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Understanding different perspectives on economic growth and climate policy

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Abstract

Should economic growth continue in a world threatened by the prospect of catastrophic climate change? The scientific and public debate has brought forth a broad spectrum of views and narratives on this question, ranging from neoclassical economics to degrowth. We argue that different positions can be attributed to underlying differences in views on (a) factors that determine human well-being, (b) the feasibility and desirability of economic growth, (c) appropriate intervention points, and (d) preferences about governance and policy options. For each of these dimensions, we propose points of agreement on which a consensus between conflicting positions might be achieved. From this basis, we distill a sustainability transition perspective that could act as a basis for a renewed debate on how to align human well-being with environmental sustainability.

This article is categorized under:

- Climate Economics>Economics and Climate Change

KEYWORDS

degrowth, sustainability, transformation, well-being

1 | INTRODUCTION

Economic growth is often singled out as the most important factor driving climate change. Empirically, the causal chain is straightforward: higher levels of economic activity tend to go hand in hand with additional energy use. As fossil fuels still account for the lion's share of global energy use, energy consumption is closely related to greenhouse gas emissions and hence to climate forcing. Yet, despite a broad agreement that economic growth has in the past contributed to climate change, the views on whether continued economic growth can be reconciled with climate change mitigation diverge sharply.

On the one hand, numerous researchers have emphasized the vast potentials of low-carbon energy sources, such as wind, solar, or biomass, that could be exploited at low economic costs (O. Edenhofer et al., 2011). From this perspective, policy instruments such as a carbon price have been promoted to incentivize cost-efficient emission reductions and technological progress for low-carbon energy sources. This view is, for instance, captured in the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC, 2014). The review of modeling studies suggests that,

even if climate change damages are not taken into account, an economically optimal mitigation pathway compatible with the 2°C climate target would reduce the average annual rate of economic growth by only about 0.06%. Some optimistic assessments even go further, arguing that green technologies could spur innovation and offer positive network effects that largely exceed mitigation costs, making climate change mitigation a "no-regret" strategy that would pay off even if climate impacts turn out to be much less severe than currently expected (Stern, 2016). In this light, low-carbon energy technologies are regarded to be not only clean, but also an inexpensive way to create employment and increase energy security.

On the other hand, there are frequent calls for degrowth[1] approaches and policies, including a deliberate reduction of economic output as a necessary condition to avoid dangerous climate change. Such calls have become influential in the public debate and are supported by academics from a variety of disciplines (Guardian, 2018). Some authors have claimed that "continuing with economic growth over the coming two decades is incompatible with meeting our international obligations on climate change" (Anderson & Bows-Larkin, 2013), while landmark publications such as "Prosperity Without Growth" (T. Jackson, 2009), "In Defense of Degrowth" (Kallis, 2018), and "Doughnut Economics" (Raworth, 2018) either strongly or implicitly support policy positions against continued economic growth. The underlying claims are that growth is neither desirable (e.g., to meet human needs and improve well-being), nor feasible (as growth cannot be fully decoupled from biophysical impacts). Other degrowth scholars have focused their critique on industrialized societies' "growth addiction", regarding economic growth as the sine-qua-non for the functioning of capitalist economies. This point of view argues that growth is required to prevent unemployment, alleviate distributional conflicts, and allow for continued public deficits, emphasizing that any measure that would reduce economic growth, such as transitioning to a low-carbon energy system, will likely face severe political resistance (Schmelzer, 2016).

A recent public survey demonstrates that even though a majority of respondents regard economic growth and environmental sustainability to be compatible, about one-third choose to either ignore economic growth as a policy aim, or would deliberately like to stop it (Drews & van den Bergh, 2016).

This article aims to further our understanding why different observers arrive at sharply diverging assessments regarding the relationship between economic growth and environmental sustainability. We argue that different views on economic growth mask larger controversies between different worldviews and narratives about the desirable political organization of societies that surface when discussing climate policy. More specifically, we characterize and distinguish different positions on growth and policy along four stylized dimensions. First, the *conception of human well-being*, that is, which factors are considered to matter for human well-being. Second, different perspectives prevail regarding the *feasibility and desirability of sustained economic growth, that is, whether economic growth improves social well-being and whether it can be decoupled from environmental impacts*. Third, views differ with regard to *preferred intervention points*, in particular concerning the question of whether technological options or interventions to change social norms and behavior are more appropriate to reduce environmental impacts. Finally, different observers have different *preferences in terms of governance and policy options, for instance with regard to whether market-based policies or behavioral changes are the right approach to reduce emissions*.

There is a large variation in positions across the field of climate change and sustainability, but polar views in each of these stylized dimensions are frequently associated with neoclassical economics and research on degrowth, respectively. Table 1 summarizes broadly how these two polar positions differ regarding these distinctions (see left and middle columns in Table 1). Even though our choice of dimensions and our characterization of the continuum of positions within each dimension can be debated, we argue that the dimensions proposed constitute a convenient perspective to characterize and compare different positions in both the academic and public debate. We hence build our analysis on the idea that people have different "narratives" in mind, each narrative providing an internally consistent mental model of how different aspects of a certain issue are related to one another (Shiller, 2017). Our approach of grouping different opinions is supported by recent research by Drews, Savin, and van den Bergh (2019), who demonstrate that there is substantial correlation between attitudes towards the feasibility and desirability of economic growth, the importance of income inequality, the potential of technology to address environmental problems and the role of government to guide the economy.

The following four sections discuss each of these categories in detail. We are emphasizing that disagreements might not be as fundamental as commonly perceived and highlight potentials how insights from one position can enrich the other one. Section 6 then draws together these points of consensus in the four dimensions considered to distill a "sustainability transition perspective" (right column of Table 1) to advance the debate on the relationship between economic growth and climate change mitigation.

