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Angaben zur Veröffentlichung / Publication details:

Pieper, Maximilian. 2024. "Technology as a strategy of the human? A comparison between the extension concept and the fetish concept of technology." Philosophy & Technology 37 (1): 6. https://doi.org/10.1007/s13347-024-00697-0.

Philosophy & Technology (2024) 37:6
https://doi.org/10.1007/s13347-024-00697-0

RESEARCH ARTICLE

Technology as a Strategy of the Human? A Comparison Between the Extension Concept and the Fetish Concept of Technology

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Received: 4 August 2023 / Accepted: 3 January 2024

Abstract
Discussions on the Anthropocene as the geology of mankind imply the question whether globalized technology such as energy technologies or A.I. ought to be first and foremost conceptualized as a strategy of the human in relation to nature or as a strategy of some humans over others. I argue that both positions are mirrored in the philosophy and sociology of technology through the concepts of technology as an extension and as a fetish. The extension concept understands technology as an extension of the human body and its capabilities, resulting in a local 'inward' perspective. The fetish concept offers a contrary 'outward' perspective by drawing attention to the global socio-material context of modern technology. Despite their differences, I argue that both concepts share an underlying operation principle of technology as functional simplification. Technology always involves a functional simplification of physical as well as social causality. Sociologists and philosophers of technology would do well not to give primacy to the former as it leads to the belief in technology as a universal tool that neglects how technology is not embedded in but consists of (unequal) social arrangements.

Keywords Technology · Extension · Fetishism · Anthropocene · Luhmann

1 Introduction

Is globalized technology, encompassing domains such as energy or A.I., at its core a strategy of *the human* (in relation to nature) or is technology a strategy of *some humans* over others?

This is a biased question. It evokes the problematic dualism between nature and humans that has been rightly criticized and problematized, for example in feminist

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Published online: 09 January 2024

philosophy and in the environmental humanities. The distinction between nature and humans, and by extension the distinction between nature and culture, is an artifact of the particular 'European thought system' (MacCormack, 1980, p. 8) and, when instantiated as a dualism, carries with it the historical baggage of colonialism: The colonizer sets up a dualism in which one side is conceived of as the reference point –valued and superior – in contrast to which the other side is devalued and defined as 'otherness' (Plumwood, 2003, p. 41).

Concepts of 'technology' are inscribed into distinctions between 'humans' and 'nature' as well as 'some humans' and 'others' as these distinctions become possible by referring to particular concepts of technology. Supposedly, it is technology that enables humans to become to some extent independent (and therefore distinct) from nature, just as it is technology that enables some humans to live materially more intensive lives than less-privileged others.

The starting question of this paper highlights not only the role of technology in constructing these distinctions but also articulates two opposing positions in the discourse around the so-called Anthropocene that can be understood through the concepts of technology as an extension and as a fetish.

My aim is not to uncritically replicate the distinctions inherent in both positions. Instead, I want to emphasize that each distinction relates to a different conceptualization of technology – the distinction between nature/human to the extension concept and the distinction between some humans/others to the fetish concept. I investigate the potentials and limits of these differing concepts of technology to arrive at a more nuanced and critical understanding of technology in the Anthopocene.

The term 'Anthropocene' refers to the present geological epoch, in which the earth system is said to be fundamentally shaped by the human species. The technologies that are of the global impact that the Anthropocene implicates are itself globalized – meaning they depend on the globalized exchange of labor and resources. While many different forms of technologies are globalized in this regard, in the context of the Anthropocene one might consider energy technologies and A.I. as the most important globalized technologies. The supposed advantages and problems of both forms of technology are central in discussions on solutions towards the various environmental crises of the Anthropocene. The shift towards 'green' energy technologies such as solar or wind is widely argued to be the central measure towards climate change mitigation (Owusu & Asumadu-Sarkodie, 2016), while critics hold that the low EROI (energy return on energy investment) and high material intensity of 'green' energy technologies furthers the toxicity of extractive business in the Global South that causes other severe environmental problems (Moriarty & Honnery, 2016; Seibert & Rees, 2021). A.I., as portrayed by its proponents, promises increasingly powerful means to combine information and detect patterns in dealing with the complexity of the multitude of ecological crises (Huntingford et al., 2019; Reichstein et al., 2019). At the same time critical voices point out that A.I. is built on an extractive logic because of its increasingly high energy demand and its reliance on low-waged labeling- and monitoring work, through which A.I. arguably exacerbates humanity's global environmental impact and social injustices (Crawford, 2021; Gray & Suri, 2019; Mohamed et al., 2020). I urge the reader to keep in mind that (if not differently stated) these are the specific technologies I have in mind when I refer in

the following more broadly to 'technology'. This, however, does not mean that the following elaborations are not also applicable to a wider set of technologies.

In the Anthropocene, humans because of their increasing technological capabilities now have become a geological force, with consequences out of their control. Beyond this basic premise, however, the fundamental nature of technology and therefore its future role in the Anthropocene is contested.

Some scholars assume that further technological progress is fundamentally connected to environmental destruction. Therefore they argue for an ethos of releasement (Heikkurinen, 2018), of less technological development and application all together – a position widespread among degrowth scholars (Kerschner et al., 2018). Others opt for further technological development and innovation to eventually control nature for good. Advanced green technologies ought to enable humans to live ever more prosperous lives without harming nature. One can find such proposals in the 'Ecomodernist Manifesto' (Asafu-Adjaye et al., 2015) or in the idea of a 'Good Anthropocene' (Ellis, 2011). A third position would neither categorically condemn nor endorse technology but understand it as a way for the human and more-than-human world to interact with each other – not necessarily in a controlling hierarchical, but in a cooperative and adaptive manner, one that ultimately dissolves the categories of subjects and objects, nature and culture. Examples of such a position can be found in the post-humanist tradition, for example in Bruno Latour (1994, 2008), Donna Haraway (2000) or more recently James Bridle (2022).

However, inside the confines of the Anthropocene-hypothesis – the age of *the human* – all three positions display a tendency to conceptualize technology in relation to *the universal human.* While this might be more obvious for the degrowth and ecological modernization positions, the same tendency arguably exists for certain post-humanists as well. Posthumanism in the tradition of Bruno Latour emphasizes the agency of objects and calls for a strict empiricism that traces the networks between human- and non-human actants. However, this expansionary understanding of agency to non-animate entities (such as rocks, mountains, or hotel-keys) traceable through a strict empiricism that looks at individual actors/actants effectively displays a lack of interest in societal macro-level power-structures and concomitant socio-economic inequalities between human actors (Hornborg, 2014; Martin, 2014; Winner, 1993). Although posthumanism cannot be accused of anthropocentrism, these conceptual commitments make it difficult to observe the power-structures and intra-species inequalities that would call into question the human as a uniform category. I am hereby not saying that there exists uniformity either among degrowth scholars, scholars of ecological modernization or posthumanism on the conceptualization of technology in relation to the universal human. My sole intention is to highlight how this sort of conceptualization runs across these different schools of thought (however heterogeneous they might be on the inside) in the Anthropocene discourse.

