sustainability

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The (Un)availability of Human Activities for Social Intervention: Reflecting on Social Mechanisms in Technology Assessment and Sustainable Development Research

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Abstract: This article considers human activities as a central but deeply problematic aspect of sustainability. We argue that radical reduction in human activities could be an important lever to counter problems such as climate change. However, instead of pursuing a normative hypothesis that human activities ought to be subjected to specific kinds of sustainability measures, we pursue the hypothesis that human activities are largely unavailable for sustainability measures, because as an aggregated global phenomenon they are subject to social mechanisms, which accelerate rather than slow down activities. While social mechanisms are human inventions that render (inter)actions unlikely likely in the first place, they have evolved towards structural and historical embeddedness, which makes them unavailable for any instrumentalized design. The question is, how can we, experts in technology assessment, recognize social mechanisms in strategies to reduce human activities and to achieve a transformative impact on systemic reproduction. Our discussion centers on technical, psychological, and communicative social mechanisms of reproduction, and experiments with ideas of how to utilize social mechanisms and the (un)availability of human activities in technology assessment and sustainable development research.

Keywords: sustainability; motivation; social mechanisms; communication; social systems

Citation: Büscher, C.; Ufer, U. The (Un)availability of Human Activities for Social Intervention: Reflecting on Social Mechanisms in Technology Assessment and Sustainable Development Research. *Sustainability* **2022**, *14*, 1394. https://doi.org/10.3390/su14031394

Academic Editor: Antonio Boggia

Received: 7 December 2021
Accepted: 23 January 2022
Published: 26 January 2022

1. Introduction: No Limits to the Growth of Human Activities?

In the face of the diverse crises that threaten the global socio-ecological system, scientists increasingly pursue research for sustainability as a means to a normative end. From the normative interest in advancing sustainability, conceptional branches, such as "sustainable development" (SD) [1] and "degrowth" [2,3], as well as technology assessment (TA) [4] or "responsible research and innovation" (RRI) [5], emphasize potential pathways towards systemic transformation. They focus, for example, on technological change and corresponding, often unintended, consequences for society, and on societal dynamics, such as changing institutions, knowledge, norms, ethics, and individual and collective behavior. Many of these approaches share a critical modernist bias in their preconception that the right kind of activity will cause the desired transformation of society. The degrowth debate, as one prominent example, is centered on the critique of prevailing action premises (the bias of individual versus collective welfare), decision programs (prosperity through technological progress and economic growth), and rationality frameworks (competition, efficiency, productivity, utility, etc.) [6]. TA tries to expose the negative effects on sustainability if technological development activities do not consider social consequences and ignore the precautionary principle regarding expected long-term impacts [4]. RRI criticizes R&D activities for indifference towards societal values and the lack of inclusion of non-technical and non-economic perspectives [7]. As a consequence, all of those fields of research delineate how technologies and practices themselves could, and should, become sustainable, thereby

leading transformation towards a more sustainable organization of society at local and global levels.

However, there is an evident gap between, on the one hand, efforts invested into research and communication about pathways towards sustainability, and, on the other hand, societies' actual advances on this path. In addition, while the apparently sustainable nature of unsustainability [8] is a research issue in some systemically oriented analyses, this gap is rarely acknowledged in normatively oriented sustainability research. The core aim of this article, therefore, is to depart from the normative *orientation of goal attainment* and attempt to direct attention to social mechanisms as drivers of unsustainable human activities and unsustainable relations with the ecosphere. To this end, we develop a conceptual model of the permanence and historical thrust of social mechanisms. Our method for this conceptual development rests on the identification of a number of social mechanism and their comparison with regard to potentials for deceleration and acceleration of human activities. For this purpose, we draw on the notion of functional differentiation and develop an analogy between the permanence of social mechanisms and the permanence of energy degradation in thermodynamic systems. If our considerations do not lead to sustained policy packages, or clear roadmaps to achieve sustainability, this is quite consistent with the skeptical distance of our approach to normatively guided research for sustainability. However, in our conclusions, we attempt to open up some perspectives of how our critical approach can still make contributions to sustainable development, if only by creating awareness of potential conceptual opacities that threaten to misdirect efforts in societal transformation.

Humans have been extremely successful in inventing social mechanisms that render unlikely events likely; mechanisms that relate motives and acceptance in a way that makes social interactions successful when activities build upon each other in extremely complex, distributed, interdependent, and often lagging chains of operation [9]. Here, we discuss technology as a paradoxical relief mechanism, the internal logics of socio-cultural mechanisms, as well as the mechanisms of politics, money, and spirituality, but these do not deny the relevance of other social mechanisms, such as law or trust. All these social mechanisms, and many more, open up possibilities for economic, political, legal, scientific, as well as artful or leisure activities in a structured and systematic way, at an increasingly faster rate, with a larger geographical reach, greater interdependence, and with an increasing number of involved agents [10]. Additionally, as we will show in the following, technology and cognitive mechanisms simultaneously support the acceleration of, and widen the scope for, human activities.

In this light, it is difficult to foresee how the volume, intensity, and acceleration of human activity can be slowed down. We have to observe that humankind has been and still is very successful in increasing activities. The need to address human activity as a lever for sustainable development has been widely recognized, as many areas of human existence are experiencing exponential increases in activity, with equally dramatic impacts on socio-ecological systems [11]. However, only communicative surrogates, rather than the mechanisms bringing about the undesired activities, seem to be available as objects of human intervention: *Communication and education* about sustainability, a *rhetoric* of deceleration [10], the *moralization* of behavior [12], *theoretical and scientific knowledge* (models) about climate development, resource limitations, or about the habitat, Earth, in general, *visions* about (im)probable futures [13], or an increasing focus in sustainability studies on *narratives* of change and transformation [14].