TABLE 1 Categories to characterize different perspectives on the relationship between economic growth and environmental sustainability

	Neoclassical economics	Degrowth	Sustainability transition
1. Conception of human well-being	Consumption	Wide range of well-being indicators; capabilities; procedural aspects	Human needs
2. Feasibility/ desirability of economic growth	Feasible and desirable	Infeasible and not desirable	Agnostic (empirical issue); reduce growth dependence
3. Preferred intervention points	Technological options	Emphasis on structural interventions and changing social norms and behavior	Combine technological options with measures that address social norms and power relations
4. Policy and governance preferences	Market-based policies. Central state as central actor (top-down)	All policies that affect the demand or supply side, including broader social/political system change. Individual action (bottom-up)	Carbon prices, policy sequencing, polycentric governance

2 | ALTERNATIVE CONCEPTIONS OF HUMAN WELL-BEING

Most analysts and practitioners of public policy-making would agree that promoting human well-being should be the overarching objective for societies and policy makers. Many disagree, however, on the character of "well-being", and how it should be promoted. As highlighted in the chapter on "Social, Economic, and Ethical Concepts and Methods" of the Fifth Assessment report of the Intergovernmental Panel on Climate Change (Kolstad et al., 2014), different concepts regarding justice, equity, and responsibility as well as values and well-being can lead to radically different conclusions with regard to the extent, timing and design of socially optimal climate change mitigation.

2.1 | The material foundations of human well-being

In neoclassical economics, an individual's well-being is frequently regarded as a function of the consumption of goods and services. It is further common to assume that individual preferences can be aggregated into a utilitarian social welfare function that maximizes "the greatest good for the greatest number" by equating societal welfare to the sum of individual levels of welfare. While utilitarians acknowledge decreasing returns to consumption, increasing welfare is still considered to be a direct function of higher levels of consumption. As a measure of all economic activity, gross domestic product (GDP) includes current consumption as well as investments, which enable future consumption. Hence, as long as there are no negative side-effects associated with consumption or production (see Section 4.1. for a discussion of such externalities) and the depreciation of human, physical and natural capital is correctly accounted for, a corrected GDP indicator (often called the Net National Product) can be regarded as an appropriate measure for well-being in a society (Edenhofer, Kadner, von Stechow, Schwerhoff, & Luderer, 2014).

Neoclassical economists are not oblivious to the fact that many dimensions of human well-being are not included in GDP. Yet, more consumption is frequently regarded as the best way to enable improvements in these dimensions. That is, economic theory does not suppose that all types of consumption are equally conducive to well-being. Rather, it takes the perspective that disposing of more economic resources facilitates the achievement of social objectives. For instance, GDP growth has been found to be robustly correlated with decreasing poverty rates (Dollar, Kleineberg, & Kraay, 2016). Likewise, broader measures of well-being taking into account leisure, mortality, and inequality are positively associated with GDP, even though there is substantial amount of variation among countries (Jones & Klenow, 2016). However, other factors that might be deemed important for human well-being seem to be either unrelated to GDP growth beyond some threshold (Easterlin, McVey, Switek, Sawangfa, & Zweig, 2010) or are even negatively correlated (Brekke, Howarth, & Nyborg, 2003).

The utilitarian perspective of contemporary neoclassical economics has, however, often been subject to severe criticism on philosophical, empirical, and conceptual grounds. First, on normative grounds, Rawls (1971) argues that individuals who do not have prior knowledge about their talents, wealth and standing in a society (i.e., act behind a "veil of ignorance") would opt for a social welfare function that maximizes the situation of the worst-off member of society. Hence, maximizing an aggregate utilitarian welfare function might lead to unjust outcomes. Among other rationales, this modification of the welfare function can help to rule out perverse situations in which a standard utilitarian approach would mandate imposing substantial harm on some members of society if this harm results in larger welfare increases for others, even if these are already better off (Kymlicka, 2001). Second, it has been argued that a focus on one single indicator, such as aggregated consumption, incorrectly implies perfect substitutability between types of consumption with normatively different weights (e.g., "luxury" vs. "subsistence" goods). In this view, well-being can only be assessed by explicitly accounting for attainment of minimal threshold levels in multiple imperfectly substitutable indicators, such as access to food, shelter, democratic rights, and so on for all members of a society (Doyal & Gough, 1991).[2]

2.2 | What money cannot buy

Neoclassical economics has made substantial efforts to broaden the analysis of human welfare, for instance by taking into account inequality aversion and discounting future well-being, or adopting a Rawlsian "maximin" approach that aims at maximizing the well-being of the worst-off members of society (Kolstad et al., 2014). From this perspective, and given that currently about 20% of global income accrues to the top 1% of earners (Anand & Segal, 2017), improvements in human well-being could be achieved by means of progressive forms of redistribution of income, without the need to increase economic output. Nevertheless, approaches focusing on the distribution of wealth or income remain inherently utilitarian in nature and are not able to appropriately capture some important aspects that are relevant for well-being, such as health, education, or political rights and freedoms.

An extensive literature has discussed non-utilitarian concepts of well-being. A *hedonic* perspective focuses on the determinants of what makes people happy. This literature points to the fact that beyond a certain threshold, additional income does not result in higher levels of reported subjective well-being (Kahneman & Deaton, 2010) and emphasizes the importance of non-monetary factors, such as health, family relations, and stable employment (Dolan, Peasgood, & White, 2008). The category of so-called *eudaimonic* approaches examines what is required to enable human flourishing (Sen, 1999). Even though it is acknowledged that the concept of flourishing is culture-specific and highly dependent on individual choices, tangible services (such as access to healthcare and education) and social goods (functioning institutions, procedural justice, healthy personal relationships) are required to ensure that individuals dispose of the capabilities to succeed in leading their desired lives (Nussbaum, 2011). In this respect, multiple proposals on how to measure human well-being beyond simple consumption-based metrics have been brought forth (Fleurbaey & Blanchet, 2013). Eudaimonic well-being also provides strong justification for the broad set of indicators captured by the Sustainable Development Goals (SDGs; Lamb & Steinberger, 2017).

An additional non-monetary dimension of human well-being concerns inter-generational justice. While there is broad agreement that current generations should avoid actions that undermine the opportunities of future ones (Barbier, 2016), there are different perspectives on how such sustainable development can occur. That is, the question of whether natural capital can be substituted by other forms of capital has been a long-standing debate in economics (Dasgupta & Heal, 1974). Neoclassical economists frequently consider environmental quality as an input to production, such that depletion of natural resources can go hand in hand with increasing levels of well-being as long as sufficient amounts of physical capital, knowledge, or technology are put aside for future generations (Hartwick, 1977). Others, however, have highlighted that environmental capital might, at least beyond a certain threshold, not be substitutable (Daly et al., 2007). This might be rooted in "planetary boundaries" (Rockstrom et al., 2009) that once crossed would imperil planetary stability and—in an extreme case—the survival of the human species in the long run. That is, once certain environmental thresholds are violated, adverse environmental impacts on human well-being exceed any possible monetary compensation. This issue becomes even more salient if one not only takes into account the use value, but also the existence value of the environment, for instance as a foundation of cultural development.

