PLOS Sustainability and Transformation

RESEARCH ARTICLE

Translating system-level change to individuals: Experimental evidence on avenues to communicate about degrowth and green growth

Dallas O'Dell[1,2*], **Frédéric Basso**[2*], **Ganga Shreedhar**[2*]

1 Institut de Ciència i Tecnologia Ambientals, Universitat Autònoma de Barcelona, Bellaterra, Spain, **2** Department of Psychological and Behavioural Science, London School of Economics and Political Science, London, United Kingdom

* dallas.odell@uab.cat (DO), f.basso@lse.ac.uk (FB), g.s.shreedhar@lse.ac.uk (GS)

OPEN ACCESS

Citation: O'Dell D, Basso F, Shreedhar G (2026) Translating system-level change to individuals: Experimental evidence on avenues to communicate about degrowth and green growth. PLOS Sustain Transform 5(5): e0000245. https://doi.org/10.1371/journal.pstr.0000245

Editor: Patrick Schroeder, Royal Institute of International Affairs: Chatham House, UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND

Received: March 24, 2025

Accepted: April 20, 2026

Published: May 28, 2026

Peer Review History: PLOS recognizes the benefits of transparency in the peer review process; therefore, we enable the publication of all of the content of peer review and author responses alongside final, published articles. The editorial history of this article is available here: https://doi.org/10.1371/journal.pstr.0000245

Abstract

Degrowth is gaining scholarly attention as a means of transforming affluent societies, by downscaling production and consumption whilst guaranteeing a good life for all within planetary boundaries, through collectively defined self-limitation. However, little empirical research has investigated communication and framing techniques to translate degrowth's system-level focus into individual consumption decisions and self-limitation practices. There is also little critical reflection on the role of the messenger, that is, how commercial versus non-commercial messengers may effectively promote sufficiency or support the degrowth agenda. In two online experiments and subsequent regression analyses, we explored how framing messages around degrowth versus green growth influenced intentions, values, and behaviors to act more sustainably amongst U.K. millennial respondents (N1 = 969, N2 = 933). In Study 1, comparing the effect of sufficiency-promoting marketing (SPM) messages expressing self-orientation without (green growth) or with (degrowth) limits uncovered little difference in consumption attitudes and behaviors between conditions. SPM appeared ineffective at making degrowth values relevant to individuals or promoting widespread self-limitation, making it incompatible with any degrowth agenda. Study 2 tested whether Degrowth- or Green-Growth-framed communications from a non-commercial messenger affected civic-oriented values and policy support for collective limitations. Green Growth framing garnered higher environmental policy support, whilst Degrowth framing increased the likelihood of choosing degrowth or a-growth positions in the growth-versus-environment debate. These findings suggest degrowth framing inspires values whilst green growth spurs policy support. Further, degrowth messaging focused on system-level problems and solutions based on reductions may disengage individuals from mobilizing for societal change. This research exposes the paradoxical nature of sufficiency-promoting marketing. However, it also reveals potentially counterproductive psychological implications of

Data availability statement: All data and programs to run the analyses are available online through OSF. DOI: https://doi.org/10.17605/OSF.IO/QCZSH.

Funding: These studies were funded by The London School of Economics and Political Science. Funding was received from LSE Generate, an internal funding opportunity connecting entrepreneurs and academics (to GS). Additional funding came from the internal research budget of LSE's Psychological and Behavioural Science Department (to DO, FB & GS). Preparation of this manuscript was also supported by the European Research Council's Horizon Europe (ERC-2022-SYG REAL, reference number 101071647 to DO). The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Competing interests: The authors have declared that no competing interests exist.

degrowth messaging that can guide advocates developing communication strategies in non-commercial contexts.

Author summary

Degrowth and green growth present two agendas for transitioning to sustainable consumption and production systems, with diverging perspectives on economic growth, environmental protection, and well-being. Despite mounting academic interest in their implications for production, little research has explored how to relate these agendas, especially degrowth, to people's everyday consumption practices or how to communicate about them. Prior research has explored marketing techniques; wherein commercial entities advocate for reducing consumption by purchasing their products. However, it is critical to test whether commercial or non-commercial messengers may be more effective sources, to avoid the risk of commercial co-optation of degrowth messages. Study 1 tested commercial marketing messages expressing self-orientation without (Green Growth) or with (Degrowth) limits. These messages appeared ineffective at making degrowth values personally relevant or promoting widespread self-limitation. Study 2 tested whether Degrowth- or Green-Growth-framed communications from a non-commercial messenger affected civic-oriented values and policy support. While Degrowth framing did inspire values critical of economic growth, its focus on system-level causes and reduction-oriented solutions may disengage individuals from mobilizing for societal change. Based on our results, we advocate for degrowth communication strategies by non-commercial entities that empower groups or communities, as well as expansive restrictions on advertising.

1. Introduction

Whilst increasingly alarming research indicates that humanity has already breached seven out of nine planetary boundaries [1], some social scientists have emphasized the need for *societal* boundaries to guide socio-ecological transformations by critically evaluating capitalist economic systems [2]. Such boundaries entail collective self-limitations, or a freedom to not consume at the expense of other humans and non-human entities, now or in the future [3]. Transformation thus implies drastic changes to both how and what goods are produced, as well as people's consumption and lifestyles. As there are limits to how much consumption behaviors can change within the confines of capitalism [4], the economic system and business operations must be a key site of transformation.

One way of approaching transformative changes is through the framework of degrowth, which has recently emerged as a critical sustainability paradigm [5]. Here, political and social transformation entails drastically reducing energy and resource demands of the highest emitting countries historically, shifting the emphasis from economic growth to improving quality of life within planetary boundaries [6]. It would

require an equitable and democratic downscaling of production and consumption in affluent nations [7,8]. From an individual's perspective, this may include the need to cut or limit excessive consumption (e.g., purchase fewer goods, reduce meat consumption), as opposed to just consuming 'greener' products and technologies, which has an important impact on business activities [9,10].

Meanwhile, policymakers and businesses alike have tended to focus on green growth, i.e., "greening" economic growth, primarily through technological innovation and market incentives [11,12]. Absolute decoupling, wherein an increase in GDP is associated with a fall in emissions or resource use, would be necessary to achieve sustainable economic growth [13]. However, mounting evidence suggests that decoupling CO2, let alone resource use, from GDP growth is unlikely to occur at the speed or scale needed to avert climate catastrophe [14–16]. Given the material requirements of production, some form of downscaling will be necessary to avoid transgressing all nine planetary boundaries.

The green growth and degrowth paradigms offer different routes to address climate change through production and consumption systems. Degrowth focuses on building independence from economic growth especially within production systems [8], offering a "less is more" approach of enhanced well-being through limits to economic growth [7,17]. These limits can be self-imposed both individually (e.g., as consumer) and democratically (e.g., as citizen) in rich countries [2,3,18]. In contrast, green growth focuses on making growth cleaner and more efficient, allowing for a "win-win" approach whereby well-being is increased without limits to economic growth [12]. There is growing interest in how to translate these system-level paradigms into frames of communication that can persuade people to undertake more sustainable consumption [19,20].

Extant literature lacks adequate evidence to understand how these divergent paradigms relate to individuals' consumption decisions or daily practices [9,21]. Past studies in this area largely involve self-reported support and perceptions of certain phrases or concepts, rather than how these concepts may influence people's intentions and behaviors to consume more sustainably [22–24]. There is little empirical evidence on how degrowth or green growth relates to individual level constructs or practices [25,26], or how limits in consumption and policy manifest at the individual level [3].

