Chapter 5
Louis Althusser: Science and Ideology

Rereading Marx

In terms of design and key objectives, this volume entails a triadic syllogism. Continental thinking constitutes its source material, and first of all I offer a concise exposition of the way in which Hegel, Marx, Engels, Bachelard, Lacan and Heidegger allow us to come to terms with technoscience. As indicated, notwithstanding multiple differences and interventions, I see their oeuvres as building on a common ground. I also acknowledge the second moment (the negation), however, consisting of claims (brought forward by various authors) that this corpus of literature, or parts of it, are invalid or outdated, for instance because the future belongs to neo-liberalism (as Francis Fukuyama argued), or because continental thinking is flawed by Eurocentric and androcentric biases. Rather than countering or criticising this type of criticism directly and extensively (which would result in more or less "theoretical" debates), I have adopted a more "cataphatic" course. By outlining its basic logic (its methodology) and by extrapolating it to a number of case studies, my aim is to demonstrate the viability, urgency and contemporary relevance of a continental approach ("via positiva").

This chapter is different, however, in the sense that an exception is made for Louis Althusser. His work may be seen as an obstacle blocking the way, and obstacle "from within" moreover, notably his claim that the approach which is presented as a unity here, is actually dirempted by an epistemological rupture, between Hegel ("ideology") and Marx ("science"), although according to Althusser the early Marx still errs on the Hegelian side of the divide. The criticism of Engels discussed in Chap. 3 was likewise an attempt to create a divide between science and ideology, in this case, between Marx and Engels. In order for my exercise in retrieval to be convincing, these "obstacles" from within must be duly addressed, also because of their impact on more recent debates, not by eliminating them, but by thoroughly considering it and sublating them.

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In Chap. 3 we already indicated how, according to Louis Althusser (1918–1990), Karl Marx founded a new science with a methodology and problematic of its own, so that his role in history is comparable to that of Galileo in physics and Lavoisier in chemistry. Absorbed in his scientific activities, however, Marx never managed to produce a dialectic of his own, Althusser contends. He never found or took the time to write a Marxist version of Hegel's *Logic*, although the outlines of a Marxist philosophical method are nonetheless available. They can notably be found in the prefaces and epilogues accompanying his major scientific publications, such as *Contribution to the Critique of Political Economy* (published in 1859) and *Capital, Volume I* (published in 1867). In order to bring the *specificity* of the Marxist dialectic (compared to the Hegelian model) to the fore, Althusser adopts a quite remarkable reading method, positing a rupture, not only between the younger ("ideological") and the later ("scientific") Marx, but also between Hegel and Marx (although the formidable spectre of the former continued to haunt the writings of the latter, both implicitly and explicitly).[1] This reading method actually entails a series of apodictic *interventions*, contradicting (or at least challenging) literal statements made by Marx and Engels themselves concerning their relationship with Hegel. More precisely, the idea of a rupture reflects Althusser's effort to reread Marx from a Spinozist perspective. Although Althusser (1964) claimed that the birth of Marxism was an unexpected event (in the absence of a legal father), what he actually tried to do was to replace Hegel (as Marx's intellectual father figure) by Spinoza. In other words, he drastically adapted the actual (historical) intellectual genealogy by disconnecting Marx from Hegel and reconnecting him with Spinoza. In terms of the logic of chemism, Althusser saw a stronger intellectual "affinity" with the latter.

Rather than being a contribution to "Althusser studies", this chapter focuses on the impact of Althusser's remarkable move for developing a dialectics of contemporary technoscience. Although Althusser's endeavour (his effort to systematically eradicate the Hegelian legacy from Marx's oeuvre) inevitably results in a series of contradictions, of a questionable and inhibitory nature as I will argue, on closer inspection some of his results may nonetheless contribute to, and become incorporated into, the development of a philosophical dialectic: an exemplification of the cunning of reason, if you like. As indicated, my aim is to sublate, rather than eliminate his arguments.

The syllogism elaborated in this chapter consists in a number of steps. First of all, as was already pointed out, we must keep in mind that, while Marx produced an immense body of literature (part of which was co-authored with Engels, and only part of which was published during his lifetime), Althusser limits himself (filters his reading) to a relatively small set of documents, as if to protect himself against overstimulation. Indeed, one inevitably gets the impression that Althusser carefully selected and analysed a containable sample of discursive input for his project. It was never his intention to conduct a "scholarly (i.e. "literal" and comprehensive)

[1] This chapter focusses on Althusser's influential publications from the 1960s. According to Agon Hamza (2016, p. 138), later in life Althusser became critical of his concept of the *epistemological break* and even came to admit that Marx did not break away from Hegel.

reading of Marx. Rather, his aim was to restore Marx's work to clarity, as he phrased it, seeing Marx's own writings as raw materials as it were. In his autobiography, Althusser (1985/1992) explains, moreover, that his philosophical method did not involve reading philosophical texts or oeuvres in their entirety. Rather, he would "drill" or "bore" into them, so as to draw a "soil sample" from the "discursive formation" at hand, from which to intuit the whole. Even when reading such core samples, moreover, Althusser tends to read them quite selectively, as we will see, with a strategic objective in mind. For Althusser, philosophy is *intervention*, and this already applies to the reading process, which can be characterised as a *transformative* reading practice.

As these key methodological documents written by Marx were already briefly discussed in Chap. 3, the focus will now shift to Althusser's reading of them, highlighting the tension between his initial (still rather dialectical) reading during the 1950s and the more radical ("Spinozist") style of reading adopted during the 1960s, resulting in *Pour Marx* ("For Marx", 1965/1974) and *Lire le Capital* ("Reading Capital", 1965/1968). As indicated, the relationship between Hegelian and Marxist dialectics (continuity or difference?) is the core problematic of Althusser's writings. Initially, Althusser sees Marxism as a scientific and materialistic version of Hegelianism, in line with how Marx and Engels themselves envision their own work. This is the position adopted in *On Marxism* (1953/1997), where Althusser stays relatively close to the literal self-positioning by Marx and Engels. During the 1960s, however, Althusser claims that an insurmountable *rupture* separates Hegelian dialectics ("ideology") from Marxist dialectics ("science"). In accordance with the spirit of the sixties, moreover, this claim tends to radicalise in the course of his writings. Althusser discards the authority of Hegel, who is replaced by other (more radical) authorities, such Spinoza and Mao Zedong. Although Marx and Engels themselves consistently retained their connection with Hegel, Althusser argues that we are now in a position to develop a more rigorous understanding of the *specificity* of Marxism as a science.

Subsequently, Althusser's reading will be critically assessed. I will point out how his interventions inevitably result in a series of contradictions (or even cul-de-sacs) which can only be addressed convincingly if reconsidered from a dialectical perspective. Special attention will be given to two of Althusser's interventions, namely his segregation between the "object of knowledge" and the "real object", and his interpretation of Engels' comparison between Marx and Lavoisier. Finally, my critical assessment will be put to the test by reading *Philosophie et Philosophie Spontanée des Savants* ("philosophy and the spontaneous philosophy of the scientists"), published by 1967, a text in which Althusser explicitly discusses contemporary life sciences research (biochemistry and evolution).

Practising Dialectics: Active Reading (First Moment)

In an early text on Marxism, entitled *On Marxism* (1953/1997), Althusser explains how Marxism is both a science and a practice. It is a science which is tested, verified and developed *in practice*, a science which both studies *and* practically addresses the contradictions arising in social reality. And while historical materialism is the scientific study of the development of social formations, dialectical materialism is Marxist philosophy (the Marxist dialectic). Dialectics is not something which emerges spontaneously, moreover. Precisely because it is a science, it must be consciously developed and taught. It inspires practical political activity, but also seeks verification through practice. Whereas Marx and Engels continued to use dialectical concepts adopted from Hegel (such as "interaction", "contradiction" and "qualitative leaps") their practice is nonetheless different, because they study society as a real material process rather than as an expression of ideas. According to Hegel, the development of ideas determines the development of the real world (in conformity with the triadic dialectical laws), but Marx and Engels opt for a reversal: the real world now constitutes the starting point. Hegelian dialectics is an "anticipation" of Marxist dialectics as a scientific method, but the latter entails a drastic modification of dialectical laws, making them more precise and consonant with a scientific approach.

Dialectics studies contradictions, both in human history and in nature, as especially Engels emphasised, Althusser contends. This also implies that Marxism embraces materialism, not as a metaphysical position (an ideology), but as a scientific practice which emphasises the primacy of existence over consciousness, and of external reality over ideas. Matter is primary, consciousness is secondary. To see human consciousness as primary is a bourgeois point of view.

Besides Marx and Engels, Althusser also builds on texts by Lenin, notably *Materialism and Empiriocriticism* and the *Philosophical Notebooks*, which include his "Conspectus" of Hegel's *Science of Logic* and of his *Lectures on the History of Philosophy* (Lenin, 1976). Lenin likewise argues that materialism is a practice verified by science. Materialism is a *scientific* philosophical position: a rejection and radical criticism of idealism, a critique of bourgeois philosophy (which sees the thinking subject as the demiurge of a fictitious subjective pseudo-world). While Marxism studies actuality (the actual world), bourgeois idealism amounts to intellectual "onanism". From a dialectical materialist perspective, atoms and electrons are not only moments in the concrete development of a science, but also aspects of material reality. Technoscience is materialistic also in the sense that it actively *transforms* the world. In contrast to bourgeois idealism, technoscience consciously generates material change. Dialectical materialism is informed by the results and experiences of scientific research, but provides methodological guidance to research as well.

