beliefs about the role of books in that period (which distanced them from goods producing environments). Thus, even while some treatises were written which were aimed at artisan workshops, their impact seems to have been modest. However, in the productive processes which today we call artistic, and some other similar processes, they had a relative influence and were decisive in the productive processes of the university guilds from the twelfth and thirteen centuries onwards. On the other hand, the first link in chronological terms between codified knowledge and productive processes is through bookkeeping, in which the codification of knowledges is related to the externality of productive processes. For a long period this occurred predominantly through the measurement of stocks and surpluses, but from the advent of merchant capitalism – let us say, in the fifteenth and sixteenth centuries – accounting codification was systematically integrated into the rational assessment of returns. In turn, the codified knowledges played a considerable role in spreading terms (stimulating linguistic IKs), values (axiological IKs) and norms (normative IKs) that would inform productive activities. Finally, the mobile printing press had a direct and immediate impact on the IK productive processes and also an indirect, later, impact on the technology IK productive processes.

This leads to intersubjective knowledges. We shall begin with *recognition*. Obviously there are many recognition networks that could be outlined, from the most intimate social relationships up to the widest ranging. Recognition exists among family, in a corporation, at university and so on. But the most

general category that captures recognition in this extensive period is *community*. The subjects recognise each other as part of an immediate unity, deeply imprinted by mechanical solidarity, by the powerful presence of the collective in the individual subject and by the traditional and affective bonds established between them, but also by the weak presence of what in sociology is known as goal-oriented rational action. The subjects, in general terms, act more under the guidance of traditional, affective, and value-based patterns than instrumental means-ends adaptation. On a much smaller level of recognition, directly linked to economic life, it is interesting to mention the existence of *brands,* those used to mark livestock, diverse products, and later those strictly related to guilds. These symbols (codified OKs) administrated by corporations or other institutions (normative IKs), in the last instance, manage flows of recognition usually mediated by a particular good.

Three comments concerning *linguistic* knowledges are necessary. The meaning of terms such as *techne* (which assembles knowledges that later separate) or invention (which means discovery or importation and not creation from scratch) reveal the unity of categories that would later manifest themselves to us as dichotomies, the oneness of knowledge (see below). The same unitary conception can be inferred from the terms *monopolies*, *privilegi*, *patents*, which in their nomenclature do not distinguish the character of the protected knowledges. In turn, some Arabic concepts partly transmitted through texts have a decisive impact on the language that propels mercantile capitalism: *zero, algebra, customs, bazaar, cheque*. In general, the predominant languages throughout this period are the *natural languages*. From Latin to English, Quechua to Mandarin Chinese, they are languages which emerge slowly, through the intersubjective tapestry, without being planned or oriented towards a specific goal.

Organisational knowledges, just as all IKs, can be found on different levels. On the most abstract level, this stage has a limited functional division, coherent with the notion of community that is suggested as the most general form of recognition. Thus, the form in which the social collective organises its metabolism entails a limited division of activities. The spheres that would later separate are superimposed here, and particularly some of the spheres that industrial capitalism would sunder between instrumental and consummatory are blended together in this stage. In this sense, it is notable that the flows of organisational knowledges do not in general split the domestic unit from the productive unit; consequently the intersubjective injunctions regarding the distribution of productive tasks are incarnated, primarily, in the familial group. The family is the basic organisational cell of the unit of production for agricultural processes but also for the majority of manufacturing or artisanal processes. However, in certain productive processes, the situation is somewhat more heterogeneous. Thus, in some medieval urban manufacturing, as in textiles, a significant organisational development can be observed.

The values that flow through a single social collective are, already, abundant. Those that circulate for centuries in dozens of societies are essentially infinite. It is not possible to present a summary of the *axiological knowledges.* But it is possible to restrict our comments to a much more delimited group of values: those related to knowledge itself. That is, beliefs prevalent in diverse communities about how knowledges are conceived, of which there are basically three. Firstly, the oneness of knowledge. It is worth especially emphasising that the distinction between the instrumental and the consummatory (theoretical-practical, culture-economy, etc.) was not frequently expressed. Secondly, the absence of the search for originality. It was not groundbreaking knowledges which were valued, but rather those consecrated by tradition. Thirdly, and connected to this, the notion of an ex-nihili individual creator did not exist. The creator discovered – bringing to light what was already there, although previously hidden. Thus, he re-elaborated materials whose origin was lost in the mists of time, or he was inspired by supernatural forces, but on no account was he seen as a demiurge.

Finally, this brings us to the *normative knowledges*. Approximately, according to the form in which we believe that capitalist regulations view the world today, we can distinguish between two general types of regulation: those concerned with physical and knowledge matter. In the feudal and slave relations that largely survived in the period being analysed, the regulations of physical and knowledge matter are reasonably separate. *The feudal lord and the ancient master, as seen above, hold sway over the destinies of the former*. This merits two clarifications. In the first place, our schema enables us to understand how the lord and the master dominate all physical matter, without the distinction between whether these are human or natural being as emphatic as it would be for industrial capitalism, with its humanist ramifications.[137] They are owners of the energies of rivers, but also of peasants. Subjects' bodies, as we know, are bound to a region and are not quite different from other resources that the *dominus* controls. In second place, the master and the lord, for different reasons, have much less influence over the regulation of knowledge. In the case of feudalism and its transformation into mercantile capitalism, this is due to a relatively strict and growing division between the regulation of physical and cognitive aspects. On the one hand, religious institutions in all historical periods have played a fundamental role in the regulation of IKs, but they have also actively participated in the regulation of codified knowledges. The progressive specialisation of the regulation of knowledge led in the Middle Ages to forms of *trade guilds* that primarily managed techniques, although also trademarks (recognition) and, in a certain way, technologies. In particular, with the appearance of the printing press, printers' guilds emerge which regulate codified knowledges. In turn, the *university guilds* regulate these flows and also the transmission of values (axiological knowledges) and, to a lesser extent, certain techniques.

Starting from the fifteenth century – with the 1474 Venetian Statute and later the English Statute of Monopolies in 1624 – even more specific and formal regulations

Type	Subtype	Characteristics
SK	Explicit	One to one, face to face transmission Absence of mass reproduction of SK Restricted physical mobility of the carriers of SK Persistence over time
	Implicit	
IK	Recognition	Community
	Linguistic	'Techne', 'Invention', 'patent', 'privilegi', 'monopoly' 'Zero', 'cheque', etc. Natural languages
	Organisational	Productive units not distinguished from the home Low complexity in general, especially in agriculture, but advanced division of labour in some manufacturing
	Axiological	Oneness of knowledge, absence of a search for originality and absence of the idea of the individual creator
	Normative	Physical matter: Master/Lord ownership Knowledge matter: Guild legislations Monopolies, privilegi, patents Universities Church and other religious institutions
OK	Objectified (Technologies)	Simple tools: technologies propelled by biological energies Complex tools: less common Machines: practically absent
	Codified (Information)	Codification strongly associated with the *accountable* exteriority of the productive processes Low level of written codification of pre-Gutenberg knowledges Scarcely any direct relation to the content of the production of goods over the whole period Close relationship with the university after the seventeenth century

Table 3.5: The Cognitive Material Configuration (CMC) in the pre-industrial period.
Source: Zukerfeld 2010**.**

take shape: *patent laws* are born which to some extent, subvert the logic of prior institutions such as *monopolies* and *privilegi* – conceded in a discretionary manner. They also, primarily, regulate techniques, but little by little they also came to exercise control over technologies. Once again, it should be emphasised that in this period there is no distinction made between instrumental and consummatory, economic and cultural knowledges etc. Table 3 summarises the CMC for the extensive period cursorily examined in these pages.

3.6.2 The Cognitive Material Configuration of Industrial Capitalism

As is well known, the explosion of physical matter consumption is a fundamental characteristic of this stage. But this does not merely express quantitative changes. In the pre-industrial period, energy depended on renewable materials, different forms of biomass, the biological powers of animals and persons, on natural forces. In the industrial period, by contrast, energy is increasingly derived from fossil, non-renewable, fuels. Of course, the paradigmatic case is coal during the eighteenth and nineteenth centuries, but it would later shift to oil and gas. The 'matter' that flows through the industrial world, mostly transformed by human activity, have already lost all trace of their natural source. The *intensity* of physical matter – the consumption per unit of production – would increase at the rhythm of the development of the industrial sector; at a global level their decline would arrive with the end of the period in question.

As regards subjective knowledges, they fall into three tendencies, more or less separated in time. The first concerns the period contiguous with the industrial revolution: (i) the importance of some specific techniques is foregrounded (in agriculture and metallurgy); (ii) the transcendence of the liberation of flows of subjective knowledge that the rupture of feudal ties implies, (iii) the relevance, for the most sophisticated knowledges of the era, of the dissemination of specific associations which favour their transmission; (iv) the role that flows of information begin to play in translations between subjectivities. Points ii, iii, and iv refer to *explicit* SKs. Meanwhile, and this is the second tendency, during the nineteenth and twentieth centuries a notable process of unpaid copying (what we describe as exploitation through reproduction in chapter 5) of *implicit* workers' knowledges by capital developed. Some of these knowledges were objectified in machinery. Others were codified in procedure manuals. Thirdly, the importance of formal education (that from the mid-eighteenth century conquered vast sections of the populations of industrialised countries) to the transmission of subjective knowledge must be noted.

In relation to objective knowledges**,** the most apparent aspect of technologies is the development of *energy technologies* in the form of *machines*. Human beings increasingly dominate physical energies and accomplish the objectification of knowledges in order to set them to work in a systemic and continuous way. Mechanical driving force first emanated from steam, and then electricity, oil, and gas. Although the steam engine would take decades to make its influence felt on national products, its key feature is that it constitutes a general purpose technology: it articulates dissimilar technologies such as marine and land transport and, of course, industries like textiles. Nonetheless, *information technologies* also make significant progress. In terms of innovations firstly the expansion of *sensors* should be mentioned – converters of 'matter' and energy into information – which are pivotal for scientific advances, but also for economic production. Secondly the technologies of *transmission* of information

arise, which enable the reduction of distances for the circulation of flows of codified knowledge. These and other enhancements naturally have an impact on *information* itself: the quantities of books, magazines and the pioneering encyclopedias grow steadily. The growth of stocks of information is also driven by translations from other bearers that have been mentioned. The fact that information starts to penetrate the productive processes is crucial: time-and-motion, office procedures manuals, instructions on the use of machines etc. However, this is penetration which in every case requires human translation: the foreman who operates the clock, the worker who learns procedures, the engineer who consults the manual.

From among the *intersubjective knowledges*, *linguistic* knowledges express a tendency towards the development of *formal languages*. This concern for the instrumental rationalisation of language acquires a ceaseless momentum that is inseparable from the increasing flows of information, technological advances in general, from the values of the period and, definitively, from the rationalisation of productive processes. The latter is expressed in *organisational* knowledges. This group has at least four tendencies worth mentioning: (i) the emergence of specific organs dedicated to reflecting upon the organisation of the productive process (organisational knowledge moves from consciousness to self-consciousness, in Hegelian terms); (ii) the split between so-called 'manual' and 'intellectual' labour or rather, between two types which express an inversely proportional relationship between corporal energy and subjective knowledges; (iii) with the appearance of the assembly line, a large portion of organisational knowledges leave intersubjectivity and are objectified in machines; (iv) strictly intersubjective organisational knowledges are relegated to a set of internalised templates regarding what a productive process should be like: in relation to time management, hierarchy etc., that Bell described as 'engineering rationality' and Foucault as 'discipline'. To put it in an excessively simplified way, *recognition* in industrial capitalism lies in the division between 'individual' and 'society'. This split opposes the elemental unity that the community supposes. In society the bond is functional and generally anonymous. The self-recognition of specific subjects as individuals assumes they are no longer unitary, indivisible beings (the etymological meaning) but self-sufficient, autonomous beings. This conception reaches its zenith with the idea of the *self-made man*. Both extremes are mediated by a series of intermediate insertions, particularly those related to the world of 'work', as bestowers of identity. *Axiological* knowledges engage, as always, with forms of recognition and with the organisation of productive processes. Thus, it is necessary to also treat the dialectical pair individual-society as values. In turn, property in the modern sense emerges as a not insignificant value for these nascent individuals. Of course, instrumental rationality expands over all the axiological schema of the period and it is especially expressed in the profound dichotomisation between instrumental and consummatory spheres, from which arises, among others, the division between *economy and culture*.

All the above provides us with the materials to give an account of rearrangements of *Normative knowledges*. With regards to the regulation of physical matter, industrial capitalism establishes a dichotomisation which had not operated until then, or at least not at all clearly, in spite of seeming perfectly natural to us: some physical matter became the object of *property* and are commodities in the strictest sense. These are inert physical matter. Regulations of land (above all the enclosures) place it in the commodity sphere. Others, human physical matter, cannot be the property of any being other than the living subject who carries them. The tendency of capitalist productive processes, reluctantly but definite nevertheless, is towards the abolition of slavery.

The normative knowledges concerned *with knowledge* are inseparable from the other types of intersubjective knowledge. Indeed, the notion of a rational profit-maximising property-owning individual, combined with the process of separation between the economic and cultural spheres, results in the emergence of the figures of *author* and *inventor*. These are expressed, sooner rather than later, in specific legislation. In both cases, a certain combination of legislations and judicial rulings results in the stabilisation of copyright regimes and patents towards the end of the eighteenth century. In both cases also arises the notion of public domain as a positive, not an unlegislated residual space. That means, while the pole of individual proprietor receives copyrights, and industrial property (patents, trademarks, trade secrets), the pole of society is manifested in the notion of public domain. The aforementioned legislations seek to achieve a balance between the two poles. During the nineteenth century, while capitalist productive processes grew in magnitude, the ownership of knowledge would pass from the hands of individuals to those of business. At the end of the century, the Berne and Paris conventions would provide – with industrial property and copyright always separate – a legal international basis. Thus, the CMC of industrial capitalism can be summarised as follows and in table 3.6..

3.6.3 Cognitive Material Configuration of Informational Capitalism

In relation to *physical matter*, while the quantities consumed rise at a global level, in the case of the most developed countries the increase of absolute values starts to decelerate from the 1970s onwards, particularly in countries where the productive structures are more informationalised. Furthermore, when the per capita energy consumption of these countries is taken into account, the reductions in this decade signal the end of sustained increase and point towards a certain stabilisation. In the same sense, it must be noted that oil, being the principal energy source in global terms, has experienced a 10 per cent fall in its relative share (from 46.2 per cent in 1980 to 36.3 per cent in 2006). The intensities, that is the relationship between energy consumption and product, offer more interesting data: informational productive processes – along with the rise of

Type	Subtype	Characteristics
SK	Explicit	Strongly driven by flows of information, specific associations, and formal education
	Implicit	Flows liberated by the movement of subjects, little learning in factories Translation from these knowledges into machines owned by capital
IK	Recognition	Individual-Society, recognition mediated by intermediate institutions, especially those connected to work: profession, union etc.
	Linguistic	Artificial, particularly formal, languages Resignification of terms like 'Individual' Appearance of 'Copyright' and 'Patents' (modern sense)
	Organisational	Self-consciousness in the productive processes: specialist officials emerge with Taylorism. Objectification of the organisation of machinery Dichotomisation between workers who use large proportions of energy and low subjective knowledges and vice versa (separation between 'manual and intellectual labour') 'Disciplinary' organisation
	Axiological	Individual, instrumental rationality, property. Dichotomisation between instrumental-consummatory, e.g. economy-culture
	Normative	Physical matter: Physical property (self-ownership of human matter; commodification of non human matter) Knowledge matter: Copyright and author's rights Patents and industrial property Public domain
OK	Objectified (Technologies)	Physical technologies: decisive development of machines Information technologies: sensors and transmission technologies
	Codified (Information)	Massification of flows of information Penetration of information in the productive processes, but only through translation towards subjective knowledges

Table 3.6: The Cognitive Material Configuration (CMC) of Industrial Capitalism. Source: Zukerfeld 2010.

service sectors and the shrinking of manufacturing – mean that the current stage of capitalism has seen the reduction of the quantities of physical matter consumed per product unit.

Now we shall explore the characteristics of knowledge matter. Regarding biological knowledges, there are four significant tendencies: (i) advances in genetics, that is the translation of flows of organic information towards bearers legible to humans and (ii) developments in genetic engineering, in the capacity to produce post-organic knowledge bearers; (iii) the decodification and manipulation of the grammar of life is bound up with capitalist commodification; (iv) the tendencies described in (i) and (ii) are irrevocably linked to digital technologies and digital information in those processes, that is to say, with the objective knowledge typical to the period, as shall be seen further on.

With regards to subjective knowledges**,** explicit knowledges become less significant than they were in previous periods ('know-what' loses importance in the face of digital information). However, formal education, which in the preceding period was a privileged route by which to transmit these knowledges, expands, especially at tertiary and post-graduate levels. Now, these *certified* knowledges (for under- or post-graduate degrees) have, contrary to currently fashionable discourse, a more tenuous link with wealth creation than in the preceding period. Other sources of subjective knowledges – 'learning-by-doing', vocational training, home-based and internet-facilitated learning, etc. – by contrast seem to have considerable influence. This leads us to the growing importance of implicit knowledges ('know how') and to mention three issues that partially divorce them from formal education: (i) the importance of an cluster of meta-skills: the ability to permanently handle a multiplicity of stimuli, preparation for constant retraining, capacity to work under pressure etc. These are, evidently, a set of knowledges that are not guaranteed by any academic diploma; (ii) the growing link between the knowledges that circulate, are disseminated, and are learnt in free time and the techniques that the labour market requires; (iii) the obsolescence of productive processes and, therefore, of specific techniques. Certified knowledges, in most areas, move too slowly to keep up with them. Therefore, the continuous renewal of subjective knowledges is indissociable from the speed with which generations of other types of knowledges supersede each other. It is the fruit of the vertiginous transformation of the world of digital technologies, presided over by 'Moore's Law' (see below).

Regarding the *objective knowledges*, we must distinguish between technologies and information. In terms of *technologies*, the hegemonic phenomenon is the advance of *digital technologies* that tend to subsume all information technologies. This advance is due to the self-fulfilling prophecy known as Moore's Law and that is expressed by the exponential progress and cost reduction of the most varied types of digital technologies: processing, storage, transmission, and conversion. In turn, the fact that these technologies have converged

in the same artefacts is crucial: tablets, smartphones, and notebooks. One of the implications of the tendencies related to these means of production is that the physical property of the means of labour in the informational sector is not a decisive element in the determination of the stratification of subjects. The workers have access to computers, but this does not necessarily free them from exploitation by capital.

In relation to *digital information*, there have obviously been enormous intensifications in production, circulation, and consumption. The divergence between the expansion of the first two variables – even greater than Moore's Law suggests – and the modest advances of the third, reveals the problem of the scarcity of *attention*. That is, the consumption of superabundant information requires finite, and scarce, human attention. Such a divergence is the material basis which explains why attention becomes a particularly important value. Goods which are composed purely or principally of digital information we describe as informational (software, music, videos, texts, data etc.). Software is an especially significant type of informational good. It is the most important means of production of our era and has various peculiarities: it can generally be reproduced at close to zero costs; in some cases, it arises in non-capitalist productive processes like those of free software. Beyond the importance that the circulation of informational goods associated with so-called 'cultural industries', it is important to note that money has also become an informational good: the material fact that more than 90 per cent of the money in the world exists in the form of bits is extremely important if we are to understand the financial phenomena that shake the surface of informational capitalism.

Moving on to *intersubjective knowledges*, in relation to *linguistic knowledges* there are at least three features to mention: (i) the English language spreads widely, not so much on the basis of military domination (as was the case with the languages of previous empires) but due to intersubjective and technological domination. English is the language of digital technologies and software, and this galvanises it intensely; (ii) 'Chat' dialect: a set of recent but clear codes that provide templates for written communication through digital technologies: emoticons, abbreviations and the like; (iii) programming languages, beyond their importance, have the special quality that in many cases they become commercial products and, for the first time, configure entire systems of exchange as commodities.

As for *organisational* knowledges, there are two characteristic modalities. One is that of the well-known *network enterprise*, in their interior and exterior: the company as a group of islands, projects articulated in a relatively flexible way, the company as a network reaching towards the exterior, outsourcing anything that exceeds its core business. For this modality, organisational knowledge tends to operate *control* as a principal mechanism of *power* (complementing or replacing the *discipline* of the industrial period). The other modality is *collaborative production* (production of informational goods among peers over

the internet, usually during free time). This includes, of course, Wikipedia, but also forms which are hegemonised by for-profit firms such as social networking sites (e.g. Facebook, YouTube). The network company and collaborative production share features related to reticular organisation, the circulation of flows of information, the contingency of each particular configuration, etc., that twin them as prototypical forms of informational capitalism.

Regarding *recognition*, the attenuation of the typical mediations of industrial capitalism must be mentioned in first place: those associated with labour and even the concept of society itself. In contrast, *networks* impose themselves as the prototypical form of recognition in this period. However, they achieve this by interacting with those particular nodes which are *dividuals*, subjects who in this period recognise themselves only in the linking framework they share with other subjects, only in relation to being connected. Some of the particular forms that networks assume, as spheres of recognition, are the social networking sites and mobile social networks. This mediation is not innocuous: dependence on internet platform companies subsumes recognition networks under the commercial objectives of those companies.

For *axiological* knowledges we must also emphasise a regression: that of physical property as a value – which, of course, has a certain affinity with the swift obsolescence in the world of technology. We find that *connection to reticular flows of attention* seems to be the supreme value: being connected and that those plugged into this connection will receive massive and continuous flows of attention is the supreme desire. Of course, this vocation is constitutive of *dividuality* and is expressed through the value of *extimacy*: the affirmation of a self-identity through the digital display of what during industrial capitalism was condemned to the private sphere. Finally, while industrial capitalism valued mediacy, deferred gratification, the long term etc., informational or cognitive capitalism value the immediate and ephemeral.

The *normative knowledges* of industrial capitalism no longer adequately regulate the functioning of the commercial sphere in the present stage. In effect, physical private property, in spite of having managed to expand its kingdom by commoditizing so-called 'natural resources', has serious shortcomings in organising informational productive processes. This is because the physical component, which is the element that it subsumes, carries much less economic weight. The same is true of the crystallisations of such processes, informational goods, whose susceptibility to cheap reproduction makes them elusive for physical property. Finally, a period in which the CMC – 'the development of the productive forces' – has placed informational productive processes centre stage is a period in which physical private property must abandon its position on the pedestal of capitalist regulations. This does not mean that physical property will disappear or even that it will dwindle to a role of marginal importance, but rather that other modalities of regulating access to resources will win the spotlight. Naturally, the first regulatory modality to audition for the role is

Type	Subtype	Characteristics
BK	Organic	Genetics: decoding and translation of the language of DNA. Use of Digital Technologies and commodification
	Post-organic	Genetic Engineering: creation of post-organic forms of information. Use of DT and IT and commodification
SK	Explicit	Loss of importance, advances in academic qualifications but divorce from the product
	Implicit	Meta-skills, 'Windows subjectivity' or multitasking, capacity for constant re-skilling. Convergence between work skills and those used in free time
IK	Recognition	Networks and Dividuals Commodification of Recognition
	Linguistic	Natural Languages: Expansion of English, Chat dialect Formal Languages: Programming languages 'Network', 'Intellectual Property', 'Information'
	Organisational	Network Enterprise Collaborative Production
	Axiological	Immediacy, Connection, Attention, Dividuality, Extimacy
	Normative	Physical matter: Limitations to subsume informational processes; commodification of natural resources Knowledge matter: Expansion of Intellectual Property Emergence of Inclusive Appropriation
OK	Objectified (Technologies)	Digital Technologies: Moore's Law, Convergence
	Codified (Information)	Digital Information: Expansion of production and circulation. Less progress for consumption of various types (scarcity of attention) Expansion of Software, replicable means of production

Table 3.7: Summary of the Cognitive Material Configuration (CMC) of Informational Capitalism.
Source: Zukerfeld 2010.

intellectual property. Indeed, the *expansion* of intellectual property is the main adaptive manoeuvre taken by capitalist normative knowledge ('relations of production') in the face of new productive processes. Such expansion manifests itself in seven dimensions: semantic (unification of rights and propertisation), magnitude, duration, legislation, scope, litigiousness, and jurisdiction.

However, the very replicable ontology of digital information, along with various flows of knowledges mentioned above – networks, dividuals, scarcity of attention, etc., in other words, the CMC – demarcates limits on the success of

the mission that in the initial moments of informational capitalism was delegated to intellectual property. Therefore, another capitalist regulatory modality has arisen to complement it. This concerns regulating not to exclude but rather, on the contrary, to include, and in that way to obtain knowledges and attention from users for free. This kind of inclusive appropriation is configured via contractual agreements (typically terms of service of online platforms), and provides clear examples of exploitation through reproduction and attention (see chapter 5). The business of YouTube and Facebook which takes advantage of the unpaid character of the contents created by users, the utilisation of data by Google and other companies, and the attention of internauts to sell advertising, the harvesting of free software as an input by forms that have not invested in their development, among others, are examples of this modality.

Thus we have an initial approximation of the CMC of informational capitalism. Perhaps the most important point to underline is that the characterisation of each period cannot be unilaterally reduced to a single factor (digital technologies, organisation in networks, etc.), but must be considered systematically. This represents an ensemble of flows and stocks of knowledges that are in permanent tension, overflow, are translated, but without ever losing sight of the fact that they constitute a totality.

However, although we have spoken about a dialectical, dynamic approach, that gives an account of flows, no concept has been presented which would help us to understand how knowledge of one type is transformed into another. Thus, next we will turn to the theoretical tools which will be utilised to account for how physical and knowledge matter are transmitted through time and space.

CHAPTER 4

Knowledge Flows: From Translation to Capitalism

4.1 Three Simple Operations: Transduction, Sensory Conversion and Actuating Conversion

Clearly, physical and knowledge matter are not immutable stocks, fixed blocks, as they are represented in the knowledge typology table. On the contrary, this is an unjust abstraction, a snapshot that misrepresents the moving picture. Flows of knowledge are condemned – due to their notorious characteristic of always being more than they appear to be at a given moment – to mutate, multiply, or vanish. Any form of sedentarism or paralysis within a determined bearer is no more than a temporary situation or an imperfect halfway house for practical ends. Overall, for the purposes of our theoretical framework the transformations and replications of different forms of physical and knowledge matter are given the name operations. There are three elementary operations.[138]

The first is *transduction*. This term, which in various branches of physics (Busch-Vishniac 1998, 2–3) and biology (Frings and Bradley 2004, 272; Krauss 2008, 441) has slightly different meaning, is adopted here with flagrant disregard for its strict definition, to indicate the transformation of any form of 'matter' or energy into any other form of 'matter' or energy. When a fuel is transformed into calorific energy, or kinetic energy, these are examples of transduction.

The second and third operations are forms of *conversion*. Conversion, as a general operation, designates the transformations that link, in one sense or another, physical matter with some form of knowledge matter. Thus, starting with what in physics are called 'sensors' (Busch-Vishniac 1998, 8), the second operation is *sensory conversion* and entails the transformation of physical matter into some type of knowledge matter. This occurs when a thermometer

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transforms a certain magnitude of heat into information about the temperature, when human tactility converts the material into flows of biological information about the qualities of the entity that has been touched, or when a video camera transmutes the physical matter moving before it into a stream of bits. Thirdly, appropriating the concept of 'actuators' (Busch-Vishniac 1998, 9), we have the operation of actuating conversion: the transformation of a type of knowledge matter into physical matter. The mechanical arms of industrial robots that receive digital signals and convert them into dextrous actions are an example not too far removed from how human muscles function. Indeed, living organisms are brimming with actuating conversions at various levels: endochrine, neural, or genetic flows are destined, at some point, to produce certain forms of physical matter. Each of these operations represents the crossing of *a* frontier. However, the most significant operation for the theoretical framework presented here is situated on a higher level, and involves traversing multiple frontiers.

4.2 A Complex Operation: Translation

Translation – the fourth and most important operation – is based on the interlinking of conversions and transductions. *Translation is a transformation or reproduction of a form of knowledge matter into another, or the same form of knowledge matter.*[139] However, unlike transduction, it is not a basic operation, due to knowledge requiring a physical matter bearer. Therefore, to move from one form of knowledge to a new one, it is necessary to resort to a multiple stage process that involves long chains of the three basic operations. For example, a translation is produced when this sentence is typed into a computer. In this case, a form of knowledge with a subjective (explicit) bearer stems from a sequence of operations that includes various transductions and reaches completion with the actuating conversion of fingertips on the keyboard. Thenceforth, the keyboard performs a sensory conversion, translating the impulses of kinetic energy into digital signals. After a series of manipulations of this digital information, it is converted into the symbols that appear on the computer screen. The translation in this example, to express it in a condensed fashion, moves from certain subjective knowledges to a form of digital information.

For these flows of conversions and transductions the two extremes chosen were *arbitrary points*. Indeed, the chain of transformations can be traced back to forms of knowledge pre-existing a given conscious idea – e.g. the sequence of flows of biological information that partially explain it. We could also follow the chain of events forwards, after the words appear on the screen – how the idea is sent via email and translated to a subjective bearer etc. Thus, describing as translation the passage from one form of knowledge to another is not to

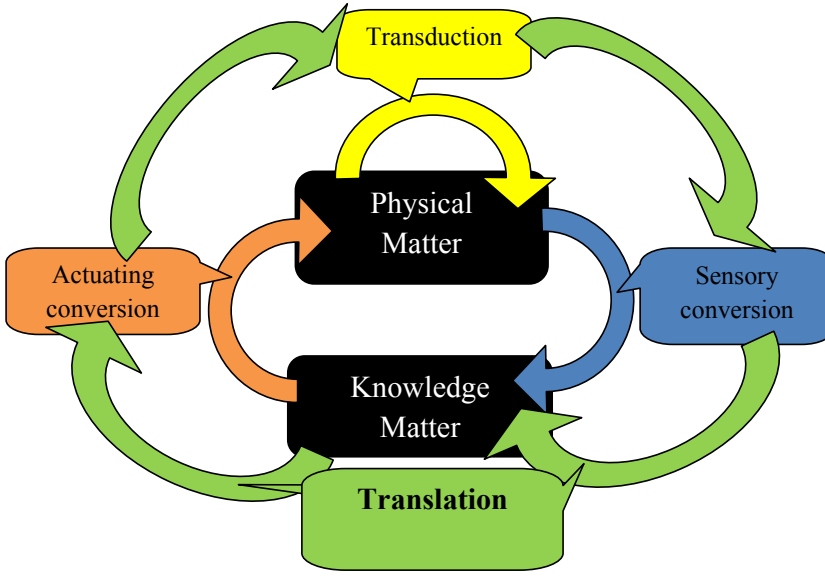

Fig. 4.1: The operations: translation, transduction, actuating conversion and sensory conversion.
Source: Zukerfeld 2010.

overlook the fact that the study of determined translations involves more or less arbitrary clippings of infinite chains.

In turn, the idea of translation suggested here is closer to the old Italian adage ('*Traduttore, traditore*'), *than the notion of linguistic equivalents. This is because, as stated above, the passage from one knowledge bearer to another has consequences: something is always added or subtracted – and in general, both occur.* Unlike transduction, due to which no 'matter' or energy are gained or lost, at the end of the process of any translation not only the form, but also the content is distinct from how it began. But this is a virtuous flaw. Genetic mutation, and along with it the evolution of species, is nothing more than a distortion in the natural translation of DNA (organic biological knowledge).

Of course, there is an enormous variety of forms of translation. Some occur within the inner life of a subjectivity – when an implicit knowledge is transformed into an explicit one –while others span large processes, such as when for a subjectivity, with the mediation of all kinds of objective knowledges, a knowledge overthrows the dominant axiological intersubjective knowledges. For example, the Protestant Reformation, woven from threads such as Luther (subjective knowledge), the printing press (technologies), the Bible (information), and intersubjective (axiological) beliefs.[140]

Many other forms of translation can be observed. Combining the typology of knowledges with the concept of translation it is possible to define *humans* as those beings who can, generically, *translate knowledges to and from biological, subjective, intersubjective, and objective bearers*. No other species of animal can perform these four translations and, of course, no type of machine can either.[141] Furthermore, concepts such as *communication*, *learning* and *thought*,[142] among others, should perhaps be understood as forms of translation also and thus be given materialist definitions. What these notions have in common is that they share a reception of knowledge through subjectivity. However, the translations that aspire to reach subjective knowledge require, as an obligation, that a certain quantity of human *attention* allows them entry. This is a key concept which will be developed in the following section. Nonetheless, the main category that follows on from the notion of translation is that of *productive processes*, which will be submitted to our scrutiny later on.

4.3 Attention

The concept of attention has been the object of various definitions throughout the history of psychology. Perhaps the first came from William James:

> Everyone knows what attention is. It is the taking possession by the mind in clear and vivid form, of one out of what seem several simultaneously possible objects or trains of thought ... It implies withdrawal from some things in order to deal effectively with others, and is a condition which has a real opposite in the confused, dazed, scatterbrained state. (James 1890, 403)

Without launching into a discussion of recent debates, it can be suggested that human *attention* can be understood as a combination of human energies and knowledges that lay the foundations for a potential translation (including sensory conversion operations) of determined knowledges (or physical matter) from any bearer to a subjectivity.

This, therefore, implies opening the floodgates of subjective knowledge, and channelling the translation towards a particular stimulus, to the detriment of the others. Needless to say, attention does not necessarily operate consciously.

One type of translation in which the importance of attention is clearly manifested under informational capitalism is the type that moves from digital information to subjectivity. In a context of a superfluity of information, as Herbert Simon notes, human attention becomes particularly scarce. Thus, the wealth of digital information generates a poverty of human attention. Although the modulation of subjectivity to accommodate several simultaneous stimuli can broaden its range, the limits of human consumption of information cannot be

overlooked. This idea, easy to grasp intuitively, and which has been pointed out by various authors (Goldhaber 1996; Simon 1996b; Rullani 2000; Rodríguez and Sánchez 2004; Davenport and Beck 2001; Piscitelli 2001; Lanham 2006; McLellan and Berman 2001; Zukerfeld 2011a), features as the mathematical conclusion of a paper by Neuman, Park, and Panek. Beyond the intuitive nature of this idea, there are studies which eloquently demonstrate it. In 1960 there were 98 minutes of information available for every minute of human attention. In the distant past of 2005 each unit of attention was competed for by 20,943 minutes of digital information (Neuman, Park, and Panek 2009, 11). As the authors state, under industrial capitalism the options were within the range of decision-making of each individual subject. But a superfluity of stimuli characteristic of informational capitalism can only be dealt with by digital management of information: above all, search engines like Google. It should be noted that, in effect, one of the most powerful companies in the digital world, or by extension the whole world, is predominantly an organiser of human attention. It signposts our way through those 20,000 minutes seeking our consumption, streamlining (or rather, regulating) our scarce resources in that sea of sounds, images, information, and programs. Thus, even though capturing attention has been a necessary component of the capitalist dynamic through different periods – for example the advertising industry flourished during industrial capitalism in the battle to capture it – only in informational capitalism has a real subsumption of human attention to capital been achieved. Indeed, it is in the current stage that the CMC has laid the groundwork for the development of a true attention economy and for the blossoming of a modality of capitalist exploitation based on taking unpaid advantage of human attention (as we shall see in chapter 5).

4.4 Productive Processes

On several occasions the phrase productive processes has cropped up, and it will appear a few more times hereafter. Although its meaning can, partly, be grasped intuitively, we shall now try to circumscribe it within some margins. Productive processes are a certain type of translation, specifically intentional and significant alterations to the state of existence of some portion of physical matter and knowledge matter governed by some form of subjective or intersubjective knowledge that result in a product (goods or services).

In summary: ('Matter' + Energy) Knowledge = Product

For example, let us imagine the productive process of a small software company. The subjective knowledges of its owner are present, guiding the process, along with the subjective knowledge, usually techniques, of the programmers. Biological knowledges participate, for example, in the cerebral processes involved. All the forms of intersubjective knowledge are present: linguistic, which permits the human subjects to understand each other, recognition, by

means of which the humans that participate in the productive process perceive themselves and recognise other participants as part of said process, organisational knowledge which is embodied in the division of labour that the collective assumes, the normative knowledge that indicates to them the rules that should be respected (from private property to working hours), axiological knowledge, that delineates some common parameters about right and wrong which are shared for the activity, technological knowledge is implicated in the artefacts (computers, tables, buildings) that are used in the productive process, and also in the data supply (software, information etc.). Of course, the materials that compose the artefacts are necessary. And the energy involved includes not only electrical energy, but also the biological energy that animates the humans engaged in the process. The main product may be a piece of software (a codified knowledge, objectified in an artefact).

However, there are also secondary products, or externalities (like the subjective knowledges that are translated from one subject to another: the learning that occurs over the course of the process). Productive processes then, are distinguishable from the natural alteration of 'matter', energy and knowledge, such as transformations which arise from meteorological phenomena, natural evolution, or any action performed by a resourceful animal. In all these cases there is no intentionality involved in the changes and/or there are no flows of social knowledges guiding the process.

4.4.1 Types of Productive Process

Naturally, the idea of productive processes includes the *processes of commodity production* as the principal category. These processes are defined by their orientation towards manufacturing products with the aim of exchanging them for others. That means, the knowledges which direct the processes have not devised them for the purpose of satisfying the appetites of the entities that participate in the process itself, but instead so that the goods and services produced are exchangeable for others on some sort of market.

But the concept of productive processes extends beyond the production of commodities: it also includes the combination of flows of physical and knowledge matter which may be far removed from the price system and even from instrumental action. Some recreational and after-work activities, certainly those connected to personal consumption, are definitively part of the productive processes, clearly because sooner or later, they have an impact on the dynamic of the economy.[143]

Reason rebels immediately against this idea: is it possible to equate a casual conversation between friends with a Fordist labour process in which those same friends are involved? Can the plasticine doll a child makes be considered in the same category as the manufacturing process that produces the plasticine?

The key lies in the degree of *alteration* that is produced and in the relationship with the transformation of the totality (for example, the particular capitalist configuration), in a mediated or immediate manner. In a Weberian sense, the ideal type of productive process is one which offers the greatest alteration to the flows of 'matter', energy, and knowledge that are input into it, and that is essential (in its aggregate level) to the functioning of the system. And, to go to the heart of the matter, if the transformation is considerable, it is irrelevant whether the process produces commodities or not. The most obvious example is housework, which even economics has increasingly begun to recognise as a productive process on which capitalism depends, to a greater or lesser extent.[144] On the opposite frontier of innovation is peer-to-peer production (P2P or collaborative production) which produces Wikipedia, open software, and other informational goods. In both cases it is clear that there are productive processes which are as important for the capitalist dynamic as they are exterior to the price system.

Another crucial example in the capitalist productive dynamic is war. Obviously, this phenomenon is a productive process according to our definition: wars entail tremendous alterations to physical matter. Additionally, they annihilate living humans and inert cities with little distinction (theoretical humanism does not have the least practical use, instead revealing itself in practice to be its own counterpart). Wars, it must be said, also generate mutations to normative knowledge: they lead to changes to prior norms, to capitulations, treatises that in all likelihood favour determined commodity production processes. However, wars are only the extreme pole of a type of non-commercial productive process essential for capitalism: that of organised violence, one of the forms taken by what further on will be designated *regulation*. Of course, violence also has an expression as a commercial productive process, under the prosperous guise of security firms, mercenary armies, and other proud members of capital's family.