One common theme of those putting forward a degrowth perspective is that a wide range of indicators, capabilities, procedural rights of political participation, and limits to substitutability should be considered when conceptualizing human well-being. This has important implications for discussions about policy and governance approaches, as we will point out below.

2.3 | Human needs and sustainable development

The preceding discussion points to the conclusion that material conditions certainly matter for human well-being, but are not its unique determinant. Hence, a sustainability transition perspective should focus on the question of which material foundations are required to build a thriving society that ensures the highest possible level of human well-being, taking non-material determinants into account. An important insight in this question can be derived from theories of human need (Doyal & Gough, 1991). The respective literature argues that in contrast to "wants", "needs" are clearly defined (e.g., sufficient nutrition, appropriate housing, etc.) and can be satisfied. Hence, higher levels of GDP are desirable to the extent to which they are employed to meet human needs. In this regard, deliberative processes to determine what counts as basic needs are an important element to ensure that economic activity contributes to human well-being (Büchs & Koch, 2019) and to inform policy that would aim at securing the attainment of such basic needs (see below).

For example, historical evidence indicates that higher levels of human development are closely linked to more energy use, at least up to the point of crossing the threshold required to ensure decent living conditions (Steckel, Brecha, Jakob, Strefler, & Luderer, 2013). This observation can be explained by the fact that energy is crucial to provide access to services such as healthcare, sanitation, and household electricity that are key to meeting basic needs. A number of studies have investigated how energy use relates to the achievement of the United Nations' Sustainable Development Goals (McCollum et al., 2018), and it has been pointed out that the amount of energy that would be needed to provide access to such basic services would be relatively small (O'Neill, Fanning, Lamb, & Steinberger, 2018).

For the question of intergenerational equity and sustainable development, the central question then becomes whether and how these human needs can be satisfied in a manner that does not undermine the integrity of essential natural systems (Gough, 2015; Jakob & Edenhofer, 2014). With respect to climate change, humanity is confronted with the challenge of addressing the under-provision of infrastructure and services to meet basic human needs while at the same time preventing the overuse of the atmosphere as a disposal space for emissions. These goals can be achieved in three ways: first, by constraining economic output, and hence energy consumption and related environmental impacts, in areas that do not help to fulfill basic human needs; second, by reducing the amount of energy required to produce economic output; and third, by reducing the environmental impacts of energy use, for instance by switching to cleaner sources of energy. The respective implications of these options will be discussed in the next section.

3 | FEASIBILITY AND DESIRABILITY OF ECONOMIC GROWTH

The different perspectives on welfare discussed in the previous section are closely related to the positions taken on the question of whether continued economic growth is (a) feasible and (b) desirable. Whereas some argue that reductions in economic activity are a central element to mitigate environmental problems (degrowth), others emphasize the importance of decoupling economic activity from environmental impacts (neoclassical perspective). Prior to discussing the differences between both camps in detail, it is worth noting that different perspectives differ fundamentally on the notion of economic growth. In neoclassical economics economic growth results (inter alia) from technological progress from, for example, learning by doing (Lucas, 1988; Romer, 1986) or targeted investments in R&D (Aghion & Howitt, 1992; Romer, 1990). In contrast, degrowth proponents frequently interpret economic growth as an expansion of the prevailing economic system serving political goals or ideologies (Kallis et al., 2018). Furthermore, it matters whether growth of aggregate economic activity results from population growth or from growing per-capita incomes. As changing consumption patterns lead to a saturation of energy consumption at relatively high levels of per-capita income (Jakob, Haller, & Marschinski, 2012), the latter type of growth can be expected to exert less pressure on the environment than the former.

3.1 | Economic versus uneconomic growth

Both the neoclassical and the degrowth perspective recognize that human well-being and GDP are only well-aligned if the latter appropriately reflects the value that society puts on desirable economic output (e.g., health or education) as well as its undesirable side-effects (e.g environmental pollution). Different perspectives on the feasibility and desirability of continued economic growth can hence be straightforwardly discussed in terms of the benefits and social costs

related to economic activity, as illustrated in Figure 1. Whereas benefits result from increased consumption possibilities, costs result from environmental impacts. It seems reasonable to assume that the relationship between GDP and its associated benefits (blue line) is concave, in line with diminishing returns to consumption of monetary as well as non-monetary conceptions of well-being (Doyal & Gough, 1991): With every additional unit yielding a lower additional benefit, consumption features diminishing returns; for example, fulfilling basic needs makes a larger contribution to human well-being than luxury consumption. As long as GDP growth is accompanied by a proportional increase of emissions, there are good reasons to believe that the relationship between GDP and environmental degradation (green line) is convex. Such a more than proportional increase of environmental impacts could for example arise from nonlinear climate damages related to irreversible tipping points in the Earth system that might potentially destabilize the entire climate system and lead to catastrophic losses (Lenton et al., 2008). At the same time, possibilities to adapt to climate impacts, even if technologically and economically feasible, might face severe social and political constraints (Adger et al., 2009). Optimal consumption is then obtained at the point at which the net benefits of economic activity is maximized (i.e., the marginal benefits of economic activity equal its marginal costs). Any increase in GDP beyond this point will actually lower human well-being, and hence result in what is sometimes called "uneconomic growth" (Schumacher, 1973). Further, passing the threshold at which environmental damages become so large that they reduce the net benefits of economic activity to an extent that does not even allow for subsistence consumption results in a regime of ecological collapse.

Different perspectives in the growth versus environment debate may then be classified according to their point of view on where we are located in Figure 1. Those who believe that we are still on the left-hand side of optimal consumption argue that further economic growth can be expected to yield benefits that are large compared to its environmental impacts (Lomborg, 2007). In contrast, those who believe that globally, or at least in rich countries, we are located on the right of the point of optimum consumption see further economic growth as making us in effect poorer and bringing us closer to ecological collapse (Randers, 2012).