In short, Althusser's essay *On Marxism* concurs with the dialectical position that was adopted by Marx and Engels. It is the first moment if you like (M_1) in Althusser's reading of Marx. Compared to this initial position, his writings during the 1960s present a moment of negation: of rupture and separation (M_2). Now, his aim is to emphasise the *specificity* of Marxism as rigorously as possible, notably by invoking

an (allegedly insurmountable) rupture between Hegelian ideology and Marxist science. In the course of the 1960s, Althusser's position radicalises into an overtly anti-Hegelian stance.

Symptomatic Reading (the Second Moment)

In *On the Young Marx* (1961/2005), Althusser's verdict is still relatively mild. For Marx as a young bourgeois intellectual, Althusser argues, Hegel was not the "library Hegel", but the Hegel of the neo-Hegelian movement: present as a hovering spectre. Yet, although Marx was "haunted" by the long shadow (the "spectre") of Hegel, at a certain point he managed to liberate himself from this legacy, *passing* over into materialism, thereby radically changing the "problematic" of his work. In other words, Marxism as a science is the result of a rupture, an intellectual mutation. Marx now becomes active in a completely different field, addressing a completely different spectrum of questions than Hegel did. The problematic of his oeuvre is not immediately manifest, however, but must be actively brought to the surface, via a process of "symptomatic reading", even if this means contradicting the author's own statements and proclamations. Thus, even if Marx proclaims himself a scholar of Hegel, the symptomatic reader (Althusser) may nonetheless discern an insurmountable break between the two oeuvres, in order to *force* Marxism to attain a clearer awareness of its own specificity.

Young Marx entered the scene in a particular intellectual world: the world of German ideology, haunted by Hegel's idealistic legacy. Germany was politically and economically underdeveloped compared to England and France, and this underdevelopment was *compensated* by ideological and theoretical overdevelopment. German idealism was part of this intellectual hypertrophy, this ideological compensation, lacking a solid grounding in real material problems. Marx's task was the rediscovery of real history beyond this enormous ideological layer, and this implied a *retreat* from German ideology (Hegel's legacy, now functioning as an ideological obstacle or *Hemmung*) and a *return* to the real history of capitalism and class struggle. Althusser now emphasises that this was not a dialectical process in the Hegelian sense: it was not a sublation or supersession ("*Aufhebung*"), nor an inversion or reversal ("*Umstülpung*", "*Umkehrung*"). It was a *rupture*: a prodigious *eruption* of real history into an ideological context. This put Marx on the track of his Long March, crossing enormous distances on his way to reality, sharpening his clinical sense, until he managed to publish his prodigious masterpiece *Capital*. Hegelian ideological overdevelopment had merely served as a propaedeutic: a training in the manipulation of abstract concepts structured as a system, *independently of its validity.* After the break, Marx founded a new discipline, opening up a completely new problematic, a completely new area of research.

This same idea is taken up, albeit in a more radical manner, in *Contradiction and Overdetermination* (1962/2005) where Althusser now definitely wants to rid Marxist discourse of the idea that Marxism is an "inversion" of Hegelian dialectics,

shedding the ideological shell while retaining the dialectical core, – even though these are literally the terms in which Marx and Engels themselves describe their relationship to Hegel, the Master thinker of their youth. Althusser persistently denies that core Hegelian concepts (such as "negation", the "negation of the negation", the "identity of opposites", "supersession", the "transformation of quantity into quality", "contradiction", etc.) are still valid and functional in Marxist dialectics. These dialectical concepts now raise suspicion. We should no longer allow Hegelian schemata and formulae to "think for us". Key dialectical concepts, even though they are demonstrably borrowed from Hegel, are to be rigorously re-casted. Althusser now claims, for instance, that the Marxist conception of "contradiction" completely differs from its Hegelian precursor. In the case of Marxism, contradictions are *overdetermined*. This term (adopted from psychoanalysis) indicates that there are multiple interacting factors at work, and that causal relationships may shift and become displaced from one causal factor to the next. The latter mechanism is also called "metonymic causation", a term coined by Jacques-Alain Miller, combining the dialectical concept of *contradiction* with the psychoanalytic concept of *displacement* ("*Verschiebung*"). Furthermore, a sudden explosive accumulation, condensation and exacerbation of contradictions may give rise to a fusion, a revolutionary situation, as was the case in Russia in 1917. Althusser explicitly denies that this dynamic concurs with the Hegelian idea of a quantitative increase of tension which suddenly passes over into qualitative change. It is something "quite different": an irruptive dramatic rupture or mutation, rather than a supersession or sublation. It is not, as Engels phrases it, a parallelogram of forces building up a tension, but an unforeseen event ("événement"), without precedent.

This is taken up again in *On the Materialist Dialectic* (1963/2005), where Althusser again emphasises discontinuity, contrasting Marxist dialectics (science) with Hegelian dialectics (ideology), separated by a rupture. All dialectical concepts are to be completely reworked, as the theoretical practice of a science is completely distinct from its "ideological prehistory". The distinction between ideology and science takes the form of an "epistemological rupture", a concept Althusser borrowed from Gaston Bachelard (who supervised Althusser's Master's thesis on Hegel). Marxist dialectics entails practical political action in the advent of an emerging rupture, rigorously detaching itself from its ideological past, revealing this past as ideological. Prominent Marxists such as Engels and Plekhanov are now criticised because they merely *applied* dialectics, notably to the natural sciences, but a mere *application* is not a genuine *transformation*. Marxism as a theoretical practice has to struggle continuously against the ideology that haunts it, via theoretical and practical interventions that rigorously determine its own specificity. So far, Marxists active in fields such as law, religion, art and science used a Hegelian dialectic instead of a truly Marxist one, even if they proclaimed to conduct dialectical materialism. The specificity of their problematic was not yet rigorously defined: not as a *transformative* practice. Even Marx, although he practiced his dialectical method in *Capital*, never rigorously determined its logical and methodological specificity.

Marx wrote an impressive series of monumental books, but without ever writing a discourse on method, although it would have been quite valuable to us today, allowing us to address the problem of the specificity of the Marxist dialectic in a more rigorous manner. In *Capital*, we can see Marx's method in action, however, transforming ideology into science and knowledge. This method *is* the Marxist dialectic, but actively practiced, rather than theoretically determined. We lack a genuine "Logic", which Marx refused us, even though we know perfectly well that we have it, and where it is: in his dialectical works, in *Capital*, etc. We can find it there, but in a practical state, not in a theoretical state. Engels and Lenin knew this: they knew that the Marxist dialectic existed in *Capital*, but only in a practical state. The same goes for texts by Lenin, such as *What is to be done?* It is not a text on dialectics, rather a text written for immediate political use, but dialectics is actively at work in it.

What exactly is the problem with Hegel, according to Althusser? This is difficult to grasp in a rigorous manner because Althusser refrains from providing exact references to Hegel's work. He consistently refers to Hegel in a remarkably vague and general manner. Basically, Hegel is accused of seeing reality as a projection of the auto-development of the idea. For Hegel, Althusser claims, the movement of the idea from the abstract to the concrete is an auto-genesis of a concept. The point of origin is the abstract concept (in itself) which develops via alienation into an end result. This end product, however, is no more than its beginning. Hegel ignores the real transformations and discontinuities that constitute the political process. Hegel is not at all a political thinker. He imposes an ideological model: the model of the triadic development of interiority, the auto-genesis of the concept. Thus, instead of complexity, Hegelian dialectics envisions the auto-development of an original substance, the self-manifestation of an idea. Hegel is basically similar to Haeckel and fails to see the real in terms of overdetermination. For knowledgeable readers, however, is difficult to ignore the obvious tensions between Althusser's "image" of Hegel and Hegel's actual writings, with their emphasis on the importance of conflict, contradiction, drama, negativity and otherness, but this will be taken up later.

In addition, Althusser argues that, for Hegel, the material is merely an expression of the spiritual. Material nature is basically contingency for Hegel, which must be superseded by spirit. As a concrete example, Althusser (in concordance with Hegel's view that everything is a syllogism) refers to the American continent as a syllogism whose middle term – the Panama Isthmus – happens to be quite narrow, so that it is difficult for this continent to become a spiritual unity, although this is what should happen, dialectically speaking, for all differences must be negated, while segregation must be overcome and material contingency must be superseded. In Marxist dialectics, however, contradiction gives way to overdetermination, to structural complexity and unevenness. Change is now conceived in terms of mutation and transformation, condensation and displacement. Thus, contradictions become decisive, explosive and revolutionary. Every social formation is affected by unevenness, and the new situation is separated from the old formation by an insurmountable caesura.

Reading Capital

This same problematic is taken up in *Lire le Capital* ("Reading *Capital*"), a book resulting from a reading seminar at the *École Normale Supérieure*, parts of which were written by his pupil Étienne Balibar (Althusser & Balibar, 1965a, 1965b). Reading *Capital* is a challenging adventure, Althusser argues, not only because of the prodigious immensity of the book, but also because it is the protocol of a reading process itself. In *Capital* we see Marx actively at work: reading, assessing and transforming (intervening in) existing discourse (political economy).