Likewise, the concept of productive processes is an attempt to also include the phenomena of the production and reproduction of intersubjective knowledges, which are the most difficult to fathom. Let us imagine, for example, any social event: a remembrance day, a festival etc. These environments, apparently opposed to the instrumental logic of economic production, function as systematic spaces for the production of knowledge matter. The reader, without too much resistance and perhaps remembering Bourdieu, will accept that social capital, recognition knowledge, forging bonds, or whichever description is preferable, is an authentic productive process that is set in motion in these instances. It is tempting to say that, in practice, the productive processes of academics, intellectuals, and artists largely occur within this tapestry of recognition knowledge rather than among books or easels. But it is much more than that. It is quite common that from these environments signifiers emerge, and signfieds are established (linguistic knowledge). Is it not thus, that natural languages develop? Neither is it unusual that purely casual group conversations

end up destabilizing some values and establishing others (axiological knowledge). Who has not witnessed, in the most unexpected places, the intersubjective death of some belief or other? And who has not observed the rise of some alternative belief, or the same one in a new disguise?

Furthermore, we would argue that in the social rumination and digestion of the torrents of information that the mass media regurgitates, there is a productive process. Of course, we are not speaking here of the processes of production of media information and its transmission, nor of the capturing of human attention (which are effectively commodity production processes), but of the complex battlefield of internalisation. Lounging on a sofa in front of the television, where subjects seem to be enjoying the height of unproductivity, decisive knowledge production processes are in play for the capitalist dynamic. Collective subjects are produced and reproduced, renewed as a consequence of the dialectic between the knowledges of a diverse character that they already bear, and the flows that reach them, in our example, through the television. Naturally, this dialectic is partially tentative and contingent: the media flows could be swallowed without a thought, intellectually chewed over, or spat out immediately. In the first two cases, if the same occurs at a mass level, we are presented with productive processes: there is a profound alteration to the configuration of intersubjective knowledge. That is, if one human reads a newspaper and incorporates into her explicit memory some of the informative flows it transmits, it does not represent any production of intersubjectivity. But when millions of humans internalise, with the benefit of naturalisation, a set of media discourses, then we have a process of production of collective subjects, and possibly of ideology. It is important to reiterate, extending the example given: *there is nothing more remote from our approach than the idea that large media corporations unilaterally produce subjects. These corporations produce flows of information (codified objective knowledge) and capture attention through them.*[145] *This is the (commercial) productive process that they control absolutely. Here we are referring to another, complementary, productive process, which also counts on the participation of the subjects who internalise, acritically or otherwise, these torrents of information. It is the collective subjects themselves who produce collective subjects, not the large corporations.* Far from being passive, it is the material configuration of a subject's prior knowledge that moulds the productive process, which permits or denies the new flows access to memory etc.

Now, at first glance it could seem strange that we consider individual or collective subjects (although actually it is the knowledge that they carry) as an *output* of some productive processes. Resistance to this idea could have at least two root causes: on the one hand, humanist ontological inertia. On the other hand, a vague idea that productive processes result in 'goods and services' and not subjects. In terms of the first, in effect the dominant ontology, especially since industrial capitalism, accustoms us to making a rigid division

between objects and subjects: it is a tacit but firmly held belief that objects are produced, but subjects are not. Of course, denaturalising and rejecting this perspective is not at all novel. There are recent and fashionable antecedents in Foucault ([1966] 2002), but above all in Haraway (1991, 1992), Fuller (2009), Sloterdijk (2016) and many more.[146] Unfortunately, these authors do not usually recognise that it is Hegel who, in *Phenomenology of Spirit*, shows with clarity that subjects produce themselves at the same time as they produce the world. Our concept of productive processes aims to take this Hegelian element and combine it with more contemporary ideas and, above all, to bring it to bear on the historical, empirical, and even economic terrain (although in a different sense to Marx[147]).

On the other hand, we are accustomed to associating the result of productive processes with *goods and/or certain services*. Let us explore this a little. Goods, that is, entities that survive the moment of their production and over which property rights can be exercised, are varied. For example, tables, paper airplanes, software, or texts. Even though the last two are of a particular type (informational goods), it is not difficult to understand that all these examples emerge from something that it is appropriate to call productive processes, which are not necessarily commodity production processes but could be the fruits of leisure time or production for personal consumption.

In the case of services, that is, activities which are consumed at the moment of their production, over which property rights cannot be granted, there are at least two kinds. Firstly, services that result in a transformation of physical matter: a hair-cut, transport in a vehicle, washing up plates, in other words services which can be described as physical. Here it is also clear that these productive processes can, possibly, be outside of the sphere of exchange and the price system. Then we have cognitive services: the inoculation of human subjects with different forms of knowledge. When this inoculation occurs as a goal of a commodity productive process, the situation is well-known: the institutions of formal education (schools, universities), non-formal education (courses), and informal education (private classes) are obvious examples.[148]

Additionally, there are cognitive services that occur in productive processes which are not orientated towards the production of commodities. These are, effectively, most removed from all narrow definitions of productive process. However, their significance for the functioning of the totality does not necessarily depend on whether or not they are commercial endeavours, or even if they occur outside of 'working hours'. If, for example, a particular training in wine making is injected into a subjectivity as a result of a commercial productive process (through a specific diploma designed for profit by a private university), or if by contrast the training is acquired at a remove from the market (taught by a relative during free-time), the nature of the knowledge does not necessarily seem to change. In both cases we have 'cognitive service' productive processes resulting in subjective knowledge. In both cases, and this is the

central point, we have knowledge productive processes that increase the wealth of the system they are involved in. In this sense, some of the examples above (intersubjective knowledge production processes at a social event, internalisation of consumer ideologies and desires emanating from the media) illustrate this type of 'cognitive service' that takes place outside of commodity production processes, and even takes place in leisure time.

Finally, within these non-commercial cognitive services two varieties must be identified, while recognising that splitting them apart is mistaken. Some of these non-commercial cognitive services produce subjective knowledge that, subsequently, can and often is applied to commodity production processes. Others, which produce intersubjective knowledge, seem to be more distant from the productive totality. However, the fact that some knowledges (for example those related to wine-making) are directly useful for a commercial process, and others (for example instilling the values of alcohol consumption) are only necessary for the ideology that permits the realisation of value of the former, is a completely secondary question: they are both processes which produce cognitive services, or simply subjects, essential for the dynamic of the system.

To recapitulate, productive processes can be organised around two variables: (i) whether or not the process produces commodities; (ii) whether the production is of goods, physical services, or knowledge services (or subjects). The possible combinations of these variables generate six categories, as laid out in table 4.1 below.

	Product		
	Goods	**Physical Services**	**Knowledge Services (production of subjects)**
Commercial production	Construction company In-company software production Audiovisual production	Paid domestic labour Taxi journey Private security	Formal (schools) and informal (in-work) learning of subjective knowledges
Non commercial production	DIY construction Production of Wikipedia, some forms of free software	Unpaid domestic labour Journey in a friend's car War between states	Informal and non-formal learning of subjective knowledges (learning through peers etc.) Internalisation of intersubjective knowledges (advertising, ideology)

Table 4.1: Types of productive process and some examples.
Source: Author's own elaboration.

4.4.2 Capitalist Productive Processes and the Capitalist System

Capitalist productive processes are a subtype of commodity productive processes. In effect, not all processes which produce commodities are capitalist. For many of them, there is no planned and systematic striving for profit, but the exchange may be for the purposes of subsistence, for example. Furthermore, in many commercial processes, even those motivated by a thirst for profit, the regulations are not those which define capitalist processes. This is the case, for example, with the slave-owning mode of production: commodities are produced with the eventual aim of generating profit, under the command of a subjectivity that extracts the energies and knowledge of other subjects – subjects over whom a legitimate ownership is exercised. However this is clearly not a capitalist productive process. In that case, what are the features that define capitalist productive processes? Above all, the fact that the regulations express the presentation of physical and knowledge matter in the guise of two personifications: the capitalist and the worker. But to detail the features of capitalist productive processes and define these personifications, we should first revisit and refine the three types of access previously discussed when normative knowledge was analysed.

The first is exclusive access: it relates to the property forms in which the subject is owner of the resource[149] and exercises the possibility of excluding third parties as a means of obtaining an economic advantage. Physical private property and intellectual property are some current forms of this type of access, although not the only ones.

The second is non-exclusive access: it relates to the possibility of the use of a resource of which the subjects using it are either not the title-holders – but have acquired a use-right – or being the title-holder use it for themselves – without obtaining profit from the use of third parties – without availing themselves of the possibility of exclusion as a means by which those third parties are subsumed within it.

The third is the condition of no access: this usually indicates situations in which the subject gains access to the resource in question in invalid or proportionally insufficient quantities to be able to have an effect on a determined productive process. The condition of no access implies that the resource is not useful for the subject in question to differentiate themselves from other subjects and to compete for consumer goods by virtue of this resource.

Capitalist productive processes can therefore be defined in the following way:

1. They are a sub-type of commodity production processes.
2. Normative knowledges[150] determine that, within the capitalist productive processes:
   2.1 All the human subjects who participate are owners of (they have exclusive access to) the physical matter comprising their own body.[151]

2.2 Non-human and non-natural physical matter, objective knowledges (technologies, information), and the product are the property (exclusive access) of an entity defined by that title and designated as 'capitalist', which can take the form of a human subject (an individual) or have a juridical existence (a company). The capitalist can have exclusive or non-exclusive access to other types of knowledge.
2.3 The absence of exclusive access to knowledge or physical matter separate from one's own body, along with non-exclusive access to various forms of knowledge[152] (subjective knowledges in the form of skills, and diverse intersubjective knowledges: organisational, linguistic, recognition, axiological as well as normative) define an entity denominated as 'worker', embodied by individual human subjects.
2.4 The capitalist and the worker realise an exchange through which the former acquires (although in a manner limited by the quantity of time or product[153]), exclusive access to the energy and the knowledge which a worker carries, in order to utilise them in the productive process. In exchange for their energy and knowledge, the worker receives a portion of the product or its equivalent.[154] This portion of the product is approximately equivalent to the value of the energy expended through labour during the productive process.

3. Axiological IK determines that the capitalist is governed by a systematic and rational striving to obtain profits.
4. Recognition IKs determine that the capitalist and the worker mutually recognise each other as carriers of the aforementioned characteristics (meaning, as free subjects), not in an individual manner but with the mediation of intersubjectivity, of the broadest collective into which the productive process is integrated.
5. The subjective knowledges that the capitalist embodies organise the productive process, acquiring 'matter', energies, and knowledges in human and non-human bearers.[155] During capitalist productive processes, the human and non-human 'matter' and energies are obtained in exchange for their value, while at least some of the knowledges are obtained for less than their value. In turn, capitalist subjective knowledges combine this 'matter', energy, and knowledge with the aim of obtaining a product whose sale on the market is beneficial to the objective of attaining a profit.
6. The ultimate source of said profit is *capitalist exploitation*,[156] which consists of the unremunerated harnessing of the knowledge that the worker and/or other human and non-human bearers contribute. Capitalist profit is, in the end, dead knowledge.

Thus we can see the relationship, in a given productive process, between physical matter and knowledge matter on the one hand, and the relations between capital and labour on the other. This definition of capitalist productive

processes as a particularisation of flows of 'matter', energy and knowledge aspires to tackle other stages of capitalism (an elusive task for characterisations based on the length of the working day and on the *immediacy* of the categories capital and labour), and to characterise various modalities of capitalist exploitation: not only the Fordist model of the twentieth century, but also the twenty-first century Google modality.

However, the logical presentation of the concepts of labour and capital *as being derived* from those of 'matter', energy and knowledge should not obscure the fact that the historical evolution of these concepts has been in the opposite direction (with some exceptions). It is worth introducing a brief parenthesis into the characterisation of capitalist productive processes, to make a comment about the evolution of the conceptualisation of these processes by mainstream economics. In effect, productive processes since industrial capitalism began to be conceptualised on the basis of a series of 'factors' that intervene into them. A series of ingredients which, when combined, generate a product.

Traditionally, land, or natural resources (N), labour (L), and capital (K) were asserted as factors of production that resulted in a product (Y). Over the course of the nineteenth century and the first half of the twentieth, different approaches emphasised one aspect over another, subdivided these factors into various forms, labelled them heterogeneously, but ultimately remained safely in orbit around them.

Starting from the 1950s, when it became clear that the product could not be explained using the aforementioned factors alone, the idea of a fourth factor emerges, linked to knowledge (the form of combining the other factors, organisation, technique), and is symbolised by an A. Thus, what neoclassical economics describes as a 'production function' can be expressed in a simplified way as $Y = (N + K + L)\ A$. In other words, the wealth produced depends on natural resources, capital, labour, and the specific combination of them that is employed.

However, with the advent of informational capitalism and the collection of fashionable discourses about the 'knowledge society' and similar flights-of-fancy, the idea that productive processes should be conceptualised on the basis of other factors began to gain strength. Principally, it is the belief that knowledge is deserving of a central role (surpassing that of A) when it comes to explaining production that motivates alternative perspectives (Romer 1993; Chartrand 2007; García Camarero 2001). Despite these perspectives suffering from various limitations, they are correct about a key aspect: knowledge matter has special economic characteristics that differentiate it clearly from physical matter, as was discussed in chapter 1. As a consequence, in order to understand the functioning of productive processes, it is necessary to isolate knowledge.

It is immediately noticeable that knowledge is not only present in factor A, but also in L (e.g. techniques) and K (technologies, etc.). If we extricate knowledge from the other factors, what remains? The response is predictable: 'matter' and

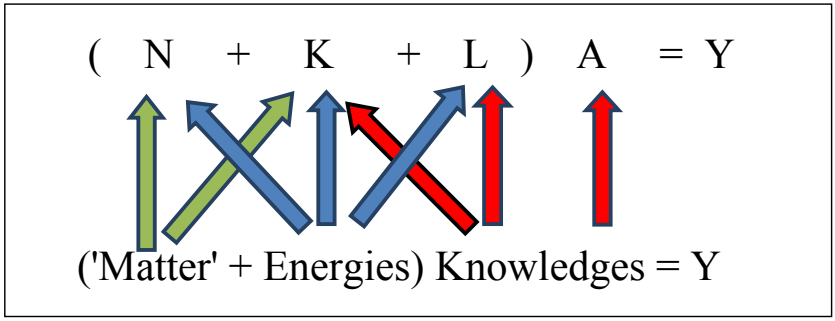

Fig. 4.2: 'Production function' and its relationship with 'matter', energy and knowledge.
Source: Author's own elaboration.

energy (García Camarero 2001). Indeed, with the cognitive materialist approach we find that the traditional factors of production are nothing more than historically situated particularisations of knowledge, 'matter' and energy: labour is a combination of energy and knowledge (as Bentham stated at the end of the eighteenth century), capital is a combination of 'matter', energy, and knowledge, and natural resources are 'matter' and energy.

It is important to reiterate that, unlike Romer and other authors' viewpoints, the emphasis we place on knowledge is by no means an attempt to dilute the contradiction between labour and capital. On the contrary, our aim is to develop tools which can analyse its varied manifestations, as shall be seen in the next chapter. Furthermore, it is this emphasis on knowledge that will allow us to understand the creation of value under capitalism, and to give an account of the manifold forms of exploitation and the accumulation of capital. This reconstruction of the categories of labour and capital cannot be explained by a vocation to advance our understanding of these two aspects, but is instead imposed as a consequence of knowledge matter and physical matter having, at least and from the historical vantage point of the present, radically divergent ontological, economic, and juridical properties which cannot be overlooked, as discussed in chapter 1. That said, the capitalist *system* should be differentiated from *individual* capitalist *productive processes*. Naturally, capitalism as a totality is, above all, an immense productive process. But it is situated on another level to individual processes. In this sense, some of the characteristics of the capitalist system that it is worthwhile underlining are as follows:

1. Capitalism is a totality that can be represented as a CMC whose features (the form that different types of knowledge and physical matter assume) vary according to its various stages (mercantile, industrial, and informational).[157]

2. However, there are some aspects related to the normative intersubjective knowledges which are maintained over these different stages:
   2.1 The ensemble of normative intersubjective knowledges that produce normative intersubjective knowledges is the hard kernel of the 'State' form. Although it is concretised in many bearers, the capitalist state is first and foremost a regulatory intersubjectivity.
   2.2 All entities are related to capitalism through the regulation of access to them, or more generically, their inscription in the property register, both in their physical and knowledge aspects, as discussed in chapter 1. Beyond this static image, capitalism also implies a permanent movement towards *propertisation* (exclusive access to those entities or derived products) and/or growing *commodification* (adoption on the part of these entities or their derived products of the commodity form).[158]
   2.3 All human subjects are property owners of (they have exclusive access to) the physical matter of their own bodies. This property is inalienable in legal terms: the subject cannot sell it.[159] As such, the integral human subject cannot be a commodity.
   2.4 All commodities can be exchanged via a set of rules designed to foster free exchange of equivalent values, which are usually condensed into the expression 'market'.
   2.5 Exclusive access to physical or knowledge matter pertinent to capitalist productive processes characterises the figure of 'capital', and non-exclusive access or no access to them characterises 'labour'.[160] Although they can be translated to various bearers, both figures are principally normative intersubjective knowledges.
3. The origin and evolution of capital is defined by three processes: *exploitation, expropriation, and regulation*.[161] Capitalist exploitation stems from purchasing knowledge matter for less than its value. Capitalist expropriation refers to capital paying for physical matter at less than its value. Capitalist regulation consists of establishing norms which enable exploitation and/or expropriation. Capitalist exploitation unfolds inside capitalist productive processes, within the norms that govern the production and exchange of commodities. Expropriation happens outside capitalist productive processes,[162] in the sphere of exchange, but against the norms of market. Regulation happens outside of capitalist productive processes and the sphere of exchange, and always entails more or less violently uprooting pre-existing norms, including those which eventually sanction the exchange of equivalences and a particular property form.[163] Thus, even though capital is, in the last instance, nothing more than dead knowledge matter, capitalism as a system also owes its progress to the theft of physical matter by means of the violence of the law.[164]
4. The origin and evolution of labour is defined on the basis of the regulation of access to physical matter and knowledge matter which result from the

exploitation of knowledge matter it carries, and the expropriation of the physical matter which it is deprived of.[165]

5. Capital and labour are the names that the fundamental dialectical contradiction of capitalism assumes. Capital and labour may have different bearers. Therefore, the contradiction can take shape *between* human subjects, *within* these human subjects, or between *human and non-human* bearers.[166]
6. The capitalist system, as a productive process, includes capitalist productive processes but also, and decisively, all other productive processes.[167] These non-capitalist productive processes within capitalism are not incidental or provisional phenomena: they constitute part of the essence of capitalism.[168] In other terms, the second dialectical contradiction that defines capitalism is that which arises between capitalist and non-capitalist productive processes.[169]

With that, we have arrived at the end of this brief chapter which began by analysing the flows of different types of knowledge and swiftly moved on to the concept of translation. One type of translation focused on was what we call productive processes. Within these we identified commodity production processes and a sub-set of these: (individual) capitalist productive processes. From that point, a condensed characterisation was presented of capitalism (as a system) as an immense productive process. From this last characterisation three key concepts emerged: exploitation, expropriation, and regulation. It is these that explain the origin and evolution of capital. And, taken as a whole, they are the motor that drives capital accumulation. Without doubt, the most significant of them is exploitation, an in-depth exploration of which will be undertaken in the next chapter.

CHAPTER 5

Capitalist Exploitation

5.1 Introduction: Regulation, Expropriation and Exploitation

In this chapter a theory of capitalist exploitation will be advanced which, naturally, stems from the concepts discussed in previous chapters and that, even though it has various points of contact with several other theories of exploitation, entails a divergence from them. In this sense, the main thesis presented here in a systematic way is that *capitalist exploitation depends, in the last instance, on unremunerated knowledge*. And, more precisely, there are three varieties: capitalist exploitation through *alienation*, through *reproduction*, and through *attention*. However, to arrive at capitalist exploitation in its varieties we must first cover a considerable distance, and encapsulate it within two broader constellations.

Capitalist exploitation is, evidently, the central core of the capitalist dynamic, the accumulation of capital, the historical development of capitalism. However, conceptually capitalist exploitation is merely a particular form of exploitation, which is a much more comprehensive concept. Indeed, almost any generic definition of exploitation is applicable to the relationship between slaves and masters in antiquity or between serfs and lords in the Middle Ages. Furthermore, exploitation, even within the capitalist system, also occurs outside of capitalist productive processes. For example, traditional patriarchal exploitation in the home or the exploitation of illegally enslaved workers. We must, therefore, define the general concept of exploitation and then distinguish the particular features of capitalist exploitation.

But, on the other hand, even if capitalist exploitation is the essence of the accumulation of capital, this cannot be sufficiently understood if the processes of *regulation* and *expropriation* that frame and complement it are disregarded. In this sense, the idea that capitalist exploitation and, more generically, the accumulation of capital, rely on processes extrinsic to it, emerges for the first

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time with Marx's concept of *primitive accumulation* (Marx [1867] 1990, part 8): it was necessary to strip the peasants both of their lands and of their feudal ties in order to force them to seek out a subsistence from employment in the capitalist productive processes. Even in this extreme summary it can be observed that the idea of primitive accumulation combines two distinguishable elements that must have been present from the outset of capitalism: on the one hand, the sanction of laws, especially those which demarcated private property (the 'enclosure acts'), but also those related to exclusive access to a subject's own body, market norms etc.; on the other hand, the effective appropriation by various actors of land, precious metals, and other riches. After Marx, Rosa Luxemburg (1968) would make a crucial contribution: the observation that these processes of primitive accumulation, far from only taking place at the birth of the capitalist dynamic, are repeated time and again, in a style more closely resembling Sunday mass than original sin, and not only as the basis for exploitation, but above all as a consequence of it. In Marxist terms, the fact that exploited workers cannot absorb the totality of the commodities produced by capital leads to cyclical crises of capitalist overproduction. This obliges capitalism to expand into unknown regions, to export its markets, property and doubly-free labour to regions lacking agreed norms so that in them surplus value can be realised. Along the same lines, David Harvey (2003) proposes the term *accumulation by dispossession* to account for this continuous and systematic dynamic of the accumulation of capital. From other perspectives, various theories on imperialism (Hilferding., Hobson, Lenin) and unequal exchange (Emmanuel, Braun) have corroborated this source of capital accumulation independent from direct exploitation through productive processes.

Despite their value, these authors' contributions suffer from some limitations. The one it is worth underlining here lies in them failing to clearly distinguish regulation from expropriation. And, although regulation and expropriation act together, and often simultaneously, they are logically independent and are even situated on different levels, as will be discussed below.[170]

In any case, expropriation and regulation also have an existence prior to their particular capitalist forms, so that we must also first understand regulation and expropriation in general in order to subsequently define their specifically capitalist forms. Only after covering this ground will we be able to define capitalist exploitation and its three varieties with any precision. In summary, the accumulation of wealth by some subjects in detriment to others is not an innovative phenomenon for capitalism but a feature of social organisations situated in widely diverse times and geographies. To give an account of these processes we deem these generic concepts of regulation, exploitation, and expropriation to be suitable.[171]

Provisionally, let us say that exploitation – this is, all exploitation, not only the capitalist type – refers to the asymmetrical exchanges that occur within productive processes, exchanges that mean one of the parties, the exploiter,

obtains a greater economic value than the other and that it is obtained at the latter's cost. Expropriation, on the other hand, supposes a direct confiscation of resources – often without compensation – that, crucially, takes place in the sphere of exchange and not that of production. Meanwhile, regulation consists of the imposition of norms (legally sanctioned or through other means) that frame exploitation and expropriation. For example, the conquest of America by the Spanish crown began with a process of regulation (through the violence of the law and the law of violence) that normalised the expropriation of lands, gold, and other resources, and the exploitation of the original inhabitants who were thrust into some kind of productive process. Naturally, these three concepts should be discussed more thoroughly.

5.2 Regulation

Regulation, in its generic form, refers to the stabilisation of knowledges with normative intersubjective bearers that legalise and eventually legitimise relations of exploitation and expropriation. This merely reiterates a theme mentioned in the previous chapter, with the exception of now extending it to other historic forms beyond capitalism. In effect, the processes of accumulation of wealth at a macro level, at least since antiquity, have had the vocation and the need to put certain rules in place which would constrain them. This obviously does not mean that the norms governing expropriation and exploitation are transparent, consented to or just.

Of course, regulation, meaning the establishment of the norm across its diverse material bearers, is a *potestas* of power in relation to no-power. Regulation separates the regulators from the regulated and this, usually, signifies oppressors from oppressed. The most incisive conceptualisation of this association between power and regulation should not be sought out in the latter-day blasphemies of the heretics Marx, Nietzsche, or Foucault, but in the beautiful and sacred words that a millennium and a half ago descended to this earth through the immaculate quill of Saint Augustine.

> Justice being taken away, then, what are kingdoms but great robberies? For what are robberies themselves, but little kingdoms? The band itself is made up of men; it is ruled by the authority of a prince, it is knit together by the pact of the confederacy; the booty is divided by the law agreed on. If, by the admittance of abandoned men, this evil increases to such a degree that it holds places, fixes abodes, takes possession of cities, and subdues peoples, it assumes the more plainly the name of a kingdom, because the reality is now manifestly conferred on it, not by the removal of covetousness, but by the addition of impunity. Indeed, that was an apt and true reply which was given to Alexander the Great

> by a pirate who had been seized. For when that king had asked the man what he meant by keeping hostile possession of the sea, he answered with bold pride, "What thou meanest by seizing the whole earth; but because I do it with a petty ship, I am called a robber, whilst thou who dost it with a great fleet art styled emperor." St. Augustine ([426] 1995, Book IV, chapter 5).[172]

The brave pirate's riposte does nothing less than tear away the fetishistic veil of regulations, in other words, of the frontier that separates the pirate from the emperor. This is a frontier which does not obey the essence of regulated conducts (that are fundamentally alike on either side of the limit of the law that separates them), nor does it obey any transcendent morals (which do not govern symmetrically). Regulation, obviously, has no purpose other than to treat differently what is equal, and as equal what is different, in the interests of the regulators. It is worth underlining that here the term regulation does not refer to any norm, or any standardisation of conduct, but specifically to those related to *the processes of exploitation and expropriation*.[173] In effect, regulation produces normative intersubjective knowledge, but of a particular type, connected to the management of access to physical and knowledge matter, in other words that which will at some point take the form of physical and intellectual property.

Now, how is this difference between the pirate and the emperor established? It would be as foolish to deny the role of physical force or military power, as it would be to assume that they are sufficient in themselves. In reality, the process of regulation has two instances, two dialectical moments, which have been described under different names by a wide-ranging literature of political philosophy.[174] The framework proposed here will be used to elaborate on them.

The first moment of regulation is the *regulation of physical matter*. That is, the domestication or annihilation of bodies and objects through wars, physical violence, destruction, repression, confinement. This is achieved through the mobilisation of (physical) technologies such as guns, bombs, prisons, and in many cases drawing on physical human energies (as with conflicts on a large or small scale). Within this moment of physical regulation two manifestations can be distinguished. On the one hand, constituent regulation and, on the other hand, constituted regulation. The former refers to physical regulation imposed on a given territory, against the extant norms in that territory, in order to impose new norms (at the second moment). It is the case of the foundation of any state or similar order. In the case of brutal invasions in the name of civilisation, like the Spanish in America or the United States in the Middle East, it refers to the wars that overthrew the norms that governed the indigenous inhabitants, and to physical submission. The second manifestation relates to regulation that occurs within an existing normative order. That is, subsequent to constituent regulation and the act of regulating knowledge, again and again physical regulation appears as a reassurance of the existing order – remember that

here we are always specifically referring to an order which permits expropriation and exploitation. This is no longer the inferno of invasion, but of repression and disputes around normative intersubjectivity. Where an Inca or an Iraqi (or entire cities, the same applies) breaks through the barrier of the dominant intersubjectivity and moves towards reviving the deposed norms, they run up against the edifying pedagogies of incarceration and assassination. Thus, while constituent regulation occurs against norms, constituted regulation takes place within them. Simplifying matters a little, while the former has a military character, the second is an order founded on police force.

The second moment is the *regulation of knowledge*. Here, in general, codified knowledges are produced as information:[175] sheaves of great international treaties, national laws, modest municipal ordinances, or non-state norms.[176] Here as well, there is constituent regulation (for example the constitutions themselves), and constituted regulations (that are concerned with subordinated norms). But, the key is the inoculation of norms into intersubjectivity. This means the production of some solid normative knowledge, fed by all types of other intersubjective knowledges. Indeed, information is not sufficient for this task,[177] but norms are also needed which enter into dialogue with linguistic knowledges (words, phrases, permitted and forbidden expressions which regulate conducts and opinions), with recognition (for example who should be recognised as King, which empire should be deferred to, which figures should be admired), with organisational knowledges (the norms about the organisation of productive processes) and, of course, with axiological knowledges (changes to the hierarchy of values, beliefs and specifically what has been defined earlier as *ideology*). Naturally, intersubjectivity also converses with subjective bearers, with variable outcomes: in each case the subjectivation of the norms can be more or less effective, reinterpreted as they are within the individual's framework. In turn regulation through knowledge also entails dialogue between normative knowledge and technologies: monuments, buildings, architecture, for example, all crystallise new norms. The Christian crusades constitute a simple example. There, the conquest of bodies was a mere prelude to the conquest of souls; the violence of physical matter is only the plough enabling the violent seeding of intersubjectivity. And both violences, under the ex-post guise of peaceful law, lay the foundations for exploitation and expropriation.

Of course, the process is not necessarily linear. Cognitive regulation is perpetually shored up by physical regulation, and vice versa. Indeed, it is most usual to find a dialectical interaction between the two moments of regulation. The relationship between the process of regulation, in its two moments, and knowledge with normative intersubjective bearers should be evident. As mentioned in chapter 3, the latter are knowledges. Norms, regulations as relatively stabilised stocks, are nothing more than knowledges that have achieved normative intersubjectivity. Regulation, on the other hand, refers to: (i) the processual, dynamic, aspect of the management of (ii) some norms in particular (those that

define access and enable expropriation and exploitation), and to the fact that (iii) said management of intersubjective knowledges have physical matter (the first moment) and translations from other forms of knowledge matter (second moment) as their medium.

From a cognitive materialist standpoint, the *state* may be defined as an ensemble of normative intersubjective knowledges capable of successfully performing both moments of regulation and, more precisely, *as having a monopoly of production over the normative intersubjective knowledges that are legal in a given territory.* Thus, other crucial properties that define the state in several theories (the monopolies of violence, of collecting taxes, etc.) are rather derived from the basic power of setting the intersubjectively accepted rules. Far from being linear, determined, immediately stabilised phenomena, the two moments of the processes of regulation are open fields in which the success of the regulators is far from predictable with any clarity and, above all, in which there are always contradictions present. The dialectic of both moments seeks to consolidate regulation which is never complete or perfect. Indeed, a similar but opposite dialectic can always be traced for the regulated: the resistance of 'matter' and energy (rebellious bodies, limits transgressed) and cognitive resistance (alternative axiologies, norms, and languages for example). In turn, regulation does not occur just on one level, for example on that of national laws. It also takes shape on the supra-state (international treatises) and sub-national (provincial and municipal regulations) levels. Still more importantly, regulation can and often does exist in forms independent of, and even conflicting with, those that the state promotes. Illegal productive processes (of illicit substances for example), the exploitation within them and the expropriations they practice are perfectly regulated, regardless of this regulation being contrary to that belonging to the states that contain them. Thus, regulation is an empirical phenomenon which may or may not be juridical.

This changes with specifically *capitalist* regulation. Here, expropriation and exploitation are moulded alongside the figures of capital and labour. Although in chapter 4, when characterising capitalism as a productive process, several of the features of capitalist regulation were mentioned, it is worth reiterating them here with some slight modifications specific to the approach being adopted now.

1. Normative knowledges that produce capitalist regulation have two characteristics related to their forms:
   1.1 They are legal (meaning, they arise from laws, treaties, municipal ordinances, and other legal instruments).
   1.2 They are produced by the state.[178]
2. Regarding its content, capitalist regulation has four characteristics:
   2.1 All entities are related to capitalism through the regulation of access to them, or more generally, through their entry in the property register, both in their physical and knowledge aspects – as pointed out in chapter 1.

2.2 All human subjects are proprietors of (they have exclusive access to) the physical matter of their own bodies. This property, which introduces a radical discontinuity between humans and non-humans, is imprescriptible in legal terms and the subject cannot alienate it. As such, the integral human subject cannot be a commodity.
2.3 All commodities can be exchanged by means of a set of precepts designed to favour free exchange of equivalent values which is usually summarised by the expression 'the market'.
2.4 Exclusive access to physical matter or knowledge matter relevant to capitalist productive processes characterises the figure of 'capital' and non-exclusive access or no access to them characterises that of 'labour'. Although they can be translated into various bearers, both figures are, above all, normative intersubjective knowledges.
3. The beliefs (axiological knowledges, especially ideology) that capitalist regulation invokes are not of a transcendent (a divinity, monarch, or race), but of an immanent nature (society itself, reason).[179]
4. Capitalist regulation determines specific forms of exploitation and expropriation.

Next we shall explore what exploitation and expropriation involve in order to be able to apprehend their specifically capitalist forms.

5.3 General Concept of Expropriation and Exploitation: Common Aspects and Divergences

In their general and ahistorical forms, expropriation and exploitation, meaning the relations which regulation gives shape to, share some characteristics:

1. They are framed by some kind of norm, by definition.
2. They usually occur between human actors: there are actors E and e (exploiters and exploited, expropriators and expropriated).[180]
3. The E actors extract a surplus value from their relationship with the e actors.
   3.1 The acquisition of this surplus value by the E actors is only possible through the loss of the same by the e actors.
   3.2 The acquisition of this surplus value by the E actors is an objective economic phenomenon that does not necessarily correspond with the subjective or intersubjective representations the e actors hold about the equivalence of values ceded by both parties.
   3.3 The e actors, however, would not refuse to accept a higher portion of value than that which the relationship provides them.
4. The relations may or may not have the consent of the e actors.

Thus, even on this generic level which combines both types of relations,[181] it is evident that both are distinguished from other social relations: in effect, we can infer from the third characteristic that, of course, they are differentiated from the relations which do not entail production or economic exchange, and also from those in which, these being present, the portions of value that the different actors acquire is equivalent to the value they have contributed. Specifically, characteristic 3.1 indicates that furthermore, all those relationships in which, in a context of relations between two types of actors, A and B, A obtains a greater economic value than B are not necessarily relations of expropriation or exploitation. This could be due to A exploiting or expropriating a third type of actor, C. Therefore, the exploitation or expropriation between A and B requires that the source of additional value that A obtains from this relationship to specifically be extracted from B.

Characteristic 3.2 indicates that the fact that the *e* actors consider the relationships they establish to be legitimate or even desirable does not prevent those relationships from entailing exploitation or expropriation. An extremely frequent error is associating social relations eschewed by the e actors with subjective suffering on their part etc. This use of common sense that unfortunately permeates the world of academia assumes that, for example, being 'exploited' is just having wage or working conditions that are subjectively judged to be unsatisfactory. And vice versa: 'no, these subjects are not exploited, she likes doing it/they think it's a decent salary/he chose that job'. The point is that neither exploitation nor expropriation depends on these perceptions, but rather on an *objective* asymmetry.[182]

Of course, this discrepancy acquires particular force as regards capitalist exploitation (under which by definition human subjects face each other as free individuals).

However, it does not necessarily have to be this way, and in fact it is not at all clear that this situation is the rule, in empirical terms. Some exploited or expropriated actors, in many of the heterogeneous situations in which they have historically been manifested, prefer to enter into certain relations of expropriation or exploitation, rather than other, worse, forms of exploitation and expropriation, or other alternatives. For example, the peasant who abandons their labours in the rice paddy in exchange for being exploited by capitalist industry hardly misses their agricultural work; the expropriated subject who is paid a given sum for their land, far below the market value, could be satisfied with this transaction for various reasons: it could be the case that the typical customs of the time and place did not involve any compensation, that the alternative was summary execution, or even in another context, that they lacked explicit subjective knowledge of values on the real estate market. But these examples assume rationality, a calculation of costs and benefits, in the definition of exploitation and expropriation. More specifically, they assume an assessment on the individual, subjective, level. However, this is no more than a

level. On the contrary, more relevant is the action of ideology that occurs on the intersubjective level, and for the acceptance of which no rational calculations intervene but rather emotional attachment, such as in the case of expropriation in which the colonised subjects accept that a new monarch will levy a new tax in kind on them, by cross and sword.

However, it is more important to assert that a central part of the process of regulation, particularly the second moment, consists of inoculating axiological knowledges, specifically the right doses of ideology, to stimulate the acceptance of expropriation and exploitation as legal, legitimate and even natural relations. In other words, a cognitive material configuration (CMC) in which the bulk of the e actors *intersubjectively* reject expropriation and exploitation is one in which the process of regulation is obstructed and, consequently, cannot sustain itself for long. Resorting to fire and bloodshed at the moment of physical regulation can buy a little time, but if the knowledge regulation does not become intersubjective, the cognitive material configuration and along with it the forms of exploitation and expropriation in question, are mortally wounded.

The fact that the relations of expropriation and exploitation are not necessarily rejected and that, at least partially, they must be ideologically accepted on the intersubjective level, does not mean that these actors are completely satisfied. As characteristic 3.3 shows, these actors are willing to receive more resources. The peasant transformed into industrial worker or the formerly unemployed person who has now been hired prefer their current situation to the previous one, but they would not turn down a wage increase; the person who accepts a minimal payment for their land would not be offended if the agreed value of the contract of sale were higher, nor would the colonised subjects who submit to an order that two cows be expropriated from them protest if only one was taken. These examples serve to distinguish expropriation and exploitation from donation and gift. Indeed, in those relations (which fulfil criteria 3.1 and 3.2) the person who cedes a greater value would not usually prefer that a portion of them be reimbursed to him.[183]

However, not every relationship in which A obtains an economic advantage over B fulfilling characteristics 3.1, 3.2, and 3.3 constitutes exploitation or expropriation. The first characteristic of these relations shows us that expropriation and exploitation are distinct from unsystematic theft, looting, kidnapping and bondage *because the former are protected by some type of norm*. This is what, in relation to expropriation, the story of the pirate and Alexander the Great exemplifies. Theft, due to the two moments of regulation, has transmuted into legal and even virtuous conduct. As for exploitation, while the term suitably describes part of the situation of a slave in antiquity for example, its application to a situation of forced labour under capitalism is more questionable. In effect, if we are dealing with a prolonged, systematic, normalised bondage – such as the case of many textile workshops and brothels all around the world – it is indeed a form of exploitation. The fact that actually existing regulation

contradicts state regulation in no way dismantles it.[184] If, by contrast, the situation is unsystematic and lacking rules, the term exploitation is not appropriate to describe it.[185]

Now, expropriation and exploitation have substantial differences between them in any of their manifestations (and even more under capitalism). Therefore, while expropriation generally occurs in the sphere of circulation and exchange, exploitation occurs within the productive processes. In turn, expropriation refers to the dispossession of physical matter (mostly non-human, although human on exception) which previously was under the control or at least within reach of the expropriated. This means, the expropriated subject stops having access to lands, precious minerals, clean air, animals, utensils, or their own body, as productive resources. This dispossession of physical matter usually occurs with no compensation, though sometimes with non-economic compensation or with economic compensation whose eventual value is objectively lower than the value of the expropriated resources (for example, 'security', the permission to carry out some type of economic activity, an insignificant payment, etc.).