Opposition to this framing of the Anthropocene, and concomitantly to the framing of technology as a strategy of the universal human has been formulated in a co-authored paper by Andreas Malm and Alf Hornborg (2014). They highlight that the species category in the Anthropocene narrative glosses over intra-species inequalities which they understand as an integral aspect of the current ecological crises. The increasing ecological impact on the planet is attributed to human nature

and the unfolding mastering of different technological means – starting from the manipulation of fire, the invention of agriculture, to the invention of the steam engine by James Watt (Malm & Hornborg, 2014, p. 2). Malm and Hornborg counter that when looking at the fossil transition during the industrial revolution in 19th-century Britain, it becomes clear that "the historical origins of anthropogenic climate change were predicated on highly inequitable global processes from the start" (Malm & Hornborg, 2014, p. 3). Steam technology was from the beginning a strategy for the control over local British labor power and for the exploitation of the colonial 'peripheries' of the world (Malm, 2018, p. 2). Because modern technology to this day continues to rely on an uneven global distribution of resources for its very existence (Hornborg, 2022), the modern technology can only exist in privileged parts of the world system. This means that the Anthropocene is in no way the outcome of human nature and its technological capabilities. Instead, the Anthropocene is the outcome of a tiny affluent part of humanity, while the consequences have to be shouldered by the remaining majority. Data produced by Oxfam and the Stockholm Environment Institute reveals that between 1990–2015 the richest 10% of the world's population were responsible for 52% of cumulative emissions, while the poorest 50% were responsible for only 7% of emissions (Kartha et al., 2020).

Considering this, is it accurate to think of modern technology in the Anthropocene as a strategy of *the human* or should technology be instead reconceptualized as a strategy of *some humans over others*?

I argue that we can understand these opposing views on technology through two concepts in the philosophy and sociology of technology, that have as of yet not been related to each other – the concept of technology as an extension and the concept of technology as a fetish. The concept of technology as an extension understands technology as the interaction between a subject and a technological artifact whereby the subject extends its capabilities through the "intrinsic causal powers" of the artifact (Lawson, 2010, p. 217). The concept of technology as a fetish, on the other hand, understands technology as inextricably embedded in a socio-material context whose obscuring leads to the attribution of magical qualities to technological artifacts (Hornborg, 2014).

Both concepts grasp technology with regards to the strategy in which it is inherently embedded. I should add that authors of both the extension and fetish concept do not implicate that extension and fetish are consciously formulated strategies by the actors making use of them, but that the observable usage of technology can be interpreted in one or the other way. In the concept of extension, technology is a strategy of the human to extend itself. In the concept of the fetish, technology is a strategy of some humans over others. The extension concept grasps technology 'inwards' and focuses on the complete revealing of the intrinsic causal powers of the artifact and the subject. The fetish concept grasps technology outwards by focusing on the complete obscuring of the socio-material context of the technological artifact. These two concepts display what the anthropologist David Graeber (in a different context) termed "structural inversions" of each other (Graeber, 2012). The 'inwardness' of the extension concept and the 'outwardness' of the fetish concept highlight that their key difference arises out of the spatiotemporal context in which technology as a strategy ought to be assessed – the direct local or the global requirements and

repercussions of a technology. This 'spatiotemporal context' is the point of comparison between the extension and fetish concept in this paper.

I am aware that bringing concepts of technology as extension and as fetish conceptually together involves bundling a diverse set of authors together and risks oversimplifying their positions. However, I do hope to convince the reader throughout this paper that drawing the novel connection between extension and fetish concepts yields new insights that are worth taking this risk and do not rely on unreasonable simplifications of the positions at stake.

Both concepts offer valuable perspectives on technology that gain in clarity by being juxtaposed against each other. While both concepts remain incompatible with regards to the inherent *strategy* in which technology is embedded, I argue that both concepts can be aligned along one common *operation principle* of technology. Here, I draw on Niklas Luhmann's definition of technology as 'functioning simplification'(Luhmann, 2021, p. 524). However, contrary to Luhmann's broader system-theoretic perspective, the approach I am taking is more closely aligned with critical theory.

In reading extension and fetish theories of technology through the operation principle of functional simplification but differentiating between the functional simplification of physical and social causality, I ultimately argue that the Anthropocene controversy on whether technology constitutes at its core a strategy of the human, or of some humans over others can be clarified. Technology only appears as a strategy of *the human* – and thus as an extension – in so far as we understand technology solely as a functional simplification of physical causality. What the fetish concept of technology emphasizes is, however, that modern technology is simultaneously also always characterized by a functional simplification of social causality. By functionally simplifying the way in which humans relate to each other, it becomes easier for some actors to exert power over others. Such power dynamics become invisible, however, if technology is solely understood as a force to shape the physical realm of reality.

In what follows, I will first discuss and compare the concepts of technology as an extension (Sect. 2) and technology as a fetish (Sect. 3). I proceed by reevaluating both concepts as expressions of functional simplification (Sect. 4) to finally draw a conclusion (Sect. 5).

2 Technology as an Extension

The most widespread conception of technology might be that it acts as an extension of the human organism (Kiran & Verbeek, 2010, p. 412). Technology is hereby generally understood as technical artifacts that extend human physical faculties, cognitive capabilities, or intentions (Lawson, 2010, p. 218). Central contributors to theories of technological extension are Ernst Kapp (2015), Alfred Lotka (1925), Sigmund Freud (1997), Arnold Gehlen (2009), Marshall McLuhan (1994), David Rothenberg (1995), Phillip Brey (2000) and Clive Lawson (2010).

While the origin of the extension concept is generally attributed to Ernst Kapp's 1877 "Elements of a Philosophy of Technology" (Kapp, 2015), its origin can be

traced back at least to René Descartes' mind-matter-distinction and his description of the human and animal body in analogy to a machine (e.g. Descartes, 1984, p. 115). However, even before Descartes referenced spring-operated and hydraulic automata, Aristotle referred to the catapult to describe the movement of the body (Canguilhem, 2021, p. 48). While this is not the place for a historical etymology of the extension concept, it is worth acknowledging the centrality in Western philosophy of conceptualizing the body and technology in relation to each other (Canguilhem, 2021). When the extension concept was eventually carved out in its by then most explicit form by Ernst Kapp in 1877, this also became the founding document of the philosophy of technology (Ihde, 2004, p. 92; Rapp, 1981, p. 4; Ropohl, 1990, p. 13; Vries, 2018, p. 68). The concept of extension has since then been a central concept of discussion for the discipline.

There does not exist one uniform extension theory, but a vast variety of authors who could not possibly be "lumped into one theoretical category" (Heersmink, 2012, p. 4). Still, while the authors give different answers, they all engage with a set of similar questions (cf. Steinert, 2016). The argument I lay out in the following is that extension theories – though different from one another – tend to propose an 'inward' or local conceptualization of technology. First, this is because of the conceptual limitation on local interaction between subject and artifact. Second, the focus on local interaction leads to an individualization of both the subject and the artifact.

2.1 Extension as Local Interaction Between Subject and Artifact

Let me first explain why extension theories rely on a viewpoint limited to local interaction, oblivious to the global requirements and repercussions of technology. The answers to this can be found in the debate on the internal or external nature of technological artifacts, albeit in an indirect way.

Extension is generally understood as an interaction between subject and artifact. This dichotomy between subject and object led Kiran and Verbeek to argue that the extensionist concept of technology rests on an "external account" of technology, whereby technologies are external to human beings – "the two can interact but are not intrinsically connected" (Kiran & Verbeek, 2010, p. 411). At first glance this argument seems to make sense. After all, the word 'extension' already presupposes an "original starting-point", an autonomous subject that then utilizes a technical artifact for its purposes (Aydin, 2015, p. 74). As Van den Eede puts it: "An object can only be said to be able to approach, invade, and conquer a subject in that way if the two were once clearly separable entities" (Van Den Eede, 2014, p. 152). However, upon closer look this is at least not always the case. Extension theories typically employ a "functionalist view on technology, i.e. they analyze functional properties of artefacts in relation to human abilities" (Heersmink, 2012, p. 5). To focus on the function of both subject and artifact, the two must be compatible to a certain extent, which is why extension theories tend to employ either a mechanistic understanding or an organistic understanding of both subject and artifact.