Perhaps even more pronounced differences can be identified regarding the proposed solutions to avert catastrophic climate change. Some proponents of degrowth argue for limiting economic output—i.e., either reducing it, or slowing down its rate of growth—to avoid uneconomic growth or ecological collapse (slowing down the movement to the right, or even moving leftwards; Anderson & Bows-Larkin, 2013). Yet, it should be noted that even if such an approach might be appropriate for industrialized countries, it would not be suitable for poor countries that need to further increase their level of consumption to satisfy the basic needs of their populations. To provide space for further GDP growth in these countries, industrialized countries would need to substantially reduce their economic output. Even if one abstracts from the question of whether such large reduction in consumption would be politically feasible, it would arguably not only affect luxury consumption. Without careful management reductions of economic output could also

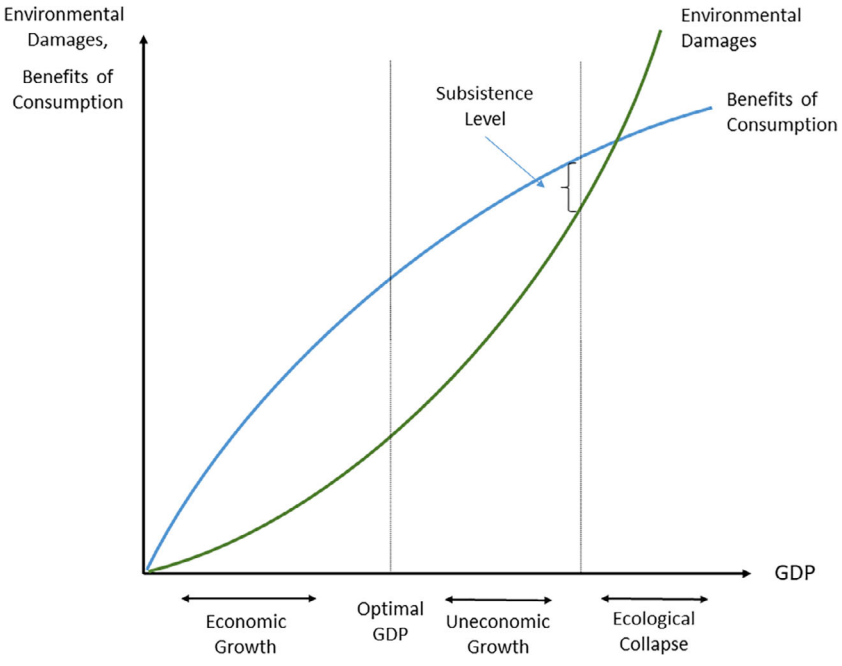

FIGURE 1 Benefits of economic activity versus their associated environmental impacts

impact on basic services such as healthcare, education and social security, and hence entail adverse consequences for human well-being.

Another argument against deliberate reductions in economic activity is that economic growth occurs as a consequence of innovation and increased productivity. Countries with more rapid economic growth often also display faster efficiency improvements, such that higher rates of economic growth do not necessarily mean more resource and energy use. In contrast, countries with low rates of economic growth have often displayed a quite negative environmental record; for instance with regard to highly inefficient energy use in the Soviet Union, or high rates of deforestation in the Congo, which both occurred in the absence of economic growth (shifting the green curve in Figure 1 upward). Hence, if reductions in economic growth are associated with less efficient use of resources, they might not result in improved environmental outcomes.

3.2 | Decoupling

Regardless of the future size of the global economy in terms of GDP, there is wide agreement that climate policy as, for example, agreed on in the Paris Agreement requires long-term decarbonization of the global economy in any case (Hepburn & Bowen, 2012). To achieve this shared goal, those skeptical of degrowth as a means to reduce GHG emissions focus on measures—such as technological innovations—to reduce the environmental impacts associated with a given level of economic activity (shifting the green curve in Figure 1 downward). One method of "shifting the curve down" is through decoupling: the separation of economic activity from its climate impacts (IPCC, 2014). Yet the feasibility of decoupling gives rise to significant debate and disagreement across neoclassical and degrowth perspectives.

On theoretical grounds, one line of argumentation stresses that in a finite world, ever increasing use of materials and energy is impossible due to the fundamental laws of thermodynamics (Georgescu-Roegen, 2011). The claim is that all economic activities require forms of thermodynamic exchange and therefore each additional unit of GDP requires a minimum throughput of energy and materials, that is, decoupling may have absolute limits. A contrary position claims that GDP is simply a measure of the total value of all produced goods and services rather than physical quantities. That is, an increasing GDP could go hand in hand with reduced energy flows through the economy if each unit of energy used accounts for a higher value (e.g., due to improvements in product quality or a shift from high- to low-energy goods and services).

On empirical grounds, it is frequently stated that decoupling has never been observed in reality, most notably in the strong global correlation between GHG emissions and GDP (T. Jackson, 2009). Actually, some developed countries have recently displayed declining GHG emissions and at the same time continued economic growth, for instance, the EU and the US (Le Quéré et al., 2019).[3] Taking the trade of products into account, however, the picture appears murkier: some claim that emission reductions in industrialized countries have only been achieved by offshoring emissions to other countries (Davis & Caldeira, 2010). Others challenge these findings based on counterfactual trade: whereas US trade indeed seems to have increased emissions in other countries, EU exports have likely avoided more emissions in other countries than the emissions that have been generated to produce EU imports (Jakob & Marschinski, 2013).

Finally, rebound effects are often regarded to set off improvements in technological efficiency (e.g., by means of substitution or increased consumption). Even though this effect has indeed been identified in the academic literature, its size is contested, as it very much depends on level of analysis and technologies considered. For instance, a recent review (Gillingham, Rapson, & Wagner, 2016) finds a central estimate of 30% of efficiency improvements that are offset by rebound effects, such that—at least on average—efficiency improvements do still result in lower net resource use. More importantly, however, is that rebound effects are commonly examined as a reaction to technological efficiency improvements. That is, the discussion focuses on the question of whether technological progress alone is sufficient to achieve environmental goals without the need for environmental policies. This means that stringent regulation, such as quantitative emissions limits under an emission trading system, would need to be in place to avoid rebound effects,.

Hence, the basic point of agreement is that economic structure needs to be changed in a rather fundamental way. To achieve net-zero global emissions required to meet international climate targets, significant technological changes in energy production will be necessary even in an economy of stable or slightly shrinking size.

