The Sci-Tech-Economic Complex: On the Subsumption of Productive Forces under Capital

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ABSTRACT: This article proposes to reconceptualise some key terms within the Critical Theory of technology. On the one hand, its goal is to bring forward a dense defence of a *Marcusean* understanding of Marxism that includes the problematisation of otherwise unquestioned premises known from certain scientist or positivist Marxisms—like the neutrality of science and technology, the positivity of labour, or the revolutionary tendency of productive forces. On the other hand, the article refutes more liberal takes on science and technology as found in works from Max Weber to Jürgen Habermas, instead reconceptualising some of their terms. Its general argument runs as follows. If technology can be deciphered, with a twist on Marx, as *undead labour*, then capitalist technology may be described as undead *alienated* labour. Instead of being a neutral toolbox, specific *ends* are inscribed into technological *means*—ends ratified, under capitalist rule, not by natural law but by capital's law of value. In this sense, the article reconceptualises *technocracy* as being not only a rule of experts, scientists, or bureaucrats but first and foremost as being the say (logos) of a techné modelled after capital's needs. This has strong implications for what we make of science and technology under capital. For liberalist paradigms, they are supposed to be outside the political questions of democratic decision and participation processes like the private, privatized and appropriated realm of capitalist economy. Yet, it is precisely this connection that allows me to introduce the term *sci-tech-economic complex* to highlight its overall subsumption under capital. Indeed, science and technology are constructed 'outside the political' only because they remain *inside* the logics and logistics of capital—or disciplined by a regime of growth, innovation, and valorisation. As such, their calculations are less *zweck-rational* (rationally directed towards a human purpose) than '*selbstzweckirrational*' (irrationally conditioned by the purpose of undirected self-continuation). Hence, the irrationality of this inversion can only be overcome if the sci-tech-economic complex is reclaimed from what the article dubs the *end-in-itself-irrationalism* of capital. Science and technology may become truly rational only in a socialist society: This is the Marcusean Marxist clue at the heart of this article.

KEYWORDS: Sci-tech; technocracy; productive forces; instrumental reason; surveillance capitalism; Weber; Horkheimer; Marcuse; Habermas.

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> "Only in a society where all [humans] become protagonists of history do technique and science become tools for liberating all individuals, to allow them to fully develop their own personality, rather than becoming instruments of their own alienation. This is the reason for our trust in socialism, which also is trust in science, but first of all trust in humankind."
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> (Cini 1975, 15)

Introduction

> "A true democratisation of society also involves citizens evaluating scientific, technological and environmental decisions." (Pelluchon 2021, 182)

Usually, the attempt to refute the argument according to which capitalism is a modern version of religion (Walter Benjamin)[1] is done so by pointing out the progress of the productive forces under capitalism, and more precisely the progress of the sci-tech-economic complex. Are not, at least, science and technology free from capitalism (as religion); have they not overcome religion and replaced it with reason, rationality, self-determination? With the means of Marcusean Marxism, I would like to propose that they, as long as capitalism exists, are not beyond capital, and thus not rational yet. Of course, not all science and technology are capital-internal, or exploitation-enhancing; but the neutrality and objectivity of science is to be replaced by the question of its origins and goals. The point of this article, then, is not to wave farewell to science or technology, but to reclaim them; moreover, the point is to show, with Marcuse and Horkheimer, that Habermas' neutrality of 'formalist reason' and 'instrumental rationality' cannot be upheld since Weberian dualism does not hold. Hence, the point is not to claim that all results of science and all technological devices are part and parcel of the logic of capital, of exploitation or surplus value, growth, or accumulation. Rather, the point is that even the supposedly neutral productive forces of capital are, to a great degree, products of the capitalist relations of production. A reappropriation of material culture, thus, will only be possible if the status quo of material culture is altered from its base: substantial democratisation means also changing what already exists, and not only deciding over its organisation.

The general argument goes as follows. If technology can be deciphered as undead labour, then capitalist technology may be described as undead alienated labour. Consequently, instead of being a neutral

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1. For a summary of the argument see Meisner 2022a; 2023a. This article was much improved by the editorial work of Thomas Bogg. I would also like to thank the two blind reviewers for their valuable suggestions, comments and critiques.

toolbox, specific ends are inscribed into technological means—ends ratified not by natural law but by capital's law of value. Along the same lines, technocracy is to be understood not only as a rule of experts, scientists, or bureaucrats but first and foremost as the say (logos) of a techné modelled after capital's needs. Accordingly, under liberalist paradigms, the sci-tech-economic complex is supposed to be outside democratic decision and participation processes. Yet, it is constructed as 'outside the political' only because it is inside the logics and logistics of capital—or disciplined by a regime of growth, innovation, and colonisation. As such, its calculations are less zweckrational (rationally directed towards a human purpose) than 'selbstzweckirrational' (irrationally conditioned by the purpose of undirected self-continuation). The irrationality of this inversion can only be overcome if the sci-tech-economic complex is reclaimed from the end-in-itself-irrationalism of capital. Critical Theory, in this way, shows that science and technology can only become emancipatory if they are reconnected to socialism in a Marxist fashion.