One organistic understanding of subject and artifact is provided by Ernst Kapp's organ-projection theory, in which the ideal human body mirrors itself in the technological artifacts (Kapp, 2015, p. 28f.; Scholz, 2014, p. 176). Technological artifacts are not conceived as opposites to nature, but as forms to reflect about the natural laws to which they necessarily must adhere. Only by extending themselves outwards, humans can reflect on the laws and mechanism that govern their own bodies. These laws must then be understood as broader laws of nature. For Kapp, it thus follows that "the human being is the ordering principle in nature" (Kapp, 2015, p. 33, own translation).

A mechanistic understanding of subject and artifact is provided by what might be called a *prosthetic theory* of technological extension. Here, the human is not seen as ideal, but as a "Mängelwesen" (Gehlen, 2009), a deficient being. Humans make up for their bodily weakness with technology. Technological artifacts act as prosthetics for "reinforcement of organs", "substitution of organs", "relief of organs", and even "suppression of organs" (Gehlen, 1954, p. 8; Scholz, 2014, p. 176, own translation). Nowadays, we see this notion of prosthesis-theory most clearly in the enhancement debate of transhumanism, in which the "hardware" and "software" of humans ought to be upgraded to *maximize* various capabilities. The mechanistic understanding arises out of the reduction of the human body along a means-end logic, in which "human nature" is seen "as a work-in-progress, a half-baked beginning", which through technology can be "remold[ed] in desirable ways" (Bostrom, 2005, p. 4).

Both organ-projection theory and prosthetic theories acknowledge the hybrid co-constitution of subject and artifact through which both retrieve their conceptualizations of technology. The claim that subject and artifact are "not intrinsically connected" (Kiran & Verbeek, 2010, p. 411) in extension theories is thus baseless. For the matter of this paper, the debate on the internal/external relationship between subject and artifact is relevant insofar as it emphasizes the focus on *local* and decontextualized interaction in extension theories. While I have argued that the technological artifact tends to be internally related to the subject in extension theories, the more important point to be made here is that extension theories offer the conceptual viewpoint from which to debate such questions in the first place.

This is because extension theories have always been as much about the conceptualization of technology as they have been about the conceptualization of *the human*. Organ-projection theory as well as prosthetic theories of extension highlight that the conceptualization of the human is central to the concept of extension. If *the* human is conceptualized through the technological artifact, *the* human becomes a singular subject, detached from the relations to others. The conceptualization of the human in analogy to technological artifacts then leads to an understanding of both only with regards to their inner functioning.

2.2 Extension as Individualization of Subject and Artifact

In one of the most refined and recent theories of extension, Clive Lawson highlights this shortcoming of extension theories and builds on the Actor Network Theory (ANT) in order to integrate the networks upon which technological extension relies

(Lawson, 2010, pp. 221–222). While constituting a considerable refinement of the extension idea, Lawson's approach highlights especially well not only the focus on local interaction of extension theories but also the individualization of subject and technological artifact that results from it.

Lawson argues that ANT can be understood as another form of extension theory, whose main proposition is that the properties of technological artifacts exist "only in relation to the networks of relations in which they stand" (Lawson, 2010, p. 222). Bruno Latour, the most well-known scholar of ANT, famously argued for the abandonment of the subject/object dichotomy. Technological artifacts are therefore not to be considered as 'objects'. Instead, Latour refers to them as 'nonhuman actors' (or 'actants') which have their counterpart in 'human actors' (Latour, 1994, p. 35). This is not a mere semantic shift, but involves that both human and nonhuman are treated symmetrically with regards to the agency they have over a certain action (Latour, 1994, p. 34). Technical mediation then works most importantly through the process that Latour calls 'delegation', in which both human and nonhuman actors 'inscribe' themselves into other human and nonhuman actors (Latour, 1994, pp. 38–39). The concept of 'society' is substituted by the concept of the 'collective', a collective of human and nonhuman actors that "extends its social fabric" by inscribing itself into nonhuman actors which are thereby "enrolled" into said collective (Latour, 1994, p. 46).

Lawson applies this approach to refine his definition of technological extension by arguing that human actors enroll technical artifacts to extend their capabilities. The twist is hereby that although human and nonhuman actors symmetrically depend on each other, it is the "intrinsic causal powers" of the technological artifacts that are harnessed "in order to extend human capabilities" (Lawson, 2010, p. 227). Lawson is thereby able to differentiate a technological artifact such as a gasoline engine from a non-technological artifact such as a dollar bill. Both artifacts extend human capabilities, but only the gasoline engine does so through its intrinsic causal powers. While the dollar bill harnesses "relational powers" of social agreements, the gasoline engine functions through its "intrinsic causal powers" whether there is a social agreement on it or not (Lawson, 2010, pp. 227–228). In opposition to Lawson, I would hold that while such 'intrinsic causal powers' of artifacts evidently exist in a restricted temporal and spatial viewpoint, the widening of such a viewpoint would clearly show how a technological artifact such as a gasoline engine must be constantly *reproduced*, as its functioning depends on a constant supply of fuel and on occasional maintenance work on its material structure, not to speak of the constant necessary work of users interpreting and making use of the functions of a technological artifact. For a technological artifact such as a gasoline engine to continually function, reproduction must be constantly ensured, a process that directly connects the solitary artifact to the "relational powers" of social agreements.

Lawsons emphasis on "intrinsic causal powers" could thus be equally criticized as ANT has been for its dissolution of any form of macro-level structure and therefore its disinterest in challenging global power structures (Bessire & Bond, 2014; Gregory, 2014; Martin, 2014). Such power structures and even larger social assemblages such as "capitalism" and "society" are unobservable with ANT because of its strict empiricism (Hornborg, 2017, p. 101).

Paradoxically, the fixation of ANT on the relationality of technological artifacts leads to an individualist conception of them. This is because all their characteristics are not related to specific macro-level structures, such as certain market laws, but to the empirically observable interactions between agents. Past interactions, in which the artifact was involved, are then viewed as *inscriptions* into that artifact, which grants the artifact *agency* instead of mere consequences (Hornborg, 2017). Different times and different places are conceptualized through recursively expanding the interaction between agents and conceptualizing all those interactions as inscriptions into the present technological artifact. (The same can be said with regards to the subject.)

We are then left with a differentiation between *relational* and *intrinsic* powers, which becomes nonsensical as soon as we escape the restricted temporal and spatial perspective of local interaction. That is because the technological artifact (insofar as its complexity is beyond that of a primitive tool) could have only gained these *intrinsic* powers of the present through the *relational* powers of human cooperation in the past. Thus, *intrinsic* powers could be understood as *relational* powers frozen in time. As the historian of technology David Noble writes, technology appears "as an irreducible brute fact, a given, a first cause, rather than as hardened history, frozen fragments of human and social endeavor" (Noble, 1986, p. xi).