Thus, Marx's *Capital* is important also from a methodological perspective. It is the paradigmatic protocol of a meticulous reading process, referred to by Althusser as "reading aloud" ("lecture à haute voix"). This prodigious protocol is now itself subjected to a meticulous reading process, "by the letter" (1965a, p. 10), by readers who follow an "oblique path" ("voie oblique", p. 10) through this immense discursive forest. The phrase "oblique path" indicates how Marx (and Marxist readers in general) adopts an "intentio obliqua": a philosophical "path" or method. "Method" literally means exploring or following a path ("ὁδός") together, reflecting on it, preferably in dialogue, as philosophical readers (μετ'+ὁδός). Althusser and his students at the ENS are underway to Marx, as it were, carefully exploring his concepts, his vocabulary, his logic ("λόγος"), his language. They read the book at least twice, the second time from an oblique perspective, focussing on the methodology of this research practice. Althusser's own book is a product, conveying the "experience" of an intense reading process.

Althusser and Balibar adopt a style of reading which, from the very outset, poses a question: the question concerning the *specificity* of Marx's discourse, the specificity of his dialectic, emphasising the difference with the ideological problematic of the early ("Hegelian") Marx, positing the Marx of *Capital* as the *real* Marx. *Capital* entails a dialectical reading of the discourse of political economy, Althusser and Balibar argue, but not in a Hegelian sense. An epistemological mutation or rupture separates Marx from Hegel (p. 11). *Capital* is an event, emphasising the gap between (Hegelian) ideology and (Marxist) science. Hegel is discarded as the ideological "pre-history" of Marxist science. According to Althusser, moreover, the epistemological model for their philosophical reading is not provided by Hegel (who sees reality as the progressive expression of the spirit) but by Spinoza, who had presented a critical method for reading the Scriptures in his *Theologico-Political Treatise*, likewise distinguishing ideology and mythology from science (p. 14).

One important ideological misconception to be discarded is the idea that science begins with observation of empirical facts. Reality, Althusser argues, is not an open book, waiting for us to be read. Rather, we tend to project ideological ideas on the real. Therefore, rather than with socio-economic facts, *Capital* commences with a meticulous analysis of established discourse, which inevitably results in a delay ("décalage", p. 14). Rather than analysing reality directly, philosophy first of all subjects established discourse to a rigorous reading procedure. The focus of attention inevitably shifts from things to signifiers, from "things in themselves" to

discursive formations: to condensations and displacements. This discourse is not considered as the expression of the spirit, moreover. Rather, it is read in a *symptomatic* manner, focussing on the deficits, the inconsistencies, the lacunae and the gaps. This is how Marx reads political economy: not as a description of reality, but as a discourse whose deficits are symptomatic indications of the bourgeois ideology haunting it. This is how Marx reads authors such as Smith and Ricardo: focussing on the lacunae, on what is absent and remains unsaid, on what these authors fail to notice themselves, even though it is actually quite close at hand, for instance when they provide answers to questions they failed to ask.

This same "clinical" method was employed by Engels (in his "reading aloud" of the writings of Eugen Dühring) and by Lenin (in his critical reading aloud of Mach and the other empiriocriticists). Now, Althusser and Balibar employ this same method in their reading of *Capital* to discern the specificity of Marxist dialectic: its logic, its method (p. 35), making manifest what is already latently there (p. 37). More specifically, their intention is to show that Marxist dialectic is not an "inversion" of Hegelian dialectic, as Marx and Engels themselves phrased it, putting dialectics on its feet again, but something quite different.

This is developed further in *Lire le Capital* part two (1965b). Again, Hegelian dialectics is discarded as the ideological prehistory (p. 5) of dialectical materialism, while Marx's *Capital* is submitted to a *transformative* reading, resulting in more rigorous definitions of key concepts of Marxist dialectics, something for which Marx himself never had the time. Practically, these concepts are already there, but they have to be extracted ("herauslesen") as it were. This applies to the term "surplus value", for instance, which is something positive (something "extra"), but also something negative: something which is unseen and somehow missed by others. "Surplus value" is more than a mere word: it is a transformative scientific concept which exemplifies Marx's revolutionary conceptual system. Let this suffice as a brief presentation of Althusser's transformative reading practice, his intervention.

Reading Althusser

For those reading Althusser from a dialectical perspective, the radical "*Entzweiung*" or segregation of Hegelian and Marxist dialectics advocated by him (M_2) seems a rather dissatisfactory result (or even impasse) for various reasons. First of all because it is in contradiction, as we have seen, with how Marx and Engels themselves, in a plethora of literal statements and proclamations, determine their rapport with Hegel. In terms of the metaphor mentioned above: they always maintained the isthmus with the Hegelian subcontinent from which they came, seeing dialectical materialism as a materialisation of dialectics: an inevitable next step, but not a radical break. Moreover, the introduction of a rupture is only possible on the basis of a drastically reduced and impoverished version of Hegel's dialectical logic, utterly ignoring the dynamic complexities of his thinking. Hegel already emphasised for instance that the dialectical process never commences with empirical facts and that

its first moment is always an unsatisfying discursive position already in place. While reading the sections Althusser devotes to Hegel, one inevitably wonders whether he ever really read Hegel. According to his comments in his autobiography, he actually read very little of Hegel, but the reliability of this source is disputable (if only because Althusser himself points out that an important objective of this autobiographic report was to show that his academic successes were built on "deceit"). According to this same autobiography, moreover, Bachelard (his thesis supervisor) did not really read Hegel either, nor Althusser's thesis for that matter, although the examination resulted in an interesting discussion about whether it would make sense to replace Hegel's (apparently Euclidean) concept of the *circle* with a more process- and system-oriented alternative, namely: *circulation*.

The question now is, would it be possible or desirable to supersede this caesura (as an intervention which forces us to discard Hegelian dialectics as such and start anew)? Would it be possible or even desirable to reconcile Hegelian and Marxist dialectics on a higher level of comprehension (thereby allowing us to reach a third position, M_3)? In the next section, this will be taken up by addressing the question what a specifically Marxist dialectical understanding of technoscience would amount to, as outlined by Althusser. In other words, would it be possible to determine, in a more precise and rigorous manner, the specificity of a Marxist (dialectical materialist) understanding of technoscience?

The Specificity of a Marxist Dialectic of Technoscience

In the previous sections we argued that the caesura posited by Althusser between Hegelian and Marxist dialectics is dissatisfactory. Separating Marx from Hegel seems only possible on the basis of a rather impoverished and schematic reading of Hegel's work. In Althusser's essays, Hegel's oeuvre is obfuscated rather than brought to the fore. For Hegelians, it is difficult to recognise Hegel's oeuvre in Althusser's exposé. Althusser consistently reduces Hegelian dialectics to the autogenesis of a concept by completely ignoring Hegel's emphasis on the importance of confrontation, negativity and otherness. Likewise, Althusser's contention that the result of the dialectical process adds nothing to the point of departure, seems difficult to reconcile with Hegel's actual views on transformation and change (which inevitably involve incorporation of conflicting viewpoints). Also, although Althusser redefines basic dialectical concepts such as contradiction, seeing it as "overdetermination" rather than as a "simple contradiction", it is questionable whether Hegelian dialectics would block such an elaboration. In short, to the extent that Hegel is read with more care and precision, the positing of an "insurmountable gap" between Marxist and Hegelian dialectics becomes increasingly questionable.

This is not to say that we should completely *identify* Marxist dialectics with the Hegelian prototype. Rather, a more productive reading seems possible, allowing for a more rigorous and precise determination of the specificity of the dialectics developed by Marx and Engels. In other words, rather than starting from zero again, it

seems more productive to determine exactly how Marx and Engels actually managed to take the Hegelian idea of a science of dialectics a decisive step further. To make this more concrete: what would be the added value of a Marxist philosophy of technoscience as envisioned by Althusser? I will first point to a number of strengths in Althusser's reading. Subsequently, I will point out some weaknesses as well.

Building on Marx and Engels, but also on Lenin and others, Althusser rightly emphasises that dialectics is a *practice*, and that a practice entails *transformation* rather than mere *application*. Thus, a dialectical assessment of technoscience should not only *interpret* scientific discourse as such, but should also result in *practical change*, affecting the way in which technoscience actually operates. And whereas Hegel's encyclopaedic oeuvre first and foremost entails a *historical* dialectic, a grand retrospective, resulting in a diagnostic of the present, a Marxist dialectics rather aims to develop a prognostic of the emerging future, preparing the ground for intervention. Finally, Althusser's most important claim is that transformations in the process of knowledge production do not begin with the discovery of new facts (1963/2005). Rather than addressing the real directly, there is always a moment of delay, as we have seen. The starting point of a scientific practice is a massive amount of written materials: established discourse. And a new science (a new technoscientific practice) can only emerge when this layer of materials is completely reworked. This process of knowledge production can be dialectically grasped and presented as follows:

M_1 (existing discursive materials and the *general* conceptual viewpoint they convey, A) → M_2 (transformation of these materials, subjecting this legacy to a critical reading procedure to demonstrate that it entails a *particular* ideological viewpoint, B) → M_3 (resulting in a series of validated concepts (e.g. "surplus value", "overdetermination", etc.) as a *concrete* product or outcome, E)

What is emphasised by Althusser is (a) the *ideological* nature of the initial problematic at work in established discourse; (b) the *transformative* impact of the critical processing of these discursive materials via symptomatic reading and (c) the scientific import of the results in the form of *validated* concepts. Thus, the decisive dialectical moment is a transformative practice ("symptomatic reading", or "reading aloud"), starting from established materials and resulting in concrete conceptual products. For Marx, who established a *particular* field of research, the British Museum was the optimal vantage point where the critical processing of established discourse could be practiced.