1. Surveillance Capitalism: The newest frontier of capital colonisation

> "The 'mechanics of conformity' spread from the technological to the social order; they govern performance not only in the factories and shops, but also in the offices, schools, assemblies and, finally, in the realm of relaxation and entertainment." (Marcuse 1998, 48)

As Shoshana Zuboff shows, surveillance is no longer a thing only of authoritarian states; it is a thing of capitalist markets. Like nature under classical capitalism's industrialisation, human nature will be exploited if not destroyed under the digital hyper-industrialisation of surveillance capitalism. Yet, unlike Zuboff's belief, there never was a "centuries-old social contract between capitalism and its communities" (Zuboff 2019, 499)—or between markets and democracies. Since capitalism is neither reciprocal nor "inclusive" (504), surveillance capitalism is less a "cruel perversion of capitalism" (518) than its next level and its most novel frontier. Instead of being conditioned on meeting humans' "new needs," (520) as Zuboff claims, capital is conditioned on *inventing* these needs to satisfy its *own* 'needs'—from valorisation via surplus to accumulation.[2]

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2. See, on that, also Böhme (2016, 11): "Es ist also nicht mehr so, dass die Wirtschaft ein Instrument zur Befriedigung der menschlichen Bedürfnisse darstellt. Eher verhält es sich umgekehrt: Der Mensch transformiert sein System der Bedürfnisse, um den Anforderungen kapitalistischer Entwicklung, d.h. eines immer weiter fortschreitenden Wachstums zu entsprechen."

This is of crucial importance not only for putting surveillance capitalism in the correct historical light, but also technology and science as they are embedded in the history of capitalism. After capital's imperialism had conquered the external world of geography in the late 19th century,[3] it needed to carry on conquering the internal world of humanity in the early 20th century[4]—from mass media and culture industries to aesthetic and cultural capitalisms. Ever since then, capitalism's survival is dependent first and foremost on *advertisement* as a 'productive force' which *produces consumers*, *supplies demand*, and *manufactures an ever new—productivist; consumerist; prosumerist— (wo-)man.*[5] Meanwhile, Google (Alphabet) and Facebook belong to the largest companies regarding market capitalisation – and indeed, their prime business comes down to advertisement. In other words: to produce a consumerist according to one's products is what is most 'productive' in our times—at least in the west.

Hence, with the early 21st as a 'neo-Taylorist' century, there has emerged not only a scientific management but a *scientific advertisement*: the "high science of targeted advertising" (Zuboff 2019, 509). With this techno-scientifically micro-targeted advertisement—and its concomitant economies of (hyper-)scale, platform-extraction, and the internet of things (from wearables to the smart home)—a new depth of colonisation of humans' internal worlds has been reached. Consequentially, an intensification of behavioural control is established that nudges us into being-addicted and being-exploited for free, if not voluntarily. To give just one example: so-called 'artificial intelligence', instead of being any magic-like entity of the future, comes down to the result of *storing time*. More precisely, it is the technologically mediated and thereby anonymised hyper-exploitation of common unpaid human immaterial labour past and present, concentrated in the harvest of big data and refinable through its algorithmisation.[6] Since for "surveillance capital", "we are merely 'human natural resources'" (100), such 'accumulation by dispossession' (David Harvey) colonises ever new territories of being human and alive in intersubjective life-worlds. Today's "surveillance exceptionalism" (Zuboff 2019, 386) knows no limit in its colonising enterprise because it is usually far ahead of state and other public regulations. The result is a lawless winner-takes-it-all reality in wild-wild-

3. For the classic on this take, see Lenin 2010, 111
4. Paul Virilio calls this endocolonisation, see Virilio 2007, 39.
5. I develop this argument in Meisner 2024a.
6. For a summary, see Lanier 2015, 421–437.

west style whose victims are our relationships, our intimacies, our affects, and our imagination.