3 Technology as a Fetish

It is peculiar that the concept of technology as a fetish has until this day never been set explicitly in relation to the concept of technology as an extension. After all, as I will argue in this section, the concept of technology as a fetish is best understood as a critique of the concept of technology as an extension. Similar to the previous section, the main question with which I will approach the fetish concept of technology concerns the spatiotemporal context in which this strategy is embedded. I will hereby argue that the conceptualization of technology as a fetish functions as a critique of extension theory, because the fetish concept posits that a solely local conceptualization of technology disregards the global requirements and repercussions. The fetish concept holds that the apparent efficacy of modern technology results out of disregard of these global requirements and repercussions. Instead of a local 'inward' perspective on technology, the fetish concept understands technology 'outwardly' as a global strategy.

As was true for the concept of extension, there is not one unified theory of technology fetishism, although the fetish theories that do exist differ less from each other than the extension theories. This is because fetish theories of technology generally base their concept of the fetish on the same foundation: Karl Marx' work on the commodity fetish. Briefly put, the fetish is thereby characterized by the fact that "the definite social relation between people […] assumes for them the phantasmagorical

form of a relation between things "[1](Marx, 2017, p. 86, own translation). Things – in our case technological artifacts such as gasoline engines, solar panels, or self-driving cars – therefore appear to possess self-contained qualities that are actually the result of the social relations between people. The fetishization of the artifact blinds one to this fact. The four key authors to which I will limit myself here – Bryan Pfaffenberger, David Harvey, Jodi Dean, and Alf Hornborg – all draw from this Marxist conception of the fetish.

To frame these fetish theories against the previous elaborations, I will first discuss the conceptualization of technology as local strategy, whereby the artifact extends bodily functions or – in the broadest sense – human capabilities. In a second step, I juxtapose – in opposition to the individualization of technology in extension theories – the relationship between global context and technology in fetish theories.

3.1 On the Global Requirements and Repercussions of Local Extension

The fact that extension is attributed to the intrinsic causal powers of the artifact would for Pfaffenberger be a result of "the Western ideology of objects [that] renders invisible the social relations from which technology arises and in which any technology is vitally embedded" (Pfaffenberger, 1988, p. 242). Pfaffenberger argues that technology not only depends on social relations in the obvious sense that labor, material, and energy have been expended to produce a certain technology. Beyond that, even the fact that a technology simply 'works' depends on social relations beyond the artifact that create "the very norms that define it as successful" (Pfaffenberger, 1988, p. 250). Thus, Pfaffenberger would argue that we are never just confronted with a technological artifact, but that this artifact is inseparably intertwined with the social relations between people.

Such perspective complicates the attribution of technological extension. While extension theories implicitly assume an extended field of action for the individual, they do not bother asking how such extension is embedded into the wider context of social relations. Differently put, extension theories do not ask if the extension is a net-positive one or whether the extension relies on a zero-sum mechanic whereby the extension of capabilities for one depends on the curtailment of capabilities for another. This question is at the center of the fetish theory of technology developed by Alf Hornborg (2003, 2009). Hornborg fundamentally questions the supposed productivity of technology through which it appears as a way to save time, resources, space, and energy. Building on the theory of ecologically unequal exchange, Hornborg argues that technological artifacts in imperial 'core regions' of the world fundamentally depend on the appropriation of labor time, resources, space, and energy from the 'periphery' through politically instantiated "global terms of trade" (Hornborg, 1992, p. 12) – a diagnosis that is increasingly backed by empirical proof from global trade flows (Dorninger et al., 2021; Hickel et al., 2021; Simas et al., 2015).

[1] Original quotation: „Es ist nur das bestimmte gesellschaftliche Verhältnis der Menschen selbst, welches hier für sie die phantasmagorische Form eines Verhältnisses von Dingen annimmt." (Marx, 2017, p. 86).

The technological fetishism emerges when these unequal exchange relations are mystified in the imperial core regions by assigning value-generating *productivity* to the individual technological artifacts (Hornborg, 1992, p. 12). In Hornborg's concept of technology as a fetish the critique of the idea that technology is a strategy of the universal human, comes through clearest. Technology ought to be instead reconceptualized as a strategy of some privileged parts of the world to appropriate labor time, resources, space, and energy from elsewhere.

We see here a critique of the dominant concept of technology as an extension that is never explicitly formulated as such. To read extension theories and fetish theories against each other, means clarifying both of them. Technology can only be perceived in terms of an extension if one focuses on the artifact in a local context and fetishizes all the global requirements for the artifact as characteristics of the artifact itself. Just as extension relies on the fetish, the fetish relies on extension as its primary subject of critique.

In the theory of technology fetishism by Jodi Dean (2005), this interdependence of extension and fetish plays a key role, although only implicitly. In her critique of "communicative capitalism" Dean argues that the deliberative democratic communication promised by the internet is a farce in which messages do not have their goal in addressing specific participants but merely add to the "pool of content" (Dean, 2005, p. 59). It is the technological fetishism which hereby suggests that we can make our voices be heard, that we can be active and engaged citizens – through technology. "[T]he promise of participation is […] [an] underlying fantasy wherein technology functions as a fetish covering over our impotence and helping us understand ourselves as active" (Dean, 2005, p. 62). The fetish of technology thereby is the false promise of enabling us to be active by extending our capabilities, but it is also the false promise of an all-inclusive 'us'. When it comes to ecologically unequal exchange or communicative capitalism, the fetish of technology blinds one to the fact that there is not one uniform subject making use of a technology. Instead, the fetish of technology makes it appear unclear, whether one is at the receiving or giving end of things.

Therefore, the fetish theories of technology by Pfaffenberger, Hornborg, and Dean all question the local achievements of technology because of its global context.

3.2 On the (in)separability of Technology From its Global Context

This leads us to the second point of discussion, namely the topic of individualization. In the previous section, I argued that extension theories individualize subject and artifact in their effort to define technology. Such individualization leads to a restricted temporal and spatial perspective in which technology appears to be characterized by "intrinsic causal powers" of an artifact. Fetish theories of technology neither individualize subject nor artifact but place them in a global context. However, there are differences in how fetish theories conceptualize the relationship between technology and global context. For one, this context is that of a global capitalism, whose existence relies on significant inequalities between Global North and Global South, neo-colonial land grabbing and extractivism to enable a continued

economic growth. Technology in this context is a fetish when it is in itself understood as a productive factor for such economic growth, while it actually is a strategy of appropriating labor time, resources, space, and energy from poorer parts of the planet. For fully grasping the different variations of the fetish concept of technology, we might ask: If this specific global context were to change, would technology cease to be a fetish? A comparison between Alf Hornborg's and David Harvey's theories of technological fetishism highlights the different answers given to this question.

I already pointed out that for Hornborg images of productivity and of "unlimited good" are at the center of the common understanding of technology (Hornborg, 1992). Therefore, the whole concept of technology can be treated as a fetish that could only arise in a globalized world system in which labor time, resources, space, and energy are exchanged in highly unequal ratios through politically instantiated global terms of trade (Hornborg, 1992, p. 12). In such a world system, technology is the fetishized artifact that makes invisible these unequal flows of labor time, resources, space, and energy and thereby contributes to their continued existence (Hornborg, 2014, p. 123). Without a capitalist world system based on global forms of appropriation, technology as we know it would therefore cease to exist. This would also mean that technology is a phenomenon that arose together with the Industrial Revolution, but before did not exist.