By contrast, exploitation refers to the unpaid character of human energies and, above all, to the diverse types of knowledges utilised in a productive process. Thus, the exploited subject no longer possesses the energies that she has spent in the productive activity, although she still carries the knowledges that, for example, have been objectified in the product of the labour. Furthermore, in general exploitation entails an *exchange*, more specifically, an economic exchange: the exploited subject receives compensation in goods or services (in kind or money) for the productive deployment of their energies and knowledges.[186]

Thus, we can characterise expropriation and compare it with exploitation:

We are now presented with a characterisation of expropriation and exploitation as generic relations. It is important as a complement to this, to insist that expropriation must be distinguished from regulation. The establishment of rules, for example, that legalise the appropriation of land, and the appropriation itself, are two different processes. In some cases they can overlap in time, which tends to engender confusion. Typically, the conqueror's regulation of natural resources and the expropriation of them may occur on the same day and be carried out by the same actors. The violent drive to impose regulation (in its first moment) can be extended and lead to expropriation. But this simultaneity of the conquering 'big bang' obscures the fact that both processes can develop while disentangling themselves and separating. Expropriation can potentially continue long after the conqueror's regulatory law is imposed. In fact, at the second moment of regulation when the norm achieves intersubjectivity, expropriation continues. The regulation has established orbits but the planets of expropriation continue their rotations and movements. The law declares land or slave to be property of the expropriator. But he must organise the process in order to concretely appropriate them. He must enclose territory, evict and dispossess its inhabitants, he must safeguard the confinement of his slaves and

	Expropriation	Exploitation
Similarities	Framed by norms	
	Relations between two types of human actor, E and e	
	The E actors obtain an objective surplus value in relation to, and at the expense of, the e actors	
	The subjective perceptions of the e actors about the nature of the relations between E and e are not relevant when defining them The e actors would accept a greater portion of value than they receive	
Differences	Sphere of circulation and exchange	Sphere of production, within productive processes
	Confiscation without exchange or asymmetrical exchange	Asymmetrical exchange
	'Matter' and/or Energy (mostly non human)	Knowledges and/or energies (human)

Table 5.1: General concepts of expropriation and exploitation: similarities and differences.
Source: prepared by author.

administrate their lives and deaths, he must dirty his hands with the concrete dynamic of the appropriation of physical matter.[187]

The concept of regulation with its two moments, and its difference from expropriation, enable us to study the tensions, struggles, and instabilities of these processes. Even when regulation was stabilised, expropriation would open space for resistances; even when the conqueror was successful in inoculating norms into intersubjectivity, the peasants whom the law orders to be dispossessed or the subjects who were ordered to be enslaved can struggle in the interstices, combating the molecular process of expropriation.

5.4 Capitalist Expropriation

So far, a set of generalities about expropriation have been detailed. But what specificity does *capitalist* expropriation present? Predictably, capitalist expropriation must accommodate itself to the corresponding regulation. This, concretely, means that three features should be added to those which all expropriation presents:

1. Capitalist expropriation only includes *non-human physical matter.*
2. Capitalist expropriation must take the form of *exchange*, and even equal exchanges between free subjects.
3. Capitalist expropriation is *legal*.

The first feature points to the idea that physical human bodies cannot be appropriated. Therefore, capitalist expropriation relates to non-human physical matter. In contrast, every subject is their own master. This assertion, in the contractualist spirit, can be improved by emphasising the 'doubly-free character of labour', as Marxists do: the flesh of the worker cannot be expropriated, but that of the cattle that gives them sustenance must be forcibly expropriated. A third way, perhaps the clearest, of presenting this first feature of expropriation under capitalism stems from stretching Latour (1993) a little: *capitalist regulations introduce a radical discontinuity between human and nonhumans*, in such a way that the former are inalienable while the latter must be traded. This approach allows us to reinforce one of the arguments running through this book: humanism (that leads in theoretical terms to privileging categories of 'action' and, as highlighted above, its derivative: 'labour') has no other material basis than this; it is irrevocably associated with capitalist regulations that are clearly expressed in the modality of capitalist expropriation itself.[188]

The second feature of capitalist expropriation, the second discontinuity regarding other forms of expropriation, lies in it appearing phenomenally as the negation of its essence, as its own inversion. Expressed more simply: expropriation is nothing more than legalised theft, but under capitalism it must appear to be an exchange between free subjects. While, for other regulations, explicitly assuming expropriation as a part of the transcendent attributes of the expropriator was an option, capitalism can only assert the market and the exchanges of equivalents, so that expropriation cannot be simply presented as a straightforward confiscation. Capitalist expropriations cannot manifest themselves as they usually are: appropriations without exchange or with minuscule compensations. Ergo, the losers of a war relinquish their lands, but receive in exchange 'security', 'mutual aid', possibilities that their citizens can travel to the empire, or some other aspiration. This, in effect, was an option for prior expropriations. But for capitalism it is a necessary modality; a cosmetic modality that, nevertheless, has acquired such a sophistication that on many occasions it has become extremely effective. In this sense perhaps the arena in which capitalist expropriation is expressed more strikingly is that of 'unequal exchange' (Emmanuel 1972) under the auspices of international trade. The norms that present interactions as an equal exchange obscure the expropriation based on the power of regulations (that either stimulate supply and demand or strictly prohibit it). Typically, the physical matter of the peripheries are acquired by the centres (within a national sphere or between countries) through a framework of exchanges, the disparity of which leaves traditional colonial transactions little envied now.

The third and last feature of capitalist expropriation relates to legality. Here it is not the case that expropriation is subject to some type of informal, parastate norm, but that the properly capitalist modality of expropriation requires

sanction by state or supra-state authorities. This does not mean, obviously, that the domination of capitalist regulation prevents non-legal expropriations, but simply that the latter must be distinguished from properly capitalist forms. Now that regulation and expropriation have been minimally characterised, we can go on to discuss exploitation in general, and then focus on capitalist exploitation.

5.5 Commercial and Non-Commercial Exploitation

Relations of exploitation include temporally and spatially far-flung productive processes, but also vary in terms of the goals pursued by said processes. We shall now distinguish two types of exploitation, commercial and non-commercial.

Some forms of exploitation are orientated towards the production of commodities.[189] Others, although they take shape in processes which produce goods and services, do not have this goal. From among the latter, the most important are those associated with domestic labour and other forms of production for domestic consumption. These forms of exploitation include a broad spectrum that ranges from ancient slave labour in agricultural production for domestic consumption, to the current and still unrecognised domestic labour of women under the patriarchal order.[190] It is worth stressing that not just any form of unpaid domestic labour configures a relationship of exploitation, but rather the specific situation in which the aforementioned features are observable, particularly when the set of exchanged values are clearly asymmetrical in terms of their commercial equivalences.[191] It is necessary to emphasise that non-commercial productive processes, meaning those which take place outside of the price system and, specifically, those that occur within domestic units, have not only been extremely important in pre-capitalist societies but continue to be so today. So although these forms of non-commercial exploitation are not the object of this book, they should not be relegated to the margins in any serious analysis of exploitation.[192]

But, beyond domestic exploitation, another form of non-commercial exploitation is *one* of those which can occur in *statist*, meaning self-proclaimed socialist or communist societies (Castells 1996).[193] In those societies, it is assumed (in many cases accurately) that what is produced does not take the form of commodities. The productive processes are not directed towards realising profit through exchange on the market. However, the fact that it is the state that manages the productive processes and the destiny of the products does not in any way guarantee the absence of exploitation. Here the key lies in finding out to what extent the physical and knowledge resources appropriated by the state are returned, in equivalent terms, to the e actors. In effect, in the case that the e actors receive compensation inferior to the contribution they make, non-commercial exploitation is taking place. In other words, in order to define

whether or not there is exploitation, the question of if it is a private actor or the state (independently of whether this is done in the name of this or that ideology – for example, abolishing all forms of exploitation) that appropriates the surplus is irrelevant. For its part, commercial exploitation is that which, as has been stated, fulfils the features of all forms of exploitation discussed above, and additionally the feature that the productive processes it is incorporated into are orientated towards the production of commodities. However, not all commercial exploitation is capitalist exploitation. Indeed, there are numerous forms of commercial exploitation that do not fulfil the criteria imposed by capitalist regulation: legality of the relationship, and human subjects being proprietors of their own bodies (or physical freedom).

For example, the relations that in pre-capitalist periods could be observed between masters and slaves, lords and serfs and *that resulted in the production of commodities* (not goods and services for the direct consumption of the exploiter actors) conform to this description, though even if the condition of legality is observed, they do not necessarily establish human subjects' ownership of their own bodies. In a similar way, the slave or quasi-slavery relations that can be observed in modern capitalist societies must be paid due attention: their illegal character should not lead to a belief that they are scarcely relevant in capitalist societies. For example, the cases of slave or quasi-slave labour in the textile industry or trafficking of women for sexual exploitation, configure situations of exploitation that, far from being a residue from the feudal past, have an evident continuity with, and in some cases are integrated into global value chains. But, in that case, are they forms of capitalist exploitation or not? It should be stressed that they are not, wherever the requirements of relative liberty and legality that define capitalist bonds are not present. Thus although logically capitalism is defined partly by its characteristic form(s) of exploitations, other modalities enter into dialogue with it/them.[194] *In generic terms the totality plays out its development in the dialectic between capitalist and non-capitalist relations that occur at its heart.*

In turn, these relations of non-capitalist commercial exploitation, similar to the forms of non-commercial exploitation, in almost all cases present a feature worth mentioning so it can then be contrasted with properly capitalist forms of exploitation. This is the fact that the exploiters exercise *domination* over the exploited. The meaning of domination used here is close to that proposed by Weber: the existence of a high probability that an order issued by the dominator will be obeyed by the dominated subject.[195] And, indeed, in the relations proper to the slave-owning and feudal modes of production, in patriarchal relations and other forms of non-capitalist exploitation, the exploiter is at the same time the dominator: they exercise a decisional power that, notably, surpasses the productive activities and influences all life activity of the dominated actors.[196] Now we can focus on the central object of this chapter: capitalist exploitation.

5.6 Capitalist Exploitation

One feature of this concise book, and this long chapter in particular, is the priority given to presenting a theoretical proposal through the process of anchoring each idea in bibliographical references. However, before defining capitalist exploitation it would be wise to at least minimally show the relationship of our approach with other previous perspectives. Of course, the basis for these discussions about capitalist exploitation is the approach taken by Marx ([1867] 1990) and Marxism, from which we retain the necessity of exploitation, understood as a relationship of free and legal exchange of objectively asymmetrical magnitudes, to all stages of capitalism. In opposition to that approach, neoclassical economics considered exploitation to be a problem of compensation for a factor of production at below its marginal productivity (Pigou 1920; Flatau 2001). A liberal theory of exploitation can be found in Steiner (1984), who conceives of exploitation as situations in which a third party (i.e. the state) limits an actor's exercise of liberty, making it impossible for this or other actors to be able to buy or sell a good for the value that another party was willing to offer. Among other limitations, not that of the actor's freedom but of these perspectives, is that they only give an account of individual, contingent situations; another more significant limitation is that according to these approaches the exploiter could be, for example, a worker who in the face of the capitalist asserts her techniques in order to demand a wage increase. In that view, the unionised worker would exploit the capitalist. Other significant approaches arise from reformulations of the Marxist theory of exploitation which criticise and abandon the labour theory of value, an idea shared here. In sociology this is the case for analytical Marxism (Cohen 1979; Roemer 1989; Elster 1985) and some institutionalist authors (Hodgson 1980) and the Sraffians in political economy (Garegnani 1979). However, none of these perspectives sufficiently incorporates the exploitation of knowledge. The explicit idea that the surplus value the exploiter appropriates (the capitalist exploiter in particular) could have some relationship with the knowledge carried and put to use by the exploited, is not adequately discussed. However, in various investigations into the relationship between knowledge and capitalism time and again we have empirically found diverse manners by which companies successful in the accumulation of capital legally take control of those vital knowledges without paying their value for them (Zukerfeld 2010; 2012; 2016). In these cases, labour does not lose those knowledges, it continues possessing them, but capital has copied them and can then dispense with the bearer that the workers represent.

Partial exceptions to this disdain for the role of knowledge in the tendencies mentioned above are the formulations suggested by Roemer and, especially, Erik Olin Wright. Wright proposes a theory of exploitation based on the unequal distribution of property of different productive assets, two of those being 'skill assets' and 'organisation assets' (Wright 1985; 'inalienable assets' and 'status' in

Roemer 1985). In such a way, knowledges would be resources that allow their owners to exploit other actors. In reality this relates to the exclusive access to knowledge that the capitalists enjoy.[197] However, this is not the issue that stood out for us empirically, in fact quite the contrary. The interesting question to explore is that of knowledges which upon being cultivated by the exploited are then harvested by the exploiter. In this sense some research has studied capitalist exploitation of knowledge (Kreimer and Zukerfeld 2014; Liaudat 2015) and particularly the modalities that take shape through the internet (Terranova 2000; Petersen 2008; Briziarelli 2014; Dolcemáscolo 2014; Yansen 2015; Zukerfeld 2014a), the treatment of which is unavoidable for any theory of exploitation in capitalism's present stage. However, this research has not adequately integrated these modalities occurring mostly in leisure time and in spaces outside the company into a general and systematic theory of capitalist exploitation.

On the other hand, authors from the autonomist, and cognitive capitalism, current in particular have repeatedly given consideration to the production of value outside of working hours and have discussed, to a greater or lesser extent, the relationship between knowledge and exploitation and even the role of intellectual property in this process (Vercellone 2011; Fumagalli 2015; and especially Moulier Boutang 2011). Moulier-Boutang in particular makes a valuable contribution by identifying two forms of exploitation ('degree 1' and 'degree 2'). However, the author assumes that each form of exploitation is specific to a stage: degree 1 exploitation (traditional Marxian) principally occurs in industrial capitalism while that at degree 2 (related to knowledge, creativity, inventiveness) occurs largely in (what the author calls) cognitive capitalism. However, there are various difficulties with this perspective. On the one hand, although Moulier Boutang recognises that both forms of exploitation are present over the various stages of capitalism, he concretely asserts that the manual worker is not exploited at degree 2. This presupposes a risky conception: that manual skills have no relevant cognitive component.[198] On the contrary, as any academic who has turned their hand to repairing electrical wiring or plumbing would confess, what explains their failure are not physical shortcomings, which are otherwise undeniable, but their cognitive limitations. Moreover, there is no unequivocal, operationalisable, definition of either of the two degrees of exploitation. In any case, it is clear that exploitation at degree 2 refers to 'invention-power'. But the exploitation of knowledge on the part of capital cannot be reduced to new, innovative, knowledges, that is, to inventions. As the cases of reproduction of traditional knowledge demonstrate, capital also exploits knowledges that were honed and polished by human collectives *in illo tempore* and which the worker merely carries.

In any case, the idea of the production of value outside the working day and the integration of intellectual property into the analysis can be retained from these authors, while taking care to avoid the aporias that the concept of cognitive capitalism implies. Along these lines, in relatively recent studies

(e.g. Zukerfeld 2015) we suggested a distinction between two forms of exploitation: one we called 'material' (traditional industrial exploitation, identified by Marx), and the other called 'cognitive' (which entails the reproduction of knowledge which capital does not pay for). Both, of course, operate constantly over the different stages of capitalism. We have integrated them into a general theory of capitalist exploitation and conducted fieldwork on that basis (Liaudat 2015; Yansen 2015; Dolcemascolo 2014).

Nonetheless, this approach had at least three limitations. The first, fundamentally, is that it was misguided to designate one of the modalities with the term 'cognitive'. In effect, all capitalist exploitation has a cognitive component; as will be explored below, it is based in the last instance on unremunerated knowledge. Therefore, even for capitalist exploitation in its traditional Marxian sense, in which the worker generates more value than she receives in exchange for her labour power and skills which are objectified in the product of labour, these skills are a key ingredient in the relation of exploitation. The second limitation lies in the ill-advised choice of the term 'material'. As has been discussed in chapters 1 and 2, from a materialist perspective it is impossible to conceive of a modality of exploitation that is not material.[199] However, that the names were unfortunate is not to say that the concepts were completely erroneous. Now it is possible to address two of the varieties of capitalist exploitation which will be presented here: exploitation through alienation and exploitation through reproduction. In both cases the capitalist appropriates knowledge without paying, but the first case concerns knowledges which have been objectified in the product of labour – the physical property of the capitalist – while the second relates to the copying, usually by codification – in texts, recordings, and their respective intellectual property rights – of the knowledges the worker carries.

However, this does not complete the panorama of exploitation under capitalism and particularly the forms proper to informational capitalism. Indeed, a part of the exploitation of internauts by companies like Google and Facebook cannot be understood as exploitation through reproduction (or even less as exploitation through alienation). Here we have exploitation that stems from mass exposure to advertising, as cultural materialism and associated approaches point out. It is, more precisely, a capitalist exploitation of the audience commodity (Fuchs 2010, 2012a, 2015b; Fisher 2012, adopting Smythe's concept, 1977, 1981). From our perspective, this modality is not based on the objectification or codification of knowledges but quite the opposite, on the capture of attention to inoculate certain knowledges, and so we shall call it exploitation through attention.

Having made these superficial references to the literature, we can now move on to defining capitalist exploitation and its three varieties. Some features of capitalist exploitation are intrinsic to all forms of exploitation and have already been discussed. Meanwhile, others will appear here for the first time. Capitalist

exploitation refers to reactions between human subjects that can be defined by the following characteristics:

1. They occur in the framework of *capitalist productive processes*.
2. They generate *exchanges* that are *objectively asymmetrical* in terms of the economic value exchanged between two types of actors, *E (exploiters)* and *e (exploited)*.
3. The E actors acquire an objective *surplus value* in economic terms in relation to, and at the expense of, the e actors.
4. The e actors contribute their energies and different types of knowledge to the productive process, and receive a compensation approximately equal to (not less than) the value of the expended energies, *but not all (or nothing) of the value of the translated knowledges*. Thus, the essence of capitalist exploitation is the unremunerated knowledge of the e actors.
5. The E actors, in subjective terms:
   - 5.1 Set in motion the productive processes with the aim of:
     - 5.1.1 Producing *commodities*.
     - 5.1.2 Obtaining *an economic profit* from the sale of these commodities.
   - 5.2 Have a wide-ranging vision of the productive process.
6. The e actors, in subjective terms:
   - 6.1 Consent, to a greater or lesser degree, to the specific exchange they participate in.
   - 6.2 May represent to themselves the exchanged values as equivalent or otherwise.
   - 6.3 Have a fragmentary, limited, view of the productive process in which they are incorporated.
7. In terms of intersubjective knowledge:
   - 7.1 Regarding normative knowledges, the productive processes and exchanges within them take place within the framework of the *law*.
   - 7.2 With respect to axiological knowledge, exploitation takes place framed by *ideologies*.

Characteristics 1, 2, and 3 are shared by all forms of exploitation and have already been adequately discussed above. Characteristic 4, however, although it has been partially anticipated, is crucial. Our starting point is that the e actors contribute their energies and knowledges to the productive processes. These are knowledges of different types, in different bearers, and different proportions of knowledge in relation to the energies expended, depending on which productive process is in question. These energies and knowledges have, as seen in chapter 1, quite diverse economic, ontological, and legal properties. The energies utilised in the productive process are exhausted in their productive consumption, while the knowledges are not. But for now we will focus on energies. They set a clear parameter for the compensation of the exploited

subject: the set of goods and services that allow them to reproduce their physical attributes, that is, to recover their energies in order to participate in the productive process. Thus, the goods and services that the exploiter contributes may meet these basic living expenses for food, clothes etc., or may not. In the negative case, we are presented with a situation in which the exploited will not be able to remain within the productive process for long and, this is the point, this modality was part, even an essential part, of some forms of pre-capitalist exploitation. For example, many slaves received (and receive) compensation below the minimum needed to guarantee their subsistence. In these cases, a considerable portion of the surplus value appropriated by the exploiter stemmed from these unremunerated human energies. Of course, this human consumption in which their cognitive capacities were misused constituted a pitiful basis for accumulation. So, the repugnant character of compensating humans as though they were animals (or even worse when the former were more abundant than the latter), does not permeate our intersubjectivity for the ethical caresses of the humanist velvet glove so much as for the iron fist of capital encased within it. It is capital that discovers that paying for basic household provisions (that is to say, treating humans better than animals) can result in greater accumulation, on the basis of unpaid appropriation of knowledge in its various bearers. The physical reproduction of the exploited must be assured in order to be able to exploit them on more solid foundations: their productive knowledges which, although consumed every day, do not require feeding any more than sporadically. Because, if what is exploited, for example, are the manual skills of the worker, undermining the bearer in which these are embedded, the body, only damages the scaffolding which upholds profits for the capitalist. This, self-evidently, is due to the fact the knowledge cannot exist without a physical bearer. In this sense, resorting to the depletion of physical human life does not form part of the repertory, however wide that may be, of distinctively capitalist exploitation. When the compensation of the exploited for their participation in the productive process is situated below the energy subsistence level, we are faced with a different, well-known, phenomenon: *super-exploitation*. Naturally, super-exploitation is not an exceptional phenomenon in the capitalist system, but it places the productive processes that practice it inside the crowded territory of non-capitalist productive processes that operate within the capitalist totality.[200] On the other hand, the idea that the energies spent are integrally compensated under capitalist exploitation should not deceive us: it could mean that the compensation represents an ample provision of goods and services in the case of energy-intensive tasks but, at the same time, it could mean that the compensation becomes negligible when the energies consumed are equally as negligible. This is the case, as shall be seen below, for some forms of exploitation through reproduction and attention, in which knowledges are exploited without requiring a great deal of energy expenditure on the part of the exploited.

So far we have run through some general comments about compensation for expended energies. With regards to knowledges, their compensation can vary under capitalist exploitation. It can never be complete, as this would dissolve the exploitation. However, it can vary from the total absence of cognitive compensation to considerable reimbursement. Of course, this is not a question of nominal values, but of proportions: if there is capitalist exploitation, there is a portion of knowledge which is not adequately compensated.

Characteristic 5 refers to exploiters. On the one hand it asserts that, as with all processes of commercial exploitation, the productive process must produce commodities. But to be capitalist it must also produce commodities that are a means for obtaining an economic profit, whose origin lies in exploitation but that can only be realised on the market. Thus, the exploitation in productive processes for which the driving force of the exploiter is merely to exchange commodities in order to harness their utility, their 'use value', does not constitute capitalist exploitation. However, we can add a relevant aspect here: the exploiters, or their representatives, have a general broad view of the productive process, in contrast with the standpoint of the exploited. The latter, moving on to characteristic 6, have a decidedly fragmentary, limited, and partial view of the productive process they are integrated into. The idea of alienation in Marx's 1844 manuscripts (1981) grasps this phenomenon for the case of productive labour processes. But others are included here, for example the internaut who uploads her videos to YouTube so that this company can use them for profit has a fragmentary and alienated view. However, the most significant aspect about the exploited is that they consent, to a greater or lesser extent, to the relationship they participate in (6.1). This is not to say that in all cases the subjects enter into these relationships by virtue of a purely free will, but that there are diverse degrees of consent. However, by definition, and this is crucial, in no case is there a total lack of choice, an inescapable obligation. This flows from the fact that they recognise themselves as owners of their own physical matter, their bodies, as free subjects (a recognition knowledge that defines capitalist productive processes). With regards to exchanged values it is irrelevant, for the definition of capitalist exploitation, whether the exploited consider the relationship to be asymmetrical or not. This refers to a point discussed above: what interested us here is the objective phenomenon, not its subjective perception. Of course, the representations of the exploited actors are undeniably important on other levels, such as that of political action.

Moving to intersubjective normative knowledge, capitalist relations of exploitation take place within the framework of the law (7.1). More precisely, they are *not-illegal* relations: they do not entail any clear, evident or indisputable violation of any current legislation. That is to say, they can occur in positively regulated zones, or non-regulated zones – as with the case of varied forms of exploitation through reproduction – but not in zones unequivocally prohibited

by capitalist law. As we have repeatedly asserted, in these latter cases there is still exploitation, but it is not capitalist exploitation.

Last but not least, capitalist exploitation is framed by ideologies (7.2) that to some extent veil the objective asymmetry in the exchanged values. As discussed above, the second moment of regulation involves the inoculation of ideologies that naturalise relations of expropriation and exploitation. Although in previous periods asymmetric exchanges did not necessarily need to be disguised, some normative knowledges of capitalism (the market, meaning exchanges of equal values; free individuals, meaning they can choose the relationships they participate in) require the intersubjective mediation of ideologies to close the breach between the objective asymmetry and intersubjective representations. The effectiveness of ideologies in achieving their goal is variable. Moreover, different stages and types of capitalist exploitation shape different kinds of ideology. For instance, exploitation through alienation in industrial capitalism was based on the ideology of the hardworking, money-saving, autonomous, self-made individual. In contrast, exploitation through reproduction in informational capitalism draws on the ideology of networked dividuals, free sharing, open knowledge, communities, collaborative production and so on. More precisely, both exploitation through reproduction and exploitation through attention rest on quite successful ideological efforts conducted by companies such as Google and Facebook towards internet users. The more an ideology becomes naturalised, the more difficult is to discuss it. Therefore, it is hardly surprising that the exploitation of internet users by those companies is energetically denied by prosumers and academics: ideology is operating at its zenith.

Beyond the explicit debates that the proposed definition implies, there are various tacit discussions within that. Enumerating them could help us to pin down the shared aspects and differences from other approaches.[201] Firstly, it is necessary to discuss the convergences and divergences between the approach proposed here and the Marxist idea according to which workers must immerse themselves in relations of exploitation that have a 'work'-related nature (they occur in 'working hours' and in a 'productive unit') because they lack 'property' of the 'means of production' and particularly of the 'means of labour'. More generally, in some versions the worker tends to be represented as being dispossessed of all productive resources extrinsic to his own corporeal energies. This situation that Marxism describes is contemplated in the proposal advanced here (in fact it is the most common example of what we call exploitation through alienation). However, the circumscription of exploitation to this concatenation of categories limits our understanding of other forms of capitalist exploitation.

Indeed, as pointed out in chapter 4, labour as a figure shaped by norms under capitalism is not necessarily characterised by an absolute lack of resources, beyond the possession of their own body. As we shall see in chapter 6, the lack of minimal knowledge or physical resources is only characteristic of one type of worker, the excluded. The usual situation in this case is that they suffer

super-exploitation or unemployment, rather than them being integrated into normal capitalist productive processes. In fact the typical workers in capitalist productive processes have at least non-exclusive access to certain knowledges. In many cases this is even extended to non-exclusive access to physical -intensive resources – these types of productive resources are discussed in chapter 6. The point here consists of emphasising that the worker exploited by capitalism should not be imagined as being completely dispossessed of productive attributes. If it were otherwise, it would be difficult to appreciate the dynamic of capitalist exploitation in the twentieth century, to say nothing of the twenty-first. In contrast from a cognitive materialist perspective, the only prohibition that defines workers' access to productive resources is having exclusive access (as defined in chapter 4) to any recourse that is extrinsic to their own physical energies.

Along these lines, a further step must be taken to point out that capitalist exploitation does not always and necessarily manifest itself in relation to the division between possession and non-possession of *means of production* in the traditional sense (artefacts – tools, machines etc. – inputs, 'matter', and energy). In informational capitalism in particular, informational workers – programmers, designers, journalists, musicians, data entry clerks, etc. (Zukerfeld 2013) - are 'owners' (in the Marxist sense) of the relevant 'means of production'. In their homes they have, for example, computers, software and internet connections that are comparable to those provided by the company they work for; they possess the same techniques they use during working hours; the costs of the physical matter they consume in the productive processes can be independently defrayed by them quite easily etc. However, this does not prevent many of them entering into capitalist productive processes in which they are exploited.[202] Why do they participate in those processes then?[203] In our view, this is because the (capitalist informational) companies enjoy exclusive access to certain types of knowledge (for example, recognition knowledge translated into a particular demand, organisational knowledge regarding the productive process, and others).[204] On the other hand, still continuing to trace the divergences from the bulk of Marxist approaches, rather than a simplified version, for cognitive materialism exploitation is not necessarily circumscribed either to a *labour relationship* or to a productive unit. In fact, we understand that capitalist exploitation can occur between different units of production as long as they form part of the same productive process.[205]

Moreover, although exploitation is intrinsic to capitalist productive processes, the exploited may or may not be performing *labour* in the usual sense of the word. This implies at least two questions. On the one hand, the cognitive and/or material production that is harnessed by capital can occur during the working day or in free time. Some forms of exploitation through reproduction, for example those related to unremunerated videos uploaded to YouTube free by internauts, or the production of free software that companies like IBM or

HP later benefit from, typically occur in free time. More precisely, capitalist exploitation can take place in situations in which *the variable 'time' is not especially relevant*.[206]

Similarly, the idea of *work*,[207] as a conscious activity in pursuit of a particular goal, may not be present in situations of exploitation.[208] Indeed, situations are possible in which the exploited produce without having any conscious intention or information about what they are doing.[209] What interests us here is that the conditions mentioned previously are in place. In other words, while activity channelled towards a particular objective, implying intentionality, is fundamental to defining work, from our standpoint considering the existence of exploitation without work to be possible, cases can exist in which the fruit of an involuntary, not intentional or conscious, activity can be exploited. Exploitation through attention, that is, the unpaid harnessing of human attention by means of the inoculation of the exploited with determinate knowledges, is the simplest example but not the only situation in which exploitation without work occurs. The unpaid copying of the ethnobotanic knowledges of indigenous peoples, a form of exploitation through reproduction, can occur without necessarily any conscious and intentional activity on the part of the exploited in relation to the productive process.

Secondly, capitalist exploitation is not necessarily linked to *domination* (in the usual, Weberian sense of the term). Unlike non-commercial, and non-capitalist commercial, modalities of exploitation, here domination may or may not coincide with exploitation. In many cases, the most well known ones, there is an alignment between exploitation and domination. But in other cases, that does not happen. There are two sources of this eventual discrepancy which have tended to dominate in successive periods of capitalist development. In the industrial period, the sharp division between work and free time also formally demarcates the time and space of the exploiter over the exploited. At least in legal terms, the exploiter does not necessarily need to be obeyed by the dominated subject outside of the spatiotemporal structure of work. In informational capitalism, although forms of domination emerge outside of working hours (as autonomist and cognitive capitalist authors emphasise in their own terms), forms of exploitation that occur outside of any working environment also ascend, and are clear demonstrations of exploitation without domination. Producers of software, content, and data through which companies such as Google or Facebook make a profit are not contractually obliged in any way to obey the orders of these firms.

Third, and lastly, it must be underlined that the magnitude of the contribution by made by the exploited does not define exploitation. The interesting point is the asymmetry between what is given and what is received. That fact that an exploited individual makes a small or an enormous contribution is of no significance settling the question of whether or not exploitation is present. What is relevant is the place that it occupies in the totality of the productive process. If the process

depends on this levy to exist, we are dealing with exploitation.[210] This comment arises from a vital debate about whether it is appropriate to describe as exploitation the profit-seeking use, not of contents (videos, texts, images), but of users' personal data by companies like Google or Facebook. The objection raised to this was that the value of each individual's personal data was so insignificant that it made no sense to describe this relationship as exploitation. However, the question about exploitation must be raised in relation to the totality of the productive process. If, in a manufacturing productive process, a worker works ten hours and is paid for the value of five hours, evidently she is exploited. Is this situation different from those in which a thousand workers each contribute 36 seconds and are paid for 18? Is there not exploitation in this case? If the productive process combines billions of contributions, the exchanges are asymmetrical, and the other conditions are fulfilled, then we are dealing with processes of exploitation, possibly exploitation through reproduction. These are situations in which large companies take large quantities of modest individual contributions in the form of digital information and profit from them. Disguised with discourse about collaborative production, networks and communities, the exploitative character, in the strictest sense of the term, of these social relationships is obscured.

Finally, two orientations about the relationship between exploitation and capitalist productive processes. On the one hand, capitalism cannot survive without capitalist exploitation – although it is complemented by other forms. It should not be deduced from this that all capitalist micro-productive processes achieve success with their relations of exploitation. This inference would involve a confusion of levels, extrapolating what occurs on a macro level to the micro level. Any given capitalist productive process is described as such for its aspiration to *realise* capitalist exploitation. By the same token, it should not be concluded that any *moral* judgement is being made here about capitalist exploitation. The notion of capitalist exploitation does not arise, at least not in these pages, from anything other than the question about how the capitalist machinery is fed, how it expands, and how it reproduces itself.

5.7 Three Types of Capitalist Exploitation

Next a simple summary will be presented of the three types of capitalist exploitation and then some specific aspects of each of them will be discussed. For the rest of the chapter, unless expressly stated otherwise, we refer to situations in which all the features proper to capitalist exploitation are present.

***Exploitation through alienation*:** determinate knowledge borne by the *e* actors is objectified during work time in a product which is alienated by the *E* actor. This is the traditional conception of exploitation, with two caveats: the key lies in the knowledge (that is the source of surplus value) objectified in the product and that this modality includes not only what occurs within the productive unit but also the products of outsourced or autonomous workers.

***Exploitation through reproduction*:** Determinate knowledge borne by the *e* actors is codified by the *E* actor, who becomes the owner of this knowledge. The *e* actors, however, continue to possess it in the original bearer. This happens when capital copies knowledge that hadn't typically been generated for profit, with the goal of making profit and without providing sufficient compensation (for example, the skilled movements and techniques of workers which are copied and translated into a procedure manual under Taylorism, who nevertheless still possess their knowledge after their dismissal).

Exploitation through attention: Determinate knowledge transmitted by the *E* actors is subjectivised or intersubjectivised towards the *e* actors. This moves in the opposite direction from the other two modalities: especially in an economy in which the scarce resource is attention (Simon 1996b), the attention of audiences is harnessed without sufficient compensation (Smythe 1977; Fuchs 2010) and is sold to advertising companies (normally in combination with data obtained through exploitation by reproduction) in order to inject particularised cognitive flows into it. In appearance, it seems that the E actor cedes or even gives something, whereas in reality they take something more valuable for free: human attention and the possibility of taking advantage of the cognitive structure of the e actors in order to dock advertising knowledges there.

It is crucial to point out that the three modalities are not mutually exclusive, but rather that two or three of them act in many productive processes simultaneously. In this sense, social media sites can provide a useful example. Indeed, exploitation through alienation occurs on social media sites for the paid back office and offline workers on the platform (programmers and other technicians, either in-house or outsourced), but also for those who act online (moderators, but also, for example, teachers who give live classes, or some other service). In turn, exploitation through reproduction encompasses user generated content (text, videos, photos, music) and all sorts of data whose profitable use is ceded through acceptance of the 'terms of use'. Last but not least, exploitation through attention on social media sites occurs systematically, and on a massive scale, by means of numerous varieties of targeted advertising, which the users open their cognitive floodgates to in exchange for access to platforms, software, and content. Thus, for example, companies like YouTube or Facebook can potentially combine the three types of exploitation. Naturally, many other combinations between the different forms of exploitation are common. Now it is possible to explore each of the three types of exploitation in a little more detail.

5.7.1 Exploitation Through Alienation

This modality relates to the usual meaning of the concept of exploitation in the social sciences and, typically, designates situations that register on the Marxist radar and that in general are amenable to this approach. They refer to situations in which the worker 'sells' their 'labour power'[211] to the capitalist for a lim-

ited period of time. In the case of manufacturing production this is expressed clearly: there is a working day and the fruits of it are the property of the capitalist. However, this is not the only situation that should be included here. In many cases during, but above all before and after the industrialist boom, the worker works outside of the productive unit and is paid a piece rate, meaning per unit. Both situations are homologous as regards the exploitation that occurs and can be extended to other economic sectors and historical periods.

We can illustrate this with the help of Guasuncha, a cook, as skilful as she is temperamental, who we find towards the end of her youth at the beginning of the 2000s. Guasuncha spends eight hours per day working in the stylish restaurant 'La Boutique' and there we observe her, arguing furiously with the owner, Raul, who is reprimanding her for the sin of *gluttony* while she hurls the accusation of *greed* at him. But first let us rewind a decade. La Boutique does not have its own premises yet and, far from being a restaurant, is just a delivery service with limited capital: a telephone line direct to Raul's apartment and ovens, baking trays and other tools that Raul has deposited in the apartment of his then neighbour, Guasuncha. Raul had noticed Guasuncha's culinary virtuosity and orders around 40 plates of food a day from her, without caring at what hour of the day they are produced; Edgardo, son of the porter of their building and the third member of this incipient gastronomic drama, is in charge of delivering them to the clients' doors.

What these two moments in the life of La Boutique have in common is that at both points exploitation takes shape through the same crucial element: the capitalist has control of the product (good or service) of the work. Meanwhile, the worker only receives a portion of the wealth they have created, in the form of wages, that consist of the (exchange) value of the socially necessary (abstract) labour it takes to produce and reproduce their productive capacity under certain social conditions. For now it suffices to note that in both situations Guasuncha produces the same amount of meals and that to reproduce her productive capacities, the value of 30 meals, which is what Raul pays her, is enough.[212] So far, nothing new: incorporating a series of plausible assumptions we arrive at Raul pocketing a surplus value of 10 meals or, amounting to the same thing, two hours of work for Guasuncha. However, a crucial question arises here: where does this difference originate from? At first glance the question might seem trivial, and the Marxist answer is vehement: 'it evidently comes from Guasuncha's labour'. Of course, but how to account for the fact that Guasuncha can produce, let us say 25 per cent more than she needs to reproduce herself? It is not at all clear that Marxism has equally emphatic answers to this question. Perhaps the response would be that this is due to 'generic human capacities' or something of the like. Next we would possibly be subjected to a succession of generalities that would likely include skilled bees and incompetent architects, consciousness and tools, yards of linen and, above all, the 'value' form and exchange on the market, but no materialist explanation of the origin of this empirical,

ontological, feature that, in certain contexts (capitalist productive processes) facilitate Guansuncha's exploitation through alienation. In all probability, the Marxist response would eventually slide into a circular reasoning that, stripped of all the dead foliage, sounds more or less like this: human labour has the property of generating more use values than it requires to reproduce itself because that is a property that defines human labour. The limit of this reasoning and, indeed, the limit of labour value theory, is that labour appears as an ultimate, indivisible, unit, an atom in the sense imagined by the materialists of antiquity, as Echeverría (2011) points out. The decisive step then consists of asking what labour is made up of? From which substances is it composed? Naturally, this implies daring to consider that labour might not be an ultimate substance. This is the threshold which proponents of the labour theory of value would be wise to shelter behind: once the question about the elements that comprise labour is accepted (as a valid one), it is difficult to retreat.