This article examines whether green growth or degrowth framing affects an individual's intentions, values, and behaviors to act more sustainably. Specifically, we sought to test whether these abstract, system-level paradigms could be translated in meaningful ways that influence concrete consumer- or civic-oriented decisions in line with each paradigm's objectives, without explicit reference to these terms. In Study 1, we applied tools from sufficiency-promoting marketing (SPM) [27], as marketing typically targets the individual level. SPM literature has linked directly to degrowth in justifying its focus on consumption reduction [28]. As both environmental paradigms emphasize personal benefits in terms of well-being but strongly differ regarding the limits to growth, we structured their opposition as promoting sustainability through self-orientation within limits (Degrowth) or without limits (Green Growth). In Study 2, we focused on framing the two paradigms more directly within a citizenship context using a non-commercial messenger, exploring people's engagement with collective self-limitations at micro and macro levels. Our experimental studies were conducted in the United Kingdom.

This article contributes to academic literature in four main ways. First, we contribute to the literature on degrowth and sustainability transformations by translating degrowth and green growth paradigms into consumer-relevant messages. We tested whether framing these opposing sustainability agendas around self-orientation within and without limits disparately influenced attitudes and intentions toward consumption. Second, we contribute to the literature on SPM by critically reflecting upon the paradox of using marketing to promote a degrowth agenda. We empirically amplified this critique by using the same experimental methodology as prior studies that assert its potential. Third, we contribute to business research on degrowth by exploring whether brands can influence consumer's decisions in line with degrowth to assess the possibility of corporate co-optation [29,30]. Finally, we contribute to the environmental psychology and communications literature by examining effects across both commercial (consumer) and non-commercial (citizen) decision settings [31,32]. Comparing these contexts helps to assess whether private or public sector institutions are the best messengers to communicate about degrowth. We present the first empirical evidence suggesting that people's tendency to perceive the nuances between green growth and degrowth might depend on the decision context.

2. Literature review & hypotheses

2.1. Implications of degrowth and green growth for consumer behavior

Although there is growing consensus that some adjustments must be made to the way affluent societies consume and produce to avoid further environmental damage [33], proposed solutions vary substantially [34]. Despite some overlaps in recognizing common sources of environmental harm and the need for renewable energy [17], the degrowth and green growth agendas take opposing positions regarding economic growth and environmental sustainability. Table 1 provides an overview of the distinctions between the two paradigms, including behavioral implications.

Green growth rests on the fundamental assumption that economic growth and environmental preservation are compatible, upholding economic growth as a main policy objective [17]. Economic prosperity and environmental protection are both core values [17], which can be preserved through decoupling. Policy proposals include, e.g., an expansion of renewable energy capabilities, individual adoption of renewable and efficient products, and subsidies for research and innovation of efficiency-improving technologies [15,35,48–50].

Meanwhile, degrowth scholars assert that infinite growth is incompatible with planetary boundaries and environmental preservation [5,14]. Its core values include protecting the environment, social equity, and human well-being [17]. Mitigation is achieved through an equitable downscaling of consumption and production of the most environmentally harmful industries, whilst shifting toward public provisioning to satisfy needs [6,8,51]. Policy proposals include, e.g., work-time reductions, universal basic services, and restricting certain types of advertising [20,52–54].

Table 1 also provides some unique implications that degrowth and green growth have on an individual's behaviors and lifestyles choices. Green growth preserves growth as a societal goal, which can only continue if consumption levels do not decrease [55]. For individuals, it implies an expansion of 'green' consumerism, increasing access to sustainable alternatives while maintaining self-interested motives and status quo in purchasing volumes [17,56]. As green growth is a capitalist paradigm, it perpetuates the individualistic, entrepreneurial, and free-market values that dominate current economic logic [57]. Meanwhile, in light of the systems-thinking approach [58], a degrowth economy epitomizes a radical change of the values, goals, and worldviews that underpin the system of institutions in developing climate solutions [59]. For instance, degrowth emphasizes values like (social and climate) justice, inspiring redistributive policies, and sufficiency, rather than just those promoting efficiency. Its central goals are to reduce human environmental impacts, redistribute wealth, and develop a community-oriented society [17,52]. Although degrowth conveys a strong other-oriented dimension, this environmental paradigm also encompasses a self-oriented element. For individuals, it implies consumption to satisfy needs, not wants or desires [60] and self-limitations that can enhance well-being [3,10]. It further implies an altered relationship with time and a slower pace of life, spending fewer hours in paid work and more time in care and community work, whilst deriving meaning outside of consumption [Despite their oppositions, there are some overlapping views within the two agendas with regard to human causes of climate change, the goal of environmental preservation, and adoption of certain technologies (see Table 1), which become especially relevant when considering behavioral implications. For example, wasting less food could reduce demand (i.e., degrowth) and increase resource efficiency (i.e., green growth). Similarly, spending more time in a park could heighten one's desire to protect nature (both agendas) whilst additionally improving well-being (degrowth). Of course, certain behaviors may be more or less compatible with each agenda, as spending time in nature departs further from market activities, in line with degrowth, than food waste behaviors.]. In short, green growth would imply business as usual with direct substitutions for most consumption practices to maintain limitless self-orientation, while degrowth would mean fundamentally new ways of consuming and living that involve limits. We address the dearth of work exploring these individual level implications, especially with respect to degrowth, empirically.

A concept related to degrowth is sufficiency, i.e., restricting consumption within planetary boundaries whilst ensuring minimum levels of social protection are met for a good quality of life for all [10,61]. While sufficiency research has incorporated psychology and behavioral science [62,63], as well as business research [64,65], these individual-level insights have less commonly been applied to degrowth given its focus on production [23,66,67]. We target this gap in degrowth

Table 1. An Overview of the Distinctions between Green Growth and Degrowth.

	Green Growth	Degrowth
Fundamental assumptions & main mechanisms for mitigation	• Economic growth and environmental sustainability are compatible through decoupling resource use and GDP growth [17]	• Continuous economic growth is incompatible with planetary boundaries, necessitating an equitable downscaling of production and consumption (e.g., in the most harmful industries) in the Global North [17]
Implications for behaviors and lifestyles	• Mass adoption of energy efficient consumer products and technologies (e.g., electric vehicles, smart meters or appliances), retrofitting and insulating homes • Green *consumerism* (i.e., continued expansion of green products consumed) for economic growth [35] • Supporting green finance with sustainable investing [36] • Purchasing carbon offsets for high-carbon activities, e.g., flying • Maintaining status quo where possible	• Where necessary, adopting energy efficient consumer products and technologies (e.g., electric vehicles), retrofitting and insulating homes • Reducing excess and wasteful consumption (higher income groups) • Altering our relationship with time, choosing tasks that are slower and more deliberate (e.g., cooking, growing food, reading) • Less time in paid work, more time for care work, community-oriented activities [37], donating time (e.g., time banks), and green *citizenship* • Expanded access to "commons"[1] and publicly funded programs to meet basic needs (e.g., healthcare, basic income, housing, transportation, community grown food etc.) • Using community currencies instead of private banking • Walking and cycling over car use (enabled through infrastructure) • Slow and more local leisure travel, e.g., via trains instead of flights
Criticisms	• The evidence of absolute decoupling on a global scale is lacking, especially in the necessary timescale [13,14] • Efficiency gains in energy production, needed for decoupling, often lead to rebound effects of increasing overall consumption [38,39] • Deployment of negative emissions technologies, and inadequate material use reduction threaten other environmental constraints [14] • Maintains unequal balance of energy use and resources between Global North and the Global South [6]	• Fails to capture the qualitative aspects of economic growth [40] • GDP is positively correlated with many positive outcomes related to progress [41,42] • Growth needed in countries of the Global South to reduce global poverty means net global growth is likely [43] • Degrowth as a word and idea is unpalatable among the general public, who will lack political will to support it [23,44] • Support for degrowth amongst policymakers is highly infeasible [45] • It will be more pragmatic to be agnostic to growth (i.e., "a-growth") than explicitly call for downscaling of the economy [45]

Note: Where an explicit reference is not included in the section on implications for behaviors and lifestyles, the degrowth ideas are broadly inspired by Kallis et al. [46], and the green growth ideas were inspired by OECD reports on behavioral insights [47].