For sure, this colonisation of the not-yet-conquered, of ever new frontiers is part and parcel of capital's classical predator-logic, whose primitive accumulation has been ongoing for more than 500 years. Hence, that our future is stolen from present to present is nothing specific to surveillance capitalism, but something built into capitalism and *its* modernity from the start. As a result, pace Zuboff, our "right to the future tense" (328) was never to be found in liberal law but can only be *struggled* for beyond capital's insatiable hunger for further colonisations. To struggle, however, we first need to understand: not only surveillance capitalism or digitalisation but the internal correlation between modern science, modern technology, and modernising capital. Concepts found in the tradition of Critical Theory—from Habermas back to Horkheimer and Marcuse—will be of help to theoretically inform the struggles needed to reclaim our present, our future, and our past from both surveillance and capitalism.

2. Reconceptualising critical concepts (I): Technique, technology, *technocracy*

> "Every unchallenged assertion of the neutral goodness of technology
> supports and sustains the status quo." (Bridle 2019, 245)

If technology, for a Marxian analysis, can be deciphered as (un-)dead labour, then capitalist technology is to be described as (*un-)dead alienated labour*.[7] If technology is undead labour, and capitalist technology is undead alienated labour, however, then it follows that *technology must be alienated under capitalism as well*. Consequentially, instead of being a neutral toolbox, specific *ends* are inscribed into technological *means*—ends ratified not by *natural law* but by *capital's law of value*. Along the same lines, *technocracy* is to be understood not only as a rule of experts, scientists, or bureaucrats but as the say (logos) of a techné modelled after capital's needs. Along these lines, I would like to delve more deeply into the notions of technique, technology, and technocracy now—also to understand why critiques of the latter two do not have to

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7. Technology, as one form of capital, is also one form of dead, ossified, or materialised labour, or labour 'outside of the labourer'. If this outside has been produced under alienated conditions, then the product itself has the capacity to alienate the labourer or producer in turn. Since technology, whereas being 'dead' (not organic, ossified), is still able to move (like the auto-mobile), it may be said to be 'undead': Its effects, if caused by alienation, can well be uncanny.

be technophobic at all. Rather, the critique of technology and technocracy is a critique not of any technical means but of the loss of humans' end, or: a critique of capitalist alienation.[8]

To begin with, *technique* may be defined as a mean or tool towards an end or telos—a tool or mean that is used if and only if this specific telos or end is supposed to be reached. The most often used example for a technique, then, is a hammer. It may be put to different uses—also to 'good' or 'bad' ones (like, say, hanging a picture or smashing a skull)—but neither one of these specific uses is *pre-inscribed* into the design of the hammer. The hammer, thus, remains a mean and cannot, by way of its design, become an end-in-itself.

By contrast, *technology* must be described as engendering an inherent *logic* which is not neutral but has its own developmental dynamics. This is because a technology is a *technique with its own logos*, law or say in the world—it is a technology. More precisely, a technology is a technique not destined to realise a natural potential in the environment but to realise its *own* logos by inscribing *this* logos into the world, thus transforming the world into *its own* environment. Random examples for technologies are planes, coal mines or atomic power stations with their real-worldly consequences. Certainly, these consequences could be different if politics would decide to use other technologies: that we are dependent on technologies which cause climate change is not a neutral, necessary, or anthropological feature but the outcome of a historically specific way of organising the metabolism of culture and nature, this is, of humans and their environments.

The most obvious example of technology in the Fordist 20th century was the car. Seen only from the standpoint of a *technique*, a car may be understood as a means to travel by oneself wherever a road may lead. As a *technological design*, however, a car by necessity individualises, atomises, and isolates people from each other in a militant manner, since it is constructed as a mobile fortress of accelerated monads. Even more, the technological design of a car includes the surrounding infrastructures without which it would not be able to realise its own potential. As a totality of streets, then, the technological design of the car cuts through cities and landscapes, destroys not only eco-systems but also public spaces, until both cities and landscapes no longer belong to those who live there but, rather, to the axes of trade and travel. In this way, the plurality of places becomes the one-dimensional monism of space.

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8. For an updated critique of alienation for the 21st century, see Meisner 2022b.

As a result, more and more homes—including the 'mobile home' of the car—become castles or gated communities to safe-guard their fragile individuals from the plane of speed and acceleration. It is no wonder, then, that cars represent virile aggression and 'enginious' masculinity. As we have all experienced whilst driving a car, many otherwise peaceful and considerate people systematically break into thundering excesses of wrath towards their fellow human beings. In that sense, the futurists' prayers to technology's brutality were less poetic fantasies than mimetic reproductions of the phantasmagorical element always materially inscribed into the logos of capitalist technology.