If participants in such communications about sustainability trust in the transformative impact of performative speech acts, their hopes have yet to materialize: more than half a century after the apodictic claim that humanity was close to reaching "the limits to growth" [15], and in spite of uncountable specific sustainability measures over many decades in the domains of technology and societal change, the European Environment Agency's 2020 report states that "the intensity of human activities has caused tremendous pressures on the Earth's life support systems" [16]. In other words, although natural lim-

its to growth have become an issue within the communicative surrogates of sustainable development, they have neither restrained overall human functional activity, nor its unsustainable nature. Instead, limits to growth have been pushed ever further (for example in *committed emissions* [17] or in committed funds towards fossil fuel activities [18]). In view of the ongoing increase in human activity—both in highly industrialized nations and in the emerging economies—we need to consider the hypothesis that the total social reproduction of growth-oriented systems operates independently of the communicative surrogates about restrictions that should be imposed on individual sectors, or members of society. Humans will continue to expand their activities *as long as their environment allows it*.

2. Social Mechanisms and Functional Differentiation

In institutional research, approaches using concepts of social mechanisms seek to reconstruct more or less complex cause–effect relationships [19]. Concrete interactions are analyzed in their processes, for example, using exogenous variables (biophysical environment, community, rules) and by situation descriptions, which results in a rather complex explanatory framework [20]. These attempts at causal reconstruction seem relevant for our considerations about the availability of human activities: we can ask here how such mechanisms affect activity levels or how these mechanisms might be manipulated. For example, social norms may act as tipping points, in the sense of Granovetter's concept of behavioral thresholds [21], and thus trigger behavior that seems desirable for the attainment of certain goals, for example, sustainability [22]. However, treating explanations of mechanisms as a normative guide to correct behavior quickly leads into qualifying analyses, i.e., the elaboration of criteria for sustainable action, which we do not want to engage in here. Moreover, causality frameworks always groan under the weight of excessive complexity, as Ostrom states [20].

In our understanding, social mechanisms define powerful and historically embedded socio-cultural achievements, such as social systems, technology, capital with its paradigms of growth and acceleration, and the structure of functional differentiation in modern society. The genesis and evolution of these inventions was provoked by problems of social organization, to which social mechanisms have provided adequate solutions [23] which thus have grown roots within the socio-cultural systems of modern societies. Being part of such deep historical social structures, social mechanisms cannot be turned on or off in any instrumental sense, because they are not caused by purposeful individual motivation; historically speaking, they are rather unexpected results of aggregate activities. This makes social mechanisms unavailable as objects of sustainability measures. Mechanisms can thus be seen as functionally differentiated social achievements with specific inherent logics [9]. In this understanding, the evolution of mechanisms is variable and conditioned by the problem they are meant to solve. Therefore, the logics of one social mechanism, for example expansion and acceleration of surplus production through capital, can be inherently consistent and successful even though they are contradictory to long-term goals of social reproduction, such as sustainability.

3. Permanence of Human Activities and Irreversibility of Events

Sociality is sustained and reproduced on the basis of *irreversible* events and *permanent* activities. Actions or decisions cannot be reversed: one can only regret what has been done and try to clean up the mess. However, even this, again, involves new activities. Actions have to be taken again and again in order to reproduce social structures, or to adapt, change and build new ones: business is ongoing, power needs to be preserved and order maintained, etc. The irreversibility of human activities are the historical conditions of social existence in that chains of events (behavior, action, decision-making) extend from the past, through the present and into the future [24]. In the following, we will pursue our conjecture that in social systems driven by growth-oriented and accelerating social mechanisms, human activities are largely unavailable as objects of sustainability measures. We develop

this consideration via the analogy of permanence and irreversibility in thermodynamic systems.

3.1. The Analogy of the Thermodynamic Hourglass

According to the second law of thermodynamics, every thermodynamic system is headed towards a state of high entropy, i.e., the terminal state in which what had once been available (energy) has been devalued into what is unavailable (anergy). With the image of a thermodynamic hourglass, Georgescu-Roegen illustrates the irreversibility of entropic degradation—the hourglass cannot be turned upside down, and energy that has been devalued to a state of high entropy cannot be reversed to a state of low entropy without the input of more energy [25] (see in Figure 1).

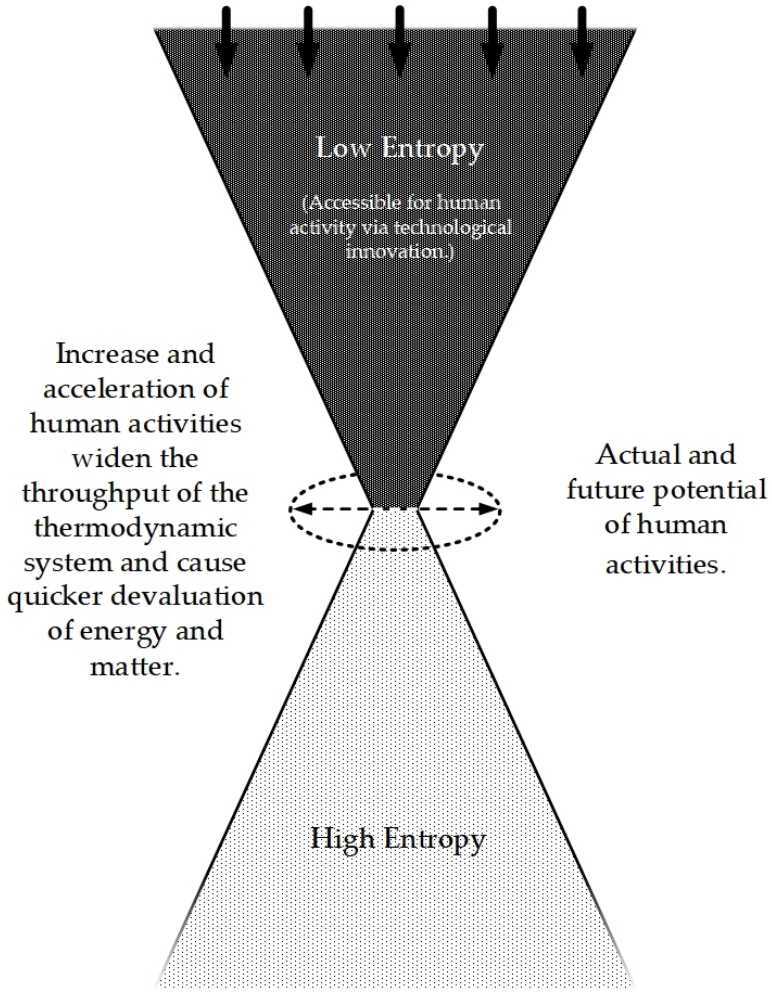

Figure 1. Increase and acceleration of human activities widen the throughput of the "thermodynamic hourglass" in articulation with the processes of social reproduction. Source [25]; p. 14; extended by CB/UU.