3.3 | Promoting human needs and reducing growth dependence

Given the adverse effects of economic activity on the climate, continued business-as-usual growth (that is, expanding economic activity without changing its basic structure) will be incompatible with climate change mitigation and indeed long-term economic growth. A similar statement might also be made in reverse: degrowth of the economy, without changing its structure, is in itself an insufficient measure to reduce emissions. For this reason, the central question a sustainability transition perspective needs to address is how fundamental changes to reduce the environmental impact of economic activity can be instigated. This perspective closely mirrors the concept of "a-growth" mandated by van den Bergh (2011), which calls to assess different possible future developments based on their implications for human well-being instead of presuming that those with higher or lower rates of economic growth are per se more desirable.

Yet, the perspective of "a-growth" should not be understood to imply that economic growth is irrelevant. For instance, it has been argued that dependence on economic growth could pose an insurmountable obstacle to the large-scale transformation of the global economy. This position suggests that economic systems are highly dependent on continued economic growth, for example, to silence conflicts over unequal income distribution, to ensure the smooth functioning of labor markets and social security systems, and to allow for maintained public budget deficits (Bailey, 2015). A common criticism emphasizes that measures reducing the rate of economic growth would—even if they were to increase aggregate well-being, for example, by improving the quality of the environment—meet resistance by challenging the perspective that economic growth is not only desirable but also necessary to ensure human well-being (the so-called "growth paradigm"; Schmelzer, 2016).

Hence, continued focus on economic growth as the overarching target of public policy may preclude interventions that are necessary to achieve decoupling. Some degrowth scholars thus argue that reducing growth dependence is an indispensable precondition to initiate the deep political and structural changes required to ensure environmental integrity (van Griethuysen, 2010). An additional argument suggests that in view of the reasonable possibility of future lower rates of economic growth, either due to environmental impacts (Burke, Hsiang, & Miguel, 2015) or to secular stagnation (Gordon, 2016), at least gradually reducing growth dependencies could be regarded as reasonable even by those who advocate economic growth as an important social objective. At the same time, lower rates of economic growth likely increase the pressure to reform economic institutions that depend on economic growth (Büchs & Koch, 2019).

Given the broadly recognized importance of altering economic structures for successful climate change mitigation, the next section addresses points in economic, political, and social systems at which such changes could be put into place.

4 | PREFERRED INTERVENTION POINTS

Interventions to reduce carbon emissions are often framed either in terms of technological options (fuel switches and energy efficiency improvements) or changing patterns of energy consumption (by changes in social norms and behavior).

4.1 | Technological options

A straightforward way to reduce emissions is to decarbonize energy production. This can be achieved through incremental efficiency improvements to existing technologies (e.g., more efficient coal firing), substitution to less carbon-intensive fossil fuels (e.g., from coal to gas) and a substitution toward zero-carbon energy sources (e.g., renewables, carbon capture, and storage) (Figure 2a). These interventions are at the heart of all proposals to address climate change, from neoclassical to degrowth perspectives, as a transition to net-zero emissions is fundamentally required, no matter the level of energy demand.

But while efficiency gains are increasingly promoted (e.g., through the phase-out of inefficient coal plants in China) and renewable energy deployment is rapidly growing, global carbon intensity (emissions per unit of energy) has remained fairly stable in the past decade (R. B. Jackson et al., 2018). It appears that improvements in some countries and sectors have been more than compensated by emissions growth in others. Indeed it is far from clear that renewable energy growth has substituted for fossil fuels, that is, to the extent that fossil fuel use is actively suppressed or infrastructure is retired (York, 2012). Both the use of renewable and fossil energy carriers has been expanding (Global

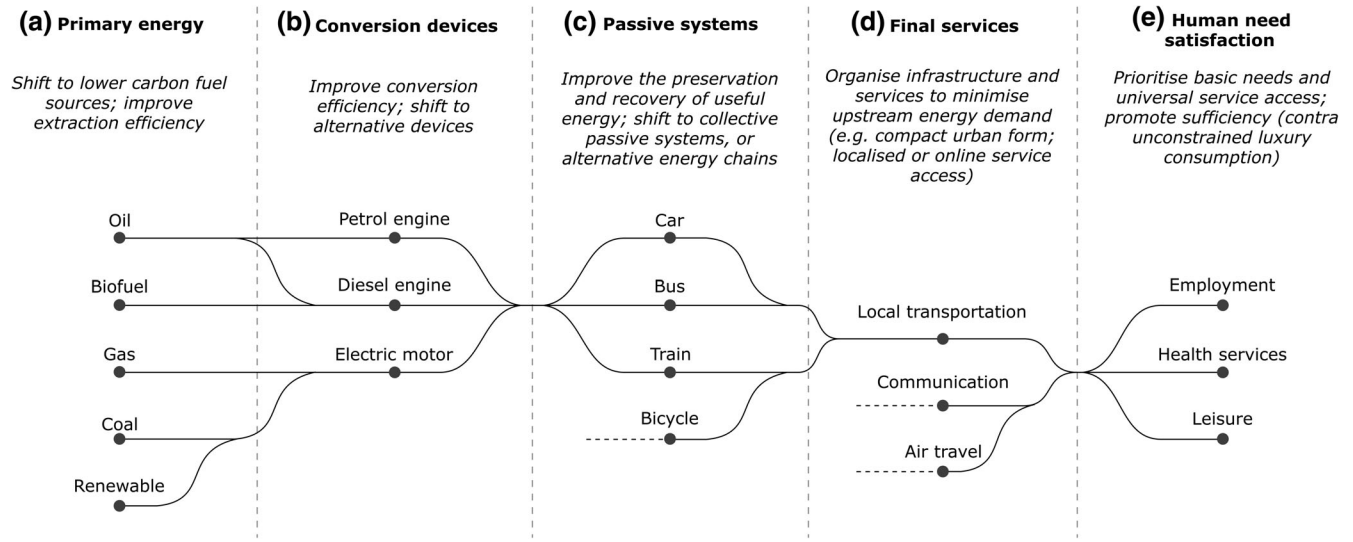

FIGURE 2 Potential interventions along a chain of energy services. Own figure based on Cullen and Allwood (2010). (a) Primary energy, (b) conversion devices, (c) passive systems, (d) final services, and (e) human need and satisfaction

Carbon Budget 2018). It is therefore widely recognized that the current speed of transition towards a low-carbon energy system is insufficient to meet the 2°C climate target (UN Environment, 2018). Hence many authors not only call for addressing supply-side changes, but also espouse an additional focus on changing energy consumption patterns and political change to gain the needed emissions reductions (Anderson, Quéré, & Mclachlan, 2014).