But let us cross the Rubicon (that metaphor which transforms any fragile idea not only into truth but even into a heroic feat) and observe that, just as at one time it was useful to investigate what atoms were made of, in other circumstances it became expedient to wonder what labour is composed of. Surprisingly or not, the latter actually occurred before the former, as this text from Bentham dated 1795 shows:

> Under the general denomination of *labour*, considered as employed in the giving of increase to wealth in any shape, two particulars may be distinguished: 1. The mere bodily energy employed in the production of the effect in question: 2. The *skill* or mental power displayed in the exercise of the bodily act, in the choice of the bodily operations carried on in that view, and in the mode of carrying them on. (Bentham [1795] 1954, 260)

In effect, Jeremy Bentham asserts that labour is nothing but a combination of energies and skills, or practical knowledge.[213] Along the same lines, much later and among other authors, Echeverría argued:

> …all labour is defined as a specific articulation that integrates, on the one hand, a certain amount of energy and, on the other, a particular information programme that defines the orientation of the deployment of energy in order to obtain a determinate result or product. (Echeverría 2011, 294–5)[214]

In sum, beyond the concepts used by various authors, it is evident that in terms of cognitive materialism *labour is composed of energies and (different types of) knowledges*, which form a dialectical unity.[215] Indeed, it is clear that energies, in other words the sweat and muscular effort Guansuncha employs to prepare her

dishes, are not sufficient. There is a portion, possibly the largest, of the wealth she creates that stems from her culinary skills, which are cultivated, incidentally, outside of any process of formal education.

But how does the division of labour between energy and knowledge relate to capitalist exploitation? To understand this, firstly we must recall that knowledge matter and energy (physical matter) have different, and even antagonistic, ontological, economic, and juridical properties. In the specific case of the energies and knowledges carried by humans, it suffices to mention just one difference: *while the former are consumed in productive use, the latter are not*. Every day Guasuncha has to replenish the energies she has spent preparing her 40 dishes. Her extenuated body must rest in order to recover and must, above all, ingest a considerable quantity of calories (which Raul insists is sinfully excessive). On the other hand, her knowledges, especially her subjective knowledges about cooking (leaving other bearers to one side for the purposes of simplicity), that is her *implicit* skills in handling different utensils, detecting the perfect cooking time etc., her *explicit* knowledges about some secret ingredient or recipe inherited and passed down by the women in her family, all those knowledges and many others, do not require rest or nourishment.

Therefore, insufficient compensation for the energy aspect of labour can only result in the depletion of the worker and, along with it, of the process of capitalist accumulation which becomes vexatious and fickle. Raul proved this when, appealing to God but praying to his own wallet, he conducted the experiment of reducing Guasuncha's compensation to below the value of replenishing her energies: vexatious and fickle indeed the cook proved to be, and with her, the fate of the business. Therefore, surplus value, even that springing from the modality of exploitation rooted in labour, cannot arise from the energy component.

It is true that super-exploitation, however incompatible it may be with capitalist exploitation, is a minor vice that capitalists indulge in. When there is an extremely abundant mass of easily replaceable workers, who carry exceedingly modest or widespread knowledges, the capitalist feels the juvenile compulsion to assail the frontier of energy replenishment, becoming a super-exploiter. This is what Raul does, after having failed with the cook, with a dozen trainees who preceded Edgardo: with a very long list of candidates, he pays them well under the rate of basic living expenses and at instance of absenteeism, hires the next one. However, beyond the lost days and the transaction costs he incurs at each replacement, the situation changes when he hires the porter's son: Raul senses firmer foundations for his business in the recognition network between Edgardo and the neighbours (who have watched him grow up, and would usually refuse to open their doors to strangers, especially those from a lower class, but have invited him into their homes, exchanged jokes with him and, above all, lavished tips on him systematically), and his rollerskating skills (whilst carrying several bags). Raul

continues to pay Edgardo what he paid his predecessors, but pointing out to him that with the tips on top (the origins of which are not disputed) he receives the value of a minimum wage, or even surpasses it.

It is, in the end, the value of Guasuncha and Edgardo's knowledges, diverse in quantity and quality that Raul exploits enthusiastically.[216] No compensation is demanded for any of them, nor does he need to be concerned about replenishing them. As if by magic, upon refilling the energy tank, the cognitive engines are kept in excellent condition. Furthermore, their use, far from depleting them, only makes them stronger. Guasuncha grows more skilful and Edgardo's recognition network spreads. Learning by doing and learning by interacting, know-how and know-who, increasing returns to scale, network externalities, and other affiliated terms have been used in knowledge economics (Foray 2004) to describe this dynamic, as Edgardo would read some years later. So, knowledges are much better candidates as sources upon which to establish exploitation. It is not just that having identified two components of labour and, one being discarded, the other is chosen. Instead it is the case that the properties of knowledge (zero subtractibility or non-depletion with productive consumption) supply positive foundations which make it manna from heaven for exploitation. Now, the capitalist pays the workers a given sum of values. Except in cases of payment in kind, there is no pay identified as corresponding to energy and another related to knowledge, which is to say that the capitalist makes no comment about whether the worker should spend the values they receive on rent and food rather than on books or dance classes. However, the worker's point of view is the same as the capitalist's in this respect: if energy needs are not covered in the first place, the bearer in which the knowledges of whichever character are embedded, becomes fragile.

So in general, the workers participating in capitalist processes of exploitation (not necessarily the case for other productive processes) effectively use their wages to satisfy their basic physical needs. In the case of Edgardo, although a portion of his income directly and manifestly springs from the recognition of his neighbours (who give him tips in a direct way) and less directly and manifestly from his implicit knowledges as a roller-skater (which increases his tip rate per hour, and even opens up the possibility of expanding the clientele base), Raul regards this portion as going towards supplementing his basic energy requirements. Thus, it is clear that the value the proprietor of La Boutique appropriates is that of a cluster of subjective and intersubjective knowledges which Edgardo carries. And the point to emphasise here is that the calculation the capitalist makes coincides with the one the worker makes because, although Edgardo would like to fund some kind of vocational training course, he must first cover his basic expenses. Nonetheless, Edgardo manages to scrape together some modest savings.

This leads on to the observation that the fact that the basis of exploitation through alienation is knowledge carried by the worker does not mean that he

does not receive any compensation for the knowledges he exercises. On the contrary, it is quite common that a part of those knowledges is acknowledged in the salary, as in the case mentioned. The essence of exploitation lies in the worker *not receiving the total value of their knowledges*, but there is a long distance between nothing and everything. It is common for capital to cede a portion of the value of the knowledges it avails itself of, with the effect of paying for the knowledges (above all intersubjective, but also some subjective) of the future generation of workers, or to update the subjective knowledges of currently active workers. This can be effected directly through wages, or with the intervention of the state. In any case, capital still pays less for those knowledges than they yield, on an aggregate level.

In sum, we have distinguished two components of human labour – energy and knowledge – and pointed out that surplus value, that is, the content of capitalist exploitation, can only come from one of them: knowledge.[217] In reality this is a phenomenon underpinned by a deeper issue discussed in chapter 1: while physical matter only transforms, knowledge matter is unique in its quality of being able to accumulate.

Picture Raul, Edgardo, and Guasuncha's building and, zooming in closer, her apartment inside it, its walls and pipes, the oven and blender, baking trays and fridge, table and chairs, television and, of course, the cook herself: there is no more than a collection of entwined 'matter' and energy and, above all, a cosmic quantity of knowledges, of dated knowledges to paraphrase Sraffa. That is, created at disparate times and places in history and which become incorporated into other knowledges, translated from one bearer to another.

Finally, why use the expression exploitation 'through alienation' to describe this modality? The concept of alienation is complex and has divergent uses in the literature that engages with the themes explored here. However, it is an appropriate term as it takes into account both the translation of knowledges from human bearers to an object and also the loss of this object in which knowledges have been objectified. The definitive reference in this sense is Hegel, who distinguishes between alienation as estrangement (*Entfremdung*) and alienation as externalisation (*Entaüsserung)* (Rae 2012). Both meanings are related to the objectification of knowledge (consciousness, spirit, or the idea, in Hegel). Both senses are reasserted here: the idea that the worker externalises their knowledges through objectification and also the idea that the product which arises from that objectification confronts them as a strange being, insofar as it is property of the capitalist. Therefore, when we highlight that exploitation through alienation involves the capitalist appropriating the knowledges objectified in the labour product, the intention is not merely to refer to Marx's concept of alienation (which emphasises the estrangement aspect, the loss of the object), but also to Hegel's which specifically includes the objectification of what here are designated as knowledges.

5.7.2 Exploitation Through Reproduction

What here is defined as exploitation through reproduction (which for some years we described as 'cognitive' exploitation) is the form that gave birth to our debates about the concept of exploitation in general. It arises from repeatedly having detected anomalies in the traditional concept of exploitation. In effect, in the history of companies, industrial branches and countries which have been successful in the project of capital accumulation, there are forms which cannot be reduced to exploitation through alienation (for which capital critically depends on the mediation of the labour *product* and labour *time*). These companies', branches', and countries' processes of accumulation are fundamentally based on the unpaid copying of knowledges from the most diverse sources, as several studies have documented (Cimoli, Dosi, and Stiglitz 2008; Chang 2009; Drahos and Braithwaite 2002; May and Sell 2006; Johns 2010; Zukerfeld 2010, 2016). Unlike the unpaid knowledges exploited through alienation, those exploited through reproduction do not need daily replenishing. They become codified in texts, objectified in machines, and even housed in subjectivities regulated by specific contracts, in all cases under the ownership of capital.

While exploitation through alienation requires the relationship between the exploited and the product of their labour as the means by which to gain access to the knowledges carried by the former, for exploitation through reproduction the capture of this knowledge becomes independent of this relationship. For this reason it is tempting to claim that exploitation through alienation represents the *formal subsumption of knowledge under capital*, while exploitation through reproduction presents us with the *real subsumption of knowledge under capital*. Exploitation through reproduction can take place within or outside of the labour process, and the knowledges implicated can arise from quite heterogeneous contexts: scientists' subjective knowledges, traditional or popular knowledges, knowledges codified as digital information and, of course, knowledges associated with work skills.

Let us focus on this latter case and return to the beginning of our history of La Boutique. Raul accumulates and invests, Guasuncha cooks and protests, Edgardo converses and saves. On the basis of exploitation through alienation, the business thrives for a decade, and eventually makes the move to its own premises, where the traditional delivery is sidelined in favour of serving diners in the restaurant's ample space. We have returned to the beginning of the twenty-first century. However, there is no rest for capital, and Raul is faced with two problems. The first, main problem consists of not being able to expand production. The limiting reactant, of course, is Guasuncha, whose culinary inventions inspire a firm following among the clientele, and who responds to entreaties to duplicate her production by insisting that she cannot produce more than her 40 daily dishes. Raul, after offering her – in what feels like a fit of heady generosity – a salary increase proportional to the number of additional dishes,

is rendered indignant by her negative response and request for an even higher raise which he, regaining composure, judges to be a futile excuse to conceal a new sin: *sloth*. Raul's calculation is simple: he can concede an increase as long as this permits the relationship between the value that Guasuncha receives and the value she contributes to remain the same, that is, a 3:4 ratio. If the wage rise results in an increase in this proportion, the process of accumulation will deteriorate. It must be emphasised that Raul's logic would be absolutely correct *in a world in which only exploitation through alienation existed*. Fortunately, in our world it is only partially correct, insofar as capital's benevolent design has conceived of other figures with which to delight its faithful worshippers.

But on the other hand, Edgardo has also become a source of concern for Raul. Increasingly marginalised in the new scheme of things – in which deliveries are less and less important – Edgardo has found himself obliged, in order to maintain his purchasing power, to try to increase his tips. He has overstepped the line in this project, at least according to the husband of an old client of La Boutique who tells Raul that he has discovered the delivery boy and his wife embarked, not on the expected delivery of foodstuffs, but on an exchange of an altogether more compromising nature. "*Lust*", cries Raul, gripped by rage;"*Envy*", retorts Edgardo. With their recognition network destroyed, the already ailing delivery service of La Boutique is mortally wounded. Edgardo, who is now more the object than the messenger of the neighbourhood gossip, is forced into exile. His savings, a student grant, and a modest severance package from Raul combined enable him to transform his disgrace into a virtue and study management at a university in the USA. The growth of La Boutique stagnates for a few years. Raul does not accumulate or invest although Guasuncha cooks and argues. Meanwhile, Edgardo studies and plans, and eventually returns.

Upon his return, Edgardo shares his plan with Raul, who eagerly agrees and names him 'Manager'. Edgardo summons Guasuncha and informs her that not only will she be granted the significant wage rise that she had been demanding for years, but that she will not even have to prepare more than 40 dishes per day. In addition, she will be assigned two employees to 'assist' her – all this and other details to be drawn up in a written contract which as soon as it is signed will be valid for six months. Guasuncha, taken aback, enjoys her pyrrhic victory. One of the assistants, a university student trainee, devotes her time to systematically making a record of the steps and ingredients, and even films the preparation of each recipe. The other, the assistant cook, has orders to faithfully reproduce each dish and to ask Guansuncha for as much instruction as is necessary for their food to be identical. Edgardo takes the precaution of obliging them to sign an agreement stipulating that all the knowledge acquired is the property of La Boutique. Six months later, Guasuncha is dismissed. The bulk of the recipes she inherited, her skills and years of experience, her implicit knowledges, are now reflected in a highly detailed book of recipes and procedures, accompanied by a collection of videos. They have now become, in part, objectified knowledges

(that La Boutique commercialises), but they have also been translated to the subjectivity of the assistant cook who in turn will have to reproduce them in other subjective bearers. Finally, in the second decade of the millennium, La Boutique embarks on its expansion to become a successful restaurant chain.

The idea that workers possess knowledges that are not objectified in the labour product but that are equally harvested by businesses without appropriate compensation has been considered at least since Marx, from two angles. The first is connected to deepening the insights afforded by Marxian concepts related to the organisation of the labour process. For example, Coriat (1979), in his analysis of Taylorism, has demonstrated how breaking the monopoly of workers' knowledges has been a decisive task for the establishment of North American industrial capitalism. The other approach is underpinned by the notion of 'general intellect' mentioned by Marx in *The Grundrisse*. This is the course taken by Italian autonomism (Lazzaratto and Negri 2001) and the theory of cognitive capitalism (Vercellone 2007; Moulier-Boutang 2011). In the present stage of capitalism, it is claimed, workers produce valorisable knowledges throughout the course of their lifetime and that firms appropriate them through the labour relationship. Beyond the literature which engages with Marxism in one way or another, the translation of knowledges carried by individual subjectivities into various forms of objective codification (or other bearers) is one of the central concerns of the *management* approach (e.g. Nonaka and Takeuchi 1995). Of course, generally speaking this literature takes for granted the corporate ownership of knowledge and does not question whether compensations to workers are appropriate or not.

In cases of exploitation through reproduction in work environments such as that of La Boutique, the relevant normative intersubjective knowledges are shaped by employment contract laws, regulations of trade secrets, and specific signed contracts. In our particular example, the business, which was initiated in an informal framework, had not regulated the ownership of the knowledges deployed by the cook (or any other employee) during working hours through a specific contract. Despite this, according to some legislations, the ownership of the inventions and works of authorship which appear in working hours belong to the employer; in the case of recipes the situation is more complex, given that these are not usually protected under such regulations of intellectual property. On the other hand, they can be considered as 'trade secrets', meaning if the cook from our example had wanted to take her knowledges to other firms, La Boutique could have attempted to prevent her, by litigation. But the problem the business faced was not obstructing the use of the knowledges carried by Guasuncha, but how to obtain said knowledges in order to preserve the productive process intact once she, or any other specific worker, was dispensed with; or even better, how to multiply those knowledges. Here we can observe the relationship between capitalist regulation and exploitation. Edgardo, in his capacity as manager, and as his first action, produces a *constituted regulation*

of knowledge that enables Guasuncha's exploitation through reproduction, by means of a six-month contract. He proceeds in the same way for the assistants, in order to avoid any similar problem in the future: it is stipulated that their roles as cogs in a process of knowledge translation does not in any way grant them ownership of said knowledges.

Above and beyond regulation, the key to exploitation through reproduction is always translation. While knowledges are carried by the subjectivity of a worker, the company has only very limited control: it can only gain access to them by means of the contingent labour relationship with their carrier. Thus, translation into bearers that facilitate the ownership of the company is imperative in relation to critical knowledges. The most significant translation is that which involves codification, that is, translation from implicit and explicit subjective knowledges into diverse types of information (the copyrights for which would belong to the company): texts, instruction manuals, videos. The other translation, which has another subjectivity as its destination – the cook's apprentice – is more of a complement to the first: the manager knows (having studied the texts about 'tacit' and 'explicit' knowledge) that codification has its limits and that there are certain forms of knowledge that are better transmitted through prolonged face-to-face contact.

A decisive ideological aspect of this subtype of processes of exploitation through reproduction (in which the E actors exploit the 'manual' skills of the e actors) consists of the e actors failing to identify their own knowledge as such. They may, like Guasuncha, value their *efforts,* their time spent working, and demand wage rises but, paradoxically, their recognition knowledge *as workers* (which generally refers to 'manual workers') sometimes prevents them from recognising themselves as producers, carriers or owners of valuable knowledges. Those axiological and (micro) recognition knowledges do not only affect the workers who suffer their consequences, but they are also disseminated across the whole intersubjective fabric – both the workers themselves and many academics have paid little attention to the utilisation of those knowledges by capital. Of course, this is definitively connected to the fact that these knowledges were acquired outside of formal education and by and large without the support of information, that is to say, as mere translations from one subjectivity to another, in general implicitly. One last noteworthy question is the relationship between both forms of exploitation (through alienation and through reproduction). Evidently, both can act simultaneously: the same worker can be exploited by both forms. However, in the example, Edgardo utilises a different strategy. Where Raul refuses to concede a significant raise – that would conspire against exploitation through alienation – Edgardo knows that by relinquishing some, or all of, the exploitation through alienation, he can acquire the most valuable resource: the knowledge, now extricated from the cook. Better the fishing rod than the fish.

In effect, capital can, in certain circumstances, pay not only above the value of energy replenishment, but also recognise the total sum of knowledge that

the worker translates to the product. That is, it can temporarily suspend exploitation through alienation in the interest of procuring exploitation through reproduction. Naturally, the latter enables the exploitation through alienation of future cooks to be intensified. This pass-the-parcel between different forms of exploitation (that also includes exploitation through attention) is extremely relevant for understanding the dynamic of informational capitalist corporations, as will be noted below.

So far we have examined a general example of exploitation through reproduction, linked to productive labour processes, specifically to those of the 'physical workers' who will be identified in the next chapter. However, exploitation through reproduction presents manifestations that are also associated with other types of knowledge and that, above all, combine these different types of knowledge.[218] This leads us to a brief presentation of these varieties, with the caveat that this is not a typology with mutually exclusive categories (like those used in this chapter and throughout this book in general), but rather Weberian ideal types. There are other types of exploitation through reproduction that occur in the labour process. These affect the workers we label 'cognitive'. Let us imagine a professional musician, for example a pianist, hired by a producer. When she provides a *service* (accompanying a singer in a live performance), for which she receives remuneration, if everything proceeds properly she will be exploited through alienation: the fruits of her labour, and specifically her time, will be the vehicle by which the company obtains a surplus value. In order to exploit her again, her services will be required show after show. But when this musician is contracted to *record,* in other words, so her subjective knowledges are translated into codification as digital information, the situation is quite different, and takes the form of exploitation through reproduction: the company can reproduce those objectified knowledges as many times as it chooses, with marginal costs tending to zero, without any additional compensation given to the exploited party, if the company proceeds according to the contract.[219] This enables the payment for a recording to be set much higher than that paid for a live performance. In effect, exploitation through alienation has once again been transitorily suspended in order to stimulate exploitation through reproduction. This form of exploitation through reproduction of cognitive workers is thriving under informational capitalism. Therefore, we can find it not only in the world of art and entertainment but also in software production and even in formal education. Of course, the process of transformation from traditional face-to-face commercial education (which involves the familiar exploitation through alienation) towards 'virtual education' is striking although scarcely remarked upon. In the case of the latter, simplifying matters somewhat and concentrating on the example of a teacher who is filmed or who writes content, they are paid only once (just as the session musician) for 'virtual classes' which are repeatedly reproduced. The company pays the teacher for their 'working time' triple what they would receive for a normal class, but instead of charging 50 students,

now payment is collected from 5,000. The teacher, naturally, believes this to be an excellent change. Furthermore, they may even receive a minimal additional income each time the course is repeated, which they judge to be a reward for the excellence of their erudition. Shortly afterwards, when they find themselves unemployed, the similarities between the teacher's fate and that of Guasuncha will become all too apparent.

A notable aspect of these cases of exploitation through reproduction lies in the ideological role of payment by the hour. The idea of labour time as the equivalent and source of wealth, brandished by both the right- and left-wing naturally leads to demands for increases to the workers' 'hourly' pay. When the source of exploitation is the knowledges objectified in a consumable product (that are no longer reasonably associated with the length of the working day) this demand leads, although along a meandering path, to confrontation between labour and capital. However, in the case of exploitation through reproduction, the repertoire of demands appropriate to exploitation through alienation leads to defeat for labour. Trade unionists, steeped in the traditions of industrial capitalism, are generally experts at negotiating break times, leisure time, overtime etc., but are usually unequipped to deal with the regulation of the knowledges carried by workers.[220] As emphasised from the beginning of this book, the bundle of rights known as intellectual property is one of the arms of capitalism that is no less powerful for being inconspicuous.[221]

With the examples of physical and cognitive workers we have left the zone of exploitation through reproduction in which exploiters contract the exploited as workers, and moved into situations in which the capitalist productive process expands further than the time and space of the labour process.

For example, here we find exploitation through reproduction of traditional knowledge. Over the last two decades the term *traditional knowledge* became widely used to refer to intergenerationally transmitted knowledge embedded in intersubjective structures, typically of indigenous peoples. It includes not only ethnobotanical and medicinal knowledges, but also cultural expressions (symbols, music, designs, artisanry, linguistic terms etc.) (Visser 2004, 207; Finger and Schuler 2004). The uncompensated appropriation of these knowledges for the purposes of profit-making is often called 'biopiracy':

> … it is a practice through which researchers or companies illegally utilize the biodiversity of developing countries and the collective knowledges of indigenous peoples or peasants, in order to develop products and services that are commercially and/or industrially exploitative without the consent of their creators or innovators (Delgado 2004, 1).

Despite an extensive literature on the subject of 'biopiracy' it has rarely been been integrated into a general approach to capitalist exploitation. An example of this is Liaudat's (2014) beautiful study of the exploitation through reproduction of

Guaraní knowledge about *káa hée* (known as stevia). Here one of the two typical issues related to the exploitation of traditional knowledge can be observed: on the one hand, the processes of translation are protracted over an extremely long timespan; on the other hand, the knowledges with subjective and intersubjective bearers (for example, about the sweetening properties of the plant, but also about how to use it, its place in a belief system), are associated with knowledges with a biological bearer (the plant's genetic properties). Thus the exploitation through reproduction requires multiple translations. The Guaraní translated some of the plant's properties into some subjectivities, and then into intersubjectivity. Towards the end of the nineteenth century a scientist translated those knowledges into his subjectivity, and later into knowledges codified as a scientific paper. Simultaneously, the plant itself was reproduced in its biological bearer in places geographically distant from its native habitat, first for scientific purposes and later for commercial ones. In turn, at some point during the twentieth century these knowledges were translated into a technology: a sweetening product and along with it the patenting process (which implies a new codification).

With regards to regulatory issues, the exploitation through reproduction of traditional knowledges proceeds typically, although not necessarily, in a context in which the patenting of biological material is permitted and/or in which traditional knowledges are not specifically protected.[222] In some manifestations, copyright systems (that do not permit, for example, the registration of rhythms or harmonic sequences, and previously did not allow the registration of melodies that were not translated onto staff paper) have enabled the exploitation through reproduction of popular music from around the world. As in the case of knowledges carried by the subjectivity of physical workers, here as well the status of 'knowledge' (academically attained, scientific erudition) is often denied to knowledges acquired or disseminated outside of the sphere of formal education. Once again, this denial should not be viewed so much as undervaluation, but above all as an ideological means to cheapen and silence its uncompensated use by companies.

The other form of exploitation through reproduction that usually occurs outside of the working hours of the exploited subject that we wish to highlight here is that related to the production of knowledges codified as digital information during free time, which in previous studies we called 'informational cognitive exploitation' (Kreimer and Zukerfeld, 2014) or 'inclusive appropriation' (Zukerfeld 2014a). The emergence of this form should be contextualised in the framework of informational capitalism. Indeed, widespread opposition to the recent and dramatic expansion of intellectual property – and particularly to copyright transmogrification – (Zukerfeld 2010, volume III) helped to boost the diffusion and legitimacy of concepts such as 'free knowledge', 'intellectual commons', 'open access', and 'p2p production'. Along with the emergence and growth of the General Public License (GPL), Creative Commons (CC), and other licenses, this phenomenon has had a well-known consequence: the growth

of a quasi-public sphere of non-commercial informational goods[223] (Benkler 2005; Ostrom and Hess 2006; Bauwens 2006). Nevertheless, the flows of 'free knowledge' also enabled the development of a (partially) unexplored region of the private and for-profit sphere. A new kind of business method is being shaped, and the management literature has already offered a warm welcome to this novelty (Tapscott and A. Williams 2007; Anderson 2009). It is based on the disguised exploitation of unpaid digital knowledge, carried out mostly during free time, for non-commercial purposes. This exploitation aspect has only recently received specific attention (Terranova 2000; Pasquinelli 2008; Petersen 2008; Van Dijck and Nieborg 2009; Andrejevic 2011; Fisher 2012; Ross 2013; Rey 2012; Fuchs 2013, Scholz 2013). However, these valuable studies feature several limitations.[224]

This form of exploitation through reproduction is expressed in three forms of informational goods: software, content, and data (Zukerfeld 2014a). The first concerns *free software*. Collaboratively produced for the most part during free time and regulated by licenses which permit their use, copying, and modification, free software can also be legally used by companies for profit with no compensation given to the community of producers. Typically, IBM and HP have benefited from the unpaid knowledge of thousands of workers who developed Linux, the most efficient operating system. These corporations copy and utilise it, with slight adjustments, in the hardware they sell and save themselves the costs of licenses that the use of other operating systems, e.g. Microsoft Windows, would entail. The second type concerns *content* (music, texts, images, videos). The typical example is video sites like YouTube that profit from the advertising attracted by the content that users upload without profit-making intentions (Dolcemáscolo 2014; Yansen 2015). The third type concerns the reproduction and exploitative use of data. This does not refer to the problem of the violation of privacy etc., but to the aspect specifically linked to exploitation: companies like Google and Facebook freely collecting data from user activities and profiting from them (Reischl 2008).

The *normative knowledges* vary slightly for each of the three forms of informational goods. In the case of free software, it is framed within the GPL license (that has contractual scope) and copyright legislation. Such a license consists of the owner *ceding* some of their rights granted by law with the effect of concretising the 'freedom' of the creation. It therefore permits, besides modification, copying, distribution etc., its for-profit use without the authorisation of the authors or any kind of monetary compensation.[225] It is in this sense that, continuing in the vein of Marxian paraphrasing, we describe these knowledges as 'doubly free' (Zukerfeld 2014a). As regards the contents and data, another normative instrument becomes particularly relevant: the 'terms of service' that are accepted with a click. Such contracts facilitate the business of data for firms such as YouTube, Google, or Facebook, despite these contracts sometimes coming into conflict with local legislation.

As for translations between different bearers, in this case the knowledges from programmers' individual subjectivities are translated into objectified informational goods. These goods, of course, undergo many types of translation, but always with digital information as their bearer: fragments of code are combined with new ones and create a software programme; later this software is adapted and the name is changed. Videos to which advertising is added, data combined with other data. The digital bearer is, of course, not a mere detail: it enables copying with close to zero costs, spatial distribution across the internet, etc.

In addition to the generic division presented thus far in relation to labour processes, exploitation though reproduction has hybrid forms. One of them, for example, concerns scientific knowledges in situations in which they are produced by researchers subsidised by the state, but in which the findings of the research are developed and eventually patented by companies that are often foreign. In these cases those directly disadvantaged by exploitation through reproduction are not necessarily the scientists. These receive a level of income from the state which – for the time being – does not usually bear any direct relationship with the commercial usefulness of the knowledges they produce. Furthermore, they can cede the knowledges to companies with the aim of attracting flows of attention, invitations to speak at conferences and publication opportunities, in other words, different forms of recognition IK (Kreimer and Zukerfeld 2014).

5.7.3 Exploitation Through Attention

Exploitation through attention is of a different nature to the two previous modalities and is possibly the most distant from the usual notion of exploitation.[226] This is a type of exploitation that occurs mainly outside of working hours;[227] the exploited usually have a relationship of externality with the company that exploits them. Additionally, as a general rule monetary exchanges are not implicated in the relationship and it is not at all clear that the exploited carry out any type of 'work'. However, all the requirements of the definition of capitalist exploitation may be fulfilled if the digital information, that is the informational goods received by the exploited, have a lower value than the attention, which they give in return. Of course, the distinctive feature is that in comparison with the other types of exploitation, the direction of the flows of knowledge is reversed: capital profits from selling the cognitive *storage* capacity of the exploited, the space to which the captured attention admits access. In this way two classes of informational goods are translated to the fertile subjectivity of the exploited subjects: advertising (the currency they pay with) and the contents and software they use (the currency they receive).

Guasuncha, (now) unemployed, spends her free time watching soap operas, chat shows and some cookery channels on TV. She is enjoying the rest, but

her meagre redundancy pay imposes a short timespan on this idle interlude. Being neither passive nor lazy, she uploads her CV onto internet platforms dedicated to human resources, she joins Facebook groups related to culinary activities and she even occasionally watches videos about some recipe or another on YouTube. Job offers are not quick to appear, but Guasuncha builds a 'social network' of 'friends' with whom she shares interests and, significantly, she starts to receive (via emails and adverts off the websites she frequents) all kinds of publicity linked to her interests. Offers of herbs, spices, and oils, which she samples one by one and then discusses her evaluations of them with her friends, but also offers of varied courses that promise to enhance her employability: how to prepare rapid meals for executives, chocolate desserts without chocolate, cola-flavoured poisonous drinks, and one in particular that repeatedly and systematically appears: 'scientific innovation in gastronomic practices' from the company *Cutting Edge Flavors*. Guasuncha and her friends decide to enrol. They enter a website, where a welcome video appears in which the 'flavour researcher' introduces herself stating that she is 'just a professional willing to share the science of culinary audacity with even the lay public'. '*Pride*', comments Guasuncha while scrolling to the next video. No sooner does this begin, than she goes pale upon noticing a familiar face, and then immediately flushes red when she spots a caption which reads: 'All contents of this site, including videos, images, audio, texts, the Cutting Edge Flavours logo, are the exclusive property of La Boutique Inc. according to copyright law and applicable international treaties'. After hearing the details of her violent outburst, '*Wrath*', is the relevant authorities' verdict.

The first clear formulation of the idea that advertising can, in certain cases, transmit a form of exploitation originates from Dallas Smythe, who elaborates it in relation to the analogue world of televisions and radios. In several texts, but especially towards the end of the 1970s and the beginning of the 1980s, Smythe defines the idea of an 'audience commodity'.

> Because audience power is produced, sold, purchased and consumed, it commands a price and is a commodity. […] You audience members contribute your unpaid work time and in exchange you receive the program material and the explicit advertisements (Smythe 2006, 233, 238).

Another relevant contribution, along the same lines, is from Sut Jhally (1987) who states that

> When the audience watches commercial television it is working for the media, producing both value and surplus value (Jhally 1987, 83).

With the birth of the internet and, especially, of social media sites and their intensive use of advertising, the concept of audience commodity regained force,

particularly through the work of Christian Fuchs and other authors in the field of the political economy of communication and Marxism (Fuchs 2015a, 2015b, 2013, 2012b; 2010; Fisher 2012; Kang and McAllister 2011; Lee 2011; Manzerolle 2010; McStay 2011; Napoli 2010; Prodnik 2012). This valuable literature shares various features: the idea that value production can take place outside of the labour process and the unit of production (that ties in well with the suggestions of autonomists such as Lazzaratto and Negri); the idea that 'audiences', the 'public' or internauts are exploited; a critical heterodox approach to a greater or lesser extent. However, as a whole it also possesses some rough edges which should be smoothed.

The first arises from the explicit assertion that the audience's activity is a form of work. This includes two possible objections: one is that it is an 'unproductive' activity. This assertion is refuted by several of the texts that point out the importance of audiences to the production of concrete and measurable capitalist commodities. In our perspective, the key to dismissing this objection is that the productive process produces knowledge with a subjective (and eventually intersubjective) bearer, and that there is a process of exploitation. Guasuncha, prostrate on her armchair in front of her screens, opens the floodgates of attention and participates in a productive process that facilitates the extraction of surplus value, but does this in such a way that the appearance of the process on its surface is the inversion of its essence: participation in a capitalist productive process manifests itself as the quintessence of leisure and unproductivity. The second objection is more important. This consists of the idea that work (as activity) supposes a conscious practice, a prefiguration of action, an intention engaged in production. None of this is true in Guasuncha's case. While even the most alienated of workers is aware that they are participating in a productive process, the subjects exploited through attention perceive themselves to be engaged in processes of recreational consumption. Again we come up against a key point: here there are capitalist productive processes, and therefore exploitation, but *there is no work* on the part of the exploited.

Another problem is that in the literature mentioned there is no clear differentiation between exploitation through attention and exploitation through reproduction of content and data that companies like Google and Facebook conduct. However, both modalities are distinguishable and, moreover, if they are treated as a homogeneous block it is not possible to properly appreciate the difference, in terms of exploitation, between a traditional television producer and a company like Facebook. Guasuncha is exploited through attention when she consumes adverts on the television. However, the platforms she uses on the web combine this exploitation with the extraction of data (that Guasuncha legally accepts, albeit unconsciously, with a click) and exploitation of content. In effect, while the contents of chat shows, for which Guasuncha is willing to consume advertising, are the fruit of a labour process (at least, there is a swarm of hosts and panellists, opinion merchants and celebrities who receive payment), the

gossip she obtains from her Facebook groups is elaborated by the same social network of 'friends' who, naturally, do not receive any income in exchange for their generation.

A third question it is important to clarify concerns the relationship between time and knowledge in this modality of exploitation. In the case of television, but also for YouTube, Facebook, news websites, free apps for mobile phones and other software programs, the subject exploited through attention feels that she receives a quantity of informational goods that she enjoys for proportionally lengthy time periods, while as compensation she must consume advertising for a much reduced amount of time. Although this latter quantity is increasing and is, above all, difficult to measure in contexts in which advertising appears in diverse and simultaneous forms (pop-ups, marketing publicity on different areas of the screen, product placement on the television, etc.), the equation does not seem to resemble the character of exploitation: more time of the desired information than the non-desired is received, therefore, the balance is positive and there is no exploitation. The error in this reasoning which denies there is exploitation arises, once again, from forcing this reflection onto the Procrustean bed of *time*. In fact, what the E companies concede is not time but access to informational goods with reproduction costs tending towards zero. The costs of those goods have no relation of equivalence with the time taken to consume them. It would be another matter if the case were a theatrical play or a musical for which the only admission was the consumption of advertising. In that case perhaps it would make sense to compare both times as an approximate measure of the values exchanged. However, the exploited subject concedes her attention time that, unlike the informational goods, is of a scarce nature. As pointed out above, both things are in fact related: the superabundance of informational goods makes a prized good of human attention in informational capitalism. In turn, the attention of the exploited subject is far from having close to zero marginal costs. The cost of receiving a new advertisement (or the same one repeated) does not necessarily decrease. Furthermore, the storage of the knowledges that she receives in her mind, in her subjective knowledges, occupies valuable and limited space. These are knowledges that must be connected, at least this is capital's hope, to consumer behaviour, but at the same time, they are knowledges which block the access of alternative knowledges. In this way, the comparison between times received and conceded does not make a great deal of sense; instead the value of what is received should be estimated in relation to the value conceded, the value of the informational goods vis-á-vis the value of the attention and incorporation of the advertising knowledges.

Fourthly, objectors to exploitation through attention could remark that there is no salary. What is the significance of this objection? The argument goes that without a monetary equivalent the energy resources to replenish those spent in the productive process cannot be acquired. However, there is nothing in the definition of capitalist exploitation that obliges the compensation the exploited

receive to take a salary, monetary, form. The exploited can and often do receive the most diverse compensations, for example for exploitation through reproduction many exploited subjects receive recognition knowledge (like the free software programmers or musicians who upload videos to YouTube). However, the objection can be further refined: the use values the cognitively exploited receive cannot be exchanged. This is an important objection. Indeed, in the case of exploitation through reproduction, the recognition that is acquired among programmers or the general public, even though it is not a salary, is perfectly capable of being translated to other bearers and, with some mediations, of being utilised as a means of gaining access to goods and services. Skilful programmers may be contracted; musicians can draw in larger crowds to their concerts. On the other hand, in the case of exploitation through attention this is more opaque. In the case of advertising connected to software, there is a possibility that this software could be used as a means of labour for the acquisition of goods and services. The same occurs in the case of the TV shows through which Guasuncha learns culinary skills (or via exchanges with her Facebook friends): the informational goods received can be translated to subjective knowledges that subsequently allow her to access goods and services. But these possibilities dwindle in the case of advertising consumption associated with the reception of purely recreational products, such as chat shows (assuming that Guasuncha will not forge a new career as a panellist). What the exploited subject receives here does not enable any translation that would result in energy replenishment. In this way, a unique situation is configured. Indeed, in the definition of capitalist exploitation we stipulated the requirement for the exploited to obtain a value not less than that of the energies consumed (and not all the value of the knowledges involved). That in general is expressed in such a way that the exploited either receives some kind of resource that can be exchanged for goods and services that enable them to replenish their drained energies, or they receive those goods and services directly. However, for exploitation through attention, at least in some cases which are not at all exceptional, this does not occur. In general, the exploited receives an untransferable cognitive payment in kind, that is, a payment which cannot be transformed into energy inputs. Does this mean that the criteria of capitalist exploitation are not fulfilled? In fact they may be, because in the definition nothing related to exchange potential is required. What must be registered is that the value received by the exploited should be at least equivalent to the energy output, not that it is directly compensated. However, the fact that digital information cannot be exchanged has a crucial consequence: the value of the energies (which must always be restored) must be obtained from another source, from another productive process. Additionally, if this is closely scrutinised, this conclusion follows on from the fact that the advertising takes effect if the subject exploited through attention completes the process by, occasionally, acquiring the product. Thus, evidently there are necessary resources which the exploited does not

receive here. Therefore, in exploitation through attention we manifestly discover something which could be present in other forms. The exploited subject, typically, must be incorporated into another productive process (imagine a typical labour process) from which they obtain compensation for the energy expended in that process and the former one as well. In this way the capital that directs the exploitation through attention benefits from the fact that the capital that exploits through alienation pays for a whole day's energies and only utilises (generally) some of them. Reciprocally, the capital that exploits through alienation can proclaim that aspects surpassing the mere physical reproduction of life are included in the salary, encompassing the cognitive aspects which are returned to the capitalist who exploits through attention.