Although Georgescu-Roegen's schematic representation is helpful to illustrate thermodynamic principles, it should not lead to energy reductionism with regard to questions of sustainability (see also the criticism of such reductionism [25]). In fact, the prospected duration of solar-energy irradiation of planet Earth cannot be grasped by any cultural temporalities and notions of history. In addition, only fractions of the geopotential of fossil and nuclear energy sources have so far been exploited. Georgescu-Roegen's thermodynamic hourglass might be wrongly interpreted as displaying a limitation of low entropy. Instead, the top lid should be considered to be open, allowing the inflow of ever-more energy, as the problem for humanity is clearly not the lack of energy, but the degrading effects on

the environment through technical forms of energy conversion, the socio-cultural ways of distributing existing energy fairly, and the challenges of dealing with waste products from energy transformation.

Of more interest for our hypothesis of the unavailability of human activities for sustainability measures is the midpoint of the hour-glass. It appears that the only variable to be influenced by humans in the irreversible flow from low to high entropy is the potential for human activity to accelerate or slow down the throughput of entropic processes, and their degrading effects on human habitats. Scientific understanding of systemic tipping points, has clearly identified that processes that are harmful to habitat Earth are accelerated once certain thresholds have been crossed [26]. Intensification, acceleration and multiplication of human activity thus influence the progressive rate of devaluation of physical resources (energy and matter), but also of social resources, such as time or capital.

Questions that can be derived from the analogy of the thermodynamic hourglass are therefore: How fast does the sand run through the clock in the direction of high entropy, i.e., from *exergy* in the direction of *anergy* [27], or from availability to unavailability? How can human activities be influenced in their quantitative extent? Finally, is the manipulated variable of the global thermodynamic flow available to instrumental sustainability designs, or not?

3.2. Contingency and the Divergence of Sustainment and Sustainability

The mechanisms of social organization limit and condition behavior, thereby creating stable orientations and expectability about the outcomes of activities. In other words, they make improbable events probable in otherwise contingent social worlds. Pursuing the analogy of the thermodynamic hourglass, each (activity) event represents a grain of sand. In this statement, the argumentative links between fundamentals of thermodynamic and sociocultural systems and their reproductive logics are inherent: Both resonate an understanding of, first, permanence of activities to sustain performances, second, irreversibility of events and consequences, and, most importantly, the rigid necessity of sustaining these activities (see for example the notions of entropy in information theory [28], the theory of institutions [29] or the theory of social systems [24]).

Society's continuous work on and with structure through aggregate activities, i.e., producing, stabilizing, or changing structures, which reduces contingency and makes activities probable again, is an essential feature of every form of social reality. Structure and orientation—understood as a restriction of what is possible, legitimate or probable—are not inventory variables but rather are variables of temporary states. Like entropy, the concept of contingency and its higher or lesser degrees serves to describe the current state of systems. It denotes the measure of determination or conditioning of possible events in a flow of occurrences produced within the system. To limit contingency, structures in the sense of cognitive and normative expectations must be permanently created and maintained—just as in the case of entropy where energy must be permanently supplied to produce specific outputs.

4. Social Mechanisms: Making the Improbable Probable

In abstract terms, the sustained increase and acceleration of human activity over recent decades—in spite of opposing communicative surrogates of sustainability—rests on the permanent and irreversible sequence of operations necessary to reproduce social systems, as well as on corresponding social mechanisms that we suspect *are not available* for human control. Numerous scientific approaches deal with the relationships between human environmental habitats and the overall systems of society, sectors and individual activities, but there is a widespread problem in not adequately taking account of the homeostatic nature of socio-cultural systems. In other words: along the path of socio-cultural evolution the conditions of reproduction of social-institutions and cultural systems can become quite independent of the material conditions of reproduction, and even more so in complex

asymmetric global systems where local socio-cultural reproduction often draws on distant material resources.

In anthropology, for example, this fundamental issue of the notion of *total* social reproduction was considered some decades ago by the school of cultural materialism and its critics. While the former viewed social institutions and culture, more or less, as epiphenomena of availabilities and constraints in the material world, the latter insisted on the potential disconnect of socio-cultural systems with their internal and largely independent logics of reproduction [8,30,31]. Many contributions to sustainability debates suggest that widespread ignorance of and incapacity to translate the experience of negative environmental feedback into socio-cultural transformation can only be compensated by decision-shaped restraint, fettering, nudging, aggravation, effort, reflection, or creation of intrinsic motivation. In terms of our interest in the role of human activity in the search for transformation towards sustainability, the interest of this line of reasoning lies in making the improbable probable, i.e., making what is possible in terms of potentially unsustainable activities (at least partially) impossible. For this purpose, values and ethics (like sustainability, solidarity, responsibility) have received increasing attention [32].