4.2 | Addressing social norms and behavior

Technical improvements to reduce the carbon- and energy-intensity of devices across the spectrum of their use in industry, transport, and other sectors (Figure 2b) are strongly supported by a neoclassical perspective. On the other hand, social scientists and degrowth scholars have often focused on substitutions between energy use devices (or chains of energy conversion), such that the same services or products are delivered with greater efficiency (Figure 2c,d), or through absolute reductions in energy use, that is, by promoting sufficiency and not consuming energy-intensive goods or services (Figure 2e). These latter options are less attractive to neoclassical economists, as they often involve normative choices between different types of consumption (say cycling vs. driving), or reductions in consumption itself (Creutzig et al., 2018).[4]

In recent model studies that examine the prospects for meeting the 1.5°C goal, feasible scenarios either involved very substantial and immediate energy demand reductions or the large-scale deployment of negative emissions technologies in the second half of the 21st century (Grubler et al., 2018; van Vuuren et al., 2018). Studied demand-side interventions include dietary shifts (less meat consumption), less CO_2 intensive transportation modes (modal switch from private vehicles to public transport and active travel), less air travel, lower per-capita floor space (small homes), and less appliance use. These interventions—now apparently entering the mainstream amid highly constrained carbon budgets—have long been the focus of degrowth advocacy and research. Consumer culture, for instance, is a central thread in *Prosperity without growth* (T. Jackson, 2009). There is also much research on sufficiency strategies, starting from the intuition that levels of energy and material use necessary to satisfy basic human needs are finite (Druckman & Jackson, 2010). Of course, if limiting consumption in this manner goes against the grain of modern capitalism, or could de-stabilize economies (as is suggested), then wider systemic change of a social and political nature becomes a precondition for effective climate policy.

4.3 | Changing the rules of the game

Climate and energy policies are known to be highly exposed to resistance from powerful interest groups and lobbies on the one hand, and public acceptability on the other (Lamb & Minx, 2020; Vogt-Schilb & Hallegatte, 2017). Vested

Interests and lobby groups can block reform through a variety of mechanisms (Geels, Sovacool, Schwanen, & Sorrell, 2017). This may arise from the strategic and fiscal significance that energy companies have for many states, who may depend on the international competitiveness of energy-intensive industries to maintain social order. There may be close working relationships between governments and industries—through consultations, revolving doors, or indeed through state-owned enterprises—which effectively pre-determine the scope of legislative possibilities. Direct lobbying via financial contributions to political parties offers another route to political capture that is widely documented (Grossman & Helpman, 1994).

Climate and energy transitions are also likely to face resistance in wider social and cultural settings. Well-established norms around consumption (e.g., private vehicle use, aviation, diets) are often significantly challenged by calls for change. These norms are continuously reinforced through axioms of individual choice and freedom, such that even desired co-benefits (e.g., reduced congestion, air pollution, and health) may be difficult to sell (Mattioli, Roberts, Steinberger, & Brown, 2020). Transitions also face pervasive distributional considerations, with some social groups facing higher burdens than others. Not least, there may be low levels of awareness regarding the existence, severity, and proximity of climate change, fundamentally hampering any social or political desire for change (Capstick, Whitmarsh, Poortinga, Pidgeon, & Upham, 2015).

We expect that a sustainability transition perspective might be able to achieve agreement across a broad range of worldviews on issues such as campaign finance reform to reduce the influence of money in politics, mass awareness campaigns to raise climate change on the social and political agenda, or democratic consultation in the design of policy and the distribution of rents (Edenhofer & Kowarsch, 2015). Such interventions are likely to hold support among most, if not all, researchers in the field. Many also argue against narrowly framed interventions, particularly those targeted at demand-side behaviors, since these may overlook the structural determinants of consumption—reflecting a wider structure-agency debate emerging from the social sciences (Fuchs et al., 2016). This question is also of crucial importance for the question of how to design effective policies, which will be discussed in the next section.

5 | POLICY AND GOVERNANCE PREFERENCES

Debates on how to mitigate climate change often pitch markets and policy instruments (neoclassical perspective) against approaches aiming to change attitudes, consumption patterns, and power structures (degrowth perspective). In this context, the former approaches are usually discussed in a top-down perspective in which the nation-state figures as the central actor, whereas the latter focus more strongly on bottom-up policies targeting individuals, municipalities, or regions.

5.1 | Market-failures and policy instruments

The neoclassical perspective focusses on the concept of internalizing externalities related to climate change mitigation. This conceptualization of climate policy suggests that assuming otherwise perfectly operating markets, implementing a tax at the level of the marginal social costs of the externality—in line with the classical analysis of Pigou (1920)—will lead economic agents to reduce the externality to the socially optimal level. Among economists, the notion that the GHG externality constitutes the perhaps greatest externality the world has ever seen is increasingly gaining acceptance (Stern, 2008). Despite the intense debate on whether carbon taxation or emission trading is the better option to internalize this externality (Goulder & Parry, 2008), broad consensus among climate economists and even beyond about carbon pricing being the most important climate policy instrument prevails (Carbon Pricing Leadership Coalition, 2017; IPCC, 2014). This is due to its feature of incentivizing all available mitigation options in a cost-efficient way by setting harmonized marginal cost of abatement that would ensure the lowest cost options are used. In contrast, all other policy instruments would either only incentivize some subset of available mitigation options, or might trigger implementation of more costly options. It is also widely accepted among environmental economists that additional market failures (e.g., in innovation markets) can justify additional policy instruments such as subsidies for low-carbon technology R&D or deployment (Jaffe, Newell, & Stavins, 2005).

In terms of governance, the central agent in this perspective is the nation state, assumed of being capable of implementing welfare-maximizing policy instruments (Dorsch & Flachsland, 2017). To address international free-riding concerns resulting from the global commons nature of the climate problem, the importance of international agreement

to ensure cooperation is emphasized. The difficulty of overcoming the free-rider effect is reflected in the slow progress of international climate negotiations.