Yet, it is not only the case that technologies adapt their environments to their own application and realisation styles. Even more, technologies, other than techniques, have specific *ends incorporated into their means-structure*. Put differently, technological design always incorporates a specific logic. For example, the notification function on mobile devices programs an "addiction by design" (Lovink 2019, 10)[9] into its misused 'users' to increase the revenues of monitoring, exploiting, and manipulating them. That 'artifacts have politics' (Winner 1980) means that they have the politics of their designers. Capitalist technologies, thus, are not just means but means-towards-specific-ends, which, increasingly, transform *us* into *their* means. Meanwhile, technologies—especially digital ones—get designed to design *us*, for example as consumerist persona or as frackable production units. The result of digitisation, then, is that our "vision is increasingly universal, but our agency is ever more reduced. We know more and more about the world, while being less and less able to do anything about it" (Bridle 2019, 186).[10]

Ever since the advent of digital technologies, we are influenced and exploited within an interior scope ranging from our experience to our know-how, from our interest(s) to our tastes, from our homes to our goals, from our desires to our bodies. Yet, the worst of this *deep exploitation* and deep manipulation is that there is hardly any escape from it. Indeed, under digital technologies, we have *less and less choice but to be decided upon*: to use a smartphone, one has to use Google's software (including its policies); to study, one is obliged to login on a Gmail-account (with which one's university has a contract); to research a topic, one is mined into the (normative-commercial) setting of a search engine; to work (especially in a lean hierarchy team-job), one is supposed to be

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9. Lovink, here, draws on a book of the same title by Natasha Dow Schüll.
10. See, on that point, also Feenberg (2017, 84) echoing Horkheimer: "we have long since reached the point beyond which technology overtakes the controllers."

on messenger apps for most basic communications; and even to engage politically, the wide-spread use of Facebook and Instagram makes them almost indispensable to organising (and for 'outreach' qualities). Meanwhile, with the greatest digitisation-offensive in history covering the Covid period, there was an even deeper push into the mediation of sociality through technologies—a technological push that can also be read as an invasion by capital. All in all, we are forced to partake in our own exploitation, surveillance, and manipulation to the same degree to which we deepen our being-caught in the *world wide web*. To be forced, to be caught, and not to be able to escape this situation of deep exploitation and alienation, however, is part and parcel of the technological design of digital capitalism.

If technology, differentiated form techniques, is read through these lenses, then Horkheimer's thesis that "technical reality is deprived of its logos, or, more precisely, that [this] logos appears as deprived of reality, as a logical form without substance" (Marcuse 2011a, 135) refers to the replacement of the former end with a new end (logos), which gets inscribed into the mean (as technique). Technology, therefore, is 'deprived of reality' because it is a *technique deprived of its mean-status*: it is a mean that became its own end, an end inscribed into its mean-structure. And technology is 'without substance' because, unlike technique, it cannot be used as a tool towards a specific (human) telos since it already carries its own (technical) telos within itself. Hence, the difference between a technique and a technology is that between a hammer and the internet, between a tool and a web that catches its victims. It is the difference between a mean and the alienation of a mean from its former end into an end-in-itself—which is: into the *telos of its designer*.

Importantly, this differentiation between technique and technology also elucidates a new understanding of *technocracy* in which it is no longer identical to *expertocracy*.[11] Experto-cracy may be described as the governance of scientists or bureaucrats, of administrative personnel or technophile elites. By contrast, techno-cracy is not just the rule of those that know how to use techniques appropriately ('experts') but rather the

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11. In Habermas' classical 'technocracy thesis', technocracy and expertocracy are used synonymously, see Habermas (1970, 105) emphasis added: "propaganda can refer to the role of technology and science in order to explain and legitimate why in modern societies the process of democratic decision-making about practical problems loses its function and 'must' be *replaced by plebiscitary decisions about alternative sets of leaders of administrative personnel*." Habermas continues to use the term in similar fashion until today, see f.e. Habermas 2015.

rule of the logos of techné—which is, the rule of the technological designers and their interests. Under technocracy, then, means have become ends-in-themselves towards a specific telos, thus using the 'users' of techniques as their own means.

This shifted meaning of technocracy, however, does not change the fact that it is a *depoliticising ideology*. As Jürgen Habermas has it: "the new ideology is distinguished from its predecessor in that it severs the criteria for justifying the organization of social life from any normative regulation of interaction, thus depoliticizing them" (Habermas 1970, 104).[12] In short, technocracy claims to be without interest, without normativity, and without politics. Yet, inasmuch as it executes a technological design, the logos of a techné, or the telos of a designer, it is doing politics nevertheless. To summarise, the technocracy of digitisation is not just the rule of experts or the mere application of technical problem-solving to the political sphere but the rule of means-as-ends-in-themselves which equals the sway of huge private corporations over our lives, ideals, and desires—and the manipulation, exploitation, and surveillance of the world's population.