[1] Commons can be defined as "living systems through which groups of people manage and share resources," which can take the form of, e.g., urban spaces, knowledge, and digital tools (46 p17).

https://doi.org/10.1371/journal.pstr.0000245.t001

literature related to empirical psychological and behavioral research by focusing on individual-level consumption and citizenship decisions [68].

The link with sufficiency helps to differentiate between degrowth as a form of self-limitation and green growth, which does not entail such limitations. Production and therefore consumption are bounded under degrowth, bringing resource use within planetary boundaries to achieve global equality whilst improving personal well-being in the Global North [69–71]. It is therefore possible to view degrowth as a form of self-orientation within limits [3], relating to topics like voluntary simplicity [72–74]. This contrasts with the conception of green growth, which is typically championed for achieving capitalist aims of economic growth, and therefore unquestionably enhancing well-being, whilst improving environmental sustainability [75]. However, this so-called 'win-win' solution ultimately allows production and consumption to continue with unlimited expansion [17,56]. On the individual level, green growth represents a form of self-orientation without limits or sacrifice, to achieve well-being and sustainability aims by preserving one's lifestyle. We utilize these distinctions to expand research on self-oriented appeals for promoting sustainable consumption [76–78].

2.2. Reducing consumption via marketing and framing

Marketing scholars have suggested that businesses bear responsibility to quell rampant consumerism as profit-seeking business models have stimulated excessive consumption levels in affluent societies, especially through marketing

[27,79,80]. Mainstream consumer marketing has historically avoided consumption reduction, as traditional marketing theory is almost entirely focused on increasing consumption and product sales [81]. As such, marketing's overarching objective is to stimulate consumer demand, and thereby economic growth [80,82]. However, some scholars suggest that we must move beyond growth imperatives to tackle the social and ecological crises of our time [72]. Marketing presented an important intervention point for our research agenda, as a direct source of communication and influence on consumption.

The recent idea that commercial marketing can promote sufficiency via SPM draws on ideas from other marketing sub-disciplines. Green demarketing (GD) is a brand strategy that incorporates environmental appeals to encourage a reduction in consumption at the category level by promoting purchasing from the given brand [83]. For example, Patagonia's 'Don't Buy This Jacket' ad urges consumers to buy fewer jackets given the durability of their offerings, but does not necessarily make broader claims to reduce overall consumption levels. SPM also draws on social marketing, which applies commercial marketing techniques to pursue social goals, e.g., smoking cessation [81].

SPM is regarded as distinct in its focus on voluntary behavior change through consumption reduction and moderation (i.e., with limits) [27,84]. However, we consider studies on social marketing and especially green demarketing equally relevant, given the shared goal of reducing some form of consumption, and the prevalence of research in this area. GD has produced more positive brand attitudes than standard green messaging for luxury products [85]. Institutional appeals highlighting brand identity or position were more effective than focusing on specific products [86]. GD was also shown to enhance a firm's perceived trustworthiness, market orientation, and environmental concern, which can influence behavior change among consumers [87]. While past work on GD and SPM have focused on brand attitudes and purchase intentions, behavioral measures related to brand perceptions have been lacking [84].

More critical reflections suggest that there are notable limitations in using marketing to achieve consumption reduction, let alone degrowth, within the dominant extant political and economic paradigm. Marketing focuses on the stimulation of demand, so consumers may perceive that it has one main purpose – to persuade more purchasing [27,88]. It is a discipline created to maintain and support a growth-centric economic paradigm. Any form of marketing, even social marketing to promote a societal good, will use tactics that "sell" and reinforce dominant political and economic agendas, including individualization of climate solutions and growth-based objectives [89]. If any marketing technique is only as sustainable as the economic model it upholds, it is not a tool for transforming that economic model. Accordingly, SPM is likely to provoke some sort of pro-consumption orientation, obscuring the intended goal of the message [90].

To communicate a message effectively, it is important to activate frames or schemas consistent with the intended message [91]. Environmental communications often activate unsuitable frames (e.g., market fundamentalism), or are missing appropriate frames (e.g., of humans as part of nature), leading to inaction or counterproductive responses [91]. As marketing is a profit-oriented activity aimed at ever-growing consumption levels, a marketing message activates a well-engrained schema of consumption in the mind, signifying the roles of the brand as seller and the viewer as buyer. Therefore, sufficiency-promoting marketing activities could backfire, given the inherent contradiction between the mental schema (more consumption) and ultimate goal (limited or less consumption). It is unclear whether brands are the appropriate senders to communicate the intended behavior of reduced consumption to individuals to achieve sufficiency or degrowth [79], or whether co-optation for profit accumulation is more likely.

Corner and Randall [89] suggested the use of deep framing as an alternative strategy to social marketing in their critique of the discipline. Instead of surface level shifts, deep framing connects communication strategies to a set of deeper values and principles [89,91]. The importance of values has been showcased in the literature on system change, to implement interventions at a deep level [58,59,92]. However, as we have highlighted, marketing's origins and profit-motives fundamentally align with growth-oriented values and principles, not values like sufficiency or self-limitation that align with degrowth. Without changing business models [64] or brand positioning toward luxury, lower volume sales, it would appear challenging to achieve deep framing in line with the degrowth (versus green growth) paradigm via sufficiency-promoting

marketing appeals alone. Marketing's preoccupation with increasing consumption and sales may further block these deeper connections in individuals' minds [93].

2.3. Consumer and citizen mindsets and behavior

Given the potential limitations of using marketing to communicate about sufficiency and degrowth [89], there is also a need to incorporate strategic communications outside of the product marketing setting [9,30]. Non-commercial settings and messengers may be especially important as degrowth seeks to transform existing institutions, and to allow for the use of "deeper" framing techniques [58,89]. To do so, we aimed to characterize the sustainability agendas more directly. In Study 2, we made the goals and values of each paradigm explicit and tested their influence on people's decisions in terms of collective self-limitation. As Kallis (3 p117) argues, self-limitation articulates individual and collective dimensions: "Living within limits then is not an individual endeavor but a collective project. Personal action is necessary, because unless we want something and can demonstrate that it works, we will not organize to get it—but organize to get it we must."

This required not only shifting the context and outcomes to civic duties in the public sphere, but also investigating the role of individuals as citizens, instead of merely focusing on consumer identity. Citizens act out of altruistic motivations, whereas consumers act based on individualistic concerns from economic incentives [94]. While humans occupy both roles [31], and consumers can engage in citizenship practices [79], most literature on sustainable consumption communication is focused on the role of consumers. Not enough research explores how citizens make decisions about consumption or institutional changes [32,92,95].