This leads us to observe a significant phenomenon: there may be asymmetry between the exploiter and exploited in the sense that the former collects all the surplus value from this productive process (exploitation through attention), while the exploited do not gather the resources they need to reproduce themselves from this productive process.

Finally, in terms of cognitive materialism, the subject exploited through attention unquestionably participates in a capitalist productive process. This process includes capitalists and workers from internet sectors and the entertainment industry (who are part of labour processes) but crucially, also the public who effectively contribute energies and knowledges (although without the consciously oriented activity that work supposes). This happens under the form of attention, and in exchange a bundle of digital information flows is received: applications and other software, access to internet platforms, television and radio programmes, etc. The value of what is received is extremely modest (because the marginal cost of its production, of offering it to an additional user) tends to zero. But the energy consumption of the spectator or internaut is also very modest. There are no great energy expenditures to replace. Here the surplus value does not arise from the knowledges that the exploited was already carrying, but from those that they end up carrying after their participation in the productive process.

Naturally, as in any of the other types of capitalist exploitation discussed, the existence of exploitation through attention cannot be confirmed for each particular case *ex ante*. In each specific situation both values would need to be compared. However, at an aggregate level, it seems plausible that companies such as television production companies or Google obtain part of their profits from this form of exploitation. For each individual situation, the fact that both the value received and that conceded, and the energies and knowledges involved represent tiny quantities makes it difficult to apprehend this nanoexploitation.

However, a decisive element is that the companies based on offering free software and contents (analogue and digital) through a recourse to advertising have prospered for decades and that, furthermore, in an attention economy in

which Google is above all else a vast advertising business, for those who wish to study the functioning of capitalism it would be a grave error to disregard an analysis of exploitation through attention.

To conclude, below the three forms of capitalist exploitation are presented. Table 5.2 provides a comparative summary.

Exploitation through alienation	**Exploitation through reproduction**	**Exploitation through attention**
The **energies** and the **knowledges** of the exploited are translated by **objectification** in the **product** of labour whose ownership is in the hands of the capitalist.	The **knowledges** of the exploited are translated by **codification** (with a possible transitory passage through subjectivity) (in)to different forms of **information** whose ownership is in the hands of the capitalist.	The knowledges administered by the exploiters, generally digital **information**, are translated to the **subjectivity** or **intersubjectivity** of the exploited.
The capitalist obtains labour **time** (energy + knowledge). This time can be inside or outside the productive unit, but the capitalist appropriates the fruits of the labour time.	The capitalist acquires ownership of certain forms of **knowledge** (produced over longer or shorter time spans, within or outside of the working day).	The capitalist obtains **human attention time** in order to inoculate certain **knowledges** (generally outside of the working day).
The capitalist pays, usually in monetary terms, for the cost of the **energies** necessary for the reproduction of the worker.	The capitalist pays in monetary or, more commonly, in non-monetary terms (such as recognition knowledge).	The capitalist pays in non-monetary terms (with access to contents or software, whose monetary cost is lower than that of attention).
The commodity (or its intermediary products) that arises from the productive process (a good or service) is alienated and erodes with consumption, meaning that the identical repetition of the productive process requires the subject be exploited through alienation again.	The knowledges (subjective or codified as information) are not alienated (they do not erode with use), so the exploited subject they have been extracted from is not generally necessary for the repetition of the same productive process.	The commodity is an accumulation of attention, and is consumed with its productive use. This means that the identical repetition of the productive process requires the subject be exploited through attention again.

Table 5.2: The three types of capitalist exploitation.
Source: prepared by the author.

Naturally, a theory of exploitation is linked to a theory about stratification and classes. The next chapter will focus on this area. However, before that we should introduce a comment that frames this link, relating to an asymmetry between capital and labour. In effect, any of the three forms of exploitation and their combinations can define one of the capitalist classes. However, in the case of the working classes, what defines them is above all the link between the forms of exploitation and the reproduction of their living conditions, that is to say their integration into productive processes that permit them to gain access to basic reproduction of energies. Therefore, it is exploitation through alienation and exploitation through reproduction that are associated with labour market insertion and determine membership of the working class. This does not prevent these subjects from being exploited in a capitalist mode in other productive processes.

CHAPTER 6

Classes: A Theory from a Cognitive Materialist Perspective

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6.1 Introduction: The Need for a Theory of Social Classes

It is difficult to imagine a more natural subject for a social scientist than social stratification: natural in terms of being proximate, but also indomitable. In the first sense, it is clear that the organisation of society into groups whose members present certain affinities between them, as well as particular divergences, is a universally accepted phenomenon. In fact, social stratification is one of the few themes in which social science finds it easy to make contact with the average person in the street. In the everyday speech and practice of this individual (who knows little to nothing of Durkheimian solidarity, Weberian typologies of action or Marxist surpluses), the notion of class pulsates. Hence, every subject who appears before his/her gaze triggers an instantaneous and profound examination: their wealth and power, their work and their way of looking at the world will be weighed up and they will end up being inscribed ineffably in this or that region of the class register.

But the problem of social classes is also natural, we claim, because it is far from having been overcome by social sciences. In effect, despite this theme

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having been approached by all the classics there is not yet anything resembling a consensus around the problematic. An analysis of the extensive bibliography about the specifics of this question is not within the remit of this text (see Wright 2015). However, we should point out that our intervention is not accidental. It emerges from a period in which the notion of class and, indeed, the idea of social strata, have been blurred in the social sciences and humanities. In this era of networks, rhizomes, multitudes, social movements, citizens, etc., class divisions are dealt with derogatorily, as a hindrance coming from outmoded totalising theories; as a simplification that commits outrage against the diverse multiplicity of Being. Naturally, it is the history of capitalism (and of its classes) which explains these trends and not the other way around.

6.2 The Proposal: Classes from an Abstract Perspective

Going back to cognitive materialism concepts introduced in chapter 1 of this book, we need to highlight that both entities (physical and knowledge matter) combine in a variable way in goods and subjects. In such a way that every good (and every subject) is linked to capitalism in two ways: both by some form of regulation of their physical aspect and also in some way relative to their cognitive side.[228] To extrapolate these ideas into a theory about social stratification we must clarify some notions about different types of resources and access to them.

6.2.1 Types of Resources: PIR and KIR

Evidently the resources contain variable proportions of physical and knowledge matter, as a result of which the weight of both regulatory methods will be varied. Both types of rights are applicable to a book, for example, but those pertaining to intellectual property, those related to the cognitive aspect, are usually more economically relevant than those pertaining to ownership of the pages, covers, etc. – in other words the physical property of the physical object itself. On the other hand, intellectual property carries less weight in the case of a table (generic) in which the most relevant regulation is that related to physical ownership of the object.

Now, beyond resources in general, for our objectives it is necessary to take into account the productive resources, that is, those which are usually called means of production. We would like to analyse two kinds: physically-intensive productive resources (PIR); and knowledge-intensive productive resources (KIR). But, how do we understand which aspect is the more or less relevant? Although the question seems intuitively simple, it is actually complex in analytical terms. There are two variables which can be confidently used to differentiate PIR and KIR:

i. The relative costs of physical and knowledge matter contained in each unit of the resource, that is to say, the proportion of production costs for the resource in question.
ii. The proportion of effective use of the physical and knowledge matter of the resource in question in the production process in which it functions as a means of production.[229]

Two further clarifications are necessary with regard to these conceptualisations. The first is that we are discussing proportions of physical and knowledge matter, and not absolute quantities. This implies that there could be KIR that contain and use lower magnitudes of knowledge than some PIR in cases when the former have recourse to tiny quantities of physical and knowledge matter. Take the example of the productive process in which a worker uses a computer merely for the purposes of inputting data. Here the worker is a KIR, because in spite of the fact that the cognitive mass put into motion by his or her activity is very small, the expenditure of energy is even lower. A contrasting case would be a highly qualified sportsperson bearing a great deal of knowledge who could be a PIR due to the expenditure of vital energy predominating in the particular productive process they are involved in.

The second clarification points to the idea that this conceptualisation can only be made in a historically situated way, which is to say synchronic and comparative. A 'manual' worker at the beginning of the twentieth century (who we imagine exhausting their vital energies to the limit and with a cognitive heritage marked more by experience than by the complexities of a prolonged apprenticeship) is a PIR, while a cognitive worker of the period, such as a journalist, is a KIR. This does not mean that if the comparison were made in a diachronic way that the result would be the same: the 'manual' worker of the twentieth century compared to a hunter from a prehistoric tribe is, of course, a knowledge-intensive resource. For this reason the classification only holds for historically determined situations.

6.2.2 Types of Access: Exclusive, Non-exclusive and No Access

We will now move on to look at the types of access[230] to these productive resources.[231] In addition to the exclusive regimes through which subjects either do or do not have access to goods, these goods can be regulated by intermediary methods. In effect, goods can – and usually do – have one (or two) of their aspects regulated under a non-exclusive regime (in other words, not privative). For example, a recently published book in a public library has its material component covered by state public property even though its intellectual aspect is subject to copyright law. The reverse happens in the case of the generic table mentioned earlier: the stored-up knowledge matter this contains is within the public domain, while its physical matter aspect is subject to private ownership.

In a more systematic way, if we imagine the relationship between a determined subject and any productive resource it is useful to present three situations, three types of access.

To recap directly from p. 109, the first is exclusive access: it relates to the property forms in which the subject is owner of the resource and utilises the possibility of excluding third parties as a means of obtaining an economic advantage. Physical private property and intellectual property are some current forms of this type of access, although not the only ones.

The second is non-exclusive access: it relates to the possibility of the use of a resource of which the subjects using it are either not the title-holders – but have acquired a use-right – or being the title-holder use it for themselves – without obtaining profit from the use of third parties – without availing themselves of the possibility of exclusion as a means by which those third parties are subsumed within it.

The third is the condition of no access: this usually indicates situations in which the subject gains access to the resource in question in invalid or proportionally insufficient quantities to be able to have an effect on a determined productive process. The condition of no access implies that the resource is not useful for the subject in question to differentiate themselves from other subjects and to compete for consumer goods by virtue of this resource. In exceptional circumstances, this category refers to situations in which the subject gains access to the resource, but for whatever reason doesn't use it as a means of production in any significant way.

The main argument of this chapter is that, combining these forms of access, which include but exceed ownership, with the two types of resources, which broaden the typically considered variables, we can obtain a potential model of diverse social groups. A model that, at the same time, gives an account of the complexity without losing the antagonistic dimension that confronts owners and non-owners of resources, exploiters and exploited, and which also allows us to think about the various historical stages of capitalism.

6.2.3 The Abstract Schema of Classes

In effect, combining the three modalities of access to both types of resources we can obtain an abstract and, within capitalism, a-historical schema of social classes. This is a preliminary but fundamental step before observing how each category takes a particular and variable physiognomy, how history moulds it and reshapes it again and again in its transformation. We will look at not only how these classes have adopted different forms and roles throughout history, but also how they have been variously described by authors from heterogeneous time periods and geographical locations. Each period will see the rise of some classes at the same time as the silent or explosive decline of others; the

period will lend its name to some of them, and at the same time those classes will name the period after themselves.

Naturally, the distinction between an abstract schema of social classes and a concrete one is not a novel innovation of this chapter. However, a contribution that we do seek to make is to take a step towards the systematisation of this distinction and to theorise about what is invariable and what is contingent in the history of classes in capitalism. That said, we can consider the schema presented in Table 6.1.

At the most general level, we must distinguish between those who obtain their income from some form of exclusive access or property and those who, lacking exclusive access, must earn it from their work.[232] The former group, who we generically call capitalists includes, in addition to capitalists strictly defined (1), two sub-groups of the same: cognitive capitalists (2) and physical capitalists (4). Additionally the extended capitalist family includes two types of rentier: cognitive (3) and physical (7) (the latter, unlike the former, do not in any way participate in the productive processes to which they lend their resources). For their part, the workers include principally the cognitive workers (6) and physical workers (8), but there are also self-employed workers (5) and excluded workers (9). We agree with several theories regarding the fact that capitalists and workers are linked, as a whole, by relations of exploitation, as discussed in chapter 5.

Perhaps it would be advantageous to specify the scope of each of these abstract categories.[233] However, due to space constraints, we prefer to allow the historical transformation to help us trace the contours of each. Throughout the remainder of this chapter the reader will repeatedly see in parentheses the numbers that identify each one of the classes from our abstract schema. In doing so we will relate determined concrete groups situated in specific coordinates with the generic classification we have presented.

		Access to Physical Intensive Resources		
		Exclusive	Non-exclusive	No Access
Access to Knowledge Intensive Resources	Exclusive	1. Capitalists	2. Cognitive capitalists	3. Cognitive rentiers
	Non-exclusive	4. Physical capitalists	5. Self-employed workers	6. Cognitive workers
	No access	7. Physical rentiers	8. Physical (manual) workers	9. Excluded workers

Table 6.1: Abstract schema of classes.
Source: Yansen and Zukerfeld 2016.

6.3 From Feudalism to Mercantile Capitalism

To understand capitalism we have to start from the feudal stage that preceded it. To do this, we turn back to the schema presented in Table 6.1, but with some caveats. The first is that we are not yet dealing with classes, given that we maintain the Marxist idea that classes, in the strictest sense, appear with capitalism (Marx and Engels [1846] 1970; Giddens 1973). The second is that as a consequence, specifically capitalist social groups (1, 2 and 4) do not appear in any significant way. However, social groups composed of rentiers and workers do appear. The third is that, once we bear the typology from Table 6.1 in mind, it is helpful to complement it by giving an account of specific periods with other charts that allow us to visualise the relative power and quantity of the different strata.

It is usually claimed that the fundamental contradiction in the feudal stage is between the feudal lords and the serfs (Marx and Engels [1846] 1970). While the former are merely physical rentiers (7), landowners and warlords, and removed from the productive process, the latter are a specific form of physical worker (8), especially agrarian workers. Put simply, in a rural economy the serfs carry out tasks which are based much more on the consumption of their energies than on the application of their mental faculties. However, this fundamental contradiction is very far from being sufficient to understand the social stratification of the period.

Meanwhile, the apex of the feudal pyramid belongs as much to the landowners as it does to the proprietors of the soul; as much to feudal powers as to ecclesiastical powers. In fact, the friendships and conflicts, the circulation and splits between them populate the surface of the history of feudalism. Here a fundamental feature of our schema appears: the religious structures, as much as those of the feudal estate, base their power on the monopolisation of resources: here not the land or military forces (which come to them as an added extra), but knowledge. Indeed, the clerical strata are nothing more than cognitive rentiers (3), wealthy proprietors not only of knowledge related to the afterlife, but also a broad range of secular knowledge; legal proprietors of a good part of knowledge as a whole.

More important is to show that, with the transformation of feudalism, between the lords and the serfs new lateral categories increasingly emerged. Categories that share an origin: they begin as serfs who in some way manage to make themselves wholly or partially independent from their lords. Some of these serfs, with the consent of the local noble, become small-scale independent farmers, exploiting communal or even privately owned parcels of land. These proprietor or smallholder peasants from the commons who have a non-exclusive access both to cognitive as well as physical resources are a type of self-employed worker (5) in our schema. That said, other serfs, far from receiving the consent of their lord, flee the estate and take refuge in the cities. There, some

remain without distinctive cognitive resources, and offer their physical energies as day-labourers (8). Others fall into vagrancy (9). But a large quantity of these escaped serfs, or rather their children and grandchildren, will arm themselves with practical knowledge. Their families and their bodies will put these valuable skills to use in order to put clothes on someone else's back. At some point, guild organisation will be born as the legal form that will regulate those cognitive monopolies,[234] and at least three types of individuals are integrated into it. At the bottom of the corporative pyramid are the apprentices, dispossessed of physical resources to strike out on their own, but with increasing knowledge. They will become, therefore, the cognitive workers (6) par excellence of this period. The clerks succeed them in rank: having certificated skills and, usually, acquiring some tools, they will have a certain level of independence (5) that will make them equivalent to free proprietor peasants. At the top of the guild hierarchy will be, of course, the masters. Holding the title to craft knowledge and with the ability to exclude, they are the ancestors of the cognitive capitalists (2). Of course, the relative fluidity of movement between these areas of artisanship makes the separation of these groups into strictly separated classes unjustifiable. We are dealing with groups with often contradictory interests between and among them, but also with a series of vigorous instrumental and affective connections as well as the bonds of tradition.

But to understand the progressive transformation of feudalism into mercantile capitalism, it remains to observe the appearance of a key element: the merchant class (4). Given that exchange was geographically limited, confined to the city and its environs, those who would liberate it were destined to expand the world. Indeed, the merchant class of this period is characterised by handling physical resources in space, by transporting them towards itself and its commodities. This class still hasn't managed to make these materials and energies submit themselves to its domination in the factory (as the capitalists will); but it does manage to transport itself with them, ploughing the seas and oceans, bringing back marvels from the Orient and from the Indies.[235] It is through the action of this class, along with a multitude of other factors of course, that mercantile capitalism starts to take shape.

Before moving on, we here present a graphical summary (which seems static but should be understood in relation to the transformation we have suggested) of the social groups from the period we have discussed. The intended purpose of this is to arrange the stratification of social groups from this period in relation to the criteria proposed by this chapter, emphasising by visual means the existence of a determined hierarchy and its respective relationship to power. If, in turn, we were to think about the chart that represents the typology in an abstract way, we can observe that there are still no strictly capitalist classes and so category 1 would be empty. Note that in this chart we represent, to the left, the social groups distinguished by their access to PIR, while to the right we locate those that owe their status to their access to KIR.

Nobility (7)	Clergy (3)
Merchants (4) Independent peasants (5)	Guildmasters (2) Journeymen (5) Apprentices (6)
Serfs (8)	Urban labourers (8) Vagrants (9)

Table 6.2: Classes towards the end of the feudal period.
Source: Yansen and Zukerfeld 2016.

6.4 From Mercantile to Industrial Capitalism

Mercantile capitalism as a category is not clearly defined. Leaving to one side the clarifications that Sombart, Braudel and other authors introduce, it suffices here to note that the term underlines the vigorous activity, or rather, the economic leadership of the mercantile groups (a kind of physical capitalists). More precisely, it aims to highlight the systematic and rational profit motive which drives them. However, naming this period 'capitalism' is a risky business, since the capitalist organisation of production appears at the end rather than the beginning of the period. For our practical means, we will use the term mercantile capitalism to refer to the period between the decline of the feudal mode of production and the consolidation of industrial capitalism; roughly between the fifteenth and the middle of the eighteenth centuries. In fact, rather than seeing it as being a period of stabilisation of a new order, in our perspective it is more useful to understand it as a period of transition, of preparation of the forces that would lead to industrialism (although, clearly, this was not an inevitable result). In this period the clear division between capitalists and workers, with their respective varieties, took shape. At least five intertwining processes must be named: (i) the expropriation of the land, particularly through the process of *enclosure* of communal land; (ii) the breaking up of the guild crafts; (iii) the emergence of intellectual property laws; (iv) the fall of the monarchic/feudal order; (v) the ascent of instrumental rationalism, especially around modern science. While the first three are related to normative intersubjective knowledge and to regulations, the last two are linked to axiological knowledge. Here we can only develop some of these processes, but the rest must not be overlooked.

The process of expropriation of the land was eventually helped by a specific type of regulation: the 'Bills for Enclosure of Commons'. The *enclosures* themselves began in England between the end of the fifteenth century and the beginning of the sixteenth, were focused on the countryside, and were stimulated (in the case of England) by the blossoming of the wool industry. This process meant, above all, the eviction of the peasants who were previously relatively

independent (5). These free peasants in some cases became the agricultural proletariat, rural workers, employed by the other class that, although it had existed in earlier epochs (Marx [1867] 1990), was now gaining strength: that of the small capitalist farmers, physical capitalists (4) who organised agricultural production with a view to attaining profit by the means of capitalist exploitation. This whole process, particularly the equation of the small capitalist farmers, was favoured, among other factors, by the relationship between contracts stipulated by long terms (Marx suggests that 99 years was most common) at fixed prices, the depreciation of gold – occasioned by the arrival of vast quantities of the metal brought from the Americas – and the rise of cereal prices.

Of course, at the root of these expulsions, legal or not, violent or peaceful, lies the tendency of the nobility to become active rentiers, maximizing the profit they could obtain from their land (7), renting it to the free farmers instead of leaving it in the fallow economic state of the commons. As is well-known, the landed nobility did not only drag the collectively owned land into the world of commodities; they appropriated for themselves the land owned by the church and the monarchy at the same time as these institutions were losing power. Naturally, this process eroded not only one aspect, but the entire feudal order itself. The relations between lords and serfs, the non-commercial bonds between subjects, etc., were inexorably dissolving. Regardless, here we are still in a transitional stage – thus the ambiguous term that gives its name to this sector: they still remain the nobility (we are not yet dealing with subjects that have attained their land in the clamour of the market); in the subsequent period they will simply be landowners.

But returning to the peasants freed both from feudal shackles and from the means of production, a large bulk of them could not be absorbed by agricultural production. It is precisely these masses who gave the impetus to capitalist manufacturing as Marx has shown in detail. That is, manual workers dedicated to more or less basic artisanal activities; but manufacturing workers after all, dependent on the means of production (especially on the raw materials) belonging to other humans: the manufacturing capitalists (4). These are a type of physical capitalist for the simple reason that their ability to exclude lies in the physical resources, and not in any knowledge they hold. In fact, these capitalists have no reason to possess any skills relating to the productive process, and in many cases are much more closely related to the merchant than to the master craftsman. Particularly at the beginning of the eighteenth century, these manufacturers assume the initial organisation of capitalist production. They adopt, in general, the *putting out system*, a system in which workers produce in their own homes or in workshops without yet being placed under the direct control of the capitalist. Of course, this source of production contributed to and benefited from the blossoming growth of the aforementioned commercial capitalists (4) who handled the buying and reselling of the manufactured goods. The development of this group is inseparable from a new group of rentiers: the

mercantile financiers (a type of financial rentier) (3). This group is so significant that for some authors (Braudel, 1985) it is their emergence that marks the beginning of capitalism. In any case, the fact of having originated in merchant capital does not impede the class that gave birth to it from transcending, or from establishing a relationship of control over other capitalist classes.

However, this is not enough to understand the transformation of classes in this period. On the one hand, it must be added to the map of knowledge intensive activities, which are usually urban. Within these, the most notable phenomenon is the progressive breaking up of craft guild organisation. This process becomes effective in the subsequent period, through the well-known Le Chapelier Law in France (1791) and the Combination Acts in England (1799–1800). What falls apart is not so much the monopoly over certain knowledge – contrary to capitalist rationality – but the link, more contradictorily still, between guild masters, journeymen, and apprentices. The former, and perhaps the second too, established themselves as artisanal capitalists. The legal bearers of secret knowledge, possessors of specialist skills, they use that ages-old knowledge to set up workshops from which magical commodities now flow. In contrast, the old apprentices, but also some day-labourers arrived from the countryside, managed to appropriate certain techniques, becoming artisanal workers (6). That said however, the form in which the cognitive capitalists became holders of knowledge which they carried was by means of securing patents, and much later on, of copyrights.

Actually, in the period between 1474 (The Venetian Patent Act) and 1653 (The English Statute of Monopolies), positive regulations began to take shape – no longer concessions at the grace of the king, at least in theory – on exclusive and temporally limited rights over technical knowledge: patents. Starting from 1709–10 (The Statute of Queen Anne, in England) a particular type of intellectual property right over literary works would be defined, namely copyright. At the same time, there is another parallelism that contributes to the formation of the physical capitalist and cognitive capitalist classes: what happens to the monarchy – and to a certain extent to some of the aristocracy – with regard to physical resources, happens to the church with regard to knowledge. From having almost absolute control over these in the previous period, they now find themselves entangled in a series of battles that, increasingly, end in defeats. Some of those defeats are a consequence of the Protestant Reformation.[236] But the most significant are those associated with the rise of modern science, and in a more profound way, of instrumental rationality. We are not particularly interested here in the content of those scientific advances, but rather the fact that these effectively disputed the church's privileged claim to knowledge. The clerical class, as cognitive rentier, was wounded, and its European flock of faithful souls was proportionally reduced. However, the overseas conquests of the crown amply compensated for these defeats. Actually, in spite of the loss of the monopoly over cognitive resources and the emergence of other suppliers to the European market, the contribution of

Landowning Nobility (7)	Commercial Capitalists (4)	Merchant Financiers (3)	Clergy (3)
Free Tenants (4)	Manufacturing Capitalists (4)	Artisanal Capitalists (2)	
Rural Workers (8)	Manufacturing Workers (8)	Artisanal Workers (6)	
Lumpenproletariat / Vagrants (9)			

Table 6.3: Classes in mercantile capitalism.
Source: Yansen and Zukerfeld 2016.

a large volume of 'demanders' for Christianity helped to maintain the economic health of the clerical class.

In sum, it is important to stress that the process of regulation that results in the commodification of the land and other physical intensive resources takes place simultaneously with that process related to knowledge. In both cases, capitalist regulation of access appears, setting the boundaries of inclusions and exclusions, hand in hand with capitalist exploitation and expropriation. And in both cases these regulations open the way for divisions between subjects who do and don't have access to different types of resources: exploiters and exploited, expropriators and expropriated. Table 6.3 sums up the schema of classes in this period.

6.5 From Industrial to Informational Capitalism

The analysis of the development of classes over this extended period requires, at least, a division. Firstly we will discuss the period between the first industrial revolution and the dissemination of Taylorism; a 'long nineteenth century' that runs from approximately the last decades of the eighteenth century to the first decades of the twentieth. Following this we look at the period from, approximately, the 1930s until the 1970s.

6.5.1 The Long Nineteenth Century

Between the end of the eighteenth century and the first decades of the following century not only did a whole series of decisive revolutionary events take place, but also the most virulent economic transformation that humanity had ever witnessed: the industrial revolution (Hobsbawm 1988). Machines

spread, humans dominate raw materials and energies, productive processes are rationalised and the quest for profit plants its flag firmly into every summit. Capital and labour finished freeing themselves from their feudal ties, and the dichotomisation between these classes becomes hardened. More specifically, industrial capitalism implies, above all, the relations of capitalist exploitation through alienation between industrial capitalists (4) and industrial workers (8). This means, in both cases, subjects that profit (the former) or work (the latter) – with different levels of access (and exclusion) to physical intensive resources.

Indeed, mechanised industry gradually destroyed in its path all possibility of competition from those sectors of physical and cognitive capital that didn't rise on the wave of the modernisation of production, most of all in the urban environment, but also gradually in rural areas. So both small manufacturing capitalists, small capitalist farmers and merchants as well as the small artisanal capitalists, in sum, the entire group of physical and cognitive capitalists from the previous stage, who yesterday fought against the feudal fetters, today merged into the great class of physical (industrial) capitalists. Others perished on the way, becoming a part of different elements of the mass of physical workers. Thus, while in the cities the industrial capitalists progressively implemented mechanisation and appropriated a large proportion of available raw materials, in the countryside the agrarian physical capitalists had to join the old nobility that acquired the form of modern landowner (7) – rentier par excellence of the current stage – following suit by taking for themselves a good part of the land.

In a parallel way, the industrial working class (8) (Marx [1867] 1990; Coriat 1979) – the class of physical workers – expands its ranks. However, the introduction of machinery means, primarily, the translation and objectification of knowledge previously carried by the 'social brain' into technological artefacts capable of being appropriated by capital (Marx 1857/58; Coriat 1979). Of course, this is an example of what we called exploitation through reproduction in chapter 5. In this way, mechanised industry brings with it, on the one hand, the use of unskilled workers, women and children among them – 'cheap labour' (Marx [1867] 1990, 504); on the other hand, it forces out a section of the labour force that would go on to form the so-called 'reserve army of labour', that only periodically participates in production.

A description centred on industrial workers must not obscure the fact that 'physical workers' also includes many workers from (what was later called) the service sector – that grows on a daily basis in the tumult of the large cities – such as messengers, transport workers, domestic workers and so on, as well as many others in rural areas. As a group, they all share the fact of working fundamentally based on their physical resources.

The totality of these movements will have as their result the brutal elimination of the class of self-employed workers (5), up until now made up of smallholding farmers and the independent craftsperson who had survived in the

cities. This class of workers is extremely diminished in this period and will not swell in size again until well into the next period, principally with the influx of self-employed professionals. In turn, although being quantitatively less relevant than physical classes, new cognitive classes began to grow. These cognitive classes were split into two branches. Indeed, still, and up until the second half of the twentieth century, regulation of knowledge clearly differentiated between industrial creations – or economic goods – and artistic and literary spheres – or cultural goods. In this way, we find, on the one hand, a modest kind of individual *inventor* connected to the industrial revolution (2), whose profits were ideally based on the patenting of diverse types of machinery: James Watt and his steam engine; James Hargreaves and the Spinning Jenny; Richard Arkwright and the Water Frame; Samuel Crompton and his Spinning Mule are some examples. It would be years later, on the other side of the Atlantic, that this class would flourish.

In addition, another group of cognitive capitalists exists (2), dedicated to the artistic or literary spheres or that of cultural goods in general, incipient information industrialists. In fact books, newspapers and magazines, but also plays, etc., become a necessity for the cities, at the same time as the first laws of obligatory primary school education are passed, which little by little expand the market for the production and consumption of these goods.

Schools and the books that circulated at that time imbued increasingly more social sectors with varied types of subjective and intersubjective knowledge, not least among them the values and norms of industrial society (Zukerfeld 2010). Also the political and administrative class, the Weberian bureaucracies – teachers, architects and other professionals – working both for the state and for capitalist businesses, form part of this still nascent cognitariat, a group of intellectual workers (6). This stratum of capitalists and their workers represents a much larger number than the stratum of inventors, although not more important.

In summary, a group of intellectual workers at the service of a still modest but not inconsiderable cognitive capital (although also belonging to state organisations) slowly develops during the period under analysis. By the beginning of the twentieth century we will find cognitive classes – capitalists and workers – already well developed.

Finally we must observe the enlargement of the excluded (9) sector. This is fed, in this period, by the lowest category in the Marxist reserve army of labour: pauperism. 'Pauperism is the hospital of the active labour-army and the dead weight of the industrial reserve army' (Marx [1867] 1990, 707), and is composed of invalids, workers of a non-working age, the chronically ill, mutilated, etc., in sum, degraded people that, for the most part, have been dismissed from their own jobs. In this way pauperism, a typical feature of this epoch, joins the ranks of the lumpenproletariat of the previous period, which has not disappeared.

6.5.2 Maturation and Decomposition of Industrialism in the Twentieth century

As we have indicated above, this period begins with the interwar years and concludes with the global economic crisis of the mid-1970s. Generally speaking, the so-called 'Thirty Glorious Years' constituted a period of stabilisation of the salaried society, with the hallmark of the welfare state that, utilising Keynesian policies, mediates capital-labour relations (Castel 2009; Hobsbawm 1994; Offe 1996). Of course, the period continues to be hegemonised by the industrial capitalists, as a concretion of the physical capitalists (4). However, it is appropriate here to mention some widely known transformations.

Firstly, the class of 'white collar workers', as a paradigmatic type of cognitive workers (6) – technicians, professionals, scientists and administrators, but also politicians, teachers and workers in the entertainment industry – takes on an unusual quantitative leadership role (Mills [1951] 1969; Lipset and Zetterberg 1963; Bell 1973). A significant proportion of them would find a home, naturally, in the service sector, which grows progressively in this period; but another, sizeable, portion would locate itself in the industrial sector, in the heart of the factories, in a context in which access to primary and secondary education continues expanding and in which college and university education begins to take off. This tendency is, in general terms, shared by all industrialised countries (Meyer and Schofer 2006; Windolf 1992; Barro 1991). In fact, subsequent generations of the working class now find themselves in a position to be able to abandon the family tradition of manual work, to join the ranks of the cognitive working class (Castel 2009), which means the shift of a substantial mass of workers from category (8) to (6).

But, we said, also within the factories. Actually, first Taylorism and then Fordism or the model of mass production which developed to complement it, had a serious impact on the productive processes and the nature of work, decreasing the presence of physical or blue collar workers (8) and increasing that of the cognitive workers (6). In this trajectory, the loss of the monopoly over productive knowledge that industrial workers had previously held took shape. Certainly, the scientific organisation of labour produces a translation of said knowledge, from the subjectivities of the workers into the codification of corporate property in procedural manuals. This is, of course, another form of exploitation through reproduction. Later the assembly line and the conveyor belt would mean – as we had identified in the case of industrial machinery – the transference of the same to the machines, imposing a strict working rhythm onto the workers. Thus, while the diversification and increasing complexity of industrial productive processes advanced, work in the factories depended less and less on the physical energies of the workers and increasingly on machines and the knowledge of cognitive workers.

Secondly, in this period, many workers, above all of the cognitive variety (liberal professionals, Bell 1973), but also – although to a lesser extent – physical workers

(taxi drivers, gas fitters, etc.), would converge in the class of self-employed workers (5). Although the growth of this class can be located, primarily, towards the end of the twentieth century, we can observe that in the current period it has begun to slowly expand again. Thirdly, the excluded (9) class is greatly reduced and re-signified thanks to the aforementioned welfare state. However, what we can call the marginalised class persists. The terms 'marginal mass' (Nun 2003) or 'marginal pole' (Quijano 1971), although with differences, refer to a mass of unemployed people who, both in urban and rural areas, seek refuge in subsistence activities such as waste collection, street selling etc. All are precarious activities that require only a negligible level of access to PIR and KIR, but that actually experience a certain containment by the state (Castel 2009). Fourthly, the cognitive capitalist class (2), as in the previous period, is still constituted by capitalists who profit from two different kinds of knowledge: those who profit from knowledge with an industrial application, and those who profit from artistic or literary works. The former and the latter, the stratum of inventors and individual authors identified previously, start to grow as corporate actors and to invest an ever increasing quantity of resources (in their R&D departments in the case of the former, see Drahos and Braithwaite 2002).

Thus, on one side the industry of radio, music, books, cinema and television, reaching mass audiences by the end of the period, ascends vertiginously. On the other hand, for example, the chemical (with its diverse facets) and pharmaceutical industries boom as well.

Next, it should be noted that in this period, many of the aforementioned cognitive capitalists incrementally start to position themselves as the pure capitalist class (1), that is as cognitive and physical capitalists combined. The Ford Motor Company for example, starts to have its physical assets closely connected to the ownership of industrial property rights: brands, designs, patents. Or AT&T industries that on one side is based on an enormous quantity of patents and rights over telecommunications, and on the other on US $5 billion worth of physical resources, and was the most capitalised company in the world in the 1930s (Johns 2010, 405–412).

Finally, in this period there is a development of the two types of rentier that merit a more detailed analysis than we will give here. Paradoxically, the most pertinent aspect is that they merge and to a certain extent become part of the same class, the analogue financial rentiers (3 and 7). That means, the financialisation of the economy by means of the mass expansion of shares, government bonds and other financial instruments, partially dilutes the origin of their assets. In the secondary market, the holders of these instruments don't differentiate if their rights pertain to cinematographic works or mineral resources. We label them with the adjective 'analogue' to highlight that their operations depend on technologies of processing and storing information of the following type: the telegraph and the telephone, paper and the typewriter, the pen and the banknote. This, of course, will change in the subsequent period.

6.6 Classes in Informational Capitalism

This section covers a period that begins halfway through the 1970s and takes us up to the present day. The first classes that concern us here are, naturally, the cognitive workers and capitalists. These take the specific form of *informational* workers and capitalists (6 and 2). What do we mean when we refer to informational work? An activity in which the worker has a PC, tablet, netbook – or something similar – as a principal work tool and whose principal output in the productive process is an informational good – that basically produces digital information (Zukerfeld 2013). The output of informational workers could usually be reproduced by close to zero marginal costs. Thus, when capitalists buy labour time from the informational workers, they receive a product that bears reproducible knowledge. Indeed, it is not uncommon for informational workers to turn out to be exploited both through alienation and through reproduction in the same productive process.

Informational work has been measured particularly in the USA and it has been found that at the beginning of the millennium it already occupied the greater part of the work force (Apte and Nath 2007; Wolf 2006). Definitively, in its activity, access to physical ownership over the productive resource par excellence (digital technologies, with falling prices for a constant capacity) doesn't carry great costs or importance, except for their own cognitive resources applied during the productive process and now objectified in an informational good, regulated fundamentally by intellectual property.

An important point in relation to this type of worker – and that is related, among other things, to the ambivalence of their main instrument of labour – is that their cognitive resources, in contrast with the previous stage, aren't necessarily acquired in formal institutions, or rather, that these skilled workers don't necessarily have formal qualifications. The instrument of labour itself is a powerful tool for the incorporation of informal knowledge (through tutorials, videos, forums etc.). In the same way, the previously mentioned ambivalence of this tool is manifested in its potential to construct networks of recognition, or social capital in Bourdieu's terminology (1985). At the same time, it is important to note that – unlike the workers of the previous stage, liberal professionals and physical workers in the service sectors – informational workers have a smooth path to freelance work (5). Certainly, the falling prices of the means of production such as the computer, are a defining factor. But not only that: the infrastructure that an informational worker requires (space, energy, devices of a different nature like modems, telephones, etc.) is easily assimilated into either the domestic environment itself or a less costly (in relative terms) space. Naturally, the conditions of the infrastructure, although in different proportions, are also modified in the case of companies.

In the capitalist sphere, the most profitable economic activities are concentrated in the exclusive form of intellectual property, but in addition, these are

the most diverse: the pharmaceutical and biotechnology industry, the audiovisual and music content industry, software production and informatics services; all these productive areas come together in the stratum of informational capitalist (2), that is constituted as a hegemonic fraction of capital during this period. Said heterogeneity and unity corresponds, naturally, to the marriage that the institution of intellectual property had managed to consummate between knowledge with an industrial or technological application and artistic knowledge, that up until the 1970s had not combined. Indeed, just as the access to goods regulated by private property loses significance in the face of access to knowledge for the informational worker, this type of capitalist is not concerned with monopolising physical intensive resources, but rather, and above all, knowledge intensive resources. In this regard, Nike is a good example, not owning 'a single factory, or machinery, equipment or real estate property' but only intellectual property (Rifkin 2000, 32). That said, if a company like Nike represents the ideal type of informational capitalist, the case of the Ford Motor Company represents the ideal type of pure capitalist (1). Indeed, a significant layer of capitalists base their profits on patents, or more generically, on intellectual property rights over their products or parts of them and, at the same time, on the sale of these articles. So it is that Ford (but also Sony and others) own both factories and R&D laboratories. A particular characteristic that capitalists assume in this period is that if, to some degree, they need the industrial workers, they have a much greater need for the informational worker, and consequently their research departments. In fact, the product life cycle is an important factor: the profits of these capitalists come much more from new and innovative products than from the prolonged sale of a standardized product.