David Harvey's take on technology fetishism differs from Hornborg's in that technology is only fetishized in its capitalist context. For Harvey, technology fetishism means that technology gets employed as a means for fetishized ends because of the contradictions of the capitalist system. Although he does not go as far as to claim that technological fetishism could be completely eradicated were capitalism to vanish, Harvey sides with "the basic Marxist insight […] to liberate […] [the] productive forces from their social and political constraints, in short from their domination by capital and a particularly noxious form of an imperially minded state apparatus" (Harvey, 2003, p. 28). While he acknowledges the fact that "social relations and *mentalités* are embedded in the technologies themselves" (Harvey, 2003, p. 28, emphasis in original), he nonetheless maintains that there is a technological core to be salvaged from fetishist beliefs. As Harvey writes that "the technological state cannot be jettisoned or laid aside as irrelevant to our future prospects" (Harvey, 2003, p. 29), it is clear that for him technology maintains at its core a technological identity that is independent of the capitalist system in which it is embedded. According to him "[a]ny major approach to combat worldwide environmental degradation, social inequalities, massive impoverishment, perverse population dynamics, deficits in global health and nutrition, and geopolitical tensions will entail the mobilization of many of these technologically defined capacities to achieve social, ecological, and political ends" (Harvey, 2003, p. 29). While Hornborg argues that the concept of technology fundamentally relies on a fetishization, for Harvey such fetishization of technology can be overcome.

The differences between both authors might be best understood with the differentiation made by Lawson between relational and intrinsic causal powers (Lawson, 2010, p. 227). Harvey's technology fetishism differs from Hornborg's technology fetishism in that for Harvey the intrinsic causal powers of technology are *corrupted* by the relational causal powers of its global capitalist context, whereas for Hornborg

the intrinsic causal powers of technology are *enabled* by the relational causal powers of its global capitalist context.

For Harvey, technology, through its intrinsic causal powers, can function as a strategy of extending human capabilities and continuously does so (Harvey, 2003, p. 7). The problem lies in the fact that the intrinsic causal powers of technologies are not employed for fighting environmental degradation, social inequality, or geopolitical tensions. Instead, the intrinsic causal powers of technology to increase productivity are employed fetishistically by capitalist actors in a contradictory effort to increase profit[2] (Harvey, 2003, p. 7). The effort is contradictory because of the Marxist insight that profit is determined not by how productive the employed technology is but by the relation between capital and labor – meaning that profit is determined by how much surplus-value can be appropriated from the laborer (Harvey, 2003, p. 7). And if one takes Marx's proposed 'tendency of the rate of profit to fall' (Marx, 2018, p. 221f.) seriously, the very effort of increasing productivity through more technology decreases the ratio of exploitable living labor to dead labor in the production process and thereby decreases the rate of profit the capitalist can extract.[3] The capitalist mistakenly assumes that the intrinsic causal powers of technology determine the amount of profit when it is actually determined by the relational causal powers between capital and labor (or more precisely in this case: the ratio between industrial machinery and labor). That the capitalist makes this wrong assumption of course is not because of his/her intellectual inferiority, but because the individual capitalist rationale is countered by the dynamics of the whole capitalist market.[4]

We can formulate the Marxist understanding of fetishism (relations between people appear as relations between things) in the way David Graeber did in his essay on fetishism as social creativity by stating that the fetish is that which humans themselves have created but which faces them in the alienated form of an object with powers of its own (Graeber, 2005, p. 409). If we reformulate fetishism like this, we can see that Harvey's fetishism is not actually a fetishism of technology. Harvey does grant technology powers of its own, that do not derive from a fetishization of human actions or – to stick with our terminology – from social causal powers. For Harvey, technology does indeed have intrinsic causal powers through which productivity can be increased. However, these intrinsic causal powers are applied by capitalist actors for fetishized ends of increasing profit (meaning that profit itself is fetishized). In this scenario, the intrinsic causal

[2] Harvey names other contexts in which he observes a technology fetishism, for example the military context. However, for the purpose of the comparison, I will only focus on his elaborations with regards to the capitalist context.

[3] Harvey himself does not mention the tendency of the rate of profit to fall in his essay. However, in Marxist theory it is a central case of how technology is embedded in the contradictory logics of capitalism.

[4] For the individual capitalist it is indeed rational to increase productivity through more technology and thereby cut labor costs. However, from the perspective of the larger market, the accumulative rational decisions of individual capitalists are irrational in that they reduce the ratio of exploitable living labor in the production process from which all profit is derived.

powers of technology are corrupted by the relational causal powers of capitalism so that technological application is not guided by deliberatively formulated goals but is trapped in a self-perpetuating and contradictory capitalist logic.

For Hornborg, the intrinsic causal powers of technology are not corrupted by its specific context but enabled by it. Through application of the theory of ecologically unequal exchange, Hornborg posits that the intrinsic causal powers of technology in the economic cores of the global market system could not exist without the cheap labor time, resources, space, and energy from the peripheries. Were this global context to vanish, modern technology itself would seize to exist. In Hornborg's conceptualization, intrinsic and relational causal powers are interconnected to such an extent, that it becomes impossible to isolate any intrinsic causal powers of technology that would stay stable if its context and thereby the relational causal powers on which it rests would change. In this conceptualization, putting primacy on the intrinsic causal powers of technology might itself be understood as a fetishization of technology.

4 Technology as a Functional Simplification

In what follows, I will argue that although the extension concept and the fetish concept of technology understand technology through two contradictory strategies, both can be reconciled along the same operation principle of technology. Here, I will draw on the social system theory of Niklas Luhmann. The differences between extension concept and fetish concept of technology are due to the fact that I have thus far assessed both strategies primarily along the different spatiotemporal context they employ – local for the extension concept, global for the fetish concept. With Luhmann we gain another perspective that does not understand technology as a strategy of certain subjects. This is because Luhmann defines 'technology' not by the actors and objects it incorporates but by its distinctive operation principle. Luhmann characterizes this operation principle as 'functioning simplification'(Luhmann, 2021, p. 524). With reference to the previous comparison, I will argue that we can specify this 'simplification' by bringing the concepts of extension and fetish together. Through such perspective it becomes clearer, how technology can be either understood as a strategy of the human versus a strategy of some humans over others. Such perspective also enables us to understand the importance of what one might name technology's communicative function through which global unequal relationships are manifested by "saving consensus" (Luhmann, 2021, p. 518).

My argument will progress in three parts. First, I will lay out why it is necessary to understand extension and fetish along a common operation principle. Second, I will go through the implications of functional simplification for the relationship between extension and fetish theories and how to analytically advance the operation principle of functional simplification. Third, I will further advance on the principle of functional simplification by considering in what ways consensus is 'saved' through technology.

4.1 The Operation Principle of Technology

The impasse of the fetish concept and extension concept might be best highlighted by an argument made by the philosopher of technology Ivan Illich. In arguing how a technological tool can subvert its original promise and take control of its user instead of the other way round, Illich argues how the modern car 'steals' time instead of saving it. He does so by calculating the effective speed of a car, which not only involves the speed of the car while traveling, but also considers the additional time one must spend on maintaining and financing the car. This includes working hours to pay for the car, for the fuel, maintenance, insurance, taxes etc. The punchline Illich provides is that if we factor in all this time, the effective speed of the car is less than 6 km per hour, barely faster than walking (Illich, 1974, p. 23).

Fetish theories of technology would interpret this as a fetishization of the car but would further add that not only is time 'stolen' from the user of the car, but that also labor time, resources, space, and energy are appropriated from the peripheries of the global market system in the continuous (re)production of the car and its infrastructure. The car itself appears to save time but only if one neglects the embedding of the car in its global context of requirements and repercussions. Extension theories of technology would posit that such a line of reasoning misses that the central appeal for the user of the car might not be that the car saves time in absolute terms but that the car saves time in a restricted spatial and temporal context. Sure, everything factored in and calculated over a time frame of a year or so, my travel speed might not be increased by the car. However, if I want to visit my family that lives 300 km away, I could *now* get into the car and reach my destination in three hours. It is in this concrete sense that technology acts as an extension of my capabilities.