3. Reconceptualising critical concepts (II): Instrumental reason, reasoning of instruments, *end-in-itself-irrationalism*

> "Technology is always a historical-social *project*: in it is projected what a society and its ruling interests intend to do with [humans] and things."
>
> (Marcuse 1968, 224f)

With the reconceptualisation of *technocracy* (taken originally from Habermas), we can now turn to a reconceptualisation of *instrumental reason* (taken originally from Weber and Horkheimer). For Max Horkheimer, formalised reason becomes a mere *instrument* of adjustment, the mere *organiser* of a "field of means," (Horkheimer 1947, 93) in which means "assume the appearance of autonomous entities" (102) behind which no substantial *human* end is left. The result is a "rationality with reference to means and irrationality with reference to human existence" (94). The only 'end' left inside instrumental reason is the end of atomised self-preservation, which is synonymous with the preservation of society at large by the exploitation of both inner and outer nature (cf. 128). Different from Max Weber, therefore, Horkheimer stresses that formalised reason is not *indifferent* to its end but precisely *tailored according to one*

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12. And Habermas (2015, 104) continues: "to the extent that practical questions are eliminated, the public realm also loses its political function."

very specific yet general end: namely, to the end of the preservation of the totality we live in.

From this difference between Weber and Horkheimer, between formalised and instrumental reason, follows a differentiation between purposeful and instrumental action. As Christian Fuchs has it: "Only specific purposeful action is instrumental action, namely action aimed at domination, exploitation, control, manipulation or exclusion" (Fuchs 2016, 216). Whereas instrumental action necessarily instrumentalises humans for the sake of adjustment to and preservation of inhumane conditions, purposeful—and even purposive—action may be purposed along the lines of human well-being. If instrumental is understood as purposive action, then, it is about reaching an end, about getting from A to B in an economic or effective manner, which is pretty much unproblematic. Indeed, if purposive action would not be reduced to instrumentality, it could still ask not only for the best means for an end but for the *reason of that end* itself – it could begin to ask 'towards which end?' in the first place. Yet, under depoliticised technocratic circumstances, reason loses its purposeful content and becomes an instrument. More so, if instrumental reason becomes technological reason, it turns into a sort of *reasoning of instruments*: it transforms into the logos of techné, the telos of a designer, or the interests inscribed in technology as binding law and forceful voice.

As much as techno- and expertocracy cannot be used synonymously, then, Horkheimer's 'computerised' instrumental reason (*instrumentelle Vernunft*) and Weber's 'calculating' purposive rationality (*Zweckrationalität*) are not identical either. On the contrary, instrumental reason, since it approximates a reasoning of instruments, is conditioned on the 'irrationality' of an end-in-itself.[13] When Horkheimer shows that the

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13. Only due to the confusion of *Zweckrationalität* with *Selbstzweckirrationalismus*, the anarcho-capitalist postmodern turn against rationality and means/ends-structures could be possible; only due to the confusion of the protestant ethic with the capitalist spirit per se could the proto-neoliberal critiques against a reduced understanding of technocracy as state bureaucracy be articulated. As Bürger (1974, 90) has it: "Nicht der bestimmte Zweck, der Profit als das die bürgerlich-kapitalistische Gesellschaft beherrschende Prinzip, wird kritisiert, sondern Zweckrationalität überhaupt. So kann der Zufall, der doch den Menschen dem ihm gänzlich Heteronomen unterwirft, paradoxerweise als Chiffre der Freiheit erscheinen." In that sense, if the aesthetic is 'beyond' *Zweckrationalität* (purposive rationality), as Andreas Reckwitz (2019, 22 f.) claims, then only because it has expanded with *Selbstzweckirrationalismus* (end-in-itself-irrationalism). This *Selbstzweckirrationalismus* was demasking itself during the late 20th century when rationalist Keynesian planning was replaced with consumerist mythology à la Berman and market mysticisms à la Hayek.

self-preservation of instrumental reason actually is the (self-)preservation of our given social totality, he implies that its 'purposive rationality' comes down to the irrationalism of a non-human purpose or end-in-itself. Yet, what may this non-human purpose be? What is this end-in-itself? For Weber as for Horkheimer, the modernisation process is intimately linked to the this-worldly 'fate' and 'destiny' of an 'iron cage' of structural 'coercion'[14]—and this secular 'fate' or material 'destiny' is what they call *capital*. In Horkheimer's laconic words: "this world is not the world of its subjects but the world of capital" (Horkheimer 1992, 224). The non-human purpose, the end-in-itself behind the technological and instrumental reason of our society is capital.