The quantitative growth of informational workers takes place in a simultaneous – and complementary – way alongside the quantitative growth of physical workers, particularly a fraction of precarious manual workers (8) and the excluded (9), radically increasing the polarisation between these classes (Castells 1998; Rifkin 2000; Fuchs and Sandoval 2014). The well-known fact that Nike's subcontractors utilise child and semi-slave labour to lower their costs points to this relationship between informational capitalists and workers on the one hand and precarious manual workers, on the other (Rifkin 2000, 75). This is a stratum of 'vulnerable' physical workers (Castel 2009) concentrated in the marginal elements of the productive processes, although not completely excluded from them. In contrast, the excluded (8) (Castel 2009; Nun 2003), in the present stage take the concrete form of the chronically unemployed and structurally impoverished. This social class, unlike the vulnerable group, 'are superfluous, they are not needed' (Nun 2003), but they also manifest an unusual quantitative explosion (Castells 1998). Naturally, the watershed between these two classes is very diffuse. Although nation states in different locations and decades adopt varying attitudes regarding these sectors, the most pertinent difference compared with the previous period is that the capitalist productive

		Access to Physical Intensive Resources		
		Exclusive	Non-exclusive	No access
Access to Knowledge Intensive Resources	Exclusive	1. Capitalists	2. Informational Capitalists	3. Digital Rentiers
	Non-exclusive	4. Industrial Capitalists	5. Self-employed (Informational and not)	6. Informational Workers
	No access	7. Digital Rentiers	8. Precarious Manual Workers	9. Excluded

Table 6.4: Classes in informational capitalism.
Source: Yansen and Zukerfeld 2016.

processes make do without them. Thus, whether we're dealing with subsidised poor or those completely without assistance, the productive apparatus experiences them more as a dead weight than as a source of energy.

Lastly, it remains to emphasise that digitalisation increases global integration of the cognitive and physical rentiers, between sectors and nations. No longer are there analogue rentiers, but rather *digital rentiers* who deal in informational goods: money, after all, is essentially a kind of digital information. Of course, the possibilities of an acceleration of the monetary multiplier which digital technologies bring are huge, and encourages 'rentierism' to move rapidly from one productive sector to another.

In sum, this chapter has attempted to put into motion a series of categories. Here at the end of our trajectory we consider it appropriate to point out some of its limitations. Indeed, to be able to give an account of the historical and conceptual exercise which we have attempted, we have evaded a whole series of important debates. For example, we did not engage with other theories about *class* and we only mentioned in a very incomplete way which ideas we have borrowed from those theories and which not. We have not included any review of the literature about social stratification and our historical references have been brief, simplistic and overly accommodating. Likewise, we have not engaged enough with the issue of exploitation, its different kinds according to cognitive materialism and its links with classes. With these and other issues we have treated certain questions as axiomatic when in fact they should instead have been presented as hypotheses, given that they are open to many alternative perspectives. However, this has been a consequence of choice rather than absolute necessity. In this instance we preferred to concentrate on outlining a proposal, rather than tracing the divisions and contours of the arguments proffered by others.

Conclusions

I

All readers of essayist or academic books yearn to find a summary at the end. Sometimes this is due to needing to be apprised of, or even formulate vehement opinions about books, we have neither the time nor the inclination to read. We shall contribute to this worthy custom with the synopsis that follows.

This book was structured around a line of argument that sprang from the following question: How do all goods and subjects relate to capitalism (understood as a totality that governs our societies)? We argued that, in the last instance, it is through two types of regulations: those shaped by physical property and by intellectual property, which in general act simultaneously. This rests on the fact that goods and subjects are made up of variable combinations of two entities: physical matter and knowledge matter. Then, we presented a comparison between these two entities in philosophical, physical, and economic terms. For the two latter categories, we stated that while physical matter is consumed in the process of its productive use, knowledge matter does not erode in this way; while the former can only be transformed,

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knowledge can be accumulated. However, knowledge does not exist as an immaterial entity (contrary to arguments sustained by numerous authors), but instead exists as an emergent property of physical matter. This led us to propose a materialist analysis of knowledge. Indeed, the particular characteristics of any physical bearer of knowledge condition several of the ontological, economic and legal properties that such knowledge matter assumes. For example, that the abstract idea of a wheel can become knowledge either as a reification in a determined object, a codification in a text, or an individual mental representation (three different bearers), confers very varied possibilities to this knowledge: of, as the case may be, being transmitted widely, being considered useful, or falling into oblivion.

So to recap exactly from p. 51 we can say, cognitive materialism has been located in relation to gnoseological traditions. It is proposed as a third position confronting epistemology, on the one hand, and Marxism and the sociology of knowledge, on the other. In all cases what is fundamental is that the disciplines that have studied knowledge share the practice of having understood it as a product of human – individual, collective etc. – subjects.

The bulk of the epistemological tradition is idealist, in two senses. Firstly, for locating these discussions around the truth-falsity axis; specifically, for the association between epistemology and the truth-falsity axis, rather than the link between knowledge and truth. Secondly, the subject whose possibilities of knowing are explored is either a universal, ahistorical, completely abstract subject, or an embodiment of the systematic thinker: the philosopher or the scientist.

The tradition of Marxism and the sociology of knowledge, in contrast, gravitates around three ideas: (i) knowledge is a product of material, concrete, empirical and contingent human subjects, and not of transcendental beings like those of epistemology, (ii) the subjects elaborating those knowledges are conditioned or determined by diverse factors, in general *social* in nature, (iii) as a consequence, in order to study the features of knowledge, these factors should be elucidated and studied.

From the perspective of cognitive materialism, these previous approaches have three limitations which can be identified: idealism, humanism, and the lack of a definition of knowledge. Ergo, the next step was to define our approach on the basis of its features as follows: materialist, emergentist, dialectical, non-humanist, scientific, and cognitive.

In order to study knowledge empirically, it is necessary to grasp its materiality: not only the 'idea' of the wheel (epistemology), or the social insertion of the subjects that create it (Marxism, sociology), but also the concrete materiality of the knowledge in question: the sensual object, the textual description, or the mental image of a given individual, and the translations between all these bearers. Thus, both the question of what knowledge is (chapter 1), and the question of how to understand knowledge (chapter 2) led us to the need to study knowledge on the basis of its material bearers.

Chapter 3 introduced one of cognitive materialism's central tools: the typology of knowledge based on its material bearers. This enabled us to distinguish between knowledge with biological, subjective, intersubjective, and objective bearers. Biological knowledge includes the genetic, endocrinological and neural information flows of living beings. Subjective knowledge includes the explicit and implicit memories of an individual's mind. Intersubjective knowledge rests on social groups. It comprises five sub-types: linguistic (knowledge about codifying, decodifying and creating intersubjective codes), recognition (knowledge of others and of the self, the glue of social networks, similar to 'social capital' or 'know who'), organisational (knowledge that arises in any form of division of labour or other activities), axiological (intersubjective beliefs and values) and normative (regulations internalised by people and usually enacted by the law – physical property and intellectual property are the two main types of normative intersubjective knowledge). Objective knowledge encompasses technologies on the one hand (among them, digital technologies), and information on the other. As is well known, information and, particularly, digital information, has marginal costs close to zero. We call this the replicability of digital information.

We used the term Cognitive Material Configuration (CMC) to describe the totality of this variety of knowledge for a historically determined situation. Of course, the knowledges of a particular cognitive material configuration (an institution, a society, an epoch) present all kinds of contradictions. Normative intersubjective knowledge is an especially significant group, as it forms part of a totality with which it is in a dialectical relationship. The cognitive material configuration has a relationship with normative knowledge which is in many ways similar to the relationship posited by Marxist theory between productive forces and the social relations of production: faced with a particular development of the former, adaptive changes are produced to the latter. By way of an example, the cognitive material configurations of the three periods of capitalism (mercantile, industrial and informational) were characterised in a condensed fashion.

While chapter 3 was dedicated to stocks of knowledges, presenting them as immobile, chapter 4 introduced the categories necessary to understand the dynamics in order to give an account of the flows of different types of knowledges. The principal concept, in this sense, is translation: a translation is the movement of knowledge from one bearer to another. This occurs perpetually: from an individual representation to objectification in an artefact, from a textual codification to an individual piece of knowledge etc. The movements from bearer to bearer, however, are not neutral: they modify the ownership of knowledge, operate changes to relations of power etc.

For the purposes of discussing the translations to human bearers it was necessary to introduce the concept of attention and to address its special features in informational capitalism: while information is superabundant and, in general terms, cheap, attention is scarce and valuable. However, the most important type of translation we presented is the one we designated the name of

productive processes. These can be organised around two variables: (i) whether they are commodity productive processes or not; (ii) whether they produce goods, physical services, or cognitive services. The combinations of these variables generate six categories.

Next, within the commodity productive processes we defined a particular type: capitalist productive processes and then, on that basis, the capitalist system as a whole. From these definitions three characteristic concepts arose: *exploitation*, *expropriation*, and *regulation*.

The lengthy chapter 5 concentrated on these three concepts, particularly exploitation. First we discussed the generic, ahistorical concepts of exploitation, expropriation and regulation. We asserted that exploitation relates to the asymmetrical exchanges that occur within productive processes, which result in one of the parties, the exploiter, obtaining a greater economic value than the other and that this is obtained at the expense of the latter. Expropriation, by contrast, entails the direct confiscation of resources – often with no compensation – that, decisively, occurs within the sphere of exchange and not that of production. Regulation, for its part, consists of the imposition of norms (legally sanctioned or by other means) that frame exploitation and expropriation. In each case, after the generalities, we discussed the capitalist particularities of each concept. In this way we arrived at the central object of this chapter: capitalist exploitation.

Capitalist exploitation means the appropriation (neither violent nor illegal) by the capitalists of surplus value that arises from the partially or completely unremunerated *knowledge* produced by or borne by other subjects. This exploitation takes three forms: *exploitation through alienation* (the traditional mode described by Marx, based on the idea that it is the capitalist who owns the product that is a result of the labour time), *exploitation through reproduction* (the mode through which the capitalist translates the knowledge that was possessed by the workers into a codified bearer in their ownership, without corresponding compensation), and *exploitation through attention* (the mode by which capitalists capture the scarce attention of subjects in order to inoculate them with certain knowledges).

Naturally, the theory of exploitation is related to a theory of stratification and classes which was the object of this book's final chapter.

Thus, chapter 6 advances a theory of classes for different stages of capitalism. To arrive at this theory of classes, two types of concepts developed in previous chapters were operationally defined. On the one hand, a division was presented between two types of *resources:* those which are physically intensive, and those which are knowledge intensive. This meant operationalising the entities physical matter and knowledge matter in concrete goods, those in which one or other entity predominates in economic terms. On the other hand, the study of normative knowledge was summarised. The categories of physical and intellectual property were operationalised into three alternative conditions of access to these resources: exclusive access (applicable to physical or intellectual *property*),

non-exclusive access, and no access. Combining the different types of resource with the different types of access, a general proposal for a theory of classes was presented. At the most general level, we distinguished between those who obtain their income from some form of exclusive access or property and those who earn it from selling their labour power. The former group, capitalists, includes, in addition to capitalists strictly defined, two sub-groups: cognitive capitalists and physical capitalists. Additionally the extended capitalist family includes two types of rentier: cognitive and physical. For their part, the workers include principally cognitive workers and physical workers, but there are also self-employed workers and excluded workers. Then this schema was applied, in a simplified way, to various periods. We analysed strata in the transition from feudalism to mercantile capitalism, the subsequent transition to industrial capitalism (in which two clearly differentiated stages were distinguished), and finally, in the current transformation into informational capitalism.

II

When the time comes to form a general opinion about the theory presented in this book, it is possible that the reader may harbour some doubts and disagreements. These apprehensions, in all probability, point to the jumble of incomplete and unresolved issues that have fallen by the wayside. The objective we set out to fulfil was broad, as is the number of loose ends that have been left hanging. However, this does not necessarily constitute a flaw. Faced with these pending tasks (the uncited references, discussions evaded, data not included), the question is: can they be tackled in other, complementary, studies? Or, on the contrary, does this proposal contain such inherent limitations that this book represents the apex of its possibilities rather than the bottom rung? This is up to the reader to judge. In any case, the question of limitations and shortfalls brings us to another point we must address, that of future lines of investigations: in which direction to continue? What further research should be undertaken on the basis of the theory advanced here? And perhaps, how to approach it? Next, with these questions in mind, some comments will be made about the lacunae in this text, suggestions about ways to resolve them and, more generally, proposals for future research. These comments are organised around three axes: theoretical, historical, and empirical.

In terms of the *theoretical* axis there are at least four pending areas. The first is that of *value theories*. A significant limitation consists of not having developed a knowledge theory of value. On discussing the theory of exploitation in chapter 5, and also in other passages, we have highlighted some deficiencies we find in the Marxist theory of value. The limitations of other value theories, i.e. neoclassical and Sraffian, are hardly trivial either. In all three cases we believe that the role of knowledges in the creation of value is insufficiently considered.

However, we have not systematically developed these criticisms, nor have we advanced an alternative theory, a knowledge value theory, although it has been implicitly suggested. Therefore, a future project, at least, is to develop a systematic critique of Marxist, neoclassical, and Sraffian value theories from a cognitive materialist perspective. Ergo, the development of a knowledge theory of value, that is, a theory specifically designed on the basis of the cognitive materialist approach, is desirable.

The second, third, and fourth areas concern *power, money* and *affects*: three central themes that we have not explored. The second we barely touched on, though we did make some tangential allusions to the conterminous concept of domination. The third we referred to only in a marginal comment, and we said absolutely nothing about the fourth. These are, of course, all extremely important areas with their own influence and independent bodies of literature. However, we unite them in this comment for a simple reason. *The way in which cognitive materialism should approach them is similar. All three cases should be analysed as forms of knowledge with different bearers*. In effect, when we speak about money the fundamental question, from a cognitive materialist perspective, is where is this money found? Is it money as an intersubjective belief?

Is it regulated by norms that indicate it is a valid form of currency for a given society? Is it in the form of linguistic signs shared by an intersubjectivity, or knowledges objectified in particular technological artefacts such as gold ingots? Is it codified as analogue information in dollar bills, or as digital information on hard drives? 'Money', considered without differentiating its material bearers, can only be studied in an idealist way. In contrast, the type of approach we have proposed suggests that it should be studied on the basis of its material bearers. Of course, a cognitive material configuration of money will uncover tensions between different bearers: a norm can assign a price to a local currency (for example, saying that ten peso coins are equivalent to a dollar bill) while, however, the intersubjective axiology could contradict this norm, assigning it a different price (let us say, fifteen pesos per dollar). In turn, the translations that occur, the passages from bearer to bearer, have enormous consequences. For example, the digitalisation of money was the condition that enabled derived financial products to generate the 2008–09 crisis. Similarly with the concept of power (and associated concepts such as domination, control, etc.). Power in a strict sense is an intersubjective axiological belief. But to study it systematically it is necessary to track it through its multiple bearers and, obviously, analyse the translations it undergoes. Power exists, unquestionably, in biological bases associated, for example, with corporeal forces. Naturally, it also depends on the subjective level. There are, therefore, techniques for the subjective exercise of power, some of which are well known and applied by businesses' human resources departments. In linguistic intersubjective terms, the disputes over imposing certain words to the detriment of others, especially in relation to public discourse, have been studied more than on one occasion. With regards

to recognition, power is expressed in hierarchy, in authority. As for norms, power can be understood as the ability to regulate, impose, or transgress norms (although it may be on the micro level). Finally, power is related to objective bearers. For example, it is clear that the technological artefacts of war, although also architectures of peace, should be considered when attempting to understand the exercise of power.[237]

In terms of affects, desires, passions, emotions, the fact that we have not considered them at all is a serious defect of this book, as it has deprived us of engaging, for example, with authors from autonomism and post-structuralism who we hold to be of great importance. Therefore, two questions must be underlined sharply. First, the study of affects is a crucial phenomenon which helps us to understand any human organisation. This implies, on the one hand, rejecting the assumption typical of some schools of economics, but also of some forms of Marxism, that humans are rational agents, and on the other hand, suggests a hypothesis contradicting that adopted by authors from those currents: it is not at all evident that the manipulations of affects plays a more significant role for informational capitalism (or control societies, empires etc.) than it did for industrial capitalism. The second question is the idea already mentioned in relation to power and money: affects are forms of knowledge, and should be studied as such, that is, on the basis of their material existence in different bearers. Affects (passions, desires etc.) undeniably exist in their biological bearer. It would be a grave error, based on a sociological reductionism, to fail to study the biological manifestations of passions, starting of course with sexuality. Naturally, on the subjective level we find conscious and unconscious affects. On the intersubjective level there are a wide range of affects that society inoculates its members with: the axiology of consumption, passion for recognition etc. Of course, the regulation of the passions is a constitutive element of any collective human organisation, and in the development of capitalism it assumes specific forms. To express this simply, regulations that prohibit certain passions in industrial capitalism, encourage them in the informational period. In turn, in terms of objectified knowledges for example, certain objects are invested with desire: e.g., certain types of clothing, in any period. Thus, three pending projects are those that, in theoretical terms, provide an account of power/domination, money, and affect/desire as cognitive material configurations.

With regards to the axis of *historical* research, there are three fundamental questions. Firstly, the development of the study of the cognitive material configuration of each stage of capitalism. Although we have partially made some progress with this project in other works, this has been done on a highly aggregate level. However, a narrower spatio-temporal framework could be fruitful for obtaining more fine-grained results. Secondly, we have data which sustains the hypothesis that the histories of companies and countries which are successful in the accumulation of capital are riddled with diverse forms of exploitation through reproduction at the outset, in their take-off period. The cases of

industrial publishing, chemistry, cinematography, and software in the United States, which took off on the basis of unpaid knowledges, constitute simple examples. It would be useful then, to trace the evolution and especially the origins of cognitively successful companies in order to verify whether, effectively, exploitation through reproduction is a necessary modality. A third historical question concerns the relationship between regulation, expropriation, and exploitation in different concrete historical situations. Here we have proposed these concepts in an abstract way, but it is highly important to analyse their usefulness to account for specific spatio-temporal configurations. Although there are partial accounts, they do not integrate the three processes. This is due to that fact that where the expropriation of physical matter has been studied, the regulation of knowledge matter has not been considered, and vice versa. However, both regulations (access to physical and knowledge matter) have advanced in step with each other throughout the history of capitalism. For example, in eighteenth-century England with the enclosures on the one hand, and the legislation and jurisprudence pertaining to copyright and patents on the other, they *conjointly* laid the foundations for the genesis of the industrial period.

The third and final axis concerns *empirical* studies. A strength and vocation of cognitive materialism, as we have pointed out, is that of nourishing itself from empirical sources. This is not an essayist or philosophical approach, but a social science theory, which must interact with data. However, we have scarcely included any data in this book, merely reiterated allusions to the data which can be found in previous research that we have based this or that assertion on. Quite justifiably the reader could easily demand *hic Rhodus, hic salta* or, the proof of the pudding is in the eating. The impossibility of satisfying this just demand here does not, however, prevent us from gesturing towards three ways of applying cognitive materialism to empirical primary and secondary sources. Here, in addition to mentioning some areas, it is worth referring to some possible operationalisations.

A first area on this empirical axis concerns the study of the cognitive material configuration of productive units. Having a systematic register of the stocks of knowledge the unit of production (a company, a state institution) has at its disposal and, especially, of the translations between the different types of knowledge, is essential in order to understand and intervene into the productive process that this organisation participates in. In particular, mapping the tensions manifested between different types of knowledge (e.g. technologies incompatible with organisational knowledges, knowledges codified as norms which are not intersubjectivised, etc.) could be extremely useful in order to streamline those productive processes. This project requires additional operationalisations. However, they should be concretised for each specific case. Typically, each type of knowledge has numerous manifestations that cannot be integrally captured in a survey. This obliges us to prioritise certain manifestations. For example, in an investigation into the flows of knowledge in public secondary schools

in Argentina, taking each type of knowledge as a variable, we had to choose dimensions and then indicators which entailed prioritising some aspects and sidelining others. For example, when analysing technological knowledges we left out (on the basis of criteria related to the particular objectives of that investigation) blackboards, buildings, and pens and we concentrated on digital technologies in particular. Zooming in on them, we realised a further adjustment through constructing indicators related to hardware and connectivity.

A second area concerns the study of different forms of exploitation through reproduction. In effect, while exploitation through alienation is widely known, this modality has been studied less. However, several investigations have made contributions (Yansen 2015; Dolcemascolo 2014; Liaudat 2014). One way of operationalising this analysis is to track the translations across different knowledge bearers and their relationships with the norms that frame them. In the particular case of exploitation through reproduction that occurs on the internet, it seems useful to include the study of different flows that circulate (money, attention, contents, advertising, see Dolcemáscolo 2014). But exploitation through reproduction, as we asserted, can be found in working environments, the sphere of science, in relation to 'traditional knowledge' and a diversity of combined situations.

Of course, following the flows of knowledges we inevitably encounter humans. Some of them act as exploiters, others exploited. But there are also those who participate in the process without being on either of those two extremes. In order to analyse these actors (as well as non-human bearers), in other texts we have had recourse, with slight alterations, to Latour's (2005) concepts of mediators and intermediaries (Kreimer and Zukerfeld 2014). These enable us to give an account of the humans and non-humans that carry those knowledges without modifying them (*intermediaries)* and those that introduce important translations (*mediators*).

The third area of an empirical character consists of the empirical study of the class schema in concrete societies. The analysis presented here remains at an aggregate level. However, there is nothing to prevent operationalising it for each country. Of course, the occupational statistics for many countries are limited, but that should not completely obstruct advances being made with these secondary sources. In turn, useful contributions can be made through primary sources. In qualitative terms, the realisation of comparative case studies between different classes in concrete societies should generate fertile ground.

III

What of public policies? It could be imagined that a theoretical book such as this would not generate recommendations along these lines. However, here we would like to make five suggestions which are simple to enumerate, but naturally not necessarily easy to implement.

Firstly, the statistical systems should be adapted, in the least worse way possible, in order to measure knowledges. Since the pioneering works of Machlup (1962) and Porat (1977), it has been well understood that measuring knowledge in economic terms is as difficult as it is necessary and, in turn, that reasonable approximations can be achieved even in the face of the existing statistical apparatuses. However, measures such as educational certification in the labour market, patents awarded, expenditure on R&D and the like, are simply not sufficient. We need to be able to measure unaccredited subjective knowledges, intersubjective and objective knowledges;, in other words, we need the power of the state to be able to develop statistical systems. This is a pending project which went unmentioned in areas for further research because it does not depend on individual researchers, but instead requires the political will of state organisations.

Secondly: knowledge should be overseen at a ministerial level. The dispersal of the production and distribution of knowledge across a myriad of institutions without much coordination imposes a significant limitation on the development of countries. Therefore, at the very least – and without requiring the violent incorporation of a materialist perspective overnight – the subordination of various portfolios related to knowledge (starting with the traditional science and technology, innovation, education, culture) under a specific institution, a ministry of knowledge.

Thirdly, there is a case in which it is necessary to implement an adaptation on the basis of cognitive materialism: that of knowledges with an objective bearer. That is, in informational capitalism an institution is needed which would centralise the diverse areas related to digital technology and information. Their dispersal across a diversity of state departments generates all kinds of redundancies, inefficiency, and unnecessary transaction costs.

Fourthly, labour legislation should consider the production of knowledges. Workers' rights, particularly but not exclusively those of cognitive workers, should include both the knowledges they objectify in the product of their labour as well as the knowledges that are so often reproduced without those workers receiving any specific compensation. This implies that labour legislation should surpass the concept of *time* to settle on *knowledge* as the basis of what is disputed between capital and labour. The cases of professions in which knowledges are copied without compensation and subsequently generate unemployment on the basis of exploitation through reproduction (as with the example of teachers mentioned in chapter 5) will drag this problem into the public arena sooner rather than later.

Fifthly, and finally, intellectual property legislation, in a broad sense, should adapt to the necessities of the development of a country: in other words, it must do what the successful countries did (maximise exploitation through reproduction by means of specific regulations) and not what they tell others to do (observe the regulations that these countries and companies impose to their own advantage).

IV

Beyond the virtues and defects of the *contents* presented on the surface of this book, in terms of *form* we have attempted to provoke dialogue across a plurality of diverse academic fields. This attempt includes a stance that should be elucidated with precision and that implies distinguishing between two terms that have proliferated in contemporary social sciences, treated almost synonymously. One of them is *multiplicity* and the other is *plurality*. Both are extolled and seem to point to the same phenomenon: celebrating diversity, denouncing the silencing of difference and the repression of the Other etc. However, in our view both are quite distinct. After a long period of hegemony enjoyed by the so-called 'dogmatic' or totalitarian discourses, multiplicity now reigns in the social sciences and humanities: new academic fields spring up constantly, with their own referential authors, concepts and institutions. Diversity is thriving and there is no kind of opposition to it. The most miscellaneous knowledges are tolerated by the academic community in a way that would have been inconceivable a few decades ago. The postmodern thaw bathes all shorelines. However, and this is the key point, all these autonomous fields that respect the existence of others have not the least interest in fostering dialogue between them. If by dialogue we do not mean exchanging opinions with those who think exactly alike.

Among other motives, the logic of accumulation within the same field, so favoured by the current regulations of the scientific system, discourages any search for translation of foreign concepts. It is much more efficient to adhere to a tendency, or an association, and remain there for one's entire academic or intellectual life. It is true that many academics or intellectuals occasionally change their research interests, their theoretical points of reference, their concepts. Unfortunately, in the vast majority of cases, this is due to direct or indirect financial incentives: typically, concepts endorsed by international organisations or the whims of bureaucrats. On the other hand dialogue, as a radical practice, is seen as a distraction, as a demonstration of a lack of seriousness. In this reign of multiplicity, difference is tolerated while it is autonomous, while there is no argument or controversy. Why debate and attempt to reach agreement if each academic atom can have its own research group, journal, and concepts? Let us avoid the overly frustrating loss of time that debate implies. Set aside the exhausting effort to convince the Other, and acrimony in the face of defeat. Why oblige the Other to speak our language? Just allow the otherness to flow, adrift on its own contingencies. Put to one side our repudiation of a colleague's paper (the expression of which would lead to an irksome argument) and shake their hand saying that we found it 'very interesting'. We should even raise a toast, be friends and commingle in a heartfelt embrace. But never, under any circumstances, should we get ourselves entangled in debate and even less one in which their arguments would oblige us to change the orientation of our own analyses and research. By no means should we interfere in their world of

beliefs – to do so would be an intolerable act of violence – and in exchange they should not trespass in ours. Ultimately, each will continue their process of academic, intellectual, and political accumulation; the postmodern multiplicity has room for infinite independent fiefdoms. If academic conferences are perfectly designed for mingling, drinking alcohol and political accumulation, why spoil them with debate? Thus, multiplicity, in the guise of a love of difference, is nothing less than its most profound negation. Behind the sophisticated loquacity alluding to the liberation of the diverse, hides a profound lack of commitment towards the Other. In turn, behind the critique of rationality, and the vindication of instant gratification and the event, lurk all kinds of speculations and unutterable calculations. Favouring multiplicity, especially in its Dionysian consumerist version, is a profit maximising strategy, for all that it presents itself as an ethical choice. In sum, behind the celebration of multiplicity is concealed a profound rejection of dialogue, of plurality.

Plurality, at least as it is understood here, includes but transcends multiplicity (dogmatism, multiplicity and plurality configure the three moments of a dialectical movement, of course). It is imperative to respect diversity, but this respect can only be consummated in the framework of dialogue. Dialogue entails a certain degree of commitment, a certain mutual recognition, a shared vocabulary, that does not necessarily mean accepting the position of the Other as correct. On the contrary, dialogue only has meaning as the confirmation of and critical respect towards difference, but with its incorporation into a totality. The search for languages in common is, therefore, an essentially political activity: that of including but not silencing the constitutive tensions of each totality.

The typology of knowledges on the basis of their material bearers, for example, seeks to offer a conceptual terrain on which different knowledges can express their differences. Thus, an important parameter by which to evaluate this study is how far it stimulates exchange between the varied discourses we have invoked in these pages. We hope that Marxists, postmodernists, poststructuralists, economists, lawyers, scholars of communication, sociologists, proponents of systems thinking, and others, will agree on two points by the end of this book. On the one hand, that there are defects – several in each case – in our theory. But, on the other hand, that there has been the chance to enter into dialogue with proposals, not so much our own, but those from other authors, other books, other fields than those they usually frequent. Having achieved that will suffice for us to feel satisfied with the project here undertaken.

It is no mystery that the notion of dialectics was, at its origin, associated with dialogue. Especially, in the earlier works of Plato, the need to personify the different forms of knowledge expressed through this discursive modality. However, over recent years, a number of the ideological features of informational capitalism which deserve a detailed exploration have come to associate the notions of dialectics, totality, and negativity with Marxist

or capitalist totalitarianisms, with the rejection of difference and cultural diversity. Below the surface of this book we have attempted to show that this is a grave mistake and that, on the contrary, the notion of dialectical totality offers fertile ground for those who would encourage plurality. The dialectical totality should return to being an integrating and transcending dialogue, a dialogue that strives to include difference (rather than ignoring it while applauding), dialogue capable of integrating even the ideas of those who debase the dialectic.

V

What of political action? Micro or macropolitics? Political parties? The horizontal democracy of networks? Class struggle? The struggle against patriarchy? The destruction of the ecosystem? Wealth redistribution? Is this a work critical of capitalism or not? In other words, if this theory is correct in any way, *what is to be done*? We do have opinions about some of these questions; about others we do not. But in any case, here we will not spend time on them. Why? Because we prefer to take shelter in an idea that Slavoj Žižek and Manuel Castells shared, two great thinkers who otherwise have little in common. This idea stems from inverting Marx's legendary thesis 11 ('Philosophers have hitherto only *interpreted* the world in various ways; the point is to *change* it').

> One is therefore tempted to turn around Marx's thesis 11: the first task today is precisely NOT to succumb to the temptation to act, to directly intervene and change things (which then inevitably ends in a cul-de-sac of debilitating impossibility: "what can one do against the global capital?"), but to question the hegemonic ideological coordinates. (Žižek 2002, 544)

There is, in effect, a particular impatience to act, for immediate practice, to search for recipes for political action which assume that theoretical questions have already been resolved (by Marx, Deleuze, or whoever). The succession of failures and frustrations that abounded in the twentieth century should suffice as indicators that the theoretical foundations upon which were raised the most praiseworthy and committed initiatives, were more fragile than was believed. This leads us, once again, to underline that the category of action (and political action as its prototype, as Arendt pointed out) is not the basic substance for social science; that place belongs to knowledge. We need political action, of course, but action dialectically related to knowledge (and this is not resolved by sprinkling the word *praxis* here and there). The time has come for emancipatory projects to free themselves from action emptied of theory on the one hand, which brandishes, even with pride, its incapacity to understand and transform

the capitalist totality, but also from action born of a dogmatic construct and intolerance of uncertainty. As Castells states:

> I come from a time and a tradition, the political left of the industrial era, obsessed by the inscription on Marx's tomb at Highgate, his (and Engel's) Eleventh thesis on Feuerbach. Transformative political action was the ultimate goal of a truly meaningful intellectual endeavour. I still believe that there is considerable generosity in this attitude, certainly less selfish than the orderly pursuit of bureaucratic academic careers, undisturbed by the labours of people around the world. […] I have seen so much misled sacrifice, so many dead ends induced by ideology, and such horrors provoked by artificial paradises of dogmatic politics that I want to convey a salutary reaction against trying to frame political practice in accordance with social theory, or, for that matter, with ideology. […] The most fundamental political liberation is for people to free themselves from uncritical adherence to theoretical or ideological schemes, to construct their practice on the basis of their experience, while using whatever information or analysis is available to them from a variety of sources. In the twentieth century, philosophers have been trying to change the world. In the twenty-first century, it is time to interpret it differently. (Castells 1998, 358–359)

Our work comes from a time and tradition partly different from and partly coincident with Castells'. It is not traversed by Marxist dogma, but rather by the still thunderous echoes of the genocide which occurred in Argentina in the 1970s. It is not the inscriptions on famous tombs that ignite our activity, but the unmarked mass graves of thousands of the disappeared who gave their lives trying to build a more just world. Or, more precisely, it is not even these massacred beautiful willpowers that appear before us every day we write, but the mutilated lives of those who survived and stayed afloat on little vessels of quiet dignity.

Those of us who navigate on those vessels, those of us who saw the noblest dreams go adrift and sink, and especially, those who choose to dedicate ourselves to the social sciences because we believe that they still have much to contribute to the construction of fairer, more equal, and freer societies, must tread a narrow path: tracing out maps without imposing the way of travelling them, being rigorous while at the same time enjoying our activity, committing ourselves without losing pluralism and aiming to understand the world without being indifferent to it. This is what we have attempted in this book.

Notes

[1] With regards to the original proposal, four chapters have been left out for the purposes of conciseness and flow of argumentation. Three of these consisted of discussions of various bodies of literature that have contributed to a materialist approach to knowledge. The first concerns the theory of public goods (and those related: club goods, knowledge networks etc). The second concerns the debates around the opposition between tacit and codified knowledge. In the third, the debates with various tendencies from the social sciences in general, and economics in particular are the basis for the typology presented in chapter 3. For the interested reader, these works are available in Spanish, and will hopefully soon be published in English as journal articles.

The fourth chapter that has been removed is much more relevant and polemical. This concerns the presentation of a knowledge theory of value, subsequent to discussing the contributions and limitations of the Marxian, neoclassical, and Sraffian theories of value. Besides the prohibitive length of this chapter, I decided that the thread of the argument in chapters 4, 5, and 6 would be interrupted by the lengthy parenthesis that including a discussion of value would entail. Regardless of this reasoning, I am not entirely convinced that the choice to remove this chapter was the correct course of action.

[2] Of course, the argument I will present is not that there is a myriad of partial truths and that therefore we must speak of knowledges because we have the truths of the indigenous peoples, of science, of common sense, and all

should be equally respected, in other words that we should use knowledges by virtue of postmodern relativism. On the contrary, I intend to advance a materialist use of the concept of knowledge that should completely distance it from the truth-falsity axis.

[3] The expression 'intellectual property' rights includes, at present, a wide bundle of regulations of knowledge: among them are patents, copyrights, trademarks, trade secrets, and others which are less common such as traditional knowledge, right of publicity and sui generis rights. The idea that these rights form part of the same cohesive whole, and that they bear a resemblance to the concept of property has been diligently constructed over the last few decades. For a summary of these issues see Merges, Menell, and Lemley 2006 and Zukerfeld 2010, Volume 2.

[4] This point is explored in more detail in a previous study (Zukerfeld 2010, Volume 2, chapters 3 and 4).

[5] This clarification follows an insightful suggestion by Prof. Christian Fuchs.

[6] The pre-Socratic period runs from 585 BCE to 463 BCE. It should be noted that they considered themselves to be physiologists and not philosophers – this term would not acquire definition until Plato.

[7] The metaphor of fire as a foundational element is also expressed in the myth of Prometheus: humanity gains access to fire (knowledge, technology, power) thanks to their intrepidity. In turn, Heraclitus' conception of humidity as alien to the equilibrium of logos, as opposed to brilliant fire configures the first philosophical critique of inebriation: a fragment is preserved in which the Ephesian thinker deplores those who go about 'with a moist soul'.

[8] It is unavoidable to mention that this simple idea is much more accurate than the profusion of nonsense about the 'immaterial' and 'intangible' which we are inundated with in postmodernity. When our typology of knowledge is presented in chapter 3 this kinship should become clearer.

[9] For a defense of Epicurus confronting the criticisms of Cicero and others, Marx's elegant doctoral thesis [1841](2000) can be consulted.

[10] In *The Book of the Balance of Wisdom*, he proposed that the gravity and the gravitational potential energy of a body varied depending on its distance from the centre of the Earth, anticipating Newton.

[11] In effect:

> Finally, therefore, we discover the problem of physical material science to be to refer natural phenomena back to unchangeable attractive and repulsive forces whose intensity depends wholly upon distance. (Helmholtz, cited in Einstein and Infield 1958, 58).

[12] A example of this is that in his *Lectures on Physics*, the Nobel Prize winner for Physics Richard Feynman asserts that if, anticipating some catastrophe, there were a single concept from science that must transmitted in order

to begin reconstructing contemporary knowledge, it would be the atomic hypothesis: all things are made of tiny particles in perpetual movement and attract or repel each other according to particular circumstances (Feynman, Leighton, and Sands 1963).

[13] Indeed, according to Einstein, before the theory of the electromagnetic field, that is at the beginning of the nineteenth century, all physics seemed to be constructed on the idea of *matter* (Einstein and Infeld 1938, 256).

[14] Of course, the emergence of the idea of energy is inseparable from the rise of industrialism and its machines, and the human being domesticating the energies of nature. In other studies we have engaged with this connection, which cannot be discussed here (see Zukerfeld 2010,Volume. 2).

[15] Contrary to the view of Galileo-Newton-Helmholtz, forces become energies, and cannot be explained by mass-matter. The energy field appears as an irreducible ontological reality.

[16] For example, Miller tackles it thus in *Living Systems*:

> Mass and energy are equivalent. One can be converted into the other in accordance with the relation that rest mass energy is equal to the mass times the square of the velocity of light. Because of the known relationship between matter and energy, throughout this chapter I use the joint term *matter-energy* except where one or the other is specifically intended. (Miller 1978, 5)

[17] Of course, some clarifications have to be made, but they are not relevant at this stage in the development of the argument. Indeed, 'matter' and energy may have different regulations in other aspects. For example, nuclear energy is subject to specific regulations, but this derives from the magnitude of power it represents, and not from the fact that it is energy. Radioactive *materials* must also abide by non-proprietary regulations. That is, under capitalism there evidently exist other regulations that surpass forms of property, and these are distributed in many ways over the different entities. The point is that in the basic aspect, property relations, capital treats physical matter as a whole.

[18] I owe a debt of gratitude to Christian Fuchs for suggesting the use of this expression.

[19] Again this is a phenomenon which is neither alien to, nor completely determined by, the history of capitalist development (Zukerfeld 2010, Volume 3).

[20] The relationship of the signifier with the Aristotelian form is self-evident.

[21] As Morin points out:

> Information is a central yet problematic notion. From this stems all its ambiguity: we can say very little about it, but we can do nothing without it. (Morin 2008, 13)

[22] Morin perfectly describes the relationship between the theory of information and biology:

> More fascinating yet was the possibility of extrapolating the theory very heuristically to the biological domain. As soon as it was established that a cell's (or an organism's) self-reproduction could be conceived from a duplication of genetic material or DNA, as soon as it was conceived that DNA constituted a sort of double helix whose rungs were constituted of chemical quasi-signs of which the whole could constitute a hereditary quasi-message, then reproduction could be conceived of as a copy of a message. In other words, reproduction could be conceived of as an emission-reception covered by communication theory: it was possible to link each chemical element to discrete units, empty of meaning (like phonemes or letters of the alphabet), combining into complex units, carriers of meaning (like words). Even more, genetic mutation was likened to 'noise' disrupting the reproduction of a message, provoking 'error' (at least in respect to the original message) in the constitution of the new message. The same informational scheme could be applied to the functioning of the cell, where DNA constitutes a kind of 'program' that orientates and governs metabolic activities.(Morin 2008, 13)

[23] Two complementary approaches to the relationship between the neurosciences and the concept of information can be found in Kandel 2006 and Damasio 1995.

[24] Miller's studies are the most comprehensive attempts to unite the different sciences in a theory of systems with a natural origin. Of course, he shares some aspects of the theories of Luhmann, Parsons and Morin, but in this case articulated by a biologist who places the greatest emphasis on living systems.

[25] Karpatschof and Kirschenmann take up Wiener's argument from a perspective akin to Marxism.