Critiques have pointed out the neoclassical perspective fails to take into account the social conditions necessary for the implementation of its recommendations. This concerns in particular the various constraints central state actors are facing due to opposition by vested interest groups. For instance, Ervine (2018) depicts carbon markets as "expressions of specific power relations rooted in the political economy of advanced capitalism, with low prices ensuring minimal disruption to business as usual". Carbon pricing is also sometimes critically regarded as inhibiting fundamental social and political changes (Gunderson, Stuart, & Petersen, 2018) and crowding out individuals' intrinsic motivation to engage in climate-friendly activities (Jakob, Kübler, Steckel, & van Veldhuizen, 2017).

5.2 | Changing attitudes, consumption patterns, and power structures

The main critique of the view of policy instruments to internalize environmental externalities is that much broader measures are required to tackle the fundamental problems related to climate change mitigation and human well-being. For instance, Jacobs and Mazzucato (2016) have argued that "[p]ublic policies are not 'interventions' in the economy, as if markets existed independently of the public institutions and social and environmental conditions in which they are embedded". At an abstract level and in the long-term, degrowth proponents aim at undermining the legitimacy of the current "rules of the game" (see Section 5.3) through academic and cultural critique, with a view to establishing radical future alternatives with significantly diminished constraints to strong climate policy (Kallis et al., 2018). These include critiques of capitalism and its core drivers of social and environmental crises (domination, profit, and accumulation) (Gunderson et al., 2018). In this regard, policies aiming at altering the dynamics driving GDP growth and GHG emissions are advocated. Salient examples include policies and governance reforms addressing consumerism, inequality, and excessive luxury consumption, campaign finance, and lobbying reform, reductions in work hours, and growth dependencies.

It has been pointed out that welfare states tend to depend on economic growth to finance increasing pension and healthcare spending (Bailey, 2015), especially in countries with an aging population. To avoid contradictions between fiscal and environmental sustainability, modifications to consumption, and work policies within integrated "eco-welfare states" have been proposed (Gough, 2016). From the perspective of sustainable investment, divestment campaigns are considered as a promising means to change financial market outcomes as well as societal norms (Braungardt, van den Bergh, & Dunlop, 2019). Fundamental norm and value changes are suggested as prerequisites for ambitious climate and sustainability policy (Green, 2018). In terms of governance approach, direct democracy approaches are highly valued (Kallis et al., 2018).

A critical perspective of these proposals might point out that their broader adoption will simply take too long to solve the imminent climate problem, even if eventually successful. Also, linking the climate and broader degrowth agendas may intensify opposition to climate policy from more conservative constituencies and intensify political polarization instead of reducing it. Hence, one could argue in favor of policies directly aimed at emission reductions instead of aiming for more fundamental social, institutional, and political changes.

5.3 | Combining top-down and bottom-up approaches

A sustainability transition perspective might reconcile the apparent contradictions between the perspective of addressing market failures by means of policy instruments and the necessity of changing attitudes, consumption patterns, and power structures by explicitly incorporating analyses of political economy (Gillingham & Sweeney, 2012). While the conceptual case for carbon pricing and internalization of externalities is usually not refuted, approaches such as the multi-level perspective (Geels, 2002), public choice (Gawel, Strunz, & Lehmann, 2014), and climate policy sequencing (Meckling, Kelsey, Biber, & Zysman, 2015) emphasize the important role of technology policies, such as subsidies and standards. Unlike carbon pricing, such policies have been successfully implemented almost globally (Biber, Kelsey, & Meckling, 2016; Grubb, Hourcade, & Neuhoff, 2015). Moreover, deep cost reductions in renewables promise to fundamentally alter the political economy of climate policy by eventually making fossil fuel use less competitive, requiring a lower and politically more feasible carbon price to push them out of energy systems (Bertram et al., 2015). Therefore, policy sequencing contributions have suggested to align the degrowth and neoclassical policy

preferences by initiating decarbonization pathways employing technology policies, while gradually phasing out their role over time and phasing in carbon pricing (Meckling et al., 2015). In a similar vein, recent research has highlighted that the optimal strategy to reduce GHG emissions combines policies to address market failures with measures to change social values (Mattauch, Hepburn, & Stern, 2018).

For this reason, proponents of degrowth might be willing to consider carbon pricing more favorably if they regard it from the perspective of a policy that shapes the institutional environment in which markets operate in a way that disallows socializing private costs and privatizing social assets rather than a policy that introduces a market into a further sphere of life. In a similar vein, proponents of neoclassical solutions might be willing to see standards and subsidies in a more favorable light if they take into account that these measures can have important roles in changing the playing field—for example, by helping to overcome non-optimizing behavior by consumers (Carlsson & Johansson-Stenman,-2012) and creating new constituencies in favor of climate policy and transfer compensation to political losers (Meckling et al., 2015).

While in this perspective the central state retains an important role, sub-national jurisdictions such as states and cities are also recognized as important actors, thereby adopting a more polycentric perspective on climate governance (Dorsch & Flachsland, 2017; Ostrom, 2012). Complementing the international negotiations perspective, a literature on transnational climate governance has emerged describing coordination efforts among cities, states, and other stakeholder groups such as business, NGOs, and religious organization (Bulkeley & Newell, 2015). Local communities and individuals are conceived as important actors in pursuing changes in lifestyles, energy, and meat consumption and related norm changes more generally (Creutzig et al., 2016).

6 | CONCLUSIONS: A SUSTAINABILITY TRANSITION PERSPECTIVE

Different attitudes on economic growth and climate policy can be related to different positions on four central issues: the determinants of human well-being, the feasibility, and desirability of economic growth, potential intervention points, as well as governance and policy options. For each of these issues, we have argued that the polar views aligned with neoclassical economics and degrowth, respectively, both neglect important aspects and could thus be enhanced by adopting insights from the opposing position. Based on the potential consensus between conflicting positions that we have outlined at the end of each section, we derive a sustainability transition perspective that could act as a basis for a renewed debate on how to align human well-being with environmental sustainability. This perspective entails the elements discussed below.