A similar structure can be discerned in other scientific practices as well. All research fields are subject to processes of transformation, so that a change in the mode of knowledge production results in outcomes which are *action-oriented* or *future-oriented*. This means, first of all, that technoscience is not a purely empirical endeavour and cannot be reduced to a mere registration of facts (data collection). The first task of a newly emerging scientific practice rather consists in a drastic reworking of the available materials (the representations, the concepts, the *Vorstellungen*) provided by previous practices, which are now exposed as

ideological and biased. These representations are processed and transformed into validated concepts (as *products*) and this is basically the work of science. Science does not start with pure (objective) "facts". Rather, science challenges existing *general* concepts which now prove to be of an ideological nature. In dialectical terms, transformative criticism is the dialectical moment (M_2) when a particular knowledge producing practice is replaced by a more sophisticated one, giving rise to validated scientific concepts (as concrete universals, M_3), produced by scientific labour (brain work):

M_1 (*Vorstellungen*) → M_2 (transformation: Conceptual processing) → M_3 (validated concepts)

In short, according to Althusser, technoscience is a *transformative practice*, denouncing previous theoretical positions as ideological, and replacing previous worldviews with validated concepts. So far, contrary to what he himself suggests, the logic of his argument concurs with the basic structure of a dialectical syllogism.

The emergence of a scientific research field entails an "epistemological rupture", but this should not be considered a spontaneous event, as we have seen. Rather, it requires a series of interventions. A science must me rigorously developed and taught. Transformative action must be taken (the epistemological counterpart of the role played by Lenin's *What is to be done?* in revolutionary politics). A scientific research practice is not about application but about transformation, drastically modifying the means of knowledge production. It is not a reflection in retrospect on a fait accompli, but entails effective enactment.

Dialectically speaking, this is again in concurrence with, rather than in contradiction with, Hegelian dialectics. Science starts with *general* conceptions (M_1), which are subjected to a process of transformation involving qualitative change (M_2), while the outcome consists of *concrete* validated concept (M_3). Such a dynamic is discernible in an experimental design, for instance. What is *negated* by a particular experimental practice are the established convictions: the existing conceptual categories which are part of a broader ideological framework of concepts (M_1). These concepts themselves were the end-result of an extended historical process. They are never self-evident as such, and their apparent self-evidence is already an ideological symptom. In times of turbulence or crisis, Althusser argues, change will not take place spontaneously. Rather, the "spontaneous" response of scientists to a situation of crisis will be to retreat to established conceptual positions. In order to supersede the crisis ($M_2 \rightarrow M_3$), targeted interventions are required, and dialectics must be actively *practiced*. Technoscience does not emerge spontaneously, but must be actively organised as a transformative practice through conscious initiatives, which open-up new fields of research, driven by a problematic of their own, employing a different vocabulary, studying particular situations or exposing specific situations to particular conditions, resulting in validated concepts (M_3). Although this dynamic can be discerned in other research fields as well (cf. Lavoisier's critical intervention in eighteenth-century chemistry, to be discussed below), Althusser

himself focusses on Marx's *Capital*, which can indeed be presented as a transformative process: reading, assessing and transforming existing discourse (political economy):

M_1 (political economy as an established discourse) → M_2 (exposed to Marx's transformative reading and critical textual processing) → M_3 (resulting in validated concepts, e.g. the concept of surplus value)

Again, whereas Althusser consistently posits an "insurmountable rupture" between Hegelian dialectics and Marxist science, such a claim seems difficult to uphold if we assess his actual analyses of the knowledge production process from a dialectical perspective. This means that we are evidently in need of a crucial test which may confirm or refute Althusser's claim concerning the incommensurability of Hegelian and Marxist dialectics. This test can only be provided by a concrete case study, a paradigmatic example of a Marxist analysis of a revolutionary scientific event, explicitly acknowledged as a guiding model by Althusser himself. As it happens, on various occasions, but most notably in *Chapter VI* of *Reading Capital*, Althusser refers to Engels's *Preface* to *Capital, Volume* Two (1893/1977), arguing that Engels's comparison between Marx and Lavoisier provides an optimal benchmark for a Marxist analysis of technoscience.

Friedrich Engels on Marx and Lavoisier

To further elucidate his Marxist understanding of science as a transformative practice (as opposed to ideology, which merely functions as a self-serving system of conceptions), Althusser (1965b, p. 6 ff.) uses a paradigmatic example of a dialectical reading process, which he also refers to elsewhere, namely Friedrich Engels' effort, in the preface to *Capital Volume II*, to elucidate the import of Marx's concept of surplus value by comparing *Capital* with Antoine-Laurent de Lavoisier's revolutionary work in chemistry. Lavoisier (1743–1794), Althusser argues, likewise represents an epistemological rupture between chemistry as a science and its ideological pre-history, prone to mystifications. Therefore, I will use this case history to elucidate the specificity of Marxist dialectics for understanding and transforming technoscience.

After 1870, Engels explains in his *Preface*, Marx' work on *Capital* came to a pause for various reasons, one of them being the fact that Marx (like Engels himself) became interested in modern science (geology, physiology, mathematics), a time-consuming detour, although other factors, such as health problems, fatigue and psychic depression played their role as well. The revolutionary import of Marx's work in political economy, Engels (1893/1977) argues, can be elucidated with the help of an example taken from the natural sciences. In 1774, Engels explains, Joseph Priestley announced that he had discovered "dephlogisticated air". He communicated his finding to Lavoisier who, triggered by Priestley's results, decided to

subject phlogiston discourse to a critical review. And this resulted in the (delayed) discovery that Priestley had actually discovered a new element, namely Oxygen. This unleashed a scientific revolution, an "inversion", putting modern chemistry on its scientific feet (Engels, 1893/1977, p. 22).

For Althusser, this example first of all demonstrates Engels's "exceptional epistemological sensitivity", his "theoretical genius" and "extraordinary intelligence" (Althusser, 1965b, p. 9, 11). It was not the observation of a new fact, but Lavoisier's decision (triggered by Priestley's communication) to subject phlogiston discourse to a transformative reading which revolutionised chemistry. And this rereading resulted in the insight that Priestley's inability to realise what he had actually discovered was due to his failure to free himself from the conceptual categories of phlogiston chemistry. Lavoisier's intervention gave rise to a completely new scientific nomenclature, to a completely new set of validated concepts. Lavoisier actually founded a new science. According to Althusser, Engels's *Preface* entails a first sketch of the concept of the break ("coupure", 1965b, p. 16): a mutation through which a new science is established, based on a new theoretical matrix, distancing itself from its ideological prehistory. Similarly, and again in accordance with Engels's "luminous formula", Marx had distanced himself from Hegelian idealism, Althusser argues.

One obvious problem of this rereading of Engels's *Preface* is, that it is highly questionable whether Friedrich Engels himself would have agreed with Althusser's interpretation. Rather, Engels' "luminous formula" seems fundamentally in accordance with Hegelian dialectics. In fact, he had been rereading Hegel's work, notably his *Logic*, in parallel to his inquiries into the natural sciences, until his responsibilities as editor of the two posthumous volumes of *Capital* forced him to suspend his project (the "dialectics of nature") as we have seen. Dialectically speaking, phlogiston chemistry was both confirmed and challenged by Priestley's experimental results. His results seemed to amount to a *negation*, to something negative, to absence ("*de*-phlogisticated air"). For Lavoisier, however, this negation became the *stimulus* which triggered him to critically reconsider the phlogiston concept as such, on which the chemistry of combustion was grounded. And this resulted in a dialectical turn ("*Umschlag*"), in the sense that negativity passed over into positivity: a positive (affirmative) result, namely Lavoisier's awareness that Priestley's discovery was not something *negative* (a privation, an absence, a "*nicht*", indicated by the prefix "de-"), but that he had actually discovered something *positive*, namely a new element: Oxygen (O_2).

Thus, in contrast to Althusser's apodictic statements, this concrete case history actually demonstrates that a dialectical isthmus still bridges the apparent gap between Hegelian idealism and Marxist materialism. Starting point for the revolution in eighteenth-century chemistry was existing chemistry discourse (M_1), revolving around the phlogiston concept, developed to grasp ("begreifen") phenomena of combustion. The term "begreifen" is important here because it indicates that scientific research (as Marx emphasises) actually entails an appropriation ("Aneignung") of the real. Work in chemistry involves a continuous *interaction* between conceptual elaborations and experimental exercises. At a certain point, Priestley claimed to

have provided additional empirical confirmation for phlogiston theory by producing dephlogisticated air in his laboratory. Paradoxically, as we have seen, the existence of phlogiston is demonstration by its absence.