[26] Umpleby's paper compiles mathematical relationships between 'matter', energy, and information. The first two are connected by Einstein's equation, 'matter' and information by Bremermann's limit, and energy and information by Szilard's equation. Umpleby, based on Bateson, suggests replacing the term information with *difference*.

[27] Gershenson's research not only analyses the relationship between 'matter'/energy and information, but also attempts to invert the usual approach: thinking about 'matter' and energy *as* information. We adopt some of this when pointing out that knowledge is present in forms of 'matter' and energy that are not codified in any way.

[28] Although the authors do not make any particularly original contributions, they do offer a good summary of the 'matter'/energy/information approach,

its relationship with living systems, the laws of thermodynamics, and the theory of information.

[29] The work of Gitt and Maartens is framed within the portentous debates about 'intelligent design' that still rumble on today in the USA. Contrary to the usual image of followers of religion or mysticism as hostile and suspicious of Western science, these texts – and many others – are part of a movement that perhaps can be described as 'hi-tech spiritualist'. They are written by scientists who postulate the discontinuity between 'matter'/energy and information/design. The idea is simple: if we can agree that something exists which is not 'matter'/energy and that it cannot be explained how the design emerged from what was inanimate, then we must acknowledge the intervention of an 'intelligent design'. Note that it is not relevant whether this design was made by a Christian god or an extraterrestrial civilisation. The point is to offer a scientific argument that disavows both materialism and the immanence of Being. It is an argument that, incidentally, is far from being naive or clumsy, as can be seen in Gitt's book.

[30] García Camarero's work is less academic than others cited here. However, long before this book was conceived he suggested an idea that we cannot fail to concur with: *labour or economic processes (productive processes in our schema) should not be conceptualised on the basis of land, labour, and capital, but on 'matter', energy, and information (knowledge, for us)*. To a certain degree he shares Paul Romer's critique of the traditional theory of factors of production and our criticism of Romer that his approach (things, ideas, and people) is not suitable for a scientific perspective, as we shall see later.

[31] For example:

> The lack of *knowledge* and *information* science-based concepts in economics literature about growth, science and technology, and in the broader field of innovation, has been acknowledged in recent papers (Ramlogan and Metcalfe 2002). This may be due to a defensive attitude manifested by mainstream economists who refrain from interdisciplinary dialogue and easily admit that the discipline should economise this kind of speculation. Therefore, a large number of texts adopt some kind of folk psychology or, at best, a widely diffused (although problematic) model of cognition. (Bateira 2003, 2)

[32] I owe the expression 'knowledge matter', which, by the way, does not have an equivalent in Spanish, to a suggestion made by Prof. Christian Fuchs.

[33] Schrödinger (1944) and Von Neumann (1966) refer to negentropy in relation to information, but here this aspect is assimilated into the concept of knowledge.

[34] As discussed elsewhere (Zukerfeld 2010, Vol. 1, Chapter. 3), the term rivalry is an unfortunate one. It imputes highly determined social relations to

objects. If the Marxian term 'fetishism' is at all useful, it is to denounce this kind of operation. However, this idea of 'rivalry' is superficially mentioned here because economists habitually use it.

[35] Romer's approach is subtler and indicates that in certain circumstances knowledge is non-rival, but it remains a reference for this basic level.

[36] The earliest formulation of these ideas was not provided by an economist, but sprang from the eloquent pen of Thomas Jefferson:

> Its peculiar character, too, is that no one possesses the less, because every other possesses the whole of it. He who receives an idea from me, receives instruction himself without lessening mine; as he who lights his taper at mine, receives light without darkening me. That ideas should freely spread from one to another over the globe, for the moral and mutual instruction of man, and improvement of his condition, seems to have been peculiarly and benevolently designed by nature, when she made them, like fire, expansible over all space, without lessening their density in any point, and like the air in which we breathe, move, and have our physical being, incapable of confinement or exclusive appropriation. (Jefferson, letter to McPherson, cited in Koch and Peden 1972, 576–577)

[37] Here we refer to the properties of knowledge in an abstract way, removed from all historicity. Once the relationship between certain modes of production and a given economic organisation is introduced, it is evident that knowledge tends to suffer something resembling *attrition, consisting of being surpassed by new knowledges that take their place at the vanguard of the productive process in question*. Marx called this – thinking only of technologies, not knowledge in general – 'moral attrition' (Marx, 1990: 492–493). However, to express this in a Marxist lexicon, it makes sense in relation to the production of exchange values, but not in terms of production of use values. The principle that governs a wheel functions just as well (or badly) when this artefact is on the technological cutting-edge as when it has been relegated to the sidelines. Even in the case of exchange value, the term 'attrition' does not seem to be the most suitable for giving an account of Marx's idea. It is not productive consumption that makes the knowledge carried by the wheel become obsolete, but *the development and diffusion of other knowledges*. The latter constitutes a process entirely independent of how much the first wheel is used.

[38] Evidently knowledges do suffer the *disappearance* of their bearer. This, however, is not *due to repeated use* if the bearer is kept in good condition.

[39] That is, it would not make sense to say that our artisan achieves the exclusion of their neighbour if, for example, that neighbour is imprisoned or banished.

[40] These are the costs of producing an additional unit, once the productive process is underway.

[41] These are the costs of producing the first unit.

[42] Bentham explains this idea to justify intellectual property:

> Mere labour, exclusive of skill, cannot be copied without equal labour: of mere labour no one therefore can have the benefit but the particular individual at whose expense (sic), or on account of whom, it is exerted. Of skill, on the other hand, it is the property to be capable of being indefinitely imbibed and diffused and that without any exertion of mental labour comparable to that, at the expense of which it was acquired. Of skill, therefore, it is the property that, the benefit derivable from it, unless effectual measures can be taken and are taken for confining it, may and naturally will be reaped by all persons concerned in any of the businesses to which such skill is capable of being applied; and, thereby, to the thousand of the millions into whose possession it is come without any expense, as well as to the individual at whose sole expense it has been acquired (Bentham [1795] 1954, 260).

[43] As is repeated in the field of social studies of science and technology, often citing Michael Polanyi and Wittgenstein but, in the best cases, having read Nonaka and Takeuchi. On the concept of tacit knowledge in relation to cognitive materialism see Zukerfeld 2010, Vol. 1, chapter 4.

[44] In relation to the idea of knowledge bearers, in addition to Romer (1993) and Chartrand (2007), the idea of 'carriers' from Mokyr (2002, 9) must also be mentioned; the term 'bearer' was introduced in Zukerfeld 2006 and, in more detail, in Zukerfeld 2010.

[45] This methodological choice may seem paradoxical: the physical bearer is used to typologise that which is more than physical. However, the definitions deal with this: any entity is determined in relation to what it is not. The formula that this procedure condenses unites the two philosophers that current trends address: Hegel takes Spinoza's '*omnis determinatio est negatio*' to its utmost conclusion.

[46] However, there are numerous antecedents that, without claiming a materialist vocation, have typologised knowledge in a way similar to a non-idealist approach. See Zukerfeld 2010, Vol. 1, chapter 5. Likewise, there are authors who use this logic without producing exhaustive typologies. For example:

> Yet, as has just been suggested, there is also a peculiar, and metaphysically interesting, feature of knowledge, to wit, that it can be embodied in rather disparate ways. Knowledge is said to be contained in (at least) books, brains, and databanks — three sorts of things that are produced in quite different ways, yet for roughly the same reason (if not to the same effect), namely, to provide knowledge. (Fuller 2005, 2)

[47] Additionally the present stage of capitalism contains, as the most complex anatomies contain, the simpler, earlier stages. We are prisoners of our own epoch, but not necessarily of those from the past.

[48] To be sure, some thinkers who have made strictly epistemological contributions should be separated from this truth-falsity axis. The most obvious case is Kuhn.

[49] Naturally, the idea of the categories of understanding that Kant developed leans on Aristotle's categories. This does not mean that the analysis of the characteristics of the knowing subject begins *ex nihilo* in modernity, but that the subject becomes the central, and certainly transcendental, axis.

[50] Here we use the term 'social' as a category proper to the authors analysed, not because we judge it to be appropriate or precise. As a great professor once pointed out, and will be reiterated below, if you want to put a social scientist in a tight spot, one only needs to ask them to simply and precisely define what 'social' means. In addition, we largely share the criticism that Latour (2005) developed about the vagueness of the term.

[51] There could be read:

> Men are the producers of their conceptions, ideas, etc. – real, active men, as they are conditioned by a definite development of their productive forces and of the intercourse corresponding to these, up to its furthest forms. Consciousness can never be anything else than conscious existence, and the existence of men is their actual life-process. […]
>
> In direct contrast to German philosophy which descends from heaven to earth, here we ascend from earth to heaven. That is to say, we do not set out from what men say, imagine, conceive, nor from men as narrated, thought of, imagined, conceived, in order to arrive at men in the flesh. We set out from real, active men, and on the basis of their real life-process we demonstrate the development of the ideological reflexes and echoes of this life-process. (Marx and Engels [1846] 1970, 47)

[52] Expressed thus by Marx and Engels in *The German Ideology*:

> Where speculation ends – in real life – there real, positive science begins: the representation of the practical activity, of the practical process of development of men. Empty talk about consciousness ceases, and real knowledge has to take its place. (Marx and Engels [1846] 1970, 48)

[53] For an excellent and comprehensive compilation of the fundamental contributions to the sociology of knowledge, see the two volumes edited by Irving Horowitz 1968.

[54] For a presentation of the history and tendencies within the STS field, see Sismondo 2010 and Kreimer 1999.

[55] As Bottomore states:

> Mainheim explicitly rejected these categories, in favour of relativism. In his essay on 'Historicism' (1924), he accepts the point of view of the German historicist authors for whom each historical period has its own style of thinking and for whom all styles of thinking are equally valid (Bottomore 1956, 54).

[56] The problem of reflexivity is that of the relationship between the author and her own theory, which has been imputed to Mannheim:

> For if all propositions are existentially determined and no proposition is absolutely true, then this proposition itself, if true, is not absolutely true, but is existentially determined. (Bottomore 1956, 55)

[57] Curiously, the partially constructivist critique of Mertonian sociology of science, with its accusation of functionalism, partly and tacitly adopts the relative aspects of Mannheim's work.

[58] It is unavoidable to point out that such an emphasis, celebrated as a discovery by these schools, is only useful for criticising positivist Marxism or functionalism. In Hegel's *Phenomenology of Spirit* much more profound formulations of these ideas appear.

[59] Three examples: Latour, Callon, and Law's actor-network theory – when thinking about networks of human and non-human actors composed of diverse materials, see Latour 2005 – the 'Fragment on Machines' in the *Grundrisse* by Marx – when discussing the objectification of science in machinery – and Foucault's *Archaeology of Knowledge* – when analysing texts as sedimentations of knowledges – etc. *However neither in these nor other cases is the emphasis placed on the materiality of knowledge*.

[60] Indeed, we invite the reader to conduct the following experiment: identify a social scientist who now and again uses the word 'knowledge'. Ask them, cautiously, what they understand by 'knowledge'. We hypothesise that, during a disorderly withdrawal, partially dissembled by hurling smoke bombs of confused jargon, the subject will appeal to the standard mantras heard at conferences. They will say, perhaps, that knowledge is more than another thing: for example, 'knowledge is more than information'. This type of mantra is based, in the last instance, on the humanist supposition that knowledge is something that only exists in human minds. Another commonly sought escape route is that 'knowledge is a social product'. If the reader succeeds in interrupting the flow of opaque verbiage to ask what 'social' is, the unfortunate academic will immediately be seen to grow visibly pale. Because in the post-modern social sciences the most extreme curiosities are stimulated, the most irreverent postures are celebrated, but asking for clear definitions of basic concepts – therein lies a real taboo. Only the academic impunity of the

current stage of capitalism would allow the bulk of scientists to use a word like 'knowledge' (or 'social') in the titles of their papers, books, lectures, and all manner of academic exhibitions, without feeling that it would be helpful to have at least a minimal operative definition of the term. Indeed, only the postmodern rejection of definitions, precisions, systematicity, coherence, and other values suspected to be highly repressive and authoritarian, enables what would make the most shameless of the moderns blush to be flourished almost with pride by postmodern academics.

[61] This literature has been discussed in detail in Zukerfeld 2010, Vol. I, chapter 2.

[62] This literature has been discussed in detail in Zukerfeld 2010, Vol. I, chapter 4.

[63] This literature has been discussed in detail in Zukerfeld 2010, Vol. I, chapter 5.

[64] We follow Mario Bunge in this regard: 'An object is real if, and only if, it influences, or is influenced by, another object, or is composed exclusively of real objects' (Bunge 1981, 23).

[65] We follow Fuchs (who draws on Engels to some extent) regarding the relationship between matter, motion, space and time:

> Motion is the mode of existence of matter in space-time. […] Both space and time express the permanence of change that is a fundamental property of matter. Matter permanently organises itself and produces an irreversible sequence of states. (Fuchs 2003, 196, 197)

This quote offers a clear link between materialism and the dialectic – we will revisit the notion of irreversibility below, when we discuss the dialectic.

[66] As Hofkirchner puts it:

> It need not necessarily be a substance in its own right (like matter is said to be) in order to qualify for a materialistic ontology. It is sufficient to consider it as a derivative of matter, that is, as a property of matter (such as structure), which holds for signal transmission as well. Either way, it is considered a material object. (Hofkirchner 2013, 151)

Here Hofkirchner uses the word matter in order to refer to what we call 'matter' here, that is, the subset of physical matter, as opposed to knowledge matter. Nonetheless, we concur with his approach to this topic.

[67] Our perspective draws to a great extent on Fuchs' works (e.g. Fuchs 2003). He offers a sound theoretical framework that is at the same time materialist, emergentist and dialectical. However, here we present a slight difference that arises from our distinction between physical matter and knowledge matter. Thus, where Fuchs (along with other authors), states, for instance, that 'Matter […] is uncreatable and indestructible' (2003, 196), we tend to

believe that a property of physical matter is being generalised to all matter – i.e. including knowledge matter. However, as discussed in chapter 1, knowledge matter has its own properties, among them those of being capable of being created or destroyed.

[68] This leads them to another, monumental, error, which is to confuse informational goods (basically composed of digital information: software, music, films, data) that are objectified, survive the moment of their production and to which can be assigned property rights, with services (that, in contrast, are not objectified, do not outlast the moment of their production, and to which property rights cannot be assigned). This point has been discussed in more detail in Zukerfeld 2013.

[69] It is remarkable that numerous social science scholars continue to forge successful careers on the strength of denying materiality to the electrons from which bits are composed. It is to be expected that progress in the 'sociology of knowledge' will soon catapult to fame and fortune those who disavow the materiality of atoms and molecules and reward them with PhDs, publications, research grants and other transcendent forms of the post-modern academic Being.

[70] Worse still, the idea of immateriality is not a marginal feature of the approaches of the authors that utilise it: it is the foundation of their division between two stages of capitalism. Of course, we concur that there is a transformation from one stage to another, but what changes is the predominant type of knowledge bearer, and what we call the cognitive material configuration, not any move from materiality to immateriality.

[71] We have tried to avoid bibliographical references in the body of the text wherever possible. These notes are based on our own reductive interpretations of Žižek (2012, mainly), but also of Hyppolite 1974; Valls Plana 1979 and Dri 1994, 1995.

[72] Presently, three principles of dialectics suggested by Levins and Lewontin will be mentioned. The fourth specifically relates to this question: 'Because elements recreate each other by interacting and are recreated by the wholes of which they are parts, change is a characteristic of all systems and all aspects of systems. That is a fourth dialectical principle'. (Levins and Lewontin 1985, 275)

[73] Hofkirchner's systemic approach is materialist, emergentist, dialectical, scientific and non-humanist. His titanic endeavour to build a monumental Unified Theory of Information (UTI) is admirable, and we draw to a great extent on his developments. Nonetheless, it is necessary to highlight some differences between his approach and ours. First, cognitive materialism is interested in the historicity of the concepts and, more precisely, in how they are born and raised by particular stages of capitalism. The UTI, on the other hand, is presented mainly as an ahistorical theory. Secondly, as pointed out in the main text several times, our theory arises from trying to understand capitalism as a totality, rather than from an ontological inquiry. Thus, we

arrive at the concept of knowledge matter as a consequence of inquiring into property regulations. As a result, the discussion of capitalism (property, exploitation, classes) is crucial in our perspective, and mostly absent in the UTI. Whereas the UTI is to some extent a conflictless theory, a theory of social harmony, about what is better for everybody (Hofkirchner 2013, Chapter 7), cognitive capitalism is exactly the opposite, i.e. a theory about the inner and inescapable conflictivity of capitalist societies. Thirdly, the UTI (as with most serious emergentist theories), resorts to the concept of information, instead of knowledge. We have tried to argue in favour of our admittedly polemical choice in chapter 1. Fourthly, in cognitive materialism, knowledge matter is studied mainly in relation to its physical bearers. The UTI, in turn, tackles information primarily through its function and complexity (Hofkirchner, 2013, Chapter 6). Indeed, systems theory (in several of its varieties) is closely related to functionalist approaches.

[74] For the reader completely new to these questions, we offer two simple (and somewhat imprecise) examples to illustrate, although in an over-simplified fashion, the functioning of these categories. A mother and her newborn child form a family as an abstract universal. This is a unity in which the infant is not separated from the totality. Their individuality has not yet 'arisen'. Puberty and adolescence give a form to the concrete particular, leading to a split: a confrontation is produced in which the youth struggles to find their own place. The adolescent separates their life off from familial rhythms and customs, dichotomising the previously undivided family. But the affirmation of the nascent identity through the work of negation is also expressed in other ruptures that the adolescent performs: regarding educational rhythms, societal values, etc. The universal concrete arrives with adulthood. The family (in whichever constellation it adopts) often recovers its unity – which continues to be contradictory – but this is *mediate*: it has transcended the oppositions and integrated them into a new level. Ideally, it is not the immediacy of obligatory cohabitation or economic dependence that unites the adult family, but the self-conscious choice of particular group rituals.

The second example is quite different: it relates to the histories of modern states. In all cases there is an abstract universal, in which the regions of a given geography are part of a unity that has not been constructed or recognised as such. A unity *in itself*. The concrete particular appears when the dichotomisations arise: different factions confront each other, often dyadically, to impose their particular as universal, to dominate the totality. These particulars can take the form of religious creeds, ideologies, or geographical specificities. What is crucial is that in this second moment the differences, the individualities assert and recognise themselves through the negation of the other's Being. The third moment is that of the constitution of centralised states. After wars, discourses and laws, a certain equilibrium emerges

between the victors and the vanquished. The dichotomies can – and often do – persist, but now subordinated to the concrete universal of the state that by definition subsumes, by means of violence and a certain degree of consent, all the particulars.

[75] These principles are better understood by contrasting them with their non-dialectical counterparts: (i) There is a natural set of units or parts of which any whole system is made. (ii) These units are homogeneous within themselves, at least insofar as they affect the whole of which they are the parts. (iii) The parts are ontologically prior to the whole; that is, the parts exist in isolation and come together to make wholes. The parts have intrinsic properties, which they possess in isolation and which they lend to the whole. In the simplest cases the whole is nothing but the sum of its parts; more complex cases allow for interactions of the parts to produce added properties of the whole. (iv) Causes are separate from effects, causes being the properties of subjects, and effects the properties of objects (Levins and Lewontin 1985, 269).

[76] This idea of emergence can be found in Hofkirchner 2013, 183.

[77] Now we can better understand the idea that the physical and knowledge matter distinction is a contingent product of this stage of capitalism, mentioned at the end of chapter 1: it is a product of its time, an interpretation of capitalism marked by the current stage, an owl with wings spread as the shades of night gather in this informational dusk.

[78] A comment for those interested in the STS field. Latour repeatedly, emphatically and convincingly criticises the subject-object/culture-nature split, that the subjects he calls the 'Moderns' (Latour 1993) attempt to produce. However, he retains the concept of action (despite attempting an imprecise reformulation). Maintaining it as a central conceptual idea and combining it with the principle of generalised symmetry (particularly with non-humanism) leads as a consequence to one of his most notorious and criticised ideas: that of nonhuman actants. That is, if the central category of analysis is action, and if the analysis must include humans and non-humans, the latter must act in some way. By contrast, if we make the category of knowledge the central idea, as we attempt to do here, there is no need to impose action on non-human entities: it suffices to understand them as knowledge bearers. Of course, from our perspective Latour's approach has other limitations: flattening the emergent levels into a single plane is one that he has started to redress in his more recent work (Latour 2013), but the lack of any interest in studying capitalism is fundamental to his work and therefore insurmountable.

[79] In other works we have produced operationalisations and empirical analysis of different objects. Regarding the history of capitalism and its three stages, see Zukerfeld 2010, vols 2 & 3 for an extensive study. For a cognitive materialist analysis of the structure of the internet see Zukerfeld, 2014b.

A study of educational institutions from this perspective, by means of a national survey, can be found in Zukerfeld and Benítez Larghi 2015.

[80] These four types of knowledge roughly coincide with the four types of systems Luhmann introduces: Machines (objective knowledge), Organisms (biological knowledge), Social Systems (intersubjective knowledge), and Psychic Systems (subjective knowledge) (Luhmann 1995, 27). Of course, our approach has a number of differences from Luhmann's, but it is interesting that the distinction between four levels is similar. By contrast, it is very distant from Parsons' concept of systems and his trisystemic or AGIL approaches. In the latter there is no notion of levels, but instead the emphasis is on aiming for the four functions to account for different systems. In the first schema, the personality system is similar to our knowledge with a subjective bearer. However, the distinction between culture and society (or between the symbolic and norms) occurs, in our view, on a different level to that which Parsons suggests. Both are subtypes (which we shall call axiological and normative) of knowledge with an intersubjective bearer. Likewise, Parsons' framework, while making a distinction which we judge to be futile on the more comprehensive level, omits the biological and objective levels of knowledge. This was partly redressed in Parsons' cybernetics phase, but only with Luhmann's decided rejection of humanism was the problem resolved with greater clarity. For a discussion about Parsons' different frameworks José Almaraz's (1981) text is highly recommended, for the discovery of which we owe a debt of gratitude to the erudite Pablo Nocera.

[81] Searle describes materialism as one of these, reductionist, forms of monism – something that is perfectly applicable to some forms of Marxism, but not to other materialist philosophies, such as the approach here.

[82] This, in passing, can help us to imagine that just as the neurological basis for ideas about the conscious and unconscious, that had been formulated long beforehand (e.g. Freud [1915] 1996), were discovered (on Milner and her case study of H.M. see Kandel 2006, 155ff.), perhaps at some point we will have the scientific elements necessary to account for *the biological fraction* of knowledges with an intersubjective bearer.

[83] Although various texts have been mentioned that accept the idea that objectified knowledge exists, it is worth reproducing David Baird's introduction to his book dedicated to supporting this argument on the specific terrain of science:

> Knowledge has been understood to be an affair of the mind. To know is to think, and in particular, to think thoughts expressible in words. Nonverbal creations - from diagrams to densitometers - are excluded as merely "instrumental"; they are pragmatic crutches that help thinking - in the form of theory construction and interpretation. In this book I urge a different view. I argue for a materialist conception of knowledge. Along

with theories, the material products of science and technology constitute knowledge. (Baird 2004, 1)

[84] In contrast, knowledges objectified in the form of goods that have only consummatory ends, are not technologies, or artefacts, but *ludic objects*.

[85] For example:

Simply put, technology is knowledge, even if not all knowledge is technological. (Mokyr 2002, 2)

The production of one type of knowledge – namely, technology – results in continuing changes in the conditions of production of many goods and services. (Machlup 1962, 9)

In Chartrand's case, the term 'tooled knowledge' is used instead of technology, but the idea is similar:

I will be dealing […] with the knowledge tooled into matter, knowledge embodied as physical functioning things (technology). (Chartrand 2007, 77)

[86] In other studies we have attempted to connect, without any type of causal relationship, the development of some artefacts with that of the techniques possessed by subjects, productive organisations, the values of an era and other kinds of knowledge. See Zukerfeld 2010, vols 2 & 3.

[87] Note that technologies of information *are not information but particular objectified knowledges which information is embedded in.*

[88] We owe the first observation that these technologies can capture unconscious aspects of human activity to Walter Benjamin ([1936] 1969).

[89] These specifics have been explored in Zukerfeld 2015.

[90] More precisely, these are artefacts in which biological energies occupy a negligible – not necessarily zero – percentage of the total energy utilised.

[91] What are the practical advantages of these definitions? If there are any, they will be discovered once the end of this book has been reached, not here, but perhaps a brief comment will suffice for now. This distinction allows us to register not only the relationship of each type of artefact with the energy source, mentioned explicitly, but also the role of knowledge. In the case of raw materials, we have artefacts that *receive* physical and knowledge matter. Tools are artefacts that transmit them, with greater or lesser modifications, to the object of the work. *The crux is that for tools the source of energy and the source of knowledge is usually one and the same.* A hammer receives its ultimate control and momentum from the same human source. These functions can even be relatively differentiated, like in the case of a bicycle: feet provide the energy and hands the knowledge, in the form of steering. Marx states that once this separation has been produced, the origin of the energy

is a side issue. Motorcyclists do not seem to agree, and neither do we. By contrast, the innovative feature of a machine is that it enables the radical separation of the source of knowledge from the energy source. Whoever drives a car only contributes knowledge – if the marginal physical effort of stepping on the accelerator and turning the steering wheel is discounted. The energy source of a machine is just that, a mindless force. Therefore, while machines can be fed by biological energies on some occasions, these must be dumb energies, without the capacity to reflect.

[92] In some sense, the concept of information that economists like Hal Varian use is similar to that used here. This is inseparable from the fact that a majority, and increasing, portion of all information that is produced will never be digested by humans, but is rather doomed to drift between giant databases (Lyman and Varian 2003).

[93] A more precise definition can be found in a text by Emilio Cafassi:

> So-called analogue information, or information through analogy, is connected to the mediation of continuous, not disaggregated, physical quantities such as time, distance, velocity, weight, temperature etc. Their magnitude can give rise to any intermediate value from among a continuous spectrum of possible values, which is at least theoretically infinite. The idea of continuity is mathematically associated with a line and assumes that, given two sequential points, it is always possible to find an intermediate one. The physical continuity of the quantities mentioned cannot be broken, whether it is because the continuity is inherent – as in the case of time – or for practical reasons that prevent it, like the fact that it is impossible to split an object in order to find out its length or weight (Cafassi 1998, 6).

[94] As Cafassi asserts:

> The first disadvantage lies in its limited and incomplete character as an original transduction, which is something like an endemic defect of the bit. It is nothing but a process of deconstruction by sampling, in order to later reconstruct the rest of the original signal by approximation. The analogue world is that of continuities, the digital that of formal discontinuity. Digital information, when emulating analog signals, represents a limit, an obstacle which only the limitations of the human senses to apprehend this character can explain its use (Cafassi 1998, 7).

[95] Software and other forms of digital information are dealt with extensively in Zukerfeld 2010, Vol. 2, Chapter 9.

[96] Although the term codification can be intuitively understood, perhaps it would be useful to clarify that here code has a meaning closer to the concept of *sign*, if this is understood without a humanist accent. In that sense, one

of the definitions provided by Peirce (along with associated concepts like quasi-mind) is useful.

> For the purpose of this inquiry a Sign may be defined as a Medium for the communication of a Form. It is not logically necessary that any thing possessing consciousness, that is, feeling or the peculiar common quality of all our feeling should be concerned. But it is necessary that there should be two, if not three, quasi-minds, meaning things capable of varied determinations as to forms of the kind communicated. (Peirce 1998, 544, MS 793:1)

In effect, here the sign is not necessarily intended for a human interpreter (and this is a period long predating computing). Of course, Peirce's theory is not materialist (the bearer is irrelevant), and the sign includes information as we understand it here, but exceeds it by far. Indeed, the focus of the author's research is on what below we will label linguistic knowledge. However, why use the term codification if this precedent exists regarding the term 'sign'? On the one hand, precisely because the concept of a sign does not assume an objective materiality and includes orality without any differentiation. But, on the other hand, not to dwell on the limitations of the one term but to highlight the virtues of the other, it must be said that codification is a particularly opportune term. This, beyond its use among economists, is due to the fact that 'codification' has extended to the area of informatics to refer to the operation of writing instructions for computers. Thus, the term already has connotations that link the human and the non-human, on the basis of an inert material bearer.

[97] In general, biologists tend to accept that the concept of information is useful for describing various biological entities. For example:

> Both philosophers and biologists have contributed to an ongoing foundational discussion of the status of this mode of description in biology. It is generally agreed that the sense of information isolated by Claude Shannon and used in mathematical information theory is legitimate, useful, and relevant in many parts of biology (Sterelny, 2007, 1).

In any case, it is important to clarify that from our perspective, in order to speak about knowledge with a biological bearer, utilising the term information is a convenience we could easily dispense with. What is crucial is that these are codified forms that can be translated into other forms of knowledge, for example natural languages, comprehensible to humans.

[98] At least since the discovery of the double helix of DNA by Watson and Crick in 1953, it is common to speak about genetics in terms of codes and information. Although it is often used with diverse, and even polemical, meanings,

there is a degree of consensus about applying the term, if a restricted use is made of it, similar to that which Shannon proposed.

[99] The neurosciences, for example, constantly refer to the flows of the central nervous system as information. For example:

> …observing the spinal cord it is possible to understand what the purpose of the central nervous system is: to receive sensory information coming from the skin through bundles of elongated nerve fibres called axons, and to transform it into coordinated motor signals that are transmitted to the muscles through other bundles of axons (Kandel 2006, 66).

[100] For example:

> But there is also another interesting category of biological processes that lend themselves naturally to an informational treatment. This includes hormonal signalling systems, and other mechanisms by which one part of the body conditions the activities of another by means of an intermediate molecule. Here, there is an obvious and almost undeniable analogy between a biological process and paradigm cases of representation use in everyday life. An example is the way that hormones such as insulin, testosterone, and growth hormone are produced in one part of the body, and travel to other parts where they interact with 'receptors' in a way that modifies the activities of various other structures. It is routine to describe hormones as 'chemical messages'. (Sterelny 2007, 10–11)

[101] The term 'post-organic' comes from Paula Sibilia's book *El hombre postorgánico (The Postorganic Man)* (2005). Used here, it refers to the crucial change in the capacity to manipulate life that arises as a consequence of the translation of the genetic code into a code understandable to biologists and, more specifically, to the possibilities that genetic engineering provides.

[102] In effect, more than half a century ago biologists started to translate the language of genes; three decades ago they started to create their own words. But the frontier of language creation is still very far off on the horizon. It is in this bunker that the defenders of 'intelligent design' take refuge (for example see Gitt 2006).

[103] So that any form of knowledge understood as such, and as highlighted in chapter 1, can be included in one of the categories from the typology.

[104] For example:

> A central idea in contemporary biology is that of information. Developmental biology can be seen as the study of how information in the genome is translated into adult structure, and evolutionary biology of how the information came to be there in the first place. (Szathmáry and Smith 1995, 227–232)

[105] Remarkably, even *creationist* scientists, opposed to the atheist Darwinians in all other respects, agree on the analogy between genetic codes and information. The most worthy example is the wonderful book *In the Beginning was Information* (Gitt 2008).

[106] For example:

> Well, to speak to this, for the past 15 years, we have been digitizing biology. When we decoded the genome, including sequencing the human genome, that's going from what we consider the analogue world of biology into the digital world of the computer. (Craig Venter, in Dawkins and Venter 2008)

[107] Nevertheless, it is important to point out that we do not possess evidence to support the idea suggested by all these authors that biology *borrowed* a set of concepts from the information sciences that had already been previously established. Therefore, the possibility that developments in genetics and biotechnology influenced the intersubjective expansion and stabilisation of computing codes is not refuted. Although this issue merits a more detailed analysis, to us it seems more likely that a dialectical interaction between these and other codes has contributed to reinforcing both.

[108] As Tennessee Williams exquisitely illustrates in *The Milk Train Doesn't Stop Here Anymore:*

> MRS GOFORTH: Has it ever struck you, Connie, that life is all memory except for the one present moment that goes by you so quick you hardly catch it going? It's really all memory, Connie, except for each passing moment. (T. Williams 1963, 33)

[109] As Schacter states:

> Implicit memory is revealed when previous experiences facilitate performance on a task that does not require conscious or intentional recollection of those experiences; explicit memory is revealed when performance on a task requires conscious recollection of those experiences. (Schacter 1987, 501)

[110] Why do we only *partially* salvage the 'social fact'? Durkheim considered social facts as collective modes of acting, thinking, or feeling. Only the last two interest us here, since action is not only knowledge. In turn, Durkheim's emphasis on the coercive character of social facts is not relevant or at all clear for all the forms of intersubjective knowledge.

[111] Qualms about Luhmann's concept of communication (synonymous with knowledge with an intersubjective bearer) arise from the Kantian foundations underpinning the author's approach.

[112] Besides the references to the social sciences made above, it is worthwhile remarking that similar ideas also exist in the exact sciences. For example, from the physicist Bernardo Huberman:

> Intelligence is not restricted to single brains; it also appears in groups, such as insect colonies, social and economic behavior in human societies, and scientific and professional communities. In all these cases, large numbers of agents capable of local tasks that can be conceived of as computations, engage in collective behaviour which successfully deals with a number of problems that transcend the capacity of any individual to solve […] When large numbers of agents capable of symbolic-processing interact with each other, new universal regularities in their overall behaviour appear. Furthermore, these regularities are quantifiable and can be experimentally tested. (Huberman 1995, 250)

[113] As illustrated in previous chapters, we take the liberty of using this term ('social') from time to time, for the purpose of facilitating a flow of communication with the reader, but we share Latour's (2005) criticisms of the ontologisation of the social. In fact, our recurrence to the term intersubjectivity is done with the aim of replacing 'the social' with an alternative rooted in the Hegelian tradition.

[114] It is tempting to point out that the combination of these five types of knowledge with an intersubjective bearer constitutes what is often denominated *Culture*. However, this term generates much confusion. Even though in some anthropological perspectives the concept of culture is used in a sense similar to the one mentioned here, in sociology (particularly the functionalist current) culture refers to a system characterised by the consummatory and non-instrumental (art, philosophy), as opposed to the sphere of the economy and instrumental reason. This use of the term culture, a product of industrial capitalism, is widespread and, evidently, is not materialist. A third type of meaning of culture is that which is associated with 'the immaterial', 'the intangible'. Although this meaning can refer to intersubjective aspects (or not), the problem is that it tends to emphasise a supposedly abstract, ethereal, mystical character of what is more appropriate to study in its concrete material manifestations. The cultural materialism of R. Williams or Fuchs strives to overcome this limitation. The concept of culture, in sum, requires an exploration that there is no space for in this succinct book.

[115] For an erudite and rigorous take on the production of Bakhtin and his circle, see Nocera 2009.

[116] As a dictionary of linguistics states:

> Natural Language: Term for languages which have developed historically and which are regionally and socially stratified, as opposed to artificial language systems, which are used for international communication or

for formulating complex scientific statements. Natural languages differ from artificial languages particularly in their lexical and structural polysemy, the potential ambiguity of their expressions, and their susceptibility to change through time. (Bussmann, Trauth and Kazzazi 1997, 322)

[117] Elsewhere (Zukerfeld 2009a) we have attempted to explain that the concept of 'capital', whichever adjective is attached to it, has shortcomings when accounting for the different forms of intersubjective knowledge, given that it has diverse properties which are even contradictory to the properties of the latter (deterioration with use, increasing returns to scale etc.).

[118] Of course, defining social collectives on the basis of a certain type of *knowledge* is relatively unusual for traditional sociology. In general, concepts such as society or community are employed in relationship with certain types of *social action*, following the influential work of Weber. Furthermore, the idea of action in many cases appears as the foundation of all the sociological categories. However, as stated above, here we adhere to the interrogation that Luhmann submits this conception to (e.g. Luhmann 1995, 163–171). In that author's perspective, the concept which is key to understanding the articulation of social systems is 'communication', associated with the reduction of complexity, in other words, opposed to the idea of transmitter-receiver and which resembles the features we attribute to intersubjective knowledge. In fact when Luhmann (1995, 154) states that 'communication is coordinated selectivity', the idea of 'selectivity' is similar to what we define as knowledge in chapter 1, while the idea of coordination is subsumed, from our perspective, under intersubjectivity. Although we have some differences with his position, the points of agreement are obvious: social bonds are made of a certain form of what here we call knowledge, and not of actions. Moreover, Luhmann's communication, just as our knowledge with an intersubjective bearer, exists on a different level to individual human subjects.

[119] As Boorstin asserts, celebrity cannot be explained by the possession of any technique (SK) or axiology, but simply by fame itself: 'A celebrity is a person known for his well-knownness. Celebrities intensify their celebrity images simply by being well known for relations among themselves. By a kind of symbiosis, celebrities live off each other.' (Boorstin [1961] 1992, 57)

[120] It could be argued that this is a phenomenon typical of any period. After all, the powerful were always celebrities, in a certain way: kings, athletes, politicians, actresses. However, whoever received attention in other periods had it as a *consequence* of other well-defined attributes. By contrast, as Boorstin or Bauman show, the prototypical celebrity does not emerge from any inheritance or from possession of a technique. In turn, the pursuit of a maximum amount of attention as a mass and structuring element of the ideal subject type – the measurement of the volume of followers, 'friends', likes, video views, etc – is a phenomenon unique to informational capitalism. The issue is not how many celebrities there are, but rather to

what extent the logic of attention-capturing moulds the intersubjectivity of dividuals.

[121] But, as mentioned a few endnotes ago, in our opinion the concept of 'culture' is put to better use if it designates all forms of intersubjective knowledge, and not only this type of knowledge.

[122] As well as the very distant concept of symbolic system or culture in Parsons, the social imaginary in Castoriadis exceeds our axiological knowledge and includes, for example, linguistic knowledge and normative knowledge.

[123] Rationality itself (in a Weberian sense) is a non-rational historical belief, a type of axiological IK.

[124] This distinction between bearers is useful for elucidating the materiality of the beliefs Žižek refers to in his discussion of the *Critique of Cynical Reason* by Peter Sloterdijk: the fact that the subject unveils a concealed order does not dissolve it. The materiality of the other, intersubjective, level is imposed on the subject, and they must behave, as Sohn-Rethel says, as a 'practical solipsist' (see Žižek 1989, Chapter 1).

[125] One of the concepts that take pride of place in the most varied social science theories is power. We cannot linger here to discuss it with the caution it deserves, but we can say that stemming from the theoretical framework presented here, power – understood in the Foucaultian sense, in the sense of Spinoza's Potestas or Weber's domination – is a form of knowledge, particularly axiological knowledge. The 'probability that a given command will be obeyed' (Weber [1922] 1968, 43) alludes precisely to the existence of a web of intersubjective beliefs that make obedience probable. Of course, in a restricted sense we are removing 'violence' from the semantic field of power. Naturally, this issue is more complex and although axiological knowledge is the decisive foundation of power, this can be effectuated through the different knowledge bearers. *In fact, a task for the studies which will follow this work is to use the typology of knowledge as a tool to capture the diverse forms of power (biological, subjective, technological, linguistic, organisational, etc).* In any case, it suffices to say that, in our opinion, and contrary to Weberian genealogy, power is not situated in the lineage of the concept of action, but rather in that of knowledge. A final clarification: it is enough to couple power and knowledge ('understanding' would be more fitting here) for Foucault's ghost to be conjured. However, Foucault's conception of knowledge-power, of the irrevocable contiguity of power and knowledge, differs from ours in various respects. One of them is that for Foucault (e.g. [1975] 1995, 27–28) both terms have a relationship of proximity, of mutual necessity, but they are distinct. In our case the concept of knowledge – which as the reader will have observed, differs greatly from Foucault's – entirely subsumes power.