First, a sustainability transition perspective needs to acknowledge that the fundamental aim of economic activity should consist of satisfying the needs of the present as well as future generations. Even though a comprehensive and broadly accepted definition of human needs might be elusive, there seems to be a broad consensus on a range of basic human needs, in particular access to basic services and relevant infrastructures, such as energy, mobility, nutrition, and housing. Even though focusing on human needs does not imply that the consumption of luxury goods needs to be actively rationed, an intensive debate would be required to determine which goods constitute luxuries and which basic needs. For instance, one would need to address the question of whether it would be morally justifiable to implement policies that result in stronger reductions in, for example, meat consumption or air travel for poorer people, or if some kind of differentiation in policy design would be required to account for basic needs. In this regard, it is of particular importance to take into account synergies and trade-offs between climate change mitigation and different dimensions of human well-being (e.g., poverty alleviation or economic inequality) and design policies accordingly. The SDGs can be regarded as expressing ethical views on decent living conditions and could hence serve as a guideline for developing universally or at least widely accepted definitions of basic needs.

Second, emission reductions that are in line with international climate targets require fundamental changes in the structure of the global economy, regardless of its size as measured in monetary terms. Decoupling emissions from economic output, that is, shifting down the environmental damage curve in Figure 1, would be necessary even in a shrinking global economy. For this reason, a sustainability transition perspective would adopt an "a-growth" position. This acknowledges that economic growth is not desirable in itself, while at the same time aiming to reduce potential growth dependencies due to social and political institutions (e.g., labor markets, social security, or public finance). Removing such "growth addictions" should have a certain appeal, regardless of whether one finds economic growth desirable or not. Lower—or even negative—rates of economic growth may indeed become a reality in the future, not only because

of environmental damages or stringent environmental policies, but also as a result of the ongoing Covid-19 pandemic and "secular stagnation" related to a slowdown in technological progress.

Third, a sustainability transition perspective needs to acknowledge that it is necessary to harness the full range of mitigation options to arrive at the large-scale social transformation required for ambitious climate change mitigation. The importance of reducing the emission intensity of energy production, for example, by deploying renewable energies, and of reducing energy-intensity by increasing the efficiency of the supply- and demand-side of energy services is widely accepted among all camps. Controversy appears to prevail in attempts to change lifestyle and consumption decisions, but even here the difference may lie in the means to achieve this rather than in the general prospect of changing norms and habits. Addressing consumption patterns and lifestyles in the complex setting of how they affect, and are influenced by, social structures and power relations has implications for policy formulation: fundamental shifts may be required to "change the rules of the game" and the participation of agents of change in the process of policy formulation seems crucial. This concerns strengthening deliberative democracy to ensure that scientific knowledge is appropriately reflected in social decision-making.

Fourth, a sustainability transition perspective must overcome the dichotomy of markets and policy instruments on the one side, and attitudes, consumption patterns, and power structures on the other. Due to the embeddedness of markets and policies in social, institutional, and cultural conditions, an increasing focus should be put on the question of how social change occurs, who the agents of change are and how they contribute to social change. People on different sides of the debate may be able to agree on a portfolio of policies to initiate a transition to a low-carbon energy system, accepting that policies they would not support in isolation may nevertheless prepare the ground for the introduction of their preferred policies at a later stage. For instance, a package of policies combining carbon pricing with interventions to change behaviors might turn out to be acceptable for proponents of the neoclassical as well as the degrowth position. In a similar vein, it is necessary to overcome the dichotomy of top-down versus bottom-up governance approaches. That is, policies need to be designed in a manner that takes into account the interaction between different levels of government, ranging from the international to the national, subnational and local level—ideally in a way that establishes positive feedback loops whereby action on one level make action on another level easier to achieve.

Even though such a sustainability transition perspective might reconcile a number of important differences between different perspectives, important disagreements are likely to persist, perhaps due to fundamental ontological and epistemological differences across scientific fields. Major points of contention include the question of whether our economic system can be fixed through incremental changes, or if non-incremental large-scale change is needed to fundamentally alter the cultural, political, and economic fabric. But even if there remain irreconcilable differences between different ideological positions, one could nevertheless start with advancing measures that would provide a first step to establish the enabling conditions for low-carbon transitions instead of delaying action until all disagreements are resolved. Even if there remain irreconcilable differences between different ideological positions due to different underlying value systems and assumptions, mutual understanding and support between communities is an important pre-condition for effective policy engagement centered on establishing short-term entry points and enabling conditions for a low-carbon transition.

Similar arguments could probably be brought forth for other dimensions of environmental sustainability, such as the depletion of exhaustible resources, soil degradation, air and water pollution as well as loss of biodiversity. This article uses climate change to illustrate the debate on economic growth and the environment because technological solutions (switch to clean energies and increasing energy efficiency) and policy instruments (carbon pricing) to mitigate greenhouse gas emissions are readily available. Assessing how the sustainability transition perspective outlined in this paper can also be applied to other environmental pressures for which either no good substitutes exist (e.g., land use), or policies are hard to design and implement (e.g., biodiversity), might be a promising field for future research.

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CONFLICT OF INTEREST

The authors have declared no conflicts of interest for this article.

AUTHOR CONTRIBUTIONS

Michael Jakob: Conceptualization; investigation. **William Lamb:** Conceptualization; investigation. **Jan Steckel:** Conceptualization; investigation. **Christian Flachsland:** Conceptualization; investigation. **Ottmar Edenhofer:** Conceptualization; investigation.

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ENDNOTES

[1] Even though there is no unique definition of the term "degrowth", the movement is characterized by a critical stance towards capitalism and neoclassical economics. For instance, Kallis et al. (2018) point out: "Scholars and activists mobilize increasingly the term degrowth when producing knowledge critical of the ideology and costs of growth-based development. Degrowth signals a radical political and economic reorganization leading to reduced resource and energy use".

[2] This also means that luxury goods only become desirable if all basic needs are satisfied and that subsistence goods need to be prioritized with regard to the production and distribution of economic output. This may explain why the concept of degrowth appears more popular in high income countries (Weiss & Cattaneo, 2017), whereas in poor countries economic growth is frequently regarded as a prerequisite for social progress. Nevertheless, with the emergence of a "global middle class" emulating energy- and carbon-intensive consumption patterns currently prevailing in industrialized countries, the debate about which types of consumption are necessary and which are luxuries beyond becomes increasingly relevant for low- and middle-income countries as well.

[3] Also, even though GHGs are of a different nature, the success of the Montreal Protocol suggests that some pollutants can successfully be phased out once the appropriate regulation and incentives are in place (Barrett, 2005).

[4] From the perspective of the avoid-shift-improve framework applied by Creutzig et al. (2018), neoclassical economists mainly focus on "improve" and to a lesser extent on "shift", while regarding "avoid" as undesirable.

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