For Lavoisier, however, this experimental result rather points to a disconnection, a *décalage* (M_2), between the object of knowledge (phlogiston) and the real object. A confrontation of phlogiston chemistry with the real is conducted, on the theoretical level (via a critical and systematic *rereading* of phlogiston discourse) but also on the practical level (by carefully designing and conducting hands-on experiments), resulting in the discovery of Oxygen (O_2). Rather than discovering negativity and absence (of phlogiston), a new element is discovered, exemplifying a new episode in the history of chemistry, a new mode of chemical knowledge production. This result (O_2) is still a symbol, a signifier (signifying an object of knowledge), so that the tension between Oxygen as a chemical element and "real Oxygen out there" is still in place. Oxygen is not something which can be literally grasped or seen. Nonetheless, compared to phlogiston chemistry, the O_2 concept is a more convincing effort to appropriate the noumenal real, a more viable procedure to reveal what, literally speaking, remains unseen: the molecular composition of air.

Phlogiston chemistry (the questionable starting-point) was effectively *negated* in the course of the process. In other words, the discovery of Oxygen was itself a syllogism: a critical reconsideration of existing discourse (M_1), which was exposed to rigorous rereading in combination with an experimental practice (M_2), gave rise to an important positive result, the negation of the negation (M_3): O_2 first of all, but also a new way of conducting research in chemistry, putting chemistry on a scientific footing ("on its feet"). Oxygen is the negation of the negation. Something allegedly negative (dephlogisticated are) is transformed into something positive (a dialectical reversal), while phlogiston chemistry is sublated into modern (scientific) chemistry. The rupture is actually a dialectical moment in the sense that the negation (of phlogiston chemistry) has a positive result (modern chemistry as the negation of the negation). In short, Lavoisier's revolution (as described by Engels) exemplifies the dialectical understanding of technoscience (as Engels already argued), allowing us to explain how dialectical materialism continues to build on Hegelian dialectics (the dialectical method or logic) while at the same time reversing it, by more consistently paying attention to the material and technological aspects of technoscience (i.e. the technical modes and means of knowledge production). Thus, while Althusser's reading is problematic (apodictic rather than dialectic), a dialectical rereading has a positive result, in the sense that Althusser's intervention allows us to further develop the specificity of a dialectical understanding of technoscience. Not only Marxist concepts (such as "appropriation") but also concepts such as "overdetermination" (borrowed from Freud) and *décalage* (delay or dislocation) may be incorporated as conceptual components of a materialist mode of dialectical research, not merely as additional tools, but as transformative contributions to the ongoing development of dialectics as a transformative and self-transformative practice.

This also applies, as we have seen, to Marx's dialectical analysis of production and consumption in the 1857 *Introduction*. Marx's analysis demonstrates how production and consumption constitute a "syllogism", how production inevitably

passes over into consumption ("productive consumption") and vice versa: an analysis which is not only compatible with, but also constitutes a further elaboration of Hegel's dialectical logic, reflecting Marx's dialectical skills. In other words, the specificity of the dialectics developed by Marx and Engels can be more rigorously determined when we see their contribution as an important next step in the process initiated by Hegel: as an effort to *transform* dialectics from a scholarly technique into a scientific practice. Hegelian dialectics is not the auto-development of a concept, but a dynamical and interactive process, emphasising the indispensable role of otherness and negativity. Marx, Engels and Lenin, but also (ironically perhaps) Althusser allow us to elaborate this research program further. In the final section of this chapter, we will discuss to what extent concepts such as overdetermination, displacement and metonymic causation may be incorporated in dialectics as a research program. First, however, we have to come to terms with two remaining (allegedly insurmountable) obstacles identified by Althusser, namely the distinction between the object of knowledge and the real object (emphasised in *Reading Capital*) and the ideological nature of Hegelian dialectics as posited in *Philosophy and the Spontaneous Philosophy of the Scientists* (1967/1974).

The Object of Knowledge, the Real Object and the Problematic of Technoscientific Appropriation

The third section of Marx's *Introduction*, written in 1857 and presenting Marx's methodology in outline (1939/1983, p. 34 ff.), is an important point of reference for *Reading Capital*, as we have seen. Here, Marx explains that, while political economists start from the empirical real as a living totality, to analyse it in terms of categories and concepts, the method of science is to move in the opposite direction (p. 35, 632): from concepts to the real. Scientific research for Marx is an *appropriation* of the real and the path or method which leads from abstract to concrete is the method (pathway) of thinking. At first glance, this seems in perfect accordance with Hegelian logic (the syllogism of research), which likewise moves from a general conception (A, M_1) via a particular mode of questioning (B, M_2) to a concrete result ($A \rightarrow B \rightarrow E$).

According to Althusser (1965a), however, this is not at all the case. Although this may not be literally visible in the text, Althusser contends, Marx aims to posit an "insurmountable distinction" between being and thinking, between the real object and the object of knowledge, between natural processes and processes of knowledge production. For Althusser, this does not entail a relapse into idealism (e.g. the segregation between the phenomenal and the noumenal), because thinking is not something which can be attributed to an individual (psychological) subject or a transcendental (epistemological) subject (1965a, p. 47). Thinking is a function of a particular system, an apparatus of thinking, a particular mode of knowledge production, emerging in a particular historical context. Thinking is not done by individual

subjects. Rather, it is the system which assigns to them the type of questions they may pose and the type of experiments they may conduct (p. 48). Thinking is the transformation ("*Verarbeitung*") of representations into concepts ("*Begriffe*").

The aim of *Reading Capital* is to determine as rigorously as possible the specificity of Marxist dialectics, emphasising the difference with Hegelian dialectics (1965a, p. 35). Although Marx and Engels themselves see their dialectics as an "overturning" ("renversement") of Hegelian dialectics, Althusser argues that this answer suffers from an internal lack ("manqué intérieur", 1965a, p. 35). For Althusser, "*Umkehrung*" is a word which is conceptually deficient. Therefore, instead of a literal reading, what is required is a reading which opens up a text that is still haunted and obfuscated by Hegel's "ideological" heritage. In other words, the aim is to reinforce the rupture as a step that was prepared by Marx and Engels, but which they themselves failed to make. While Hegel (as an idealist) saw the real as resulting from thinking, Althusser contends that Marx's discourse on method allegedly introduces an "absolute distinction" between the real object and the object of knowledge (1965a, p. 46). Although this may seem a relapse into the distinction between the noumenal and the phenomenal (as developed by bourgeois theories of knowledge), Althusser takes care to avoid such an "ideological" phrasing. The processes of production of knowledge must be segregated from real historical and natural processes. First of all, knowledge production should not be regarded as the cognitive activity of an individual subject (i.e. the epistemological version of the Robinson motif), but as the activity of a system: a particular mode of knowledge production, involving particular contrivances, technologies, social relationships, etc. This system is structured in a particular manner and its function is to transform existing materials (discourses, concepts, representations) into a consistent network of validated concepts. Thus, the starting point of the process of knowledge production is not a real original object, but an established body of ideological materials (something which belongs to the realm of thinking). And rather than looking at the history of science from a teleological perspective (where, in retrospect, the past allegedly progresses towards the present), we must learn to look at history as a series of ruptures or radical discontinuities, moments in time when a particular logical regime suddenly gives way to a subsequent regime. Althusser mentions the work of Georges Canguilhem on the concept of the reflex and the work of Michel Foucault on the clinical gaze as examples of such ruptures (p. 52).

Moreover, a rupture or discordance is posited between the logic of a particular mode of knowledge production and the logic of the real. Whereas Hegel claims that the logic of the real and the logic of human rationality are fundamentally identical (the real is rational and the rational is real), Althusser claims that Marx's theory of knowledge starts from a rigorous non-correspondence between knowledge and the real (p. 55). The categories of human knowledge are determined by an apodictic logic of their own. Thus, whereas Marx himself claims to borrow his dialectical method from Hegel, Althusser claims that Marx (unconsciously) breaks with Hegel (p. 61).

This "transformative reading" seems difficult to uphold. What Marx is actually arguing is that the scientific method cannot be equated with induction. Science does not begin with a real totality (the world out there), but rather with basic concepts

which are systematically developed. This does not mean, however, that science functions in a purely apodictic and deductive (Spinozist) manner ("more geometrico"). Quite the contrary, Marx explicitly emphasises the continuous *interaction* between knowledge and the real, also in the *Introduction*, most notably by emphasising that science is a systematic effort to *appropriate* the real. All instances of production, Marx argues, entail an appropriation ("*Aneignung*") of nature (p. 23, 619), and scientific knowledge production is a particular mode of appropriation. As Hegel points out, this is emphasized by the etymology of the term *Begriff* (the verb "begreifen" → "greifen" literally means "to grasp", and the term "concept" comes from the Latin verb "concipere": to take in, to hold). Thus, although Marx (in accordance with Hegelian dialectics) starts from concepts which are to be developed (M_1), the next step in the process is a moment of interaction and mutual exposure between the concept and the real (M_2). Knowledge entails a particular mode of appropriation of real objects (p. 65) and experimental research can be regarded as a particular mode of appropriation, an interactive and transformative mode of thinking. This evidently refutes Althusser's remarkable claim that, allegedly, according to Marx, knowledge and the real should be regarded as two completely separate realms. Somehow, therefore, Althusser must get rid of the term "appropriation", which seems to provide a dialectical isthmus, connecting knowledge with the real, and Marx with Hegel, and therefore problematising the idea of a complete rupture (both between Marx and Hegel and between the logic of knowledge production and the logic of the real).