Prior literature indicates that heightening individuals' citizenship-orientation may be compatible with more radical and democratic transformations such as degrowth. Capitalist economies, which reinforce the consumer role, often have embedded policies and institutions that resist societal change [94]. Instead, a strong sense of citizenship, collective action, and focus on common good must be cultivated to solve environmental crises [94]. Compared to green consumerism, green citizenship appears more consistent with consumption reduction, and those identifying as green citizens may accept more radical and less consumer-oriented approaches to environmental stewardship [96,97]. Making citizen identity salient can also lead to a more public-oriented response, while priming consumer identity may lead to more private and individual considerations [98]. Framing aimed at citizens could therefore be more persuasive for civic duties and could even enhance openness to consumption reduction, self-limitation, and degrowth policies. In our second study, we consider how targeting citizenship may be a bridge between strictly individual or system-level frames for communicating about degrowth [72].

2.4. Preliminary study

Given the novelty of our research concepts, we conducted a pre-registered preliminary study before collecting Study 1 data, with most of the same materials and measures, a smaller sample size (N = 502), and non-directional hypotheses to avoid employing questionable research practices [99]. This preliminary study returned mostly insignificant differences between Green Growth and Degrowth conditions. All details of this study, including methodology, results and discussion, have been included in the S1 Appendix.

2.5. Study 1 hypotheses

Study 1 was conducted as a replication with a larger participant pool to test the findings of our preliminary study. The first two outcome measures related to the brand, i.e., purchase intentions and willingness to donate additional time (WDT), were chosen to understand the consumer decision to purchase products as well as consumer engagement with the brand to co-create value, whereby active consumer engagement with brands has been used to link the marketing context to pro-environmental consumption [100] and degrowth-oriented businesses and values [101,102]. Brand co-creation integrates citizen-oriented practices such as political influence on brands, the market, and consumption patterns more

generally [101,103]. These two brand-oriented outcomes incorporate both consumer-oriented (purchase intentions) and citizen-oriented (WDT) components. By ending the study with an optional task, participants could devote more time to the study without being paid more. WDT therefore allowed us to capture the alternative relationship with time characterized by degrowth - e.g., related to time-banks and work-time reductions to provide more time for environmental stewardship - as compared to green growth. We also included intention to consume less (i.e., interest in sufficiency-oriented lifestyles) and support for degrowth to broaden the scope of SPM research beyond marketing objectives, connecting directly to the degrowth agenda and citizen-oriented practices.

As noted, Green Growth represented the individual-level construct of self-orientation without limits, where sustainability goals are not prioritized over economic and other individualized objectives [17,57]. Meanwhile, Degrowth represented the construct of self-orientation within limits, in line with sufficiency [3,10]. Using the directional trends from our preliminary study, when contrasting green growth and degrowth, we pre-registered the following confirmatory hypotheses for Study 1:

H1a. Purchase intentions will differ across the three conditions (Control, Green Growth, or Degrowth), such that the Degrowth condition will be significantly associated with lower purchase intentions.

H1b. Willingness to donate time will differ across the three conditions (Control, Green Growth, or Degrowth), such that the Degrowth condition will be significantly associated with higher willingness to donate time.

Given that evaluations of and responses to our constructs could be subject to people's values [90,100], we also pre-registered the following hypotheses (based on the exploratory moderation analyses from our preliminary study, see S3 Appendix):

H2a. Green consumption values will moderate the effect of the condition on purchase intentions, such that stronger green consumption values will result in reduced purchase intentions after viewing the Degrowth ad (compared to the Green Growth and Control conditions), but weaker green consumption values will result in greater purchase intentions following the Degrowth ad (compared to the Green Growth and Control conditions).

H2b. Green consumption values will moderate the effect of the condition on willingness to donate time, such that stronger green consumption values will result in enhanced willingness after viewing the Degrowth ad (compared to the Green Growth and Control conditions), but weaker green consumption values will result in reduced willingness following the Degrowth ad (compared to the Green Growth and Control conditions).

Our pre-registered hypotheses and results related to the political ideology moderation are included in the S11 Appendix. We finally included hypotheses related to the intention to reduce consumption and support for degrowth as exploratory due to the lack of any significant differences in our preliminary study.

2.6. Study 2 hypotheses

Given the non-commercial context of Study 2, we chose citizen-oriented outcome variables. Carbon footprint calculators have been used previously to measure consequential pro-environmental behavior of individuals [104]. There is some debate over the merits of carbon footprints, citing their creation by the fossil fuel industry to individualize mitigation efforts [105]. Nevertheless, they offer a useful metric in the context of degrowth for determining inequities in emissions by group, such as socio-economic status or country-level differences [106]. Testing engagement with the calculator also provided a mechanism for testing interest in self-limitation, i.e., learning about one's impact as a means of setting potential consumption limits.

In addition to lifestyle choices and levels of material impact that differ under degrowth and green growth, the policy agendas needed to support such transitions also diverge, especially when considering the extent to which they uphold current systems. Unlike green growth, living degrowth includes civic engagement such as rethinking society, acting political, and creating alternatives, which all point toward transformational policy ideas [107]. Therefore, we also asked participants to rate their acceptance of various environmental policies, encompassing proposals from both green growth and degrowth. These policies represented concrete collective and civic-oriented practices for setting limits by removing

structural barriers [3], in particular for the degrowth policies (e.g., limiting wealth, work time, and advertising). The engagement with carbon footprint calculation and policy acceptance (overall, green growth, and degrowth) were pre-registered as our main pro-environmental outcomes.

It was unclear a priori how the differences between the green growth and degrowth agendas may influence these outcome variables. For example, degrowth framing may make people more concerned about their carbon footprint to democratically set limits and decide about their fair share in terms of planetary boundaries [2,3]. However, green growth may be more persuasive about taking personal action and responsibility given its appeal to the predominant economic values and paradigm [17]. While the effect of Green Growth and Degrowth conditions was unclear based on literature, we reasoned that it was more likely to see any differences outside of the commercial marketing context when adopting citizen framing [97]. Accordingly, we pre-registered the following:

H1. Pro-environmental outcomes will differ across the environmental framing treatments.

H2. Pro-environmental outcomes will be higher under the citizen framing compared to the consumer framing.

We also pre-registered an interaction effect between our two experimental manipulations. Based on past literature and our first studies, the degrowth narrative appears to be confusing in a market-oriented context [30,91]. The lack of congruence between message and setting may make it difficult for people to understand the real purpose of the message and the implied behavioral response. However, because degrowth implies more citizen-oriented behaviors (e.g., engaging in cooperatives, care work) as opposed to market-based behaviors (e.g., buying green products) [72], there appears a natural congruence between degrowth framing and citizenship orientation. Green growth and the consumer mindset also appear congruent, focusing on market-based solutions and individual purchasing. Previous research suggests that emphasizing the role of consumers in a citizen-oriented policy setting reduced participants' willingness to pay for environmental policies [98], supporting the importance of message congruence. Accordingly, we hypothesized the following:

H3a. There will be an interaction effect between mindset framing (Citizen v. Consumer) and environmental framing (Green Growth v. Degrowth) for *carbon footprint engagement*, i.e., congruence between the frames (Degrowth + Citizen, Green Growth + Consumer) will result in higher levels of engagement as compared to the noncongruent conditions (Degrowth + Consumer, Green Growth + Citizen).

H3b. There will be an interaction effect between mindset framing (Citizen v. Consumer) and environmental framing (Green Growth v. Degrowth) for *overall policy support*, i.e., congruence between the frames (Degrowth + Citizen, Green Growth + Consumer) will result in higher levels of engagement as compared to the noncongruent conditions (Degrowth + Consumer, Green Growth + Citizen).

H3c. There will be an interaction effect between mindset framing (Citizen v. Consumer) and environmental framing (Green Growth v. Degrowth) for *green growth policy support*, i.e., congruence between the frames (Degrowth + Citizen, Green Growth + Consumer) will result in higher levels of engagement as compared to the noncongruent conditions (Degrowth + Consumer, Green Growth + Citizen).