Such attempts to interfere in the continuation of unsustainable activities stand in contrast to how a number of paradigmatic and historically-grown social mechanisms for social coordination enable, relieve, facilitate, and accelerate precisely such activities. Similar to the conception of homeostatic cultural systems in anthropology, social mechanisms as conceived in sociology are serving functional necessities in the course of reproducing social systems in society (in form of interaction, organizations or functional systems), a process for which only the *connectivity* of activities is inherent as normative impetus, i.e., the question of how one action links, builds on, prepares, or provokes another. Without the ability to create connectivity, communication ends and social systems cease to exist [24]. That creates the problem for any kind of long-term change measures, like sustainability, because sustainment is systemically more important on this basic level of continued and interlinking activities. Any necessity for information-gaining feedback on the link between individual actions and overall system reproduction is an additional burden and, therefore, often excluded. Such feedback can only be brought about by additional actions such as special efforts to observe causal linkages, via science and with the help of technology. The notion of long-term business cycles that run over extended periods up to 60 years, as analyzed for example by Kuznets or Kondratieff, is a good illustration: No individual's activities purposefully intend to create a business cycle, and yet aggregated activity leads to precisely this outcome, while at the same time the business cycle itself escapes active management [33,34].

All conclusions from these observations are, therefore, part of broader social interactions in science, law, politics, economics, arts, etc. Here, we concentrate on their effects on the social mechanisms of technology and identity practices.

4.1. Technology as A Paradoxical Relief Mechanism

Technological inventions in particular allow for causal simplification, for reducing contingency and thereby accelerating human activity in the short-term. However, in both thermodynamic and social systems the short-term, momentary need for *sustainment* coevolves with the long-term need for *sustainability*. While these evolutionary paths start out as non-conflictual at the beginning of a historical constellation of ecological habitat, technological innovation and social organization, they may diverge in quite dramatically contradictory fashion over the course of systemic evolution. While specific technical artifacts or techniques come and go over the process of innovation and obsolescence, social dependence on technology is total in itself; in other words, the principle of technology is not available. For sustainability measures, all that remains is the attempt to integrate sustainability into technology, thereby making technology per se conducive to sustainability. Examples can be witnessed in the domains of renewable energy (RE) sources, carbon

capture and storage (CCS), geoengineering to counter climate change, nuclear fusion to provide limitless energy, or AI to increase efficiency through autonomous systems.

However, here, autonomous vehicles aptly illustrate the problem of homeostatic cultural systems and social mechanisms which lack negative systemic feedback. Against all intentions to increase sustainability, this technological invention will likely increase, intensify and accelerate unsustainable human activities in terms of traffic volume, as well as with regard to the production, maintenance and supervision of necessary technical appliances and infrastructures [35]. Driven by the logics and rationalities of an economic system that externalizes long-term contradictions with the material world, the industry will bring autonomous vehicles to market; first by emphasizing new possibilities and then by formulating necessities [36].

Technology attains high structural value for societal organization through simplification and isolation of causal processes [37], as this ensures the expectability of events and outcomes. It may therefore seem like a paradox that technology should have brought about extreme simplification of causal relations, with simultaneous extreme complexification through the expansion and branching of technical networks (for example global transportation networks that increase the risk of spreading contagious diseases [38]). However, in this seeming paradox, we again encounter the confrontation and evolutionary divergence of different systems' internal reproductive logics: while individual technical systems in and by themselves simplify causal relations and enhance expectability, their interactions with social and cultural systems over time leads to unforeseen complications and unexpected events.

By their solipsistic nature, technical systems are most successfully disseminated when they are indifferent to contexts, as demonstrated by the "promethean invention" [25] of the combustion of fossil fuels, which isolates some physical causalities and disregards atmospheric, climatic, or social conditions on this planet [39]. In this light, the promise of renewable energies and carbon-free industries is subject to slow transformations and structural obstacles (path dependencies, lock-ins, inertia). More importantly for our argument, technological inventiveness is no guarantee of a reduction of human activity. Technology is not only an extension of the "deficient human being"—stronger, faster, more enduring, efficient, and intelligent—but is also a self-reinforcing mechanism of relief and liberation that extends human activities in quantity, range and impact. Any technological invention—from wheel to washing machine—liberates capacities and thus increases and accelerates unsustainable human activities as long as these cannot withdraw from the reproductive logics of unsustainable dominant social mechanisms.

4.2. Internal Logics of Socio-Cultural Mechanisms

Sustainability is not merely a question of technological efficiency. A much larger sociological and anthropological question looms behind, namely what people do with their time. Liberation of time for activities, for example through technological advancement, can be expected to create new problems with regard to sustainable development, since human activities evolve under a rule of functional permanence relative to modernity's paradigms of growth and acceleration. Liberated from activities, for example through machines that take over previously burdensome and time-consuming tasks, tend to be reclaimed by the dominant social mechanism and turned into new functional activities, which in turn use up resources. If technology cannot be relied upon as a relief mechanism for the increase, intensification and acceleration of unsustainable human activity, it is important to consider the possibilities and opportunities of "doing without" in individual activities. The concepts of motivation and personal identity are crucial in this regard. Motivation combines the formation of preferences, interests or inclinations, the delineation of goals and the capacity to pursue those goals along one's preferences, interests and inclinations [40]. The self-referential circle is obvious in this concept. The basic premise of this research from socio-psychology for considerations of sustainable activities is the distinction between extrinsic and intrinsic motivation. While extrinsic motivation refers to more general societal

issues, such as climate protection, intrinsic motivation expresses itself in concrete biases for or against something, such as the preference for or the rejection of ideas like "sufficiency" in consumption, ownership, or property.

While motives are certainly the result of socialization [41], according to behaviorist approaches, they also correspond to a basic psychological structure that condenses into a general tendency to reduce or avoid behavioral costs in lifestyles [42]. If we follow this line of argument with a view to our hypothesis of the unavailability of human activities for sustainability measures, humans are rationally controlled and aim at improving their own conditions. Technology here serves as a means to achieve this goal. In affluent and high energy-consuming societies, then, speed, convenience, ease of use and comfort are predominant preferences because they conform to systemic logics and requirements. Thus, the psychological structure of modern identities poses obstacles to changing one's lifestyle in terms of withdrawing activities from the dominant unsustainable social mechanisms. 'Alternative' or 'anti-systemic' lifestyles go along with multiple inconveniences and demand identity practices that often stand in conflict with mainstream social dynamics. *Nudging* acknowledges this socio-psychological undermining of lifestyle transformation by using default inconveniences instead of straightforward prohibition as a brake on human activities [43].