Althusser repeatedly admits that the question of appropriation (science as a transformative mode of appropriating the real object, resulting in an object of knowledge) has to be posed (p. 66, 67). And he also admits that the dialectical answer to this question seems obvious: the natural sciences realise their aim by appropriating the real object via a specific mode of interaction, namely: *experimental praxis* (p. 68). Yet, remarkably, this answer is rejected as "ideological" (as anything not in agreement with Althusser's reading is discarded as "ideological"). According to Althusser, scientific practice is a processing of concepts which strictly remains within the conceptual / discursive realm: there is no genuine interaction with the real, while the validity of knowledge claims is assessed *exclusively* on the basis of internal logical criteria (p. 71). Strictly speaking, there is no such thing as experimental verification (p. 72). Knowledge is produced by the system, the conceptual apparatus, on the basis of its own criteria. The idea that science appropriates the real through experimentation and interaction is an illusion. There always remains a gap or dislocation (*décalage*, p. 76).) between cognitive processes and real processes, e.g. between the work of a geometer in the literal sense (e.g. a surveyor) and the earthly real, between biology and the living real, etc.

Is Althusser's argument convincing? Although my answer will ultimately be that this is not the case, let me first point to a number of strengths in Althusser's procedure, before highlighting the fatal weaknesses. First of all, Althusser is right to point out that, for Marx, the pathway of science does not begin with empirical

observations (induction). Rather, abstract categories become increasingly concrete, so that the end result consists in a concrete totality, an interrelated multitude of relations and determinations (i.e. a system). Also, it is a strength to emphasise that technoscientific research is not the work of a single individual, and that the Robinsonade is not an adequate epistemological model. Technoscientific research involves a particular mode of knowledge production, and this not only includes laboratory technologies, but also funding schemes and organisational designs. And yes, dialectics emphasises disconnection (*décalage*) between thinking and being, between theory and practice, between cognition and the real, between biology and the living, etc., but as a crucial *experience*: a negative experience (triggering disappointment and discontent among practitioners), but also a stimulus for further research towards convergence, fostering continuous interaction between science and the real, biology and the living, until a concrete and validated understanding is attained (albeit always open to future problematisations).

A first weakness is the claim that being and thinking (the real object and the object of knowledge) constitute two completely separate realms. Marx (and this also applies to Engels) sees research as a practice and emphasises the *interaction* between both realms. Science is an appropriation ("*Aneignung*") and transformation ("*Verarbeitung*") of the real. The issue of Hegel's "illusion" is also taken up by Marx. Can categories have an independent existence? Marx answers this question in French "Ça dépend" ("That depends", p. 36, 633). Rather that positing a distinction between logical categories on the one hand ("thinking") and their historical or natural existence on the other ("being"), Marx himself emphasises how legal and economic developments always involve an *interaction* between categories and concepts on the one hand and concrete historical settings and developments on the other. The concept "possession", for instance, although being a bourgeois concept, may nonetheless allow us to understand that certain pre-historic societies may have had "possessions", but not in the modern sense of (private) "property" (p. 36, 633). Likewise, although "work" may seem a perennial concept (an inherent part of the human condition), *modern labour* is actually a fairly recent category. And while agriculture already began thousands of years ago, capitalism effectively transforms it into an agricultural industry (p. 41, 638). In short, rather than positing *being* and *thinking* (practice and concept, the real object and the object of knowledge) as separate realms, Marx emphasises continuous interaction between the two: between the real and our knowledge of the real, between historical modes of production and the categories of discourse.

From a dialectical perspective one could argue: without interaction, no disconnection (no "*décalage*"). The experience of *décalage* emerges precisely where concordance between thinking and being is expected, but for some reason cannot be achieved, an anomaly if you like. In other words, *décalage* can only be meaningfully experienced in the context of interaction (experimental or otherwise). It is an inherent and inevitable component of the technoscientific effort to appropriate the real:

Discursive development (M_1) → the technoscientific effort to appropriate the real, giving rise to the experience of *décalage* (M_2) → concrete knowledge as a precarious product of the interaction between theory and practice (M_3)

For Althusser, however, the experience of *décalage* implies that this third moment can never be reached and access to the real through interaction is blocked. There is no genuine interaction between the cognitive and the real. But this is explicitly in contradiction, not only with Marx's own statement, but also with the structure of *Capital* as such, which combines conceptual elaborations with a critical analysis of economic discourse (i.e. theoretical and historical analyses) in an interactive manner.[2]

Like Hegel, Marx distinguishes two closely interrelated dimensions: the current *system*, the current mode of production (the intrinsic *logic* of capitalism) and the *history* of the present (the dialectical process that gave rise to contemporary capitalism as a *result*). According to Marxist dialectics (and in accordance with Hegelian dialectics) previous stages are *superseded* by subsequent systems: a dialectical process of continuity and discontinuity, of quantitative and qualitative change. For Althusser's intervention (positing a rupture between the two) to work, he has to deprive words such as "inversion" and "appropriation" of their content, which is a questionable procedure. "Inversion" means that the focus of attention shifts from scientific ideas to technoscientific practice (i.e. the practice of putting elaborated concepts to the test), while "appropriation" involves a transformative reframing of the object. An experiment is never a mere application of a theory. Rather, it is a transformative activity, both theoretically (challenging theoretical preconceptions) and practically (transforming real objects into modifiable laboratory entities). This dialectical dynamic is completely lost in Althusser's views on science, resulting in the (remarkably *undialectical*) claim that processes such as elaboration ("Verarbeitung") and appropriation ("Aneignung") do not entail any form of interaction with the real. Segregating theory from practice not only deprives research of its interactive dimension, but also results in a fatal epistemological obstacle or *Hemmung* for understanding and transforming technoscience. If we follow Althusser, science could never progress beyond conceptual elaboration (M_1), could never become *technoscience*. Science as an apodictic system could never dynamically evolve through practical interaction with the real. This dynamic interaction is precisely what is expressed in the claim that Hegel equals Spinoza "set in motion" ("Spinoza mit en mouvement": Althusser, 1965a, p. 114). If we endorse Althusser's non-literal reading, the validity of knowledge claims would be determined solely on the basis of the apodictic logic (the systematicity) of the conceptual system.

[2] This is also indicated by the famous quote from the 1857 *Introduction* that human anatomy contains the key to the anatomy of the ape. What Marx is arguing here (inspired by Darwin's theory of evolution), is that an understanding of contemporary society may provide a starting point for retrospectively understanding socio-economic systems from the past (p. 78), because the former (contemporary society) is a historical *result* (p. 79).

There is another objection to Hegelian dialectics brought forward by Althusser. For Hegel, all the elements belonging to a particular historical episode express a basic concept, which is present in all these elements. If this is the case, Althusser argues (Althusser, 1965a, p. 118), how it is possible that at a certain point, pioneers of science are able to discern that a new form of knowledge production is in the making, that the advent of a new episode is imminent? From a Hegelian dialectical viewpoint, this is because they are frustrated and restrained by an accumulation of disconcerting experiences, so that at a certain point the accumulation of anomalies give rise to qualitative change. This is a moment of crises, which can only be addressed via targeted interventions and, eventually, via supersession or sublation, which means that core cognitions and results of the previous episode are reconsidered, transformed and incorporated into a reformed way of thinking (a new spirit if you like). According to Althusser, this dialectical view on change should give way to the idea of a radical discontinuity or rupture. Only in this manner, a teleological understanding of the history of science (seeing the past as a pathway towards the present, and the present as a result of dialectical transformations in the past) can be eliminated. Again, Althusser opts for segregation, this time not between thinking and being (theory and practice), but between present and past. And again, this view on change is at odds with how not only Hegel, but also Marx, Engels and Lenin experienced the logic of intervention. For them, effective interventions are informed by a solid dialectical diagnostic of the present. Rather than demonstrating the existence of an "insurmountable rupture" between Hegel and Marx, Althusser himself seems to relapse from a dialectical into an apodictic mode of reasoning. This becomes even more pronounced in his lectures on the "spontaneous philosophy" of scientists, to be discussed in the next (penultimate) section.

The Spontaneous Philosophy of Science and the Experience of a Scientific Crisis

Philosophy and the Spontaneous Philosophy of the Scientists (1967/1974) consists of a series of *apodictic* theses or propositions, in a Spinozist rather than dialectical fashion, starting with the claim that a philosophical proposition is a "dogmatic" proposition (T1). Taken together, such propositions constitute a system (T7). The question what philosophy is, can only be answered by actually *practicing* it (p. 27), but for Althusser the basic objective of philosophy is to draw lines of demarcation between ideology and science (T2). Although strictly speaking philosophy lacks a specific object of its own (T4), philosophy addresses the totality of things, zooming in on the revolutionary developments in contemporary science, notable its frontier zones, where completely new research fields (e.g. biochemistry) emerge, developments which are posing a plethora of challenging philosophical questions. Currently, moreover, science is being completely reorganised into a global industrial research enterprise ("planification", p. 22) and philosophy must have something to say about

this, although its interventions will not consist in offering solutions (T12). We are witnessing a revolutionary turning point, an event of global significance, a global cultural mutation.[3] Philosophy must intervene by distinguishing science from ideology, which is a hazardous task, if only because philosophy itself is haunted by ideology, affected by the current ideological conjuncture. For Althusser, philosophy is a battlefield in the Kantian sense ("*Kampfplatz*") between scientific and ideological, materialist and idealist tendencies.