H3d. There will be an interaction effect between mindset framing (Citizen v. Consumer) and environmental framing (Green Growth v. Degrowth) for *degrowth policy support*, i.e., congruence between the frames (Degrowth + Citizen, Green Growth + Consumer) will result in higher levels of engagement as compared to the noncongruent conditions (Degrowth + Consumer, Green Growth + Citizen).

We pre-registered some exploratory analyses, most notably using position choice from Lehmann et al. [108] and Drews et al. [109]. This measure provides respondents with four statements about the growth-vs-environment debate, which implicitly represent positions ranging from 'growth at all costs' to 'degrowth,' with 'green growth' followed by 'a-growth' as intermediate positions. In our experimental context, we tested whether our framing conditions influenced participants' views and values related to growth and the environment at the national policy level to determine whether or not collective limits should be set on affluent countries' economic and environmental priorities [108].

Complementing concrete micro-level action (carbon footprint calculator) and meso-level collective engagement (policy preferences), position choice allowed us to explore countries' abstract, macro-level policy agendas to determine the level of engagement for which these communications were most persuasive. Positions ranged from pure self-orientation and limits denial (i.e., growth at all costs) to democratically deciding on limits (i.e., degrowth). We explored the following:

EH4a. Participant's position choice (i.e., implicit preference for growth at all costs, green growth, a-growth, or degrowth) will significantly differ, such that the Degrowth framing will be associated with less growth-oriented positions (degrowth and a-growth) than the Green Growth framing.

EH4b. Participant's position choice (i.e., implicit preference for growth at all costs, green growth, a-growth, or degrowth) will significantly differ, such that Citizenship framing will be associated with less growth-oriented positions (e.g., degrowth and a-growth) than the Consumer framing.

3. Methods

In Study 1, we partnered with a sustainable toiletries startup to design social media marketing messages about the individual benefits of personal care products, promoting the idea of limits (versus no limits). As individual level constructs, green growth represented a form of self-orientation without limits, whilst degrowth represented a form of self-orientation within limits.

Study 2 incorporated a non-commercial messenger telling participants that a group of U.K. nonprofits were promoting a (hypothetical) carbon footprint app encouraging sustainable lifestyle choices. We attempted to further disentangle the influence of market-orientation by including an additional experimental manipulation – consumer versus citizen positioning of the app. We sought to establish whether the non-commercial, citizenship context and greater salience of a citizen mindset might be more compatible with the concept of limits, both personally and in terms of public policy. All studies were pre-registered using OSF [Click here for Study 0 pre-registration; Click here for Study 1 pre-registration; Click here for Study 2 pre-registration.] and received ethical approval prior to data collection.

3.1. Methods: study 1

Study 1 was designed as an online between-participants experiment, testing the effect of environmental frames within the context of a mock Instagram ad, via Qualtrics. Participants were randomly assigned to receive one out of three possible conditions – Control, Green Growth, or Degrowth.

3.1.1. Study 1 sample. The sample was drawn from Prolific Academic. Participants were required to: i) reside in the United Kingdom; ii) use social media (Instagram) at least once per month; iii) speak English fluently; and iv) be 25–40 (i.e., a millennial born approximately 1981 – 1996). Our choice of U.K. millennial Instagram users was driven by the brand's target market and social media branding strategy, i.e., identifying the most likely consumers for both luxury and sustainable bath and beauty products, to make our study as realistic as possible. We designed Instagram stories given their popular usage in marketing and our ability to screen for participants' Instagram usage on Prolific Academic. As U.K. based researchers, we also had the most familiarity with branding in this context.

The planned sample from Prolific was 1,100 participants (550 men and 550 women). See S7 Appendix for power analysis justifying sample size. Data was collected separately for men and women to ensure gender balance. N = 1,240 participants accessed the survey, N = 136 did not consent to take the survey, an additional N = 5 were excluded for failing to pass the seriousness check. N = 125 participants failed the attention check, and another N = 5 participant were missing Prolific IDs. The remaining sample consisted of N = 969 participants. Of those 969, only N = 920 reported income and N = 847 reported political ideology, as they were given the option to refrain from answering these questions based on pilot study feedback. Thus, we only have covariate data for N = 816 participants, which makes the main effects analysis with covariates slightly under powered to determine a small effect size. We have included versions with multiple imputation (see S13 Appendix) to utilize the full N = 969 for the analyses with covariates.

The three conditions did not differ significantly with respect to race, χ^2 (8) = 8.37, p = .398, age, F(2) = 0.18, p = .835, gender, χ^2 (6) = 6.05, p = .418, income, F(2) = 0.87, p = .420, education, χ^2 (8) = 6.76, p = .563, or social media frequency, χ^2 (10) = 11.95, p = .288. The characteristics of the final sample are included in S1 Table.

3.1.2. Study 1 material. The experimental stimuli for the Green Growth and Degrowth conditions consisted of mock Instagram Story imprints where participants had to click through three separate pages promoting the brand [The company was pre-launch when we began working with them, and because they never ended up launching, we consider it highly unlikely that participants would have heard of them before.]. See Fig 1A–Fig 1F for the experimental stimuli. We designed the ads to be brand-oriented as opposed to product-specific, drawing on the green demarketing literature [86]. The Green Growth frame utilized the 'win-win' concept [75], i.e., self-orientation of one's desires without limiting consumption choices. The Degrowth frame focused on a 'less is more' approach of living well by consuming less [69], i.e., self-orientation of enhanced well-being through consumption limitations. Please refer to our preliminary study in the S1 Appendix for further details on constructing these stimuli in light of the constructs of self-orientation within and without limits. Finally, the Control condition included an introduction to the company but no ad, instead of the Neutral Green ad condition included in our preliminary study (see S1 Appendix). As the Neutral Green condition contained alternative framings that did not sufficiently act as a strict control, we excluded any ads from our control in Study 1 to test the baseline effect of showing any ad related to the brand.

3.1.3. Study 1 procedure. After entering and consenting to the survey, participants were randomly allocated into one of the three conditions. All participants received the same background on the company, their offerings, and the fact that 1 shampoo bar = 2 shampoo bottles [All participants were provided this introductory text: "Its product line includes solid toiletries, such as shampoo and conditioner bars, among other products. One standard sized bar provides as many uses as two 250ml plastic bottles (i.e., 1 shampoo bar = 2 shampoo bottles)."], which was mainly meant to legitimate the claims about reducing consumption in the Degrowth condition. After viewing all three imprints (if applicable), they responded to the manipulation check, outcome measures, personal characteristics, demographics, and finally the optional willingness to donate time measure, all discussed in the following section. The average duration was around 6 minutes and 35 seconds.

3.1.4. Study 1 measures. Table 2 displays all dependent variables, covariates, and check variables included in Study 1. Further details on all measures [Where multi-item scales are used, the order of statements was randomized.] used can be found in the S6 Appendix. Unless otherwise specified, items were assessed using a 7-point Likert Scale. Participants were excluded if they did not pass the attention or seriousness checks.

3.2. Method: Ad Hoc manipulation check (Study 1)

To ensure our Green Growth and Degrowth ads were indeed conveying unique constructs, we conducted a follow-up study with new manipulation checks. A set of new participants were randomly shown one of the three ads from our preliminary study (i.e., including the Neutral Green ad to compare all possible ad iterations) and asked to rate their perceptions of how the brand intended to influence purchasing behavior. The first question asked participants their agreement with the following statement: "[The brand's] ad encourages consumers to buy:" which respondents rated on a scale from 1 ("Fewer bath products from their platform") to 11 ("More bath products from their platform"). The second question asked participants their agreement with the following statement: "[The brand's] ad encourages consumers to buy or consume:" which respondents rated on a scale from 1 ("Less in general") to 11 ("More in general"). These questions were adapted Reich & Armstrong Soule's [86] product- and institutional-level ads, respectively. They were intended to check perceptions of the brand's intended message on wider spread consumption reduction lifestyles.