Those who promote the effect of *extrinsic*, rational motivation for sustainable behavior, for example communication about negative feedback due to unsustainable human activities, are often confronted with the stubborn and enduring relevance of *intrinsic* motivations running quite to the contrary. Conspicuous consumption continues as an adequate expression of individual self-fashioning in the face of objective knowledge about many of its negative environmental impacts. Reciprocal social control between friends, neighbors, and family members could generate conformity pressure in sustainable behavior, for example through flight shame and car shame in the domain of mobility. Recent studies suggest even the emergence of moral pressure regarding family planning. "Eco-reproductive concerns" might soon have influence on demographic growth [12]. However, such social pressures work against intrinsic motivations and deep psychological structures in modern societies, such as the preference for comfort, curiosity, or against the general drive of the human species towards biological reproduction and social needs for extended families in many parts of the world. They also work against extrinsic social motivations like the maintenance of relative status and generate counter-pressures and intentional non-sustainable behavior (see the spontaneous success of the Fridays-for-Hubspace movement or the flare-up of the slogan "Free Ride for Free Citizens" in rejection of proposed speed limits on German highways). Likewise, the situational roles of modern identity easily permit psychological dissociation of sustainable and unsustainable activity, for example, people may save energy, or follow vegetarian diets, when a habitus of sustainability is required by their situational sustainably-oriented peer group, but may act otherwise when unobserved for reasons of comfort, enjoyment, or status maintenance (this argument refers to the general thesis of expectation-expectations as a basis for social actions [44]). It is one thing to understand the causal link between unsustainable activities and environmental pollution, and quite another to liberate oneself from socio-psychological drives that on aggregation seem to lead to a civilizational repetition complex.

In addition, modern individual identity is itself conceived as a project of growth, progress and evolution that depends on constant external stimulation and on the accumulation of experiences in individual lives [45]. Therefore, overtly virtuous behavior, in terms of respecting codes of sustainable conduct, may not only open up new opportunities for increased (ultimately unsustainable) activity [42]. Even if sufficiency might be enforced in some areas of modern life, it will free-up resources (time and money) that will be invested into endeavors of personal growth and cultivation as well as expression of identity, and will thus cause further activities. If psychologists are right that avoiding the "behavioral costs of sufficiency" is a fundamental mechanism of modern man's cognitive structure that cannot be circumvented, then we must suspect that convenience will in most situations

overrule inconvenience and activities invested into personal development will neither abate, nor will they avoid re-integration into the dominant functional mechanisms of a growth-oriented social system.

It is therefore not inconsistent when sustainability-oriented renunciation of activities in one sphere of life provides for new unsustainable activities in another, which in turn also takes up resources [42,43]. This is clearly exemplified by the case of leisure activities, Through the near complete commercialization of leisure in the late modern era of the 21st century leisure activities on an aggregated level are tied back to the dominant social mechanisms and are afflicted with the same burden that affects any 'anti-systemic' lifestyles: it takes a high degree of intrinsic motivation and downright courageous behavior in late modernity to practice 'anti-systemic' lifestyles, an therefore activity reducing leisure, too, is constrained to niche phenomena. Quite paradoxically, but consistent with our argument, Wilson points out that even withdrawal and escapism are ultimately systemically functional activities [46]. If the recluses eventually return to participate in the systems operations they will have replenished essential mental resources for creativity and innovation that will be exploited by the prevailing dominant mechanisms of social reproduction. From the analytic perspective of human activities, then, individuals and niche groups may make courageous attempts at refraining from growth driving activities, but on aggregate and over the long run, it seems that even the most well-intended self-inflicted restrictions eventually get redrawn into the functional gravity of social mechanisms and contribute to the overall increase of human activities.

5. Conclusions and Outlook: Restrictions on Human Activities?

It has been the main achievement of this article to demonstrate the historical thrust and activity-driving nature of self-reinforcing and acceleration-inducing social mechanisms, and to analyze and describe the latter's paradoxical and contradictory relation with the concurrent need to reduce human activity for a sustainable future. This begs the question: will the level of human activity be regulated in the future by design or by catastrophe (see the argument for the latter [47])? Further research will be necessary to develop concrete policy measures for reducing human activity, but we conclude with a few initial considerations of policy areas and their likelihood to succeed.

5.1. Constraints by Politics

A prominent case for consideration are the seventeen United Nations' Sustainable Development Goals (SDG). Some incompatibilities between the different goals themselves have already been pointed out for the European context [48]. On a global scale the demand for continuous economic growth (SDG No. 8), the need for progressing industry, innovation and infrastructure (SDG No. 9), and the imperative for ongoing consumption (SDG No. 12) correspond exactly to the historical thrust of growth and to internal socio-cultural logics that we have analyzed in this article that stand in the way of achieving sustainability.

The COVID-19 pandemic has shown how political decisions (utilizing the power mechanism) can impose far-reaching restrictions on all kinds of activities. However, the intense level of social conflict during the pandemic demonstrates that such far-reaching restrictions can only be legitimized and enforced in liberal democracies over a short period of time during immediate crisis. Although, the climate crisis is in the making, drastic and long-term measures needed for a transformation towards sustainability therefore seem extremely hard to implement and enforce politically. It took years of debate only to ban plastic bags—a comparatively minor achievement in terms of global sustainability. Quite similarly, it is to be expected that political management of the "economic-ecological double grip", as Dörre coins it [49], will restrict activities at best selectively (in private life, for example) locally, and with regard to specific sectors, but not permanently, or on a global scale.