Framed in this way, both positions cannot be merged into one coherent theoretical perspective. Extension and fetish concept remain incompatible as long as we understand them as strategies that differ from each other because we consider either few (extension) are many (fetish) socio-material requirements and repercussions to describe technology. Either it is the car itself that acts as an extension, or the car itself is a fetish hiding the globally unequal transfer of labor time, resources, space, and energy that make the car function.

While extension and fetish concepts describe differing *strategies* to which technology is employed, we could posit that both strategies align in so far as they both rest on a common *operation principle*. Here I will draw on the definition of technology provided by the sociologist Niklas Luhmann.

There is not nearly enough space here to provide a sufficient summary Luhmann's work. What suffices for our purposes is the central insight that Luhmann understands technology as consisting not of subjects or objects but of operations (Luhmann, 2021, p. 522). Differently put, a technology is not characterized by the local or global context in which it functions as a certain strategy. Instead, technology is characterized by the specific operation that differentiates technology from its environment – technology is *functionally differentiated* from its environment. Luhmann defines the specific operation that characterizes technology as 'functioning simplification' (Luhmann, 2021, p. 524) – "*enclosing* something that operates reliably and in a way that can be iterated, and *excluding* the rest of the world" (Luhmann, 1990,

p. 224f., emphasis in original). This enclosing takes place inside society, which Luhmann understands as being constituted solely by communication (Luhmann, 2021, p. 81). Luhmann is of course aware that there is a material basis to society. However, what sufficiently distinguishes society from this material basis (i.e. its environment) is that it consists of communication. Luhmann's perspective is thus one that understands technology with regards to its communicative function inside society.

A technology such as a car can be thought of as a functioning simplification because it reduces complexity in society in a distinct way: The people that use the car and even the engineers that built the car do not have to be aware of all the causal complexities involved, as long as they do not impede on the actual functioning of the car. For example, they do not have to be aware of how the burned gasoline emits greenhouse gases and contributes to the warming of the atmosphere. Although this is clearly what happens through the combustion of car engines, it does not impede on the functioning of the car and can thereby be 'simplified away'.[5] As long as the arrangements of causal elements makes the car function, we can be sure that the simplification is successful – if it works it works. Only when the car breaks down or does not function in the first place, does the need arise to unpack its complex technical details and communicate over how to make it function (again).

Luhmann introduces this operation principle of technology in the context of evolution and evolutionary achievements in the development of society. The approach I am taking in this paper does not align in all regards with Luhmann's wider system-theory. Instead, I am attempting to integrate Luhmann's functional concept of technology into a critical theory of technology, from which questions of power but also alternative conceptions of society can be adequately conceptualized. Among other aspects, this leads me in the following to speak not of a *functioning* simplification, but of a *functional* simplification. This is because I differentiate between (a) a *strategy* to which technology is employed by certain actors (in our case: technology as an extension and as a fetish) and (b) an actor-unspecific *operation principle*. Whether a technology is *functioning* can only be assessed by actors on the analytical level of technology as a strategy. Because the operation principle of technology is independent of the strategy in which it is employed, it is analytically more precise to speak non-normatively of a *functional* simplification. Technology is simplified along a function. Whether it's functioning or not must be answered critically on the analytical level of strategies where we must ask: for whom precisely is technology functioning.

Applying this perspective to the car example by Illich, we see how extension and fetish theories of technology can be reinterpreted as conceptualizations of technology as functional simplification. In the case of both extension and fetish theories, the car-technology reduces complexity by simplifying the causal chain that enables one to reach a high travel speed. Extension theories describe this simplification as an

[5] This would only change, when the emission of CO_2 becomes itself part of the technical problem to be solved – for example by electric vehicles. This, however, involves a redefinition of what it means for a car to function. The functioning of the car then does not only involve that it moves from A to B, but that it does so without causing CO_2 emissions.

extension of human capabilities. Fetish theories of technology merely represent the other side of the same coin, describing the process of simplification as a fetishization through which the car is attributed self-contained qualities that actually arise out of the obscured (or simplified) socio-material context of the artifact.

We can imagine extension and fetish theories as two perspectives at some point along the operation of simplification. Whereas the perspective of extension theories points towards the simplified causal link (in the direction of simplification), the perspective of fetish theories points away from it (against the direction of simplification), towards all that which is excluded. Both extension and fetish perspective thereby capture the operation of functional simplification, the functionally simplified causal chain that makes the car 'work' – albeit under different interpretations.[6]

4.2 Implications of Functional Simplification for the Relationship Between Extension and Fetish Theories

With the conceptualization of technology as a functional simplification we can now reframe the previous discussions around extension and fetish theories.

With regards to extension theories, I highlighted how their conceptualization of technological identity is limited to the local interaction of subject and technological artifact. The antithesis is offered by fetish theories of technology, which stress the global requirements for the functioning of any modern technological artifact. One could now argue that a conceptualization of technology as functional simplification would have to capture the global requirements if they are indeed relevant for the functioning of a local technological artifact. If functional simplification is indeed understood as enclosing a repeatable link between cause and desired effect, the influence of global production chains, energy and material requirements would have to be included. If all that is relevant to the functioning of a technological artifact is included in the simplification, how can such simplification become a fetish?

The fetish character of technology as simplification arises from the fact that these global requirements are itself represented in a simplified form. Alf Hornborg highlights the importance of money to obscure unequal exchange relations between Global North and Global South (Hornborg, 2016). In monetary terms, the value of one good is exchanged for the same value of another good. In monetary terms an exchange thus cannot be unequal. However, the price of labor, energy or land differ from core and peripheral parts of the world, not least because of political institutions such as the IMF and the World Bank that prevent peripheral countries through structural adjustment programs from protecting their local markets from international competition. They are thereby forced to a price-race to the bottom (Hickel, 2017). This enables an unequal exchange whereby the periphery exports more labor time, energy and land to the center than it receives (Dorninger et al., 2021). Such unequal

[6] To clarify, there is a difference to be made between the *act of fetishization* and the *perspective of fetish theories*. While the *act of fetishization* represents the same functional simplification as that of perceiving technology as an extension, the *perspective of fetish theories* precisely progresses against the direction of simplification, pointing towards the excluded context.

exchange remains unobservable through the simplified form of money (Hornborg, 2016). Technology as a simplified link between cause and effect, can thereby be fetishized as merely the combination of engineering knowledge and monetary investment to save time, energy, space, and resources – without consideration of the actual time, energy, space, and resources that went into their production.

This point connects well with what Lorraine Daston has written about the nature of rules in her 2022 book *Rules – A short history of what we live by* (Daston, 2022). High technology of the Global North seems to be organized by the rules of science and economics whose rational application leads to efficiency gains. However, Daston draws on Wittgenstein's rule following paradox – even the most explicit rules are built on implicit ones such as customs or institutions (Daston, 2022, pp. 142, 273). She makes the point that "islands of stability, uniformity, and predictability in an intrinsically uncertain world" depend on historical preconditions such as "empire, treaty, or trade" (Daston, 2022, p. 19). In this sense, the explicit rules of high-technological rationality in the Global North (where the combination of engineering knowledge and monetary investment yields efficiency gains) depend on the implicit rules of an unequal exchange that are in the last instance upheld by the measures of structural adjustment programs imposed by the IMF and the World-Bank, and militarized borders (Hickel et al., 2021, pp. 2–3).[7] Indeed, this captures a core aspect of the principle of functional simplification: a few explicit rules (for example in the realm of engineering knowledge) allow for the repeated functioning of a causal chain, but this functioning is not least a simplification because it rests on a vast realm of implicit rules.