The final sample consisted of N = 338 participants from the United Kingdom, using the same exclusion criteria as Study 1. This sample size is consistent with a power analysis to detect a medium effect, using an F-test (ANOVA: Fixed effects, omnibus, one-way, effect size f = 0.25, alpha = 0.05, Power = 0.95, Number of groups = 3), which suggested a minimum sample size of N = 252.

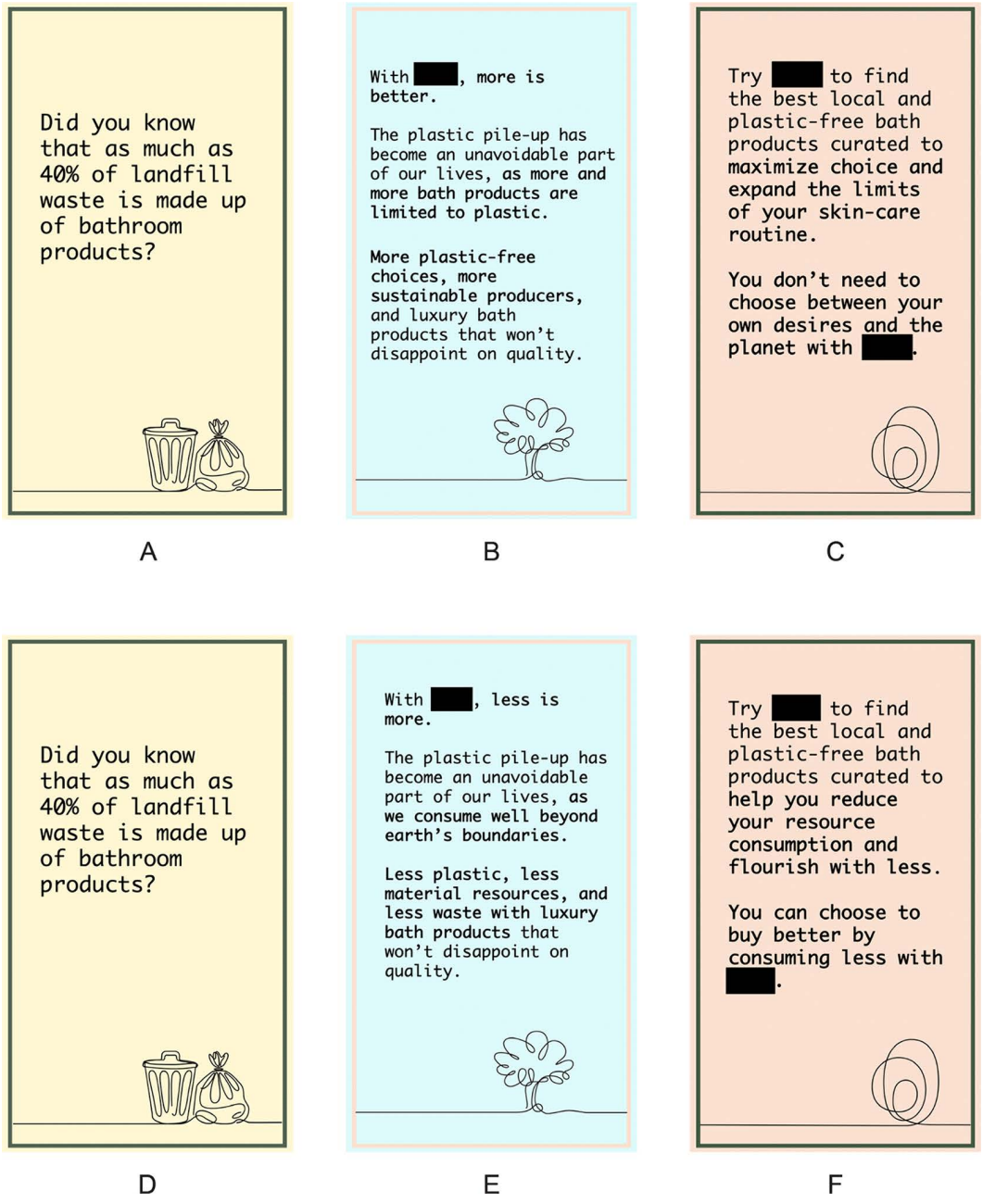

Fig 1. Experimental Stimuli of Marketing Messages. Fig 1A, Fig 1B, and Fig 1C comprise the Green Growth condition stimuli. Fig 1D, Fig 1E, and Fig 1F comprise the Degrowth condition stimuli, each mimicking an Instagram story imprint. Participants saw one image at a time and had to click "Next" before seeing the subsequent image. The company name has been redacted. Participants were randomly assigned to one of these conditions or the Control condition, which included only descriptive text about the company. Note that the designs on each image have been modified slightly from the original shown to participants to adhere to PLOS's CC (BY) licensing restrictions.

https://doi.org/10.1371/journal.pstr.0000245.g001

3.3. Methods: study 2

As the shallow framing of our marketing stimuli appeared insufficient in enabling consumers to differentiate between green growth and degrowth, we pursued a deep framing strategy in Study 2 [58,89] in a citizen-oriented context. Accordingly,

Table 2. Study 1 measures.

Category	Variable	Description	Source
Dependent Variables	Self-reported purchase intentions	4-item scale, e.g., "I would be likely to purchase [the company]'s products."	[110,111]
	Willingness to donate extra time to the brand	Agree to answer extra questions to help the brand	[112]
	The self-reported intention to reduce consumption	3-item scale, e.g., "I plan to reduce the amount of goods and/or resources I consume."	[113]
	Behavioral support for degrowth	Whether or not participant clicked link to a petition urging the UK government to embrace degrowth	
Covariates	Green consumption values	6-item scale, e.g., "It is important to me that the products I use do not harm the environment."	[114]
	Political ideology	0 (left) to 10 (right) scale	[115]
	Perception of brand ethicality	3-item scale, e.g., "I think [the brand] respects ethical standards."	[116,117]
	Consumer skepticism to green advertising	4-item scale, e.g., "I do not believe most environmental claims made in advertising "	[118]
	Socio-demographics	Age, gender, race/ethnicity, income, and education	
	Social media frequency of usage	"On average, how often do you visit Instagram?"	[119]
Check Variables	Manipulation check	"In this ad, what was [the company]'s main message?" Control: "I did not view an ad;" GG: "More sustainable options are better;" DG: "Less is more"	
	Attention check	See S6 Appendix	[120]
	Seriousness check	How seriously participants took the survey - see S6 Appendix	[121]

https://doi.org/10.1371/journal.pstr.0000245.t002

we focused on the substance of the two sustainability agendas, detailing their objectives, communicating underlying values, and explicitly addressing the growth-vs-environment debate. We also incorporated deeper outcomes, including policy support and growth-related values, to connect to the idea of limits explored in Study 1 at a more structural level [2,3,9,122,123]. Citizenship involves decision-making for collective good over self-orientation [94]. The idea of self-limitations may be more consistent with citizenship mindsets and practices, as it must be "a universal, political ambition to change the structures that prevent people from living within limits" (3 p102).