In that sense, capital's instrumental reason is less purposeful-rational (rationally directed towards a human purpose) than end-in-itself-irrational (irrationally conditioned to the end of undirected self-continuation). Instrumental reason as the reasoning of instruments, therefore, is intrinsically irrational: it is the symptom of capital's *end-in-itself-irrationalism* ('Selbstzweckirrationalismus' instead of Weber's 'Zweck-rationalität'). Under capital's rule, we all work, in alienated labour, on goals that are expropriated from us, yet try to reach them more easily, faster, more sustainably: It does not matter how much we rationalise, optimise, perfect labour processes, the telos towards which this labour is spent remains given, outside our decision-making processes. Without substantial reason that also entails the goal of an act, instrumental reason that only makes this act more rational, remains fundamentally irrational since its telos is beyond its reach. On the other hand, the end-in-itself-irrationalism of capital's technocratic reasoning of instruments is less *purposive*-rational ('*zweck*rational') than *value*-rational ('*wert*rational') if and only if value rationality follows the *value* ('Wert') of capital. And only inasmuch as purposive rationality—as the most efficient ratio of bringing together means and ends—functions under the technocratic condition that its end is *already prescribed* can it be said to be beyond *value rationality*, since only under that condition does its end not need to be decided upon in a *value-rational* way. This is, purposive rationality can do without value rationality only if inside capitalism—

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14. Cf. on that also Le Guin (2019, 36): "If science fiction is the mythology of modern technology, then its myth is tragic." That is because the reasoning of instruments is less post-metaphysical than imprisoned in a material metaphysics of immanence. For sure, such metaphysics may be described more as a technocracy than as a theocracy, the first transition to which lies in early modernity. To a certain degree, what happened here was that 'heaven' was replaced by the 'future': Death is no longer supposed to be defeated by (the belief in) God but by (the belief in) technological progress.

within which *capital value co-opts all other values,* instead of humans deciding among and due to divergent political, social, moral, and other values.[15]

Generally, if humans are used by technology instead of techniques being there to serve as humanity's tools, then the purpose of purposive action follows from the reasoning of instruments instead of the reasoning of humans. Yet, this inversion is the inversion not of rationality itself but of a *ratio* beyond or alienated from human telos-setting. Now, once we are used by the devices we create the question arises to whose service we are operated. As I have argued, under capitalism, the technocratic ratio behind the reasoning of instruments is the ratio of capital.

5. 'Prostructive' forces: Capital's *sci-tech-economic complex*

> ". . . value-free science blindly promotes certain social political values and,
> without abandoning pure theory, science sanctions an
> established practice." (Marcuse 2011b, 157)

It may be the case that, in the history of capitalism, the productive forces have exploded the relations of production. Even more, they may have already done so several times. Yet so far these explosions have always happened only *immanently*, this is, *from one mode of capital accumulation to the next*. Since productive forces thus successively inscribe in themselves capitalist relations of production, they more and more become 'destructive forces'[16]—which conveniently illustrates their end-in-itself-irrationalism. By meeting not so much the needs of humans as those of its own logic, capital's productive-destructive forces engender *creative destruction* from planned obsolescence to crises-triggering disruptions. In that sense, the forces of capital may also be called *prostructive forces*. As the term 'prosumer' describes the (subjective) dialectics of production and consumption under late capitalism, in similar fashion, the (objective) dialectics of production and destruction within the same phase of capitalism may be called its prostructive forces. Examples are the profitable forces of the military-industrial complex and the prison-industrial complex, of big oil and big tech. Capitalist productivity, after

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15. Hence, today's capitalist technocracy is *not* modelled after purposive rationality, nor is it instrumental if understood as bureaucratic or cold, non-affective or unemotional reasoning (as Weber or Habermas might think). On the contrary, since the main engines of economic power today are Google, Amazon and Co., technocracy inside immaterial-communicative-cultural identity economies turns out to be hyper-affective instead of unemotional; the same must be said about the new military-industrial complex.

16. Marcuse (2011c, 223) speaks of "productive destruction". See also, Meisner 2023b, 127 ff.

all, can equal the destruction of human values, human lives, human conditions of life; under capital, it is completely normal to produce destructivity, both destructive means and destructive characters. Equally, wars can be perfectly productive enterprises, if seen from the perspective of capital alone. In fact, nothing is as helpful to capital growth as 'creative destructions' (Schumpeter) such as wars; and the bigger the war and its destruction, the more productive it may become. Rarely has capitalism been so productive as when producing death, misery and crises on a world-scale.