It is against this backdrop that philosophy may intervene in a particular scientific research practice, where a "spontaneous" philosophy is always already at work. Notably scientific crises give rise to spontaneous philosophical activities among scientists. During the crisis which emerged at the turn of the century (around 1900), for instance, the spontaneous philosophy of science, represented by Mach and others, was anti-materialistic. Although these authors themselves considered their views as "revolutionary", they actually (but apparently unwittingly) revivified a branch of bourgeois idealism. As Lenin convincingly demonstrated in his intervention, their "spontaneous" philosophy was actually a return to Kant and Berkeley in disguise. Various ideological worldviews are lying in wait, eager to exploit moments of crisis, such as the apparent disappearance of matter in elementary particle physics, to the benefit of a spiritualist or idealist revival. Althusser notably mentions Bergson and Teilhard de Chardin in this regard. The latter is accused of exploiting the turbulent developments in research fields such as palaeoanthropology and evolution theory in favour of his Catholic faith. Rather than being eliminated by Enlightenment, such ideologies persistently await the onset of a scientific disruption which they exploit *ad majorem Dei gloriam*.

Therefore, a philosophical intervention must counteract these idealist and ideological tendencies, these ideological exploitations of experiences of crisis, which actually build on a long apologetic tradition of exploitation of science by philosophy in service of dominant ideologies. In the case of Pascal for instance, admirable work in mathematics and scientific experimentation was combined with apologetic religious treatises which aimed to exploit the tensions and contradictions of modern science in the service of his faith. And the same applies to Teilhard, Althusser argues, a palaeontologist and a priest, a present-day Pascal as it were. These spiritualist tendencies are never completely eliminated and always ready to resurge whenever the conjuncture provides the occasion. Suddenly, such voices claim that science is in dire need of a supplement, consisting of values that safeguard human dignity.

Meanwhile, the silent majority of researchers continues to work and produce results, Althusser contends, convinced that matter did not evaporate at all, but continues to subsist. These scientific workers continue to believe in the material existence of the real. In sharp contrast with his previous insistence on the difference between the real object and the object of knowledge (as discussed above), Althusser now suddenly seems to take sides with those (allegedly "naïve") researchers who, based on their daily experience of scientific practice, continue to believe in the real,

[3] As indicated, this is a common thematic among continental approaches (Zwart, 2020).

external and material existence of the objects of scientific knowledge. These scientific workers are the target of ideological exploitation, by spiritualist ideologies that question the validity of scientific knowledge and emphasise its boundaries. Philosophy, Althusser argues, must intervene in this struggle on behalf of the active brain workers and their spontaneous materialist convictions, to safeguard them against ideological exploitation and domination.

This argument is elucidated with the help of a case study: the inaugural lecture by biochemist and Nobel laureate Jacques Monod at the Collège de France in 1967, whose work focussed on DNA, described by Althusser as the "philosopher's stone" of the contemporary sciences of life (p. 123). In his reading of Monod's lecture, Althusser notices a symptomatic shift. Initially, Monod seems to adopt (as a scientist, that is: spontaneously) a materialist position, emphasising the material existence of DNA and the validity of technoscientific research methods. Biology studies the emergence of complexity in the course of evolution, while rejecting vitalism. Yet, at a certain point, there is a decisive turn, when Monod begins to describe how the biosphere gave rise to the noosphere, a higher level of complexity: the realm of spirituality and thinking, a term adopted from Teilhard. The use of the term noosphere, Althusser argues, is symptomatic, and rightfully triggers suspicion, because it indicates that Monod at this point becomes vulnerable to exploitation by spiritualism and idealism (represented by Teilhard's teleological worldview). Monod also endorses the claim that humans, while being a biological species (a product of evolution in the biosphere) are at the same time created by language ("*C'est le langage – le noosphère, l'Esprit – qui a créé l'homme*", p. 128). For Althusser, this move, this shift, this "inversion" from material life to spiritual existence (exemplified by the adoption of the seductive signifier "noosphere") is symptomatic of the extent to which modern biochemistry (and this even applies to Nobel laureates like Monod) remains vulnerable to ideological exploitation. By admitting that an axis of development can be discerned in evolution (towards increased complexity and the emergence of the noosphere) the concept of chance is transformed, so that it may function in a spiritualist (teleological) context (in the sense that selection promotes complexity, notably the development of a neo-cortex, which gives rise to the emergence of thinking and the noosphere, etc.). In short: the noosphere triumphant. Monod is unable to offer sufficient resistance to this idealistic tendency. Therefore, a philosophical intervention (e.g. Althusser's own critical review) is required. Monod's subsequent apologetics in favour of values is likewise considered symptomatic. Science has eroded traditional values, Monod argues, giving rise to alienation and disruption. Therefore, scientific research must be "supplemented" by values, preferably the ascetic values inherent in scientific practice (reliability, trustworthiness, scepticism, self-criticism, etc.).

This text once again presents us with a remarkable mixture or acute observations and problematic claims. Let us take stock by pointing out the strengths and weaknesses of Althusser's theses. On the positive side, Althusser rightfully argues that philosophy is a *practice* which addresses the totality of things, zooming in on contemporary technoscience (on the technoscientific revolution), notably in the frontier zones, where completely new research fields emerge, posing a plethora of

challenging philosophical questions, while technoscience is under the sway of "planification", evolving into a global enterprise. We are witnessing a revolutionary turning point, an event of global significance, and yes, philosophy must have something to say about this. Philosophy remains a battlefield, as Lenin demonstrated, by showing how Empiriocriticism actually revivified an egocentric bourgeois ideology, questioning the materiality and existence of the real (as was extensively discussed in Chap. 3).

What is problematic and disappointing, however, is that Althusser's actual intervention consists of a series of highly problematic and self-contradictory claims, starting with the claim that "philosophy is dogmatic" (how can a dialectical practice be dogmatic?). His criticism of Teilhard de Chardin is likewise unsatisfactory and unjustified. Teilhard de Chardin is a truly dialectical thinker (Zwart, 2017; but this will be taken up in Chap. 7) whose concept of the noosphere is the result of a dialectical understanding of evolution and the history of human thinking. And is the symbolisation, obliteration, informatisation, datafication and spiritualisation of the real (entailed in the concept of the noosphere) not precisely the inherent tendency of technoscience as a global enterprise (planification)? What is quite remarkable is that Althusser's exaltation of researchers (brain workers) who, in their daily technoscientific practice, continue to believe in the real, external and material existence of the objects of scientific knowledge, seems in complete contradiction with Althusser's previous apodictic caesura (in *Reading Capital*) between knowledge and the real object (discussed above).

From a dialectical perspective, the position adoption by Althusser in *Philosophy and the Spontaneous Philosophy of the Scientists* is unsatisfactory for various reasons. His apodictic or even "dogmatic" intervention on the philosophical battlefield results in a series of demarcations, dichotomies and contradictions (*science* versus *ideology*, *materialism* versus *spiritualism*, *science* versus *values*, *materialist* tendencies versus *idealist* tendencies, etc.), where one of the two (materialism) is valued as positive, while the opposite position (idealism) is valued as negative, and subsequently discarded as "ideological". From a dialectical perspective, however, we should rather see such polarised oppositions as moments in a dialectical unfolding, which eventually give rise to a more dynamical understanding of technoscience as a practice and as a process. Starting point is indeed the "spontaneous" philosophy of researchers, actively engrossed in practicing their research, but also already aware of the philosophical niceties involved. They endorse a "materialist tendency", based on their daily experiences as practicing scientists, resulting in a persistent believe in the real existence of the technoscientific object (e.g. genes, elementary particles, etc.) and the validity of the scientific method (M_1). At the same time, a dialectical approach will point to numerous disconcerting experiences, indicating a sense of disconnection (*décalage*) between materialist conceptions and the real, between validated research methodologies and practical results (problems of replication and so on). Such experiences (refuted expectations, etc.) are an inherent part of daily scientific practice (M_2).

When this is radicalised into a scientific crisis, Althusser argues that the spontaneous philosophy of practicing scientists becomes vulnerable to ideological

exploitation: the resurge of the Master signifier (M_1) as it were. As a first example of ideological regression he mentions the neo-idealism of Mach and the other empiriocriticists. As Lenin explained (cf. Chap. 3), a demarcation was introduced between experience and reality, between the object of knowledge and the real object, between the phenomena and the things in themselves, between thinking and being, between scientific research (as a social practice) and nature, etc.: the moment of "*Entzweiung*" (M_2). Althusser's argument that the "revolutionary" position of the empiriocriticists actually entailed a revivification of (bourgeois) idealism is valid (cf. Chap. 3), although a number of dramatic shifts must be acknowledged as well of course (from the dualism between ego and object in Descartes, via Berkeley's religious denial of the existence of external reality and the critical epistemology of Kant, which distinguishes the phenomenal from the noumenal *Ding an sich*, up to Mach, who basically re-adopted Berkeley's position, but now cleansed of its religious aspects). What is quite remarkable of course (in the sense of self-contradictory) is that precisely this position, which is now discarded as ideological, was endorsed by Althusser himself in *Reading Capital* as non-ideological.