Ultimately, we conducted Study 2 to gauge if the distinction between green growth and degrowth was more evident when participants were being persuaded toward civic responsibilities by a non-commercial messenger. We sought to explore if citizenship-orientation may be a means of connecting individual-level actions to system-level agendas [9], making degrowth and its related voluntary and planetary limits more relevant to everyday practices. We also endeavored to understand whether the persuasive communication techniques employed in sufficiency promoting marketing could i) be utilized by a non-profit actor and ii) would influence civic behaviors as opposed to purchasing behaviors. Our experiment utilized a 2 (Degrowth v. Green Growth) x 2 (Citizen v. Consumer) between-subjects design. This additional factor was meant to manipulate the salience of the roles that individuals play in society, i.e., shifting their mindset between a consumer-oriented one and a citizen-oriented one, as an individual-level construct following Pepermans & Rousseau [98].

3.3.1. Study 2 sample. We again used Prolific Academic to recruit our sample. Participants were required to meet most of the same inclusion criteria as Studies 1, though Instagram usage was no longer relevant. We tested the survey in a pilot study (N = 19), and then shortened the survey to reduce respondent burden and cost. We again released the main study in two waves by gender.

The planned sample from Prolific was 1,000 participants (500 men and 500 women). See S7 Appendix for power analysis justifying the sample size. N = 1,122 participants accessed the survey, but N = 100 did not consent to take the survey. N = 43 did not complete the survey, whilst an additional N = 15 failed to pass the seriousness check. N = 52 participants failed the attention check. The remaining sample consisted of N = 933 participants. Of those 933, only N = 889 reported their income and N = 845 reported their political ideology, making up a total of N = 811 participants for covariate analyses [This also accounts for two individuals who reported ages of 3 and 8, which we assume to be errors, given that you must

be 18 to have a Prolific account. While we kept the participants in the sample, we set the ages to missing.]. This makes the logistic analyses with covariates slightly under the required power level. We have included additional versions of covariate analyses with multiple imputations of these variables (see S18 Appendix). [N = 2 observations are also missing for position choice in Study 2, but we did not use multiple imputation on this outcome measure.]

For demographics, the four conditions did not differ significantly with respect to race, χ^2 (12) = 9.74, p = .639, age, F(3) = 0.38, p = .767, gender, χ^2 (6) = 2.88, p = .823, income, F(3) = 0.34, p = .798, education, χ^2 (12) = 14.18, p = .289. The characteristics of the final sample are described in S2 Table.

3.3.2. Study 2 material. The experimental material comprises four conditions of persuasive communications, each consisting of three pages of descriptive text. The first page introduced the climate crisis and suggests the main cause of the problem, framed either for green growth ("people") or degrowth ("the system"). The second page offered solutions to the climate crisis, again framed either for green growth ("decoupling") or degrowth ("downscaling"). The stimuli followed a problem, cause, solution format [115,124]. These first two pages did not vary by mindset framing. The third page varied by both environmental and mindset framing, comprising four versions. Addressing individuals as either consumers or citizens, it also included further framing suggesting either degrowth or green growth inspired goals for reducing their impact. See S1 File for the experimental stimuli.

3.3.3. Study 2 procedure. After entering and consenting to the survey, participants were randomly allocated into one of the four conditions. After reading all three pages of text, they were prompted with manipulation checks, followed by outcome measures, personal characteristics, and demographics. The average duration was just over 9 minutes.

3.3.4. Study 2 measures. See Table 3 for a list of all measures included in Study 2. See S14 Appendix for further details on all new measures.

Table 3. Study 2 measures.

Category	Variable	Description	Source
Dependent Variables	Engagement with the carbon footprint calculator	Engagement was measured as opting in to take part in and completing 11 questions related to transportation, food, home energy, and consumer goods. See SI for details.	Proprietary methodology from a carbon impact software company
	Environmental policy acceptance	See Table 4	
	Position choice	"Public policy in rich industrialized countries should… " Four response options implicitly represented growth at all costs, green growth, a-growth and degrowth. See SI for details.	[108]
Covariates	Perceived status	MacArthur scale of subjective social status (i.e., the ladder)	[125]
	Utopian impulse	12-item scale, e.g., "One of the most important driving forces in my life is to develop ideas that could contribute to a better world in which nothing is missing for all human beings."	[126]
	Message credibility	"How well do you think each of the following words describes the text you read at the start of this survey? 1. Accurate 2. Trustworthy 3. Believable"	[127,128]
	Green consumption values	Same as Study 1	
	Political ideology	Same as Study 1	
	Socio-demographics	Same as Study 1	
Check Variables	Mindset framing check	What was the app called? ("Green Consumer" v. "Green Citizen")	
	Environmental framing check	"In the text, what was the main cause of the problem? ("people's behavior" v. "the system")	
	Attention Check	Same as Study 1	
	Seriousness Check	Same as Study 1	

https://doi.org/10.1371/journal.pstr.0000245.t003

The selected environmental policies included five popular policies often associated with each of the degrowth and green growth agendas (see Table 4). Responses ranged on a 7-point Likert scale, from "Not at all acceptable" to "Very acceptable" [129]. Scores were averaged to obtain an overall policy acceptance measure with all 10 policies, as well as degrowth and green growth subscales.

Additional covariates included perceived status, as Degrowth has been criticized on the left for its politics of 'less' that is considered out of touch with workers and lower status groups [136,137]. We also included utopian impulse, as individual propensity to utopian thinking and action can influence the extent to which an individual is open to the degrowth agenda [126]. Given the non-commercial messenger, message credibility replaced brand ethicality.

4. Results

Table 5 summarizes the differences between the two studies and the results in each. The following sections outline the results of each study in more detail.

4.1. Results: Study 1

4.1.1. Manipulation check and reliability of scales. In the Control condition, 94% of respondents chose the correct manipulation check option about not viewing an ad. 99% in the Green Growth and 98% in the Degrowth condition chose correctly. The Cronbach's alpha for green consumption values (α = 0.90), ethicality (α = 0.89), and skepticism (α = 0.83) were highly reliable in our sample. The two dependent variables using scales, purchase intentions (α = 0.88) and intention to consume less (α = 0.90) also exhibited very high reliability.

4.1.2. Main effects. See S9 Appendix for results on normality checks. For the results that follow, covariate analyses are mostly robust to multiple imputations for missing values, included in S13 Appendix. [In nearly all instances, the coefficients of our main independent variables exhibited either the same or a higher level of significance compared to the results without multiple imputation. In only one instance, for the moderation with the green scale included in **S13 Appendix**, the DG x Green Scale coefficient went from a 5% to 10% significance level.]

S10 Appendix shows the comparison of all three conditions, while Table 6 directly compares Degrowth and Green Growth. In S10 Appendix, the Green Growth (β = 0.45, $p < .001$) and Degrowth (β = 0.46, $p < .001$) conditions were associated with significantly greater purchase intentions compared to the Control condition at the 1% significance level, which

Table 4. Environmental Policies Included for Policy Acceptance Measure.