Of course, within liberalist rationalisation paradigms aligned with capital's irrationalism, science, technology, and the economy are supposed to be outside the democratic decision and participation processes. Arguably, they are constructed as 'outside the political' simply because they are *inside* the logics and logistics of capital—this is, disciplined by a regime of growth, innovation, and colonisation. Under the technocratic conditions of capital's end-in-itself-irrationalism, it is not humans who use scientific, technical, or economic means but capital's *sci-tech-economic complex* which uses them as its tools, raw material, and labour power. For that reason, technoscience and the capitalist economy cannot be torn apart without a revolution that has this goal explicitly on its agenda. Since "[t]echnologies are always economic means, not ends in themselves", the economy must be changed to change technologies accordingly: "In a modern capitalist society, technology was, is, and always will be an expression of the economic objectives that direct it into action" (Zuboff 2019, 15).

Now, unfortunately, science is no exception within the sci-tech-economic complex—in fact, it is increasingly hard to differentiate between natural sciences and technoscience in the first instance. Since at least the scientific warfare of WWI and the atomic bomb and the industrialised mass murder of WWII, science can no longer be understood as innocent, and even less as part of a linear progression towards the greater good of all.[17] "The historical association between military, government, and corporate interests on the one hand, and the development of new technologies on the other" (Bridle 2019, 245) does not leave the 'mediator' science untouched. Precisely that modern natural science, unlike former metaphysical systems, sees no teleology in nature enables it to subsume the now desacralised nature under the telos of capital's unhampered exploitation. Ever since, because nature has no intrinsic

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17. For the two classics on this position, see Bernal 1946 and Rose & Rose 1976.

norm or worth to be followed, it can be freely disposable for whatever purposes—because nature has no value in-itself it can serve as the material basis for all sorts of capital value.

In homology to Marx's capital formula "M-C-M," then, "the scientific enterprise, according to the formula "K-R-K" (existing knowledge—research—more knowledge), is based on the constantly renewed promise of increasing the horizon [of the known as the exploitable]" (Rosa 2019, 23). There is a homology between capital's and (techno-)science's blind progression, insatiable expansionist urge, and colonising logic of accumulation. Consequentially, "the motto of the 1933 Chicago World's Fair" was: "'Science Finds—Industry Applies—Man Confirms" (Zuboff 2019, 15). The role of humans, in this game, is reduced to that of someone coming too late or post factum to endorse subjectively what objectively has already happened and is happening anyway.

This has been the case since at least the industrial revolution. With the industrialisation of (techno-)science, it no longer is—if it ever was—the task of ingenious individuals in lonesome places. Rather, (techno-)science can only be practised with a well-trained personnel of experts plugged into centralised high-tech-institutes and their complex material and immaterial infrastructures. Due to the resulting skyrocketing costs even of the most basic research, *(techno-)science today survives only if it is financed by big capital*—whether as represented in public or in private funds, in the state or in industry and its various foundations. The question, as a result, is not so much whether science is pure, 'external' to society, or unpolitical since it simply needs the great resources only a society like ours can grant it. Rather, the question should be *in which ways* is (techno-)science internal to society, by *which* political telos is it informed, *what* is it to develop because of what, and *in which direction* its research will lead.

Towards this horizon, the questions for the *goal* and the *function* of science are the questions that need to be raised again. The basic question is: who owns the sci-tech-economic complex? What is its (instrumental) reason? For which purpose is it there? Why do we let it reign? In which ways is it ideologised? How can we reclaim it? All these questions are vital today. In times of the Capitalocene, the sci-tech-economic complex's *techno-logos* increasingly negates the necessities of the *bio-logistics* of eco-systems, environments, and planet earth, at least as liveable for humans. Bio-logistics, in this sense, loses against a 'necropolitical' technocracy as long as the 'prostructive forces' of capital's end-in-

itself-irrationalism are not tamed by the purposive action of democratically uniting human beings.

Amidst climate change, our 'right to the future tense' is not given; we need to struggle for it. "Indeed, man's avidity to extend his power in two infinities, the microcosm and the universe, does not arise directly from his own nature, but from the structure of society" (Horkheimer 1947, 108). This structure, however, can be changed—and with it, the sci-tech-economic complex will change accordingly. Perhaps we have to make a decision between an ecological Anthropocene and a catastrophic Capitalocene, since what is needed is the "mastery by the whole of society of society's mastery over nature" (Schmidt 1971, 12 f.).[18] Put differently: what needs to be controlled politically is *the way* we are embedded in our metabolism with nature, instead of 'controlling' nature—as if we ever could, anyway. What is needed is a reclaiming of the sci-tech-economic complex from capital, and the end of the fateful marriage of production, consumption, and destruction.