On closer inspection however, is becomes apparent that the rupture which Althusser (in *Reading Capital*) initially posited between the object of knowledge and the real object, is now displaced by a different caesura. In the *Philosophy and the Spontaneous Philosophy of the Scientists* Althusser now posits an apodictic rupture between biosphere (a scientific concept) and noosphere (allegedly an "ideological" concept). But this intervention is again quite problematic. Precisely because of the inconsistencies of the neo-idealist position (immersed in contradictions, as Hegel would have argued), the scientific and philosophical challenge of twentieth century was to supersede (sublate) posited dichotomies (between thinking and being, knowledge and matter, the phenomenal and the noumenal, etc.) at a higher level of complexity, and this is precisely what "thinking scientists" such as Bohr, Teilhard, Monod and many others tried to achieve. Their aim was to update our concept of matter (rather than denying its existence), without relapsing either into bourgeois idealism or into crude metaphysical materialism. The time-old segregation between materialistic and spiritual dimensions of human existence is superseded via concepts such as the noosphere, understanding technoscience as a dramatic transformation of the biosphere into a noosphere (via processes such as symbolisation, informatisation and datafication of the living) while at the same time emphasising a moment of qualitative change (as thinking is no longer considered the product of the biological brains of individual researchers, but as the outcome of a collective, planetary "brain-like" network, operating through artificial intelligence, interconnectedness and distributed thinking). It is unclear why Althusser considers "biosphere" a scientific concept while discarding "noosphere" as ideological, for both concepts belong together and refer to one another (as dialectical moments), as will be argued more thoroughly in Chap. 7.[4] Although Althusser's

[4] Likewise, as Monod argues, the tension between objective (allegedly "neutral") science and "subjective" (or "outdated") values is superseded by the insights that science is inherently value-driven,

analyses often strike us as dogmatic and self-contradictory in many ways, some of his contributions may nonetheless still be of value when it comes to developing a dialectics of technoscience, provided we are able to move away from his apodictic ("dogmatic") approach and understand the emerging dichotomies as moments in a dialectical unfolding.

Incorporating Althusser

I will now briefly indicate how some of Althusser's insights nonetheless represent added value when it comes to developing a dialectics of technoscience: not as apodictic propositions, but as *results* (i.e. ideas that are validated in practice).

(a) *Philosophy is a practice*. The question what philosophy is, cannot be determined apodictically, but can only be answered by actually practicing it. Althusser rightly emphasises, moreover, that practicing philosophy is not a matter of application ("philosophical engineering") but rather of transformation. Philosophical interpretations are action-oriented and future-oriented. Philosophy is a transformative practice (and this includes continuous self-transformation).

(b) *Philosophy is first and foremost a reading practice*. Althusser characterises his own reading practice as "symptomatic reading", a way of reading which adopts an oblique perspective, by focussing on the processes at work, seeing textual archives as battlefields where various scientific and ideological tendencies collide. Symptomatic reading means "reading aloud", allowing the discourse at hand to speak for itself. At the same time, it is a form of reading which is sensitive to the contradictions, the lacunae, the unsaid. This tension can be resolved by seeing reading as a dialectical practice. The literal text serves as point of departure, and philosophical readers focus on the key terms and crucial phrases. At a certain point, the apparent coherence (M_1) of this body of documents gives way to the awareness that these texts actually constitute a precarious compromise between conflicting, perhaps even irreconcilable and incommensurable tendencies (M_2) and that the apparent coherence is actually the result of condensation, displacement and secondary revision. Flaws and contradictions may serve as indicators here. Instead of allowing these tendencies to think for us, they must be brought out into the open. The oeuvres of Pascal and Teilhard, for instance, may be regarded as strategic discursive ambiances where collisions between a negating scientific practice (e.g. paleoanthropological excavations) and a spiritualist worldview (Catholicism) are enacted (cf. Chap. 7). In such cases (e.g. Teilhard, Monod, etc.), it is clear that we are not dealing with a "spontaneous" philosophy in the "naïve" sense of the term, but rather with a

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and that research methodologies contain an inherent ethic (of reliability, trustworthiness, responsibility, sharing of results, responsible data management, duties of care, etc.).

sophisticated effort (by a scientist who is also trained as a philosopher) to supersede the inhibitory tension (M_3).

(c) *Every science has a "logic" of its own*, a series of concepts or categories which are implicitly or explicitly at work in a particular research practice, providing guidance. The objective of a philosophical (oblique) reading is to bring this logic to the surface, revealing its antagonistic relationships with rival forms of logic. Again, this is not a purely descriptive, but a transformative endeavour, revealing how categories which are considered as starting point, are actually the result of an extended history. This applies to an egocentric philosophy of science, which builds on a particular type of myth, the scientific hero, a particular version of the Robinsonade, featuring the egocentric individual as a favoured or calculating researcher. Obfuscation of the genealogy (the socio-historical genesis) of such basic concepts is characteristic of ideology. In reality, research is a social practice, driven by the means of knowledge production at work in a particular socio-economic ambiance.

(d) *Key dialectical concepts* (such as "contradiction" for instance) *must be continuously validated and redefined*. Althusser rightly points out that contradictions tend to be overdetermined, a view which is closely related to the awareness that a societal system should not be envisioned as a series of monocausal relationships, but rather as a network of multiple interacting and interdependent factors and relationships. This is exemplified by the concept of metonymic causation, which basically means that causality can be displaced from one element to the next, so that a particular element can replace another element as causal factor. While contradictions or tensions tend to be subdued by displacement, in a moment of crisis condensation may give rise to a revolutionary rupture. These specifications are not at all at odds with Hegelian dialectics, where a linear understanding of causality already gave way to an interactive view (causation as "Wechselwirkung"). If all contradictions are conceived as interactions, each position works as a stimulus triggering its own negation, while there is an obvious connection between the concept of condensation and the dialectic of quantitative and qualitative change (a rise of tensions resulting in an erupting transformation) until a situation of relative stability is reached at a higher level of complexity.

(e) Althusser's work has added value for *our understanding of technoscience as an experimental practice*. First of all (and in contrast with the philosophy of induction), facts or findings are never the starting point, but always the outcome (product) of a dialectical process. Facts are produced (as is already indicated by the etymology of the term *fact*, which comes from *facere*, to produce). Rather, we start with the established convictions (i.e. discursive materials) which are challenged or negated by a particular procedure. The relationship between established convictions and (delayed) confirmation or verification is thematised by Althusser as "décalage", which may mean both dislocation and delay, thereby emphasising the inherent precariousness of experimental verification and replication. Rather than indicating an insurmountable gap between theory and practice, as is suggested in *Reading Capital*, the term "décalage" empha-

sises the unevenness of theoretical and experimental developments, whose dynamics may be significantly out of pace, so that they continue to challenge and stimulate or even hamper one another. This explains, for instance, why the neutrino (an elementary particle which is electrically neutral and whose mass almost equals zero) was theoretically discovered in 1930 and empirically detected in 1954, while the Majorana particle (predicted in 1937) still proves a challenging enigma for experimental research up to this day. Moreover, rather than endorsing technological determinism (seeing knowledge as a mere effect of the technologies in place), technologies emerge as specific components of particular modes of knowledge production, as elements in overdetermined networks of relationships: they are "called for", in the context of a research practice. Modern computers, for instance, may be seen as instances of *conversion*, enabling revolutionary change in how research is conducted, albeit not in a deterministic sense, because *displacements* play a significant role as well, so that computers may unexpectedly evolve from a calculation device into a communication device, or from a data management device into an enabling device for interactive and participatory research (e.g. crowdsourcing). The computer should neither be seen as a neutral means, nor as a deterministic force, but rather as a protean and co-evolving phenomenon in its own right.

(f) Being inherently dialectic, the development of technoscience may display dialectical patterns spontaneously as it were. As indicated, above, contemporary information and communication technologies evolve as protean components within complex, interactive networks, exemplifying converging and enabling technologies (Althusser's "condensation"), giving rise to revolutionary situations by affecting the mode of production, whose technological, theoretical, organisational, legal and managerial dimensions tend to develop at an uneven pace (Althusser's "overdetermination"), while their role may easily shift from calculation device to communication device and back (Althusser's "displacement"). Thus, a dialectical dynamic can be discerned in *in silico* (computer-based) research. At the same time, the dialectical perspective must be consciously and carefully developed. In other words, there is *a continuous interaction between the spontaneous dialectic of technoscience and dialectics as a practice of transformative assessment and intervention*.

The result of the rereading process is that Althusser is more dialectical that he claims and that, intentionally or unintentionally, his efforts allow us to further develop a dialectical materialist approach to technoscience, building on a dialectical *interaction* between Hegelian and Marxist dialectics.

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