Beyond the simplification of global requirements, the ecological crises highlight the simplification of global repercussions, evident in the prevalence of external effects or social costs in modern societies, e.g. the climate damage of CO_2 emissions that is to a large extent not priced into the operation of technological infrastructure. Even if there was the global political will to find an 'adequate' pricing of external effects, there exist normative pitfalls of the incommensurability of nature that cannot be accounted for through the monetary calculations of external effects (cf. Spash, 2015). Additionally, most external effects are impossible to calculate for reasons of complexity – a problem that is especially obvious when it comes to the economic and ecological consequences of biodiversity loss. The problem of external costs shows that technology can be a functional simplification that simplifies global ecological repercussions by completely excluding them or representing them in the simplified form of money.

[7] There are multiple routes to further identify some of the implicit rules on which the explicit rules of technological rationality, and thus the enclosed functional simplification of technology, are built. One would be feminist philosophy. Feminist philosophers have emphasized how economic production always relies on the unpaid and largely invisible reproductive work for example carried out by "women, nature, and colonies" (Mies, 2014, p. 77) outside of the economic sphere. Another route would be what Martin Kusch and Harry Collins have labelled as RAT-work – "repair and attribution and all that" (Collins & Kusch, 1998, p. 123f.). They emphasize how a general principle of computer interfaces is to hide the RAT work required by the user in interacting with the machine.

The second point of discussion concerns the individualization of technology and whether it is best described by intrinsic or relational causal powers. If we stick to our conceptualization of technology as a functional simplification, we can posit that technology is a simplification of both forms of causal powers as long as they are simplified to a repeatable link between cause and effect. However, there is a central difference between the simplification of intrinsic powers and relational powers. We can understand intrinsic powers (of an artifact) as these powers most fundamentally governed by the physical causality, and relational powers governed by what might be termed 'social causality'. Physical and social causality work along two distinct logics. Out of physical causality one can derive laws which cannot be broken. Their power over causal chains is absolute. From social causality one can derive social laws or a social structure, but this one is never absolute. Social structure is not as rigid as physical laws and is always included in a mode of change, because it can ultimately be challenged.

If technology would singularly work as a functional simplification of physical causality, it would simply constitute a means to put nature to work.[8] In such understanding of technology, all social conflicts, all politics disappear, and humanity as a whole constitutes the singular subject that faces the Anthropocene as a mere technical problem. Solely understanding technology as a functional simplification of physical causality means that the ecological crises of the Anthropocene are mainly a problem of (technical) knowledge. Greenhouse gas emissions would be the accidental outcome out of the functional simplification of fossil fuel engines that did not include these emissions because they don't affect the functioning of the engine. As soon as we have knowledge of these emissions and their contribution to climate change, *humanity* must build different functional simplifications that do not produce them.

However, as soon as we accept that technology depends not only on a functional simplification of physical causality, but also on a functional simplification of

[8] The fact that technology functionally simplifies physical causality implies that the functionality of a technology does not depend on complete knowledge of all implied causal chains. These can be discovered after the technology is already invented. This explains why historically technological breakthroughs were as much preceded as they were followed up by knowledge on their functioning and ultimately debunks the myth that technology is applied knowledge. The understanding of technology as applied knowledge sets up the false dichotomy of unembodied abstract knowledge applied to concrete ends. Instead, knowledge is much more entwined with the form of technology. The jet engine for example was to a large extent a result of tinkering (Scranton, 2006). When the engineers could eventually figure out how to make the engine work and thereby establish a repeatable functional link between cause and effect, it took scientists many years afterwards to find out some of the crucial physical laws that explained why the engine worked (Scranton, 2006, p. 356). A much more fundamental example is that of steam engines and the first law of thermodynamics. The first thermodynamic law (of energy conservation) was discovered in the 1840s, partly in an effort to understand the workings of the steam engines (Kuhn, 2011). Simultaneously, this scientific discovery of energy was a functional simplification of social causality, as energy – formerly a mere poetic metaphor (Daggett, 2019, p. 3) now made it possible to understand work, done by humans, machines, and nature solely in energetic terms (Daggett, 2019, p. 86). This in turn enabled capitalists the better management of their efficiency. The eventual fatigue of the worker came to be seen no longer as a personal character flaw (Rabinbach, 1992, p. 48), but as a manageable aspect of the psychological and physiological energy balance of the body (Rabinbach, 1992, p. 20).

social causality, we are no longer confronted with an eventually productive cognitive shortcut through which to extend our capabilities. Instead, technology becomes charged with fetishistic beliefs, from which some actors benefit, and many others don't. Strictly speaking, a functional simplification of physical causality alone cannot lead to the fetishization of technology, because the functionality of the technology is proof of itself – "if it works, it works". The functional simplification of social causality on the other hand can very well lead to a fetishization of technology for the benefit of the few. For example, Alf Hornborg's argument for the unequal exchange of labor time, resources, space, and energy between Global North and Global South highlights how the simplification of these biophysical resources into a monetary value can indeed reverse the proclaimed ends of technology as time saving or energy efficient. To put it more generally: The functional simplification of social causality, not physical causality, leads to a fetishization of technology, because only the simplification of *social* causality can interfere with or even reverse the *socially* embedded ends of technology.

At the point at which technology requires any form of human interaction to function, we enter the realm of social causality, which becomes ontologically entangled with physical causality. That however should not stop us from analytically distinguishing between physical and social causality. To analyze means to draw distinctions and, although it might seem paradoxically, keeping up this analytical distinction is necessary to overcome it. This is because we must be able to analytically depict that physical and social causality are indeed separated from each other in the concept of extension and get confused with each other in the act of fetishization. It is necessary to analytically understand how the distinction between physical and social causality relates to concepts of technology as an extension and as a fetish, so as to show why we might need to overcome such distinction for understanding technology in the Anthropocene.

4.3 Technology as "saving consensus"

Attila Marton reframes Luhmann's operational conceptualization of "technology being a form – an inside/outside difference – of *functioning simplification and containment within the medium of causality"* (Luhmann, 2003, p. 97; Marton, 2009, p. 144, emphasis in original). He points out that the causality/technology difference can be understood as a medium/form difference (Marton, 2009, p. 144). The medium of causality consists of "loosely coupled events". Some of these events are then identified as contributing to a certain function. These events are then "tightly coupled into cause-effect chains by an observer and stabilized as the form of functioning simplification and containment" (Marton, 2009, pp. 144–145). As soon as the form of technology is stabilized by tightly coupling some events in the medium of causality (while ignoring many other causal events, that are not directly related to the function) the technological function "operates reliably and in a way that can be iterated" (Luhmann, 1990, p. 224 f.).

For Luhmann this means that technology is essentially a way to "save consensus" (Luhmann, 2021, p. 518). 'Saving' is a translation from the German 'Einsparen'

and carries a double meaning that might be less obvious in its English translation: 'Saving' in the sense of 'Einsparen' does not solely mean that consensus is stored, but also (and probably more importantly) that the need to reach consensus is circumvented. According to Luhmann, because technology simply works, there is no need to (repeatedly) reach agreement on it. To pick a rather simple example, when I decide to turn on the light I do not need to reason with the light switch – I simply press it. Luhmann mentions passingly that technology thereby saves the conflictual coordination of human actions (Luhmann, 2021, p. 518). I would argue that this aspect deserves much more attention. It must be emphasized that consensus and thereby also the conflictual coordination of human actions is not merely saved, because a social causal relation is substituted by a physical causal relation. Instead, consensus is saved because technology consists of both physical and social causal relations that are functionally simplified and therefore simultaneously implicated in the form of technology.