6. Conclusion: Politics over *technocracy*; purposive human action beyond *end-in-itself-irrationalism*; socialist democratisation of the *sci-tech-economic complex*

> "The technological transformation is at the same time political transformation, but the political change would turn into qualitative social change only to the degree to which it would alter the direction of technical progress—that is, develop a new technology." (Marcuse 2002, 232)

Under the conditions of capitalism, Silicon Valley investor Peter Thiel is not only right-wing but capitalistically right when stating a "deadly race between politics and technology" (quoted in Taplin 2018, 286). Indeed, technocratic or (post-)"modern oppression […] is a battle between de-humanized self and objectified enemy, the technologized bureaucrat and his reified victim, pseudo-rulers and their fearsome other selves projected on to their 'subjects'" (Nandy 1983, 16). Still, Marcuse has stressed the dialectics in technology. Its emancipatory potential resides in the realities of the automation of work, the rise in productivity, and the decreasing necessities of human labour. Under capitalism, this emancipatory potential leads into the powerlessness of the people, structural social insecurities, and systemically induced right-wing reactions. However, under a different social order not biased towards prostructive forces, the very same potential could result in a "pacified

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18. On this point in more detail, see also Meisner 2024b.

existence" (Marcuse 2002, 247) relieved from toil, exploitation, and alienation. As Marcuse reminds us: "The idea of qualitatively different forms of technological rationality belongs to a new historical project" (Marcuse 2001, 57). This project is always already envisioned by the political forces of contemporary social movements as historical actors. For them to seize the emancipatory side of the dialectic of technology, techniques must be emancipated from technocracy; purposive rationality and action from the reasoning of instruments; and the sci-tech-economic complex from the end-in-itself-irrationalism of capital.

As much as the (individualising) car and the (addictive) smartphone are ideological technologies, science remains ideological as long as its funding, its goals, its direction are decided upon by big capital and not democratically by the needs of the people. Equally, with these different goals, the manipulation of nature for the sake of nature's domination would be replaced by a communication with nature for the sake of a symbiosis. In that sense, the goals of science would also feed back into its methodologies and thus into its findings. Marcuse, therefore, is correct in stating that another society would lead to another science; how this other science looks in detail, however, can only be answered if the details of another society are around us—here resides the limit of every theory. At least, two things are clear at the very same time: first that the current forms of science, in their division of labour (human, social and natural science) and in their embeddedness within the capitalist totality as its genesis, tendency, goal, and function, would become different in a postcapitalist society; and second that we, as of today, living under the capitalist totality, cannot imagine how the different method and approach of science(s) would look in detail under postcapitalism.

Of course, this does not say that there is no human progress in science and techniques even as they are embedded in a capitalist totality: most obviously, there is progress in medicine (although it is closely tied to the pharma-industry) or in certain forms of engineering (from the bicycle to the high-speed-train, from green resource management to, say, central heating). Again, the point of this article was not to deny any of this. Rather, I had two other points to make: first that science and technology, and increasingly so since the advent of the 20th century, can no longer be abstractly differentiated from the economy *as a whole*, which also means that they cannot be said to be objective in the sense of 'neutral' *as a whole*; and second that we should thus differentiate, instead of neutral objectivity here, interested subjectivity there, between tech-

nique and technology, purposive rationality and instrumental rationality, and between the potentials of sci-tech and the sci-tech-economic complex under capitalism. Indeed, the end-in-itself-irrationalism built into all three elements of this complex (science, technology, economy) can only be overcome if capitalism itself is abolished, or if material culture is democratised sufficiently as a whole. The argument, in that sense, is an argument about reclaiming the goals and telos of sci-tech, and thus about taking them away from the orientation towards capital value. After all, if science, technology, and economy must form a *complex* by necessity in today's conditions, their complex can only be understood as *apolitical* if the capitalist economy is *depoliticised*, which is a misdirection. Instead, its re-politicisation under democratic conditions would include the democratisation of sci-tech, meaning the reconnection of its goal and telos to the political autonomy of societal deliberation. Marcusean Marxism stresses: Science can only save its scientificity by returning to scientific socialism, and technology may only be saved from becoming suicidal for humans if directed towards a communist telos.

Only in this (re-)politicisation can the objectivity of sci-tech be secured. Sci-tech is not without any goal and telos; the question, rather, is *which* goal and *which* telos does it have, and this question is to be replied to by humans, and not by capital.[19] Only in this way will the radicalising project of modernity with its promises of human autonomy, a rational society and qualitative individuality be realised throughout society—including not only 'the economy' but the sci-tech-economic complex as a whole. Without democratic socialism, however, the project of modernity, including the Enlightenment project, will be lost to the modern barbarisations of fascism, war, and ecocide.[20]

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19. See on that in more detail Meisner/ Omodeo 2025.
20. See for an in-depth argument in this direction Meisner 2025, 133–354.

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