Successful democratic politics, i.e., winning elections, and political careers rest on promises of welfare and benefits for clientele groups whose relative short-term needs

and desires often oppose long-term change for sustainable social organization. Threats of welfare losses represent a high political risk for democratic as much as autocratic systems, which can explain the prevailing political *rhetoric* of sustainability and welfare (including economic growth) as simultaneous policy goals, rather than an emphasis on radical transformations. Furthermore, the global fall of communist/socialist state organization has provided vivid evidence of how planned economies suffer from competition with capitalist affluent economies. The same competition must arise for any form of sustainable sufficiency society, which would have to be scaled up progressively from experimental local niches to global levels. However, it is not only clientele politics of state elites, but also a propertied global minority that bar political pathways to sufficiency with the habitus of a right to unreason, myopia, and self-interest. While such post-ecologist movements can be criticized morally, they are quite consistent with the "post-democratic condition and suitable for the politics of unsustainability" [50], which effectively prevents profound changes.

One obvious way of decreasing human activity would be the stabilization and gradual reduction of global population. Yet, regulatory restrictions on biological reproduction are inconceivable in liberal democracies, and despite global efforts at restraining growth via education, health care and global redistribution of wealth even optimistic predictions in this regard show further demographic increase followed by only slow decrease over the next decades [51]. Yet, the aforesaid paradox in combination with this demographic outlook should not lead to fatalist scenarios in which only an apocalypse enables social reorganization for a sustainable human future [52].

5.2. Constraints by Money

Recent research highlights how the money mechanism of society's global economy not only fuels production and consumption in general. Financial capital is created in a network of payment interactions between investment banks, funds, and stock exchanges [53]—out of "nothing", according to critics, such as Piketty [54]. Through financialization and speculation on future assets it also allows the ever-continuing development of fossil fuels. Hagens convincingly demonstrates how bank-organized capital production through debt and interest in the finance economy maintains the exploitation of fossil fuels, even for unconventional oil and gas and even under the most adverse conditions: "Since money is a claim on energy, then debt is a claim on future energy" [55].

In this sense, creating economic incentives that provoke sustainable action is a much-discussed possibility. Sufficiency economies, conceptualized for example by degrowth discourses, seek to reconnect the economy to local chains of exchange maintained through non-monetary mechanisms, politically enforced redistribution, less labor time, and less energy consumption [3]. For a reduction in activity, this would mean putting a price on non-activity. *Receiving money for doing nothing*, as in a premium to forgo a vacation trip, or compensation paid to those holding claims but who did not exploit fossil resources. However, this creates an enormous potential for extortion, and, despite the omission of the exploitation, a flow of capital that will in turn be used for other ventures. Retaining profits from circulation can only work for fractions of capital in a capitalist system. Other initiatives call for divestment, that is, to "follow the money trail" [56] and withdraw capital from investment in unsustainable sectors of the economy. Here, too, the question arises to what extent this can achieve a reduction in or only a detour of human activity.

5.3. Constraints by Technological and Socio-Cultural Innovations

Referring to our previous arguments we restate that technological innovation, especially regarding increased efficiency and effectiveness, is falsely considered a potential problem-solver with respect to the recognized material and physical eco-system limits. While new technology is often more economical in the use of energy and still more efficient, our considerations in this article have shown: In view of raw material reserves and geopotential, as well as the activity-reinforcing effect of the creative achievements of technological

innovation, technology presents itself as an essential driver of human activity, and on this account seems to be a barrier to, rather than an enabler of, sustainability.

Heightened attention and resources should therefore be given to socio-cultural innovations that redirect motivation and acceptance in transformative endeavors towards constraints on human activities. The varieties of past and present social formations afford many examples of non-growth-orientation, for example by refraining from surplus production [57], or by distribution, and ritual abandonment of surplus [58]. In addition, metaphysical (i.e., non-reason-based) regulatory mechanisms could play a major role in the future. To this end, transcendent constructs would need to gain traction in order to justify and reward immanent behavioral restrictions. Starting points to this end can be found in religious commandments and ritualistic taboos, or esoteric restrictions, by which specific activities, such as the ingestion of certain foods, the use of certain technologies, or certain forms of behavior are restricted in principle or temporarily. Could activity-driving religious cosmologies, like the 'Protestant work ethic' be replaced by activity reducing ecologically oriented cosmologies?

In the end we can only reiterate: along the lines suggested above policies, social mechanisms and socio-cultural innovations are direly needed to reduce the level of human activities. However, in consideration of the historical thrust of social mechanisms and of the present conditions of social system reproduction, human activities will in all likelihood continue to increase and thereby further stretch limits to growth and trigger associated conflicts.