Many impasses in the public but also academic discussions on technology arise out of the fact that technology is solely understood as a simplification of physical causality. As Hornborg argues, common philosophical critiques of technology can be sorted in three broad categories: First, technology makes the human superfluous. Second, technology harms the environment. Third, technology deforms human experience and (social) life (Hornborg, 2022, p. 220). All three critiques essentially progress from an understanding of technology as a functional simplification of physical causality. This is not to say that social and political matters of technology are not addressed. They are, but only as requirements or repercussions of technology, not as part of the technological form itself.

An important exception to this line of reasoning in the philosophy of technology is the concept of the 'Megamachine' by Lewis Mumford (1971, p. 188 f.) Mumford argues that the first technologies consisted solely of humans. As an example, he names the building of the pyramids whereby each and every slave acted functionally analogous to a cogwheel in a larger mechanism. We can now see that this situation has never fundamentally changed. Technology always relies on functionally simplified conditions in the medium of social causality: For example, any form of modern technology relies on a historically specific form of waged and highly specialized labor, whereby the complex circumstances of one's work are narrowed down to one small field of action and can be evaluated along a one-dimensional monetary unit. Because one's work is not grounded in the local and temporal specificities, but cast into the abstract form of money, it also becomes globally comparable and is thereby exposed to global competition. At the same time, the monetary form of labor also hides the unequal exchange of labor time between Global North and Global South. In the twenty-first century, digitization has only pushed this process further; all aspects of human life are increasingly simplified through sensors and tracking-technology to a form that computers can understand.

What could be leveled as a criticism to Luhmann is that he spends no time acknowledging how often technologies break down and stop functioning when the human and more-than-human subjects that are implicated in them resist. When airport workers strike and flights must be cancelled, when indigenous people riot against the privatization of their land, or when protestors close down

the roads to a copper mine, the people implicated in the functional simplification of technology – as low-waged labor power, as displaced natives, as passive citizens – resist their simplified roles.

At these moments of conflict, technologies as functional simplifications stop functioning because the logic of communication changes from a functionalist to a deliberative logic. Subjects resist their simplified roles in which all their actions (or inactions) are designated to ensure the functioning of technological processes. At these moments of resistance, formerly passive subjects overcome the 'saved consensus' and want to renegotiate the roles to which they had been confined. Or, to draw on Daston's work on rules (Daston, 2022), the explicit rules of technological functioning break down as soon as the implicit rules on which they rest are put into question. Amidst such resistance, the functioning of globalized technology depends in the last instance always on coercive means such as violence with which to keep disobedient subjects in line. These coercive means are legitimated by authorities in so far as they ensure the functioning of technological processes. When coercive means come to play, the saved consensus achieved through technology continues to be 'saved' in the sense of forcefully suppressing the process of reaching a consensus in the first place.

One general aspect of functional simplification – be it of physical or social causality – is that it works without anyone having full knowledge of the process. Causal events are connected to each other to fulfill a certain function, but that does not necessarily mean that the whole causal process must be understood (think for example of unforeseen environmental side effects). This black-boxing of technology only increases when functional simplification becomes self-referential, meaning that a functional simplification is only possible through another functional simplification (Marton, 2009, p. 147).

However, instead of declaring technology out of control and subscribing to an apparent technological determinism, it is all the more important to acknowledge the inherent difference between the functional simplification of physical and social causality. While both enable a given technology to function, it all too often happens that the physical legitimacy of a functional simplification remains unassociated with the social legitimacy of it.

Global highly unequal relationships between people can then be condemned on a semantic level in privileged cores of the global market but are legitimated and reinforced on a structural level. This is because the existence of such inequality might appear to be unrelated to one's own technological efficacy. The technological efficacy of the cores of the global market, however, is actually built on global inequality and reinforces it. When social causality is functionally simplified it lends itself to being confused with a physically functioning mechanism. This is the fetish of technology – the saving of consensus but more importantly the obscuring that there is anything to dissent from. Not only are social inequalities obscured, but an atmosphere is created in which no alternatives to the status quo seem to exist.

5 Conclusion

I began this paper by arguing that the question whether globalized technology such as energy technologies or A.I. function as a strategy of the universal human or as a strategy of some humans over others, is central to the Anthropocene discourse. I argued that this question is mirrored in the philosophy and sociology of technology through the concepts of technology as an extension and technology as a fetish.

While the extension concept understands technology as a strategy of the individual (and at the same time: universal) human to extend itself, the fetish concept understands technology as a strategy to hide appropriative and unequal global socio-material relationships behind the local objectivized form of technology.

The seeming incompatibility of the concepts goes back to the different spatiotemporal context in which they evaluate technology as a strategy. In a local context, the intrinsic causal powers of technology will stand out most of all. In a global context, these intrinsic causal powers are more easily seen to be intertwined with the "relational causal powers" of the global unequal exchange of labor time, resources, space, and energy.

I drew on Luhmann to describe the operation principle that underlies both strategies as functional simplification. I advanced on this operation principle by distinguishing between the functional simplification of physical causality and the functional simplification of social causality. I applied this distinction to reformulate both the extension concept and the fetish concept of technology and argued that the extension concept understands technology mainly as a functional simplification of physical causality, while the fetish concept understands technology as a functional simplification of both social and physical causality.

Technology can become fetishized precisely because it is a simplified causal link not only of physical and but also of social causal elements. The functional simplification of physical causality operates in a causal medium in which laws are absolute and cannot be broken. A functional simplification that works in this medium is proof of itself (if it works it works). While one does not know why a given technology functions, its functionality is proof that it is physically legitimate.

The fetish of technology arises, when we transfer such understanding of technology to a reality – our reality – in which technology depends always also on the functional simplification of social causality. Here we are confronted with simplifications, historically specific sociopolitical arrangements of human interaction that do not obey absolute laws but could just as well be made different. The physical legitimacy of a technology is not the same as the social legitimacy of it. To give priority to the former, is to fetishize technology.

Not only does such rearrangements of the analytical terms enable us to integrate Luhmann's operation principle into a critical theory of technology. More importantly, this article hopes to have made clear, that we cannot give analytical priority to either physical or social functional simplification. We might better understand the global inequalities as well as the ecological destruction of the Anthropocene if we accept that technology is never a pure extension of the universal human being. Also, technology is not *embedded* into a specific social context – technology consists of it.

Acknowledgements I want to thank Uwe Voigt, Helmuth Trischler, Alf Hornborg, Anne-Sophie Balzer, Floris Winckel, Sven Seelinger and Christian Schnurr for their helpful feedback and comments on previous versions of this paper.

Authors' Contribution The author confirms sole responsibility for the study conception and design, analysis and interpretation of results, and manuscript preparation.

Funding Open Access funding enabled and organized by Projekt DEAL. The work on this paper was supported by a stipend from the ‚Foundation of the German Economy ' (Stiftung der Deutschen Wirtschaft).

Data Availability Not applicable.

Declarations

Ethical Approval and Consent to Participate Not applicable.

Consent for Publication Not applicable.

Competing Interests The author has no relevant financial or non-financial interests to disclose.

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