[126] This procedure is, partially and in the last instance, based on Durkheim's methodology in *The Division of Labour in Society* ([1893] 1993).

[127] Ostrom 1990, 2009; Ostrom and Hess 2006; Eggertsson 2003; Vercelli 2009; Zukerfeld 2005, 2008b.

[128] In chapter 6 we shall see that it can be useful to study the variable combinations of physical and knowledge matter, that is, *resources*. But for now the distinction between the two entities mentioned will suffice.

[129] It is interesting that the need to conceptualise forms of the non-state public comes from at least two completely unrelated tendencies: one is Italian autonomism (e.g. Lazzaratto 2006; Hardt and Negri 2000; Virno 2003, 2015). The other is the study of 'common pool resources' by Ostrom and her colleagues (e.g. Ostrom and Ostrom 1977; Ostrom and Hess 2006).

[130] This distinction is one of the relevant elements which are useful to respond to Hardin's article *The Tragedy of the Commons* (1968), as famous as it is indefensible, lacking even the most minimal sociological bases.

[131] This distinction can be found in the works of Ostrom (e.g. Ostrom and Hess 2006) and Eggertsson (2003), but its first formulation seems to be from Ciriacy-Wantrup and Bishop (1975).

[132] Further distinctions could be made about the proprietor's rights that each of the regulations entail. For example, expanding the traditional ideas of *usus, fructus and abusus* (Moulier-Boutang 2004), although without explicitly naming them, Schlager and Ostrom (1992) offer five types of rights whose presence or absence characterises the different regulations: non-subtractive use, subtractive use, and the possibility of excluding from, managing, or alienating a resource. However, *in none of the texts, as far as we are aware, is a clear separation made between the forms in which these regulations affect physical matter and knowledge matter.* Remember that in Ostrom's division between 'high subtractability' and 'low subtractability' (that could resemble physical matter vs knowledge matter) both the light of the moon and a piece of digital information appear as carriers of the same properties, which is clearly mistaken.

[133] These phenomena have been scrutinised in Zukerfeld 2010, Vol. 3, chapters 1 and 2.

[134] In the abstract universal, the productive forces are barely differentiated, the different types of productive forces flow in a relatively unmediated way. At the second dialectical moment, the concrete particular, a certain degree of splitting is produced: here is where the social relations of production stand out as distinct and contradictory – to a greater or lesser extent – from the other productive forces. This micro or macro contradiction tends to resolve itself at the third dialectical moment. The social relations of production – and the other productive forces – reach a new condition, not of rest but of less tension than in the previous moment; a new fusion arises.

[135] These last paragraphs could be extended considerably, if this book belonged to the erstwhile abundant genre of Marxist theology. Before any objection that our interpretation is mistaken, ill-informed, or forms part of a global

conspiracy to prevent a revolutionary party from taking power, we at once bow down in homage before the exegetes of the sacred texts. Texts that, surely, those titans of social transformation seem to inoculate themselves with more by propinquity or osmosis than by the bourgeois habit of reading. We also, naturally, genuflect before the Marxists who may think, after reading what follows, that on the contrary, the central ideas unpacked over the length of this book 'had already been perfectly suggested-anticipated-explained-and-overcome by Marx', and that our only contribution is to change some words, adding some complicated and woolly terms in order to claim undeserved merit. To this, we throw our hands in the air and confess: guilty of both sins, if that is possible.

[136] The curious reader can find an exploration of this characterisation as well as empirical sources on which it is based in Zukerfeld 2010, Vol. 2. Due to lack of data, for the first two periods knowledges with a biological bearer are not discussed.

[137] In this sense, among others, mercantile capitalism continues to be a period of preparation for the future dominion of specifically capitalist regulations that would only take place in industrial capitalism.

[138] Although many terms from physics are employed here, it is important to clarify that they are given a use which only serves the objectives of this theoretical framework. The bibliographical references merely suggest the texts that these terms have been taken from, but in no way are they a suggestion that those texts justify the use made here of those signifiers, which is highly unlikely. This section has benefitted from opportune comments made by Prof. Emilio Cafassi a decade ago.

[139] This concept shares a resemblance with Freud's use of it to designate psychoanalytic work: the translation of the unconscious to the conscious (Freud [1915] 1996, 161). More generally, in content it is also similar to Nonaka and Takeuchi's concept of 'conversion' (1995: 68–102). Likewise, the concept of translation is used by the actor-network theory (for good summaries see Latour 2005 and Law 1992). However, for this theory, *translation* refers to the possibilities an actor – specifically a scientist – has of modifying their ideas in order to galvanise the support of 'powerful allies'. Without attempting to assess this framework, suffice it say that the meaning we attribute to the term is different. We do not refer to operations directed towards a particular goal, or even those necessarily driven by a human, but exclusively to the process by which a content of knowledge mutates on its journey from one form to another.

[140] The objection could be raised that it is not appropriate to call this translation. That actually, there are signs, symbols, or rather, 'strings' that do not carry knowledge but are instead 'affordances': they allow the human to eventually construct knowledge. In our opinion, Harry Collins (2010) provides the best version of this approach. It is, of course, a humanist perspective which brings

us to the debate about what is and is not knowledge. For Collins, and many others, knowledge only exists inside and between humans. What remains are merely patterns, among which there is no distinction between their character of being natural or a human product. And, for example, between different pieces of information there is no translation, only transformation. Meanwhile, translation refers only to languages, interpretation, to meaning; in other words, to humans. While in other aspects not mentioned here this approach has much in common with cognitive materialism, it does present several limitations. Two of these are: (i) It prevents us from conceptualizing the importance that objectified knowledge in different bearers (through patents, copyrights etc) has for capitalism. The division between strings (objective) and interpretation (human) is not consistent with capitalist regulations of knowledge and, consequently, thwarts our understanding of them. Indifference towards the capitalist dynamic is an explicit feature of Collins' perspective and, certainly, of a large part of the Science, Technology and Society field. That is not to criticise the internal coherence of the approach, but to point out the limited nature of the terrain on which it acts. (ii) It prevents analysis of the material aspects of translation. Everything seems to depend on human interpretation, when it is evident that the properties of the bearers are a significant element in order to explain the dissemination or disappearance of different knowledges. Although Collins' work in particular has evolved since the 1970s until today, placing greater emphasis on material entities and, more specifically, on translations associated with digital information, the dichotomisation between subjects and objects, in other words the humanist prejudice, deters him from analysing flows of knowledge in a sufficiently materialist way.

[141] This simple definition aims to integrate and overcome the reductionisms that characterise human beings by a particular type of translation or bearer. For example, the idea that the human being is the only being which can create technologies, that is, objectify knowledges, has some shortcomings. In the face of this, as with Marx's famous example of bees, spiders, weavers and architects, another form of knowledge is resorted to: those with a subjective bearer are those which would characterise the human being. However, these two aspects, even taken together, are insufficient, insofar as they elide the other knowledges that characterise human beings.

[142] A few provisory notes. *Communication*, in this text, designates any chain of operations that has two (or more) subjective knowledges at both ends. Thus, communication does not only involve humans interacting face-to-face or by telephone, in other words to processes occurring simultaneously which may or may not be mediated technologically, it also accounts for exchanges that occur diachronically. There is communication when a letter is found many years after it was written, but also when a melody is heard at a time and place far from the point at which it was recorded. In these cases,

communication must not be confused with translation from informational OK to SK. Communication comprises the chain that goes from a handful of broadcasting subjective knowledges to those who receive it. *Learning* can be seen as a form of translation in that, whatever is at one extreme at the opposite end is a specific form of subjective knowledge: explicit or implicit long-term memory. The original source could be another SK – communication from a teacher – and information IK – reading a text or even a SK (a knowledge which moves from explicit to implicit). Thought can perhaps be grasped as a translation of implicit to explicit SK. What was vague becomes clear, is articulable, takes shape if not in words then in images.

[143] As shall be seen in chapter 5, this is an important element which enables us to understand the existence of forms of capitalist exploitation that occur outside of the so-called 'working day', typical forms of informational capitalism.

[144] Otherwise, absurdities are produced, such as the one that Samuelson is credited with having indicated: according to a calculation of GDP (much like those which are still dominant) which does not take these domestic processes into account, if in an economy the employers of domestic workers married them en masse, the gross product would fall although economic activity would be identical. In this case, it is clear that the disavowal of the economic significance of these activities has a gender component. On recognition of these activities see Mokyr 2002, 10, footnote 12.

[145] Of course, these productive processes are highly dependent on flows of attention. More precisely, in mass audiovisual communication the productive processes of the radio or TV commercially produce attention with two aims: *the construction of intersubjective beliefs (ideology among them) and exploitation through the inculcation of particular knowledges*, as we shall see in chapter 6.

[146] Another approach that informs our concept of productive processes comes from Harry Hillman Chartrand, who specifically considers that the *results* of productive processes are persons, tools, and code. The former are explicitly considered to be intermediate or final outputs (Chartrand 2007, 103–5).

[147] Marx adopts this idea, although in a restricted sense, for his contentious division between productive and unproductive labour, which followed on from the discussions of classical economists (for a history of this discussion see Hill 1999).

[148] Remaining within the inner workings of commodity production processes, the inoculation of subjects with knowledge sometimes occurs not as a primary objective of the productive process but as a complementary or intermediate activity. On the terrain of neoclassical and evolutionary economics, concepts such as 'learning by doing', 'learning by interacting', 'routines', 'skills', 'tacit knowing' and many others refer to this: the activity of work produces certain subjective and intersubjective knowledges among those who participate in said activity, which are not objectified in goods, but in

the subjects. Naturally, in some cases this production of subjects is a mere *externality* of the productive process, but is increasingly a conscious and internalised aim.

[149] A resource is, for now, a combination of physical and knowledge matter. This concept will be explored in more depth in chapter 6.

[150] The norms referred to here can have an extremely variable scope. For example, they may be informal agreements, contracts with a company and, of course, local and national laws. However, the crux of the matter is that they are in an intersubjective bearer; in other words, they have been internalised by the subjects participating in the productive process.

[151] That is, subjects liberated from feudal fetters, from slavery and other forms of personal interdependence.

[152] The worker has non-exclusive access to knowledge. To put it another way, she carries productive knowledge (usually skills, implicit knowledges, although possibly explicit knowledge as well, such as formulas) for which, however, she is not the exclusive title-holder (she lacks intellectual property rights to them). In turn, she has non-exclusive but necessary access to a broad spectrum of intersubjective knowledges (starting with language, her participation in an organisation, a set of beliefs roughly compatible with those of the capitalist, recognition of herself and the capitalist and, of course, internalisation of norms), and in many cases to technologies (which she uses but cannot profit from excluding third parties, for example, as they are pervasive like screwdrivers, or computers in certain contexts).

[153] Although a labour contract is usually associated with working hours, this has not necessarily been the case in historical terms, nor today, and more importantly neither are there logical motives to reduce the subordination of labour to capital to a question of time. The notion of labour time, useful to give an account of numerous capitalist productive processes from the mid-nineteenth century up to the beginning of the twentieth, is insufficient for the periods prior to and after that. The category of time (as well as those of action, labour, humans) must be subordinated to other more general ones in order to be able to understand the productive processes that can be observed in the current stage, informational capitalism. For example, various forms of capitalist exploitation, as we shall see later on, do not depend on the limited notion of labour time.

[154] This can take the form of salaries, or more generally, money. But it can also assume other forms, such as recognition, access to software etc.

[155] Capital feeds diverse knowledges into the productive process which are not necessarily carried by labour. The knowledges borne by machines, by scientific manuals, by the codification of knowledge stemming from previous processes, by the subjectivity of the capitalist etc., all play a central role.

[156] In the next chapter our concept of exploitation which evidently differs from the traditional definitions, will be discussed in detail.

[157] For a characterisation of these three stages, see Zukerfeld 2010, Vols. 2 & 3.

[158] The capitalist dynamic entails the broadening of exclusive access regulations and commodity production to arenas where those normative intersubjective knowledges are absent. Thus, the dialectic between capitalist and non-capitalist productive processes (mentioned below) advances in detriment to the latter, although never managing to eliminate them entirely.

[159] In other words, human subjects are legally 'free' from the fetters of feudalism or slavery. This fundamental rule of capitalism, however, is constantly under threat. The forms of slavery or quasi-slavery, which are nothing more than a form of expropriation – explored in chapter 5 – represent the struggle of practical capitalism against its formal norms.

[160] The combination of non-exclusive access or no access to physical and/or knowledge matter produces four types of workers: autonomous workers, cognitive workers, physical workers, and excluded workers, as we shall see in chapter 6.

[161] These three concepts, particularly exploitation, will be discussed in detail in the next chapter.

[162] As indicated above, the 'matter' and energy that are fed into capitalist productive processes operate under the logic of the exchange of equivalents.

[163] How is it possible to abolish a given form of property and exchange of equivalents for the sake of expanding the realm of property and the exchange of equivalents? Here we have one of the striking paradoxes of capitalism. The property titles of some capitalists must be torn up in order to save those belonging to the most powerful; the market must be sacrificed so that oligopolistic expropriation can do its will on earth as in heaven, as Saint Matthew proclaimed.

[164] This characteristic is, of course, far from being specific to capitalism.

[165] Thus, the figures of labour and capital at a systemic level are not a mere accretion of the figures of the worker and the capitalist in individual productive processes. They represent emergent levels whose properties cannot be reduced to the meanings on the other level (or vice versa) as indicated in chapter 2.

[166] Indeed, the capital-labour contradiction is typically observed between human subjects. In this case, it refers to the traditional representation of workers and capitalists as mutually exclusive groups of subjects. This intersubjectivisation, however, is not by any means the only possible option. The contradiction between capital and labour can also manifest itself *within* particular subjects that in many cases act as a bearer for capital and/or of labour alternately (like a share-owning worker). Or it can be particularised between capital as knowledge objectified in technologies and the human workers (such as in a factory in which the workers only have contact with an assembly line or a computer). And, to the extreme irritation of the humanists, the possibility should not be discarded of future forms of the

contradiction between capital and labour arising which may adopt completely non-human manifestations (if we had Žižek's talent we could enumerate some films that suggest this, and combine them with a joke about eastern European peasants).

[167] Such as, for example, the processes mentioned above: ideologies, unpaid domestic chores, war.

[168] Productive processes as heterogeneous as war, unpaid domestic activities, and the intersubjectivisation of ideologies are as important as the processes that happen in businesses.

[169] Of course, this relationship in which a totality A is defined in relation to the dialectic between A and not A can be conceived of on the basis of a Aristotelian logic of identity in which A=A. In contrast, in the Hegelian dialectic a totality A is never equal to A. It always contains contradictions and excesses etc.

[170] The second limitation is connected to the fact that they do not even interpret expropriation as a phenomenon associated with physical matter, while exploitation, under capitalism, rests on the ontology of knowledge.

[171] It is important to note here that these concepts are not based on the labour theory of value as developed by Marx, and later Marxists. In any case, the specific relationship of the concept of capitalist exploitation with Marxian value theory is discussed below.

[172] I have used this beautiful quote in classes, lectures and articles, and it is generally well received by the audience. Though I have made no attempt to prevent my occasional readers and listeners from forming the opinion that the text had been harvested as a ripe fruit plucked from the tree of erudition, here it is probably prudent to clarify that in fact my transparent ignorance has been preserved from any direct contact with St Augustine's works that could have clouded it. Instead, I took the quote (with the only precaution of checking it against the original) from an excellent text by Kavita Philip (2005), whom I wish to express my gratitude to in this understated but emotive ceremony.

[173] This marks one of the several differences between the term regulation as used here, and concepts like codification (or axiomatic for capitalism) in Deleuze, which is broader.

[174] Arendt, Castoriadis and Negri, among others.

[175] Writing, of course, is not a necessary pre-condition. Both ancient societies that have left no written record, and present-day mafias who prefer not to leave any, have regulations that are no less strict for lacking codified manifestations in texts.

[176] Indeed, regulation can take a para-state form on macro and micro levels. In the first case, a family could have clear regulations that allow expropriation and exploitation. Usually, in a typically heteronormative family, the male figure is the regulator (who determines the norms), the exploiter

(who keeps a portion of the value that the female figure and eventually the children produce) and the expropriator (who dispossesses the other family members of certain goods). In this case the dialectic between the regulation of physical matter and that of knowledge matter can be seen clearly: the dialectic between physical violence and declarations of love that construct relationships of domestic violence are a well-known phenomenon. On the macro level, the regulations proper to religions or organisations dedicated to criminal activities are obvious examples. In effect, both modalities oversee specific forms of expropriation and exploitation that may or may not be in contradiction with the directives of the state they are embedded in.

[177] All states have more or less important cases of norms that have become (or always were) a dead letter not incarnated in intersubjectivity. According to Lawrence Lessig and other authors, this is the case for copyright regulations after the appearance and diffusion of the Internet.

[178] The state extends beyond capitalist regulation, that is, it produces norms that exceed those specific to the capitalist dynamic. Meanwhile, the state, that is usually but not necessarily present in other forms of regulation, is an essential component for capitalist regulation.

[179] Of course, the idea is not that capitalist regulation is immanent whilst the former are transcendent. All regulations are immanent. *Here the argument relates to beliefs, values which underpin the regulations*. Thus, capitalist regulations, in historical terms offer the first mass example for which the immanence of regulation is explicitly recognised: this self-consciousness goes hand-in-hand with the theories of Hobbes, Locke, Rousseau and others. Capitalist regulations, however, are not the only ones based on a non-transcendent axiology: socialist, communist, and anarchist regulations have this characteristic.

[180] The expression 'usually' might be disturbing. In fact, over the course of this chapter we will only discuss relations of expropriation and exploitation between humans. So, why introduce this uncertainty, this gateway through which non-humans can enter the relations of expropriation and exploitation? Simply because it is possible to conceive of social organisations in which intersubjectivities could arise that would enable these practices. This is conceivable along two lines (next follows two partly imagined examples, and then a conceptual argument). On the one hand, the blurring of the regulation that separates humans from robots; on the other hand, that which separates humans from animals. As regards the first of these, although property, exploitation, and expropriation are not the favourite concepts of Hollywood science fiction, it is not difficult to imagine a scenario in which these concepts apply to robots, cyborgs, or any other non-human entity capable of producing knowledge and eventually reproducing them. Could not a robot be the owner of the physical matter it carries, just as a human is? Is the robot not expropriated when it is sold? Is the robot not exploited

when it receives only a portion of the product it generates (that, incidentally, is related to its physical reproduction, while just like humans, it does not receive any compensation related to the knowledges it objectifies)? While in this case it is sufficient for Haraway to be invoked by a scriptwriter, reflections about the expropriation and exploitation of *animals* would require an emulator of Houellebecq to write a novel in which an extremist environmentalist party won a general election in some European country and decreed that animals had rights to the land that humans have expropriated from them. Extending the idea, their own 'matter' and energy (which this Green party would declare the animals proprietors of) would not be alienable (mandating veganism, naturally). Of course, the exploitation (overexploitation, technically) of those extenuated and undernourished working horses would have to be regulated too. Now, the possibility that there could be organisations for which expropriation and exploitation without humans could take shape indicates that we should use concepts such as actants (Latour, 2005) to refer both to human and non-human bearers in action alike. The use of this controversial category is extremely tempting, not least because it could prove as irritating for Latour enthusiasts (whose texts do not tolerate the word capitalism, let alone exploitation) as for Marxists (who refuse, with understandable reasons, to see the relationship between scallops and Che Guevara).

[181] The terms relations or social relations have begun to be used surreptitiously over the last few pages. This is a consequence of having defined expropriation and exploitation (for the purposes of the current presentation, it is worth repeating) as connections between humans. Once on the level of humans, these bonds can be understood as 'social relations' in a Weberian sense.

[182] This does not mean, of course, that in all cases measuring the magnitude of this asymmetry is simple or even possible. But the difficulty of numerically measuring something does not imply that it is impossible to capture, nor much less imply its inexistence.

[183] It is true that this idea (based on Steiner 1984) belongs in certain measure to the imaginary world of liberal political correctness. In practice, there are colleagues, acquaintances, and above all, companies that make contributions to political campaigns, who challenge this notion of the donator and gift-giver.

[184] For example, even though slave labour is legally prohibited in Argentina, many textile workers originating from Bolivia are submitted to this wretched condition in the city of Buenos Aires. The two moments of regulation are present: the domestication of the body through the separation of the worker not only from any means of autonomous subsistence, but also from those needed to access the free labour market – by the forced seizure of their identity documents – material restrictions of the buildings, doors,

security cameras, the regulation of knowledge through the organisation of the workshop – roles in the productive process, working hours etc – a specific vocabulary, recognition – of authority, of the other workers – a set of beliefs – that escape is impossible or disadvantageous because the worker will be deported, that it is possible to save money in order to send remittances home to their families or to free themselves in the future – and specific norms – how much should be produced, how much wages are, which conducts are allowed and which forbidden etc.

[185] Of course, the idea that expropriation and exploitation are distinct from other relations (such as theft) because the former are protected by some kind of norm is clear for the extreme cases, but it can be ambiguous in intermediate situations. In effect, where appropriation of resources occurs when there is *law* (in other words, a norm legally sanctioned by the state), we are without doubt in the territory of expropriation and exploitation. Contrastingly, when this occurs exceptionally, contingently and unsystematically without being framed by any regulation (*there is no norm*), it is evidently not expropriation or exploitation, but rather theft or some other relation. But what happens in the grey areas, where there are non-legal norms, or where the situation changes over time? It has already been emphasised above that in cases of well-defined and intersubjective norms illegality is not an obstacle that prevents the application of the concepts expropriation and exploitation. The productive and exchange processes of mafias exemplify this with crystal clarity, as do those of guerrilla and other para-state organisations. The question, however, is how 'well-defined norms' is defined. Or where to draw the line between the contingent event and a habitual practice – where, for example, something starts off being an individual act of piracy and ends up being becoming a fleet of pirate ships with well demarcated regulations. Although each situation merits specific consideration, two comments can be made. First, the idea of 'protected by norms' means either legal or intersubjectivised. Intersubjectivised means, here, that the norm (e.g. 'peasants from this region must contribute 10 per cent of their production to a particular organisation') must be extended to a large collective of subjects, and that its validity is not weakened by the disappearance of one or another believing individual. Second, explicitly drawing on the Hegelian perspective presented in chapter 2, let us say that like Minerva's owl, here we are only able to unfurl our theoretical comprehension at dusk, at a prudent distance after the events have occurred. If in eighteenth-century England the enclosure of a field by an individual was the subjective expression of a vocation for appropriation (let us say theft) or, if in contrast, it was the manifestation of an intersubjectivity suffused with norms about the individual and property that would be extended day after day, year after year (an expropriation), was an unknown that only time could reveal.

[186] Among other concerns, the question could arise about the unpaid appropriation of human energies in a non-capitalist context – is this a relation of exploitation or expropriation? It would be exploitation if what actor E appropriates is *the fruit of the application of that energy* to a productive process; it would be expropriation, on the other hand, if what E appropriates is the totality of the vital energies. Of course, in the case of expropriation of human beings it is likely that processes of exploitation will also be observed if some kind of productive process is involved.

[187] It is true that the action of constituted regulation can come to his aid when the forces of the expropriator falter.

[188] To put it more abruptly, it is curious that self-described critical thoughts essentialise the categories of 'action', 'relation', 'individual', but above all 'labour', without observing that they are based on a split that capitalism introduces. It is capitalism that materially invents humanism (including its liberal and Marxist varieties). Therefore, the humanist critique of capitalism is armed with a vocabulary forged by its enemy. This does not imply a refutation of humanism, but rather an appeal about its lack of self-awareness of the material conditions that gave birth to it.

[189] Goods and services produced with the aim of being exchanged on the market for other goods and services.

[190] However, it should not be assumed that domestic exploitation cannot take capitalist forms. Of course, situations exist in which the patriarchal relationship leads to forms of capitalist exploitation in which the fruits of women's labour are appropriated by men who commercialise them. It is not difficult to find examples of this – from agricultural labour to sex work.

[191] The reader must not confuse the term 'commercial equivalent' with the fact that we are dealing with non-commercial exploitation. The idea here is to compare the cost of the approximate monetary equivalent of the goods and services offered with those received by a producer. For example, one could compare the total goods and services that a housewife receives with the market value that the goods and services she produces outside of the price system would supposedly acquire on the market (for example by a domestic employee). If the second amount is significantly higher than the first, we have a case of non-commercial exploitation.

[192] It is not a question of studying these forms for ethical motives, to make visible and reappraise the role of women in economic production but above all, for strictly scientific reasons, because of the role that these modalities have in the functioning of the economic totality.

[193] In Castells' terms, those societies in which the state controls the surplus (1996: prologue).

[194] It is tempting to make an analogy with the humanist concept of action in its finest version, that of Weber. Indeed, the existence of an 'ideal type' of capitalist action (goal-oriented rational action) does not prevent that in practice

this is mixed in an essential, that is to say not ancillary or contingent, way with others (actions orientated by affects, values, tradition).

[195] Weber [1922] 1968, Chapter 3.

[196] In slave and feudal non-commercial exploitation this is stipulated positively. The master or the lord issue orders and the slave or serf obey, regardless of their economic or non-economic nature. With the exploitation of women (or children) in patriarchal homes the same occurs: the exploitation is a consequence of the legitimation of relations of domination. And in the statist cases in which there is exploitation, despite it formally being supposed that there is no domination, it is evident that the exploitation is accompanied by state encroachment into extra-economic aspects of life activity.

[197] Anyway, the proposed typology of knowledge allows us to incorporate both: skills relate to subjective knowledge while 'organisation assets' can be better understood by deconstructing them into organisational knowledges and recognition knowledges. In contrast the approach of these authors shares some common ground with the liberal idea mentioned earlier, and both are in the last instance connected to Weber's theory of stratification.

[198] This conception is inseparable from the idea of a 'cognitive' stage of capitalism, an idea which assumes that there have been stages for which knowledge was less significant. On the contrary, we have repeatedly attempted to show that knowledge (and regulations of it) has played an equally important role throughout all stages. What changes, evidently, are the predominant types of knowledge (Zukerfeld 2010).

[199] I am grateful to Prof. Christian Fuchs for judiciously pointing this out.

[200] Additionally, super-exploitation is often illegal under capitalism, wherever adequate compensation for basic energy replenishment, within a framework of productive *labour* processes, is habitually defined by a minimum wage.

[201] In general, these comments are the result of having modified the definition of exploitation to give an account not only of the merchant and industrial stages, but also the current stage, informational capitalism. Informational capitalism sheds light on the previous periods, much as human anatomy gives us insight into that of the ape.

[202] Of course, it could be argued here that 'means of production' *properly understood* includes, for example, the network of relationships (recognition) and the flows of attention necessary for, let us say, a self-sufficiently recording band of musicians to be able to go independent of the record label that exploits them. The key lies in 'properly understood'. It is as true that anything could be included in the concept, as it is that for Marxism the strong emphasis is on land and, especially, machines. In any case, even though it can be pointed out that informational workers do not control all the means of production, it is hard to deny that they control (and are even owners in the Marxist sense) many of them.

[203] For an exploration of informational workers and their relationship with the means of production, see Zukerfeld 2013.

[204] This idea signals a difference with authors such as Roemer and Wright, who both hold that *the exploitation processes based on this kind of resources are not capitalist*. They describe them as socialist or statist. Of course, this arises from the limited way in which they incorporate knowledge into the study of capitalist exploitation.

[205] This is an issue that has been considered by the literature (Roemer 1985; Wright 1985). However, the problem becomes apparent and pressing in relation to the tendency towards outsourcing that is increasingly observed in informational capitalism. It is unconvincing to maintain that if a worker inside a productive unit experiences exploitation, that if the same services are provided in exchange for a similar income from a unit of production or even from the worker themselves (in the case of a self-employed worker), that it would not be exploitation.

[206] Typically, for exploitation through reproduction, time is not a relevant variable.

[207] The category of labour, in the sense given to the term in this text, as a figure resulting from capitalist normative knowledges must not be confused with work as an activity, as a type of action, which is the sense given to it here, following a use shared by several authors.

[208] In this sense it is interesting that even in critical approaches to the Marxian labour theory of value that attempt to maintain the notion of exploitation, it continues to be couched in this notion of *work* (Roemer 1985; Yoshihara 2006).

[209] It is important to note that though participation in the productive processes may be unconscious (that is to say, it is not perceived as such), this does not mean that it is not consented to: the e actors consent to perform concrete actions (sharing ancestral knowledge, submitting themselves to advertising, giving up personal data etc) although they might not be aware that this means participating in a capitalist productive process.

[210] This distinction arises from group discussions in which some colleagues raised whether it made sense to speak of exploitation in situations in which the contribution made by each individual subject to the productive process was infinitesimal. I would especially like to thank Andrés Rabosto for his critical contributions to the position defended here.

[211] It is not possible here to devote any space to the origins and limitations of these expressions, other than to draw attention to the notion of 'force', omnipresent in Marx, that is indissociable from the 'mechanical physics of his era' (Echeverría 2011, 300). It would be interesting to investigate to what extent the relative (total in the case of intellectual property) neglect of the role of knowledge in Marx's thought is related to the axiological and linguistic knowledges of the time, in which force was a completely naturalised concept.

[212] A serious limitation of this book is the lack of space to dedicate an entire chapter to value theories. Nevertheless, we can make two brief comments. One the one hand, the term 'value' will be used in a sense roughly similar to the ideas of exchange value, long-run equilibrium price, prices of production, according to different economic tendencies. On the other hand, the labour theory of value is manifestly limited in its ability to account for the situations of exploitation analysed in this chapter. But neoclassical or Sraffian value theories are hardly satisfactory either. As a result, this theory of exploitation is better complemented by a value-knowledge theory that, although it is hinted at in the main body of the book, deserves a dedicated exploration.

[213] Other aspects of Bentham's work have been emphasised and criticised, fairly or otherwise, but not this one, which offers the key to the notion of capitalist exploitation, proposed here. It is unavoidable to comment that this distinction between a cognitive component and an energy component of labour, carriers of differential characteristics and requiring specific regulations, was not noted by Marx who, however, did not shrink from referring to Bentham as '…that insipid, pedantic, leather-tongued oracle of the ordinary bourgeois intelligence of the 19th century' (Marx [1867] 1990, 755) and immediately afterwards, '…Had I the courage of my friend Heinrich Heine, I should call Mr. Jeremy a genius of bourgeois stupidity' (Marx [1867] 1990, 756). I owe my reading of Bentham's text to Dr Valentina Delich.

[214] Echeverría's ideas, for which he recognises the influence of Herman Schwember, combine a Marxist background with a critique of the perspective of systems theory. Unfortunately, after acknowledging these two entities, he places emphasis on the energy aspect, sidelining the dimension which he calls 'information'. As a result of these and other motives, the author does not relate these questions with the capitalist dynamic in general or with exploitation in particular, at least in the texts we have perused.

[215] Of course, this idea of taking a concept perceived as unitary and splitting it into two aspects that form a dialectical unity is a typical technique of Marx.

[216] Questions of space mean that it is not possible to discuss all of the observations that could be made here. But let us explore one: returning to the definition of capitalist exploitation, is there not a contradiction? Do not these workers have *exclusive access* to the knowledges that the exploiter requires? And if this were the case, would it not violate the criteria of exploitation? However, neither Guansuncha nor Edgardo have exclusive access because, remember, exclusive access implies ownership, the legal possibility of excluding third parties. Exploitation through alienation, like the other capitalist forms of exploitation, takes place in a framework defined as capitalist productive processes in chapter 4. Characteristic 2.3 stipulates that within these, labour lacks exclusive access not only to knowledge, but also to 'matter' and energy. In other words, Guasuncha and Edgardo are

able to participate in a process in which they are exploited because they do not have a legal monopoly over the wide range of knowledges they use, (through intellectual or other property rights), nor over the physical intensive resources (such as the technological artefacts that Raul contributes).

[217] Although it is not possible here to present a theory of value, we can note a simple idea: the value creating entity is knowledge, across its different bearers, which pushes us out of our comfort zone and leads us to assert that *knowledges in other bearers can also create value*. As Echeverría states:

> Given that any allusion to the human factor is dispensed with, the distinctions between the subjective and the objective, alive and dead, active and passive, lose all meaning. Labour comes to be defined as the articulation between two factors (energy and information), with either being assumed or not by human beings (Echeverría 2011, 296).

[218] An earlier approach, with shared aspects and some differences, can be found in Kreimer and Zukerfeld 2014.

[219] Even in cases when compensation for performers' rights (a right 'related' to copyright) is legislated, on the rare occasions when it is recognised it is always extremely modest in relation to the value generated.

[220] Unlike the guilds that were perfectly clear about their role as regulatory institutions of productive knowledges.

[221] Another issue to mention is that in these cases it is the exploited subject themselves who translates their subjective knowledges to a bearer, of which the company then becomes owner.

[222] For example, the Andean Community of Nations, who often fall prey to this modality, has introduced sui generis legislation for this area, and Ecuador in particular has incorporated it into its constitution (Chapter 5, Article 84). However, this apparent defence of the exploited is not necessarily straightforward, due to the fact that it is the nation state of each country, which the indigenous peoples do not automatically consider to be a legitimate defender of their interests, that juridically represents them. Even while it is perfectly possible that these states play a role in combating exploitation, it is also plausible that they behave as intermediaries between exploiters and exploited, or even swell the ranks of the former.

[223] The term informational goods refers to goods that are fully or mostly composed of digital information and, therefore, can be copied with close to zero marginal costs. Software, movies, recorded music, texts and data are some examples.

[224] The first of these lies in the fact that in the majority of cases the concept utilised has not been exploitation (but rather, for example, 'free labour', or 'unpaid digital labour'). The second consists of the problem that, where the term has been utilised, it has been employed in an indirect way and/or it has

not been given a systematic definition (Reveley 2013). Thirdly, no typology has been presented which gives an account of the varieties of exploitation that take place under capitalism in general, and in the social media in particular, and more importantly, the relationship between the general and the particular levels has not been systematised.

[225] Unlike other 'free' licenses, such as Creative Commons, GPL licenses have no option that would permit the other transfers while at the same time preventing profit-making uses.

[226] I owe the idea of considering this as a modality of exploitation as such to the work of Prof. Christian Fuchs.

[227] Exceptionally, it might take place during worktime, in the case of employees who use 'social media' as a part of their work duties.

[228] As discussed in chapter 1, the ownership of both aspects (physical and cognitive) of a resource can – and usually does – fall on distinct legal subjects: whoever buys a car becomes the owner of the physical aspect, while one or more signatories continue being owners of the patent rights and brands that pertain to various parts of the vehicle. At the same time, whoever is titleholder of the authorship rights of a song is not necessarily owner of the CDs on which the music is recorded.

[229] The variable of costs refers here to the productive process of the origin of the resource, while the variable of effective use refers to the productive process of the destination. A significant limitation to the use of costs as an isolated variable lies in the fact that, as is well known, the effective use can vary in relation to the proportions in which the resource was produced. This is particularly common where the resources are subjects: in these cases it's possible that they were created as a KIR but that they end up being applied in productive processes in which they function as a PIR. But there could also be, as technological constructivism demonstrates, divergences between production costs and effective use when the resources are commodities. For example a computer, a KIR due to its production costs, can be utilised as a typewriter (a PIR).

Inversely, defining PIR and KIR based on their effective use has the drawback of losing sight of objective aspects: to continue with the example of the computer, the fact that in one given productive process it is utilised as a PIR does not remove its objective potential to be put to use as a KIR, let's suppose by another worker as the case may be. The same occurs with subjects: their objective cognitive foundation, their unutilised skills can be exploited.

How do we resolve this tension? In practical terms, maintaining both variables. Given that in most cases they coincide, there are no difficulties in classifying the resources. But in those cases where they diverge, we turn to an intermediary concept: the *potential use* of a resource. This refers not only to the current use of the resource, but also to the *possible uses within the productive process it is inserted into*. This potential outlook includes,

indirectly, the question of production costs, which configure a certain objective potential for use as PIR or KIR.

[230] The idea of using the notion of access to property in relation to social stratification is in line with Zukerfeld (2009) and, in the final analysis, takes inspiration from Rifkin (2000).

[231] This typology has been used in chapter 4, and it is related to the one presented in chapter 3 regarding normative intersubjective knowledge. However, while the latter is focused on the regulations themselves, the former refers to the relationship between subjects and resources.

[232] This scheme focuses on the productive processes where monetary exchanges take place. Unpaid workers (such as domestic workers and voluntary workers of digital media) are subsumed to the class of who pays his/her bills. This does not mean that these workers are not exploited and, even, exploited by capitalists, as discussed in chapter 5. However, we tend to think that classes should be defined according to the productive process that allows subjects to reproduce their physical life.

[233] For a more detailed description, see Yansen 2012.

[234] Marx puts it thus:

> The competition of serfs constantly escaping into the town, the constant war of the country against the towns and thus the necessity of an organized municipal military force, the bond of common ownership in a particular kind of labour, the necessity of common buildings for the sale of their wares at a time when craftsmen were also traders, and the consequent exclusion of the unauthorised from these buildings, the conflict among the interests of the various crafts, the necessity of protecting their laboriously acquired skill, and the feudal organization of the whole of the country: these were the causes of the union of the workers of each craft in guilds. (Marx and Engels [1846] 1970, 69)

[235] It is tempting to paraphrase Marx and say that where mercantile capitalism takes shape we are facing a *formal* subsumption of physical resources, and that only when industrial capitalism makes its triumphal entry will this subsumption be *real*.

[236] It is significant that one of the factors that precipitated the reform movement was the scandalous use of the cognitive monopoly: the sale of all kinds of indulgences, privileged seats in the celestial theatre, and other divine commodities.

[237] Without diving into theoretical discussions, it is worth emphasising that here we do not place power in the same line of descent as the concept of action (as in Weber and many other authors), but that of knowledge.

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KNOWLEDGE IN THE AGE OF DIGITAL CAPITALISM

'A sustained and well-informed critical philosophical study of knowledge in society and capitalism.'

Professor Christian Fuchs, author of *Social Media: A Critical Introduction*

'A bold, comprehensive theoretical book, offering a new understanding of knowledge and its role in capitalism, historically, and today.'

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Knowledge in the Age of Digital Capitalism proposes a new critical theory concerning the functioning of capitalism and how we consider knowledge and information.

This ambitious book systematically and lucidly introduces contemporary phenomena into the framework of cognitive materialism to address some of the great themes of the social sciences: knowledge, exploitation and social class in an account of capitalism's totality in the present day. Author Mariano Zukerfeld reinvigorates materialist study of communications, presenting a typology of knowledge to explain the underlying material forms of information, intellectual property and cognitive work in contemporary societies. Using current examples the book also examines concerns such as free labour and the pivotal role of intellectual property.

The book offers nothing less than an introduction to the theory of cognitive materialism and an account of the entirety of the digital (or knowledge) capitalism of our time.

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