Author Contributions: Conceptualization, C.B. and U.U. The authors have equally contributed to this article. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Acknowledgments: The authors would like to thank the special issue editors and reviewers for valuable feedback.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Pirages, D. Sustainability as an Evolving Process. *Futures* **1994**, *26*, 197–205. [CrossRef]
2. Smith, T.S.J.; Baranowski, M.; Schmid, B. Intentional Degrowth and Its Unintended Consequences: Uneven Journeys towards Post-Growth Transformations. *Ecol. Econ.* **2021**, *190*, 107215. [CrossRef]
3. Cosme, I.; Santos, R.; O'Neill, D.W. Assessing the Degrowth Discourse: A Review and Analysis of Academic Degrowth Policy Proposals. *J. Clean. Prod.* **2017**, *149*, 321–334. [CrossRef]
4. Grunwald, A. *Technology Assessment in Practice and Theory*; Routledge: London, UK; Taylor & Francis Group: New York, NY, USA, 2019; ISBN 978-0-429-80969-9.
5. Ribeiro, B.; Bengtsson, L.; Benneworth, P.; Bührer, S.; Castro-Martínez, E.; Hansen, M.; Jarmai, K.; Lindner, R.; Olmos-Peñuela, J.; Ott, C.; et al. Introducing the Dilemma of Societal Alignment for Inclusive and Responsible Research and Innovation. *J. Responsible Innov.* **2018**, *5*, 316–331. [CrossRef]
6. Muraca, B. Décroissance: A Project for a Radical Transformation of Society. *Environ. Values* **2013**, *22*, 147–169. [CrossRef]
7. Owen, R.; Macnaghten, P.; Stilgoe, J. Responsible Research and Innovation: From Science in Society to Science for Society, with Society. *Sci. Public Policy* **2012**, *39*, 751–760. [CrossRef]
8. Friedman, J. Sustainable Unsustainability: Toward a Comparative Study of Hegemonic Decline in Global Systems. In *The World System and the Earth System: Global Socioenvironmental Change and Sustainability Since the Neolithic*; Hornborg, A., Crumley, C.L., Eds.; Left Coast Press, Inc.: Walnut Creek, CA, USA, 2007; pp. 91–108. ISBN 978-1-59874-100-1.
9. Luhmann, N. *Theory of Society—Volume 1*; Cultural Memory in the Present; Stanford University Press: Stanford, CA, USA, 2012.
10. Rosa, H. Social Acceleration: Ethical and Political Consequences of a Desynchronized High–Speed Society. *Constellations* **2003**, *10*, 3–33. [CrossRef]
11. Steffen, W.; Broadgate, W.; Deutsch, L.; Gaffney, O.; Ludwig, C. The Trajectory of the Anthropocene: The Great Acceleration. *Anthr. Rev.* **2015**, *2*, 81–98. [CrossRef]

12. Schneider-Mayerson, M.; Leong, K.L. Eco-Reproductive Concerns in the Age of Climate Change. *Clim. Chang.* **2020**, *163*, 1007–1023. [CrossRef]
13. Danowski, D.; de Castro, E.B.V. *The Ends of the World*; Polity: Malden, MA, USA, 2017; ISBN 978-1-5095-0397-1.
14. Markard, J.; Raven, R.; Truffer, B. Sustainability Transitions: An Emerging Field of Research and Its Prospects. *Res. Policy* **2012**, *41*, 955–967. [CrossRef]
15. Meadows, D.H.; Meadows, D.L.; Randers, J.; Behrens, W.W., III. *The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind*; Universe Books: New York, NY, USA, 1972; Volume 5250.
16. European Environmental Agency. *European Environment Agency The European Environment—State and Outlook 2020*; European Environmental Agency: Luxembourg, 2019.
17. Tong, D.; Zhang, Q.; Zheng, Y.; Caldeira, K.; Shearer, C.; Hong, C.; Qin, Y.; Davis, S.J. Committed Emissions from Existing Energy Infrastructure Jeopardize 1.5 °C Climate Target. *Nature* **2019**, *572*, 373–377. [CrossRef] [PubMed]
18. SEI (Stockholm Environment Institute); International Institute for Sustainable Development (IISD); ODI Sales Limited (ODI); E3G; United Nations Environment Programme (UNEP). *The Production Gap Report 2021*; Stockholm Environment Institute: Stockholm, Sweden, 2021; Available online: http://productiongap.org/2021report (accessed on 6 December 2021).
19. Boudon, R. Social Mechanisms without Black Boxes. In *Social Mechanisms—An Analytical Approach to Social Theory*; Hedström, P., Swedberg, R., Eds.; Cambridge University Press: Cambridge, UK, 2007; pp. 172–203. ISBN 978-0-521-59687-9.
20. Ostrom, E. *Understanding Institutional Diversity*; Princeton Paperbacks; Princeton University Press: Princeton, NJ, USA, 2005; ISBN 978-0-691-12207-6.
21. Granovetter, M. Threshold Models of Collective Behavior. *Am. J. Sociol.* **1978**, *83*, 1420–1443. [CrossRef]
22. Nyborg, K.; Anderies, J.M.; Dannenberg, A.; Lindahl, T.; Schill, C.; Schluter, M.; Adger, W.N.; Arrow, K.J.; Barrett, S.; Carpenter, S.; et al. Social Norms as Solutions. *Science* **2016**, *354*, 42–43. [CrossRef] [PubMed]
23. Luhmann, N. Reflexive Mechanismen. In *Soziologische Aufklärung 1: Aufsätze zur Theorie sozialer Systeme*; Luhmann, N., Ed.; VS Verlag für Sozialwissenschaften: Wiesbaden, Germany, 2005; pp. 116–142. ISBN 3-531-81161-4.
24. Luhmann, N. *Social Systems*; Stanford University Press: Stanford, CA, USA, 1995.
25. Georgescu-Roegen, N. The Entropy Law and the Economic Process in Retrospect. *East. Econ. J.* **1986**, *12*, 3–25.
26. Lenton, T.M.; Held, H.; Kriegler, E.; Hall, J.W.; Lucht, W.; Rahmstorf, S.; Schellnhuber, H.J. Tipping Elements in the Earth's Climate System. *Proc. Natl. Acad. Sci. USA* **2008**, *105*, 1786–1793. [CrossRef]
27. Wenterodt, T.; Redecker, C.; Herwig, H. Second Law Analysis for Sustainable Heat and Energy Transfer: The Entropic Potential Concept. *Appl. Energy* **2015**, *139*, 376–383. [CrossRef]
28. Shannon, C.E.; Weaver, W. *The Mathematical Theory of Communication*; University of Illinois Press: Champaign, IL, USA, 1963.
29. Schülein, J.A. *Theorie der Institution: Eine Dogmengeschichtliche und Konzeptionelle Analyse*; Westdeutscher Verlag: Opladen, Germany, 1987; ISBN 978-3-322-96996-5.
30. Hertler, S.C.; Figueredo, A.J.; Peñaherrera-Aguirre, M.; Fernandes, H.B.F.; Woodley of Menie, M.A. Marvin Harris: Ecological Anthropology and Cultural Materialism. In *Life History Evolution*; Springer International Publishing: Cham, Switzerland, 2018; pp. 213–229. ISBN 978-3-319-90124-4.
31. Adams, R.N.; Campbell, D.T.; Cohen, R.; Curtin, R.A.; Davis, W.M.; De Ruijter, A.; Diener, P.; Dunnell, R.C.; Ehrenreich, J.; Ekholm, K.; et al. Natural Selection, Energetics, and "Cultural Materialism". *Curr. Anthropol.* **1981**, *22*, 603–624. [CrossRef]
32. Sen, A. Capabilities, Lists, and Public Reason: Continuing the Conversation. *Fem. Econ.* **2004**, *10*, 77–80. [CrossRef]
33. Van Zanden, J.L. Tracing the Beginning of the Kuznets Curve: Western Europe during the Early Modern Period. *Econ. Hist. Rev.* **1995**, *48*, 643–664. [CrossRef]
34. Lloyd-Jones, R. The First Kondratieff: The Long Wave and the British Industrial Revolution. *J. Interdiscip. Hist.* **1990**, *20*, 581. [CrossRef]
35. Deloitte. *Urban Mobility and Autonomous Driving in 2035. How Robotaxis Will Affect Cities and Automakers*; Data Nation Germany; Deloitte: London, UK, 2019.
36. Van Lente, H. Forceful Futures: From Promise to Requirement. In *Contested Futures: A sociology of Prospective Techno-Science*; Brown, N., Rappert, B., Webster, A., Eds.; Ashgate: Aldershot, UK, 2000; pp. 43–63. ISBN 0-7546-1263-5.
37. Luhmann, N. *Risk—A Sociological Theory*; Aldine Transactions: New Brunswick, NJ, USA; London, UK, 2005.
38. Ord, T. *The Precipice: Existential Risk and the Future of Humanity*; Bloomsbury: London, UK, 2020; ISBN 978-1-5266-0021-9.
39. Fouquet, R. A Brief History of Energy. In *International Handbook on the Economics of Energy*; Edward Elgar: Cheltenham, UK; Northampton, MA, USA, 2009.
40. Elster, J. Rationality, Emotions, and Social Norms. *Synthese* **1994**, *98*, 21–49. [CrossRef]
41. Thompson, M.; Ellis, R.; Wildavsky, A. *Cultural Theory*; Westview Press: San Francisco, CA, USA, 1990.
42. Otto, S.; Kaiser, F.G.; Arnold, O. The Critical Challenge of Climate Change for Psychology: Preventing Rebound and Promoting More Individual Irrationality. *Eur. Psychol.* **2014**, *19*, 96–106. [CrossRef]
43. Kaiser, F.G.; Arnold, O.; Otto, S. Attitudes and Defaults Save Lives and Protect the Environment Jointly and Compensatorily: Understanding the Behavioral Efficacy of Nudges and Other Structural Interventions. *Behav. Sci.* **2014**, *4*, 202–212. [CrossRef] [PubMed]
44. Elster, J. *Ulysses and the Sirens. Studies in Rationality and Irrationality*; Cambridge University Press: Cambridge, UK, 1979.

45. Campbell, C. *The Romantic Ethic and the Spirit of Modern Consumerism*; Cultural Sociology; New Extended Edition; Palgrave Macmillan: Cham, Switzerland, 2018; ISBN 978-3-319-79066-4.
46. Wilson, R.N. The Courage to Be Leisured. *Soc. Forces* **1981**, *60*, 282–303. [CrossRef]
47. Lovelock, J. *The Vanishing Face of Gaia: A Final Warning*; Basic Books: New York, NY, USA, 2009.
48. Costa, J.; Cancela, D.; Reis, J. Neverland or Tomorrowland? Addressing (In)Compatibility among the SDG Pillars in Europe. *Int. J. Environ. Res Public Health* **2021**, *18*, 11858. [CrossRef] [PubMed]
49. Dörre, K. Europe, Capitalist Landnahme and the Economic-Ecological Double Crisis: Prospects for a Non-Capitalist, Post-Growth Society. In *The Good Life Beyond Growth*; Routledge: London, UK, 2017; ISBN 978-1-315-54212-6.
50. Blühdorn, I. The Governance of Unsustainability: Ecology and Democracy after the Post-Democratic Turn. *Environ. Politics* **2013**, *22*, 16–36. [CrossRef]
51. Adam, D. How Far Will Global Population Rise? Researchers Can't Agree. *Nature* **2021**, *597*, 462–465. [CrossRef]
52. Harvey, D. *Spaces of Hope*; Edinburgh University Press: Edinburgh, UK, 2000.
53. Pineault, É. A Moloch demanding the whole world as a sacrifice. In *Große Transformation? Zur Zukunft Moderner Gesellschaften: Sonderband des Berliner Journals für Soziologie*; Dörre, K., Rosa, H., Becker, K., Bose, S., Seyd, B., Eds.; VS Verlag für Sozialwissenschaften: Wiesbaden, Germany, 2019; pp. 119–146. ISBN 978-3-658-25946-4.
54. Piketty, T. *Kapital und Ideologie*; C.H. Beck: München, Germany, 2020; ISBN 978-3-406-74571-3.
55. Hagens, N.J. Economics for the Future—Beyond the Superorganism. *Ecol. Econ.* **2020**, *169*, 106520. [CrossRef]
56. Schellnhuber, H.-J. *Selbstverbrennung: Die Fatale Dreiecksbeziehung Zwischen Klima, Mensch und Kohlenstoff*; C. Bertelsmann: München, Germany, 2015; ISBN 978-3-570-10262-6.
57. Sahlins, M.D. *Stone Age Economics*; Aldine-Atherton: Chicago, IL, USA, 1972; ISBN 978-0-202-01098-4.
58. Boas, F. *Kwakiutl Ethnography*; Codere, H., Ed.; Classics in Anthropology; University of Chicago Press: Chicago, IL, USA, 1966; ISBN 978-0-226-06237-2.