Degrowth Policies M = 5.08 SD = 1.03 α = 0.66	1. Reduction in the work week to a 4-day maximum
	2. An income tax of 100% above a certain threshold of excessive earnings
	3. Ban on new fossil fuel plants and rapid phase out of existing fossil fuel uses
	4. Restricting advertising of emissions-related products, e.g., fossil fuels, flights, etc.
	5. Universal basic income, e.g., all citizens receive unconditional earnings outside of employment
Green Growth Policies M = 5.74 SD = 0.86 α = 0.81	6. Pricing CO2 emissions through taxes and carbon trading
	7. Mandatory eco-labelling, and phasing out of less efficient technologies
	8. Subsidies to firms toward research and innovation of more efficient technologies
	9. Subsidies for green consumer technologies (e.g., electric cars)
	10. Rapid expansion of renewable energy capacities

Note: Policies 1–5 are degrowth policy proposals, while 6–10 are green growth proposals. All participants received all 10, in a randomized order. These policies were adapted from the literature on degrowth-related policies [6,52–54,130–134] as well as literature on green growth-related policies [49,50,135]. Mean (M), standard deviation (SD) and Cronbach's alpha (α) are included for each sub-group of policies. When combining all 10 policies, M = 5.4, SD = 0.85, and α = 0.82.

https://doi.org/10.1371/journal.pstr.0000245.t004

Table 5. Summary of Studies - Differences and Results.

Components	Study 1	Study 2
Context	Commercial marketing	Non-commercial advocacy
Experimental setting	Instagram ads for bath and beauty company	App for sustainable lifestyle choices
Messenger	For-profit brand	Non-profits
Objectives	To test how green growth and degrowth messages influence consumer and citizen decisions in a commercial setting	To test how green growth and degrowth messages (interacting with a consumer vs. citizen factor) influence citizen decisions in a non-commercial setting
Relation to limitations	Within experimental conditions: Testing self-orientation within (Degrowth) and without (Green Growth) limits	Through outcome variables: Support for/intention toward self-limitations at micro and macro level
Conditions	1-factor: - Green Growth (GG) vs. Degrowth (DG) vs. Strict control (C)	2-factors: - Green Growth (GG) vs. Degrowth (DG) - Consumer vs. Citizen
Outcomes	Individual-level intentions and behaviors, related to consumer and civic-oriented practices	Civic-oriented practices for setting limits at individual and structural levels
Summary of results (hypotheses)	- Lower purchase intentions under C than DG or GG (H1a) - Significant interaction effect - purchase intentions higher under DG when green consumption values are higher (H2a) - Marginally higher intentions to reduce consumption under DG than GG or C (exploratory)	- Higher overall policy acceptance under GG than DG (H1) - Significant interaction effect - consumer framing associated with higher policy acceptance under GG (H3b) - More growth-critical position choices under DG than GG (EH4a)

https://doi.org/10.1371/journal.pstr.0000245.t005

remains after including covariates. In Table 6, the Degrowth ad was associated with slightly higher purchase intentions than the Green Growth ad, but the difference is not statistically significant, with or without covariates. Counter to H1a, these results suggest that after including an ad in the condition, there is no incremental difference between the two ads on purchase intentions.

For the linear regression with willingness to donate time, there is no statistically significant difference between any conditions, shown in S10 Appendix and Table 6**.**

Because of the nonparametric distribution for willingness to donate time, we again employed a binary logit regression. See S10 Appendix for these results, as well as exploratory results of the logit regression on support for degrowth. The direction of the logit analysis of WDT is consistent with the linear model, but counter to H1b.

For non-parametric robustness checks of our linear main effects models, see S12 Appendix. While the results for purchase intentions appear robust, the results for intentions to consume less are less consistent.

4.1.3. Moderation analysis. For the analysis with green consumption values as a moderator, S10 Appendix shows the comparison of all three conditions, while Table 7 directly compares degrowth and green growth. For purchase intentions shown in S10 Appendix, there was a statistically significant difference between the Green Growth and Control conditions on the interaction term ($\beta_{GG} = .43$, $p < .001$; $\beta_{GGxgreen} = .20$, $p = .007$) at the 1% level. There was also a statistically significant interaction when comparing the Degrowth and Control conditions ($\beta_{DG} = -.45$, $p < .001$; $\beta_{DGxgreen} = 0.38$, $p < .001$) at the 1% level of significance. Both effects maintain significance with covariates ($\beta_{GG} = .22$, $p = .003$; $\beta_{GGxgreen} = .182$, $p = .020$; $\beta_{DG} = .22$, $p = .003$; $\beta_{DGxgreen} = .36$, $p < .001$).

There was also a significant interaction when comparing the two ad conditions ($\beta_{DG} = .03$, $p = .703$; $\beta_{DGxgreen} = .18$, $p = .039$) in Table 7, at the 5% level, which remains with covariates ($\beta_{DG} = -.004$, $p = .947$; $\beta_{DGxgreen} = .18$, $p = .038$). Fig 2 shows that for below average green consumption values, the Green Growth condition was associated with higher purchase intentions than the Degrowth condition. Above the average, the trend is reversed. These results directly oppose H2a and exploratory results from Study 1, instead suggesting that among green consumers, the Degrowth condition persuades consumption more than the Green Growth or Control conditions.

For the moderation analysis including willingness to donate time as the dependent variable, there were no significant interaction effects across the three conditions, shown in Table 3 and S10 Appendix.

Table 6. Main Effects Results (OLS), Green Growth & Degrowth Only - Study 1.

	(1)	(2)	(3)	(4)	(5)	(6)
	Purchase Intentions	Purchase Intentions	Willingness to Donate Time	Willingness to Donate Time	Intention to Consume Less	Intention to Consume Less
Degrowth	0.01	0.00	-0.25	-0.32	0.14*	0.13*
	(0.08)	(0.07)	(0.23)	(0.25)	(0.08)	(0.07)
Skepticism		0.00		0.05		-0.01
		(0.03)		(0.12)		(0.04)
Brand Ethicality		0.43***		0.13		0.17***
		(0.05)		(0.17)		(0.05)
Green Scale		0.48***		0.42***		0.66***
		(0.05)		(0.15)		(0.04)
Political Ideology		-0.01		0.09		-0.00
		(0.02)		(0.06)		(0.02)
Age		0.02**		0.09***		0.01
		(0.01)		(0.03)		(0.01)
Income		-0.00		-0.00**		-0.00
		(0.00)		(0.00)		(0.00)
Education						
High school diploma		-0.25*		0.02		0.15
		(0.13)		(0.51)		(0.13)
Some undergraduate		-0.59***		-0.11		-0.06
		(0.16)		(0.59)		(0.16)
Bachelor's degree		-0.45***		-0.13		-0.06
		(0.12)		(0.48)		(0.13)
Post-graduate degree		-0.20		-0.21		0.12
		(0.12)		(0.52)		(0.14)
Gender						
Male		-0.02		-0.39		-0.26***
		(0.07)		(0.26)		(0.07)
Prefer not to say		-2.11***		-5.77***		-1.16***
		(0.14)		(0.50)		(0.12)
Constant	4.83***	-0.19	5.41***	0.13	5.39***	1.00*
	(0.06)	(0.48)	(0.16)	(1.79)	(0.06)	(0.51)
Observations	647	546	647	546	647	546
R-squared	0.00	0.42	0.00	0.06	0.00	0.47

Note: Coefficients are displayed, with robust standard errors below in parentheses. Columns (1), (3), and (5) display regression results without covariates, columns (2), (4) and (6) display the results including covariates. The dependent variable is listed at the top of the column. This table only includes results for comparing the Green Growth and Degrowth conditions, as the Control condition has been excluded from the analyses. The Green Growth condition is the omitted category for condition. For education, GCSE is the omitted category. For gender, Female is the omitted category. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

https://doi.org/10.1371/journal.pstr.0000245.t006

4.2. Manipulation check following study 1

In response to the question about buying from their platform, respondents perceived marginally significant differences across the conditions, $F(2, 335) = 2.43$, $p = .089$, at the 10% level. Tukey's HSD test for multiple comparisons suggested that the Green Growth ($M = 9.12$, $SD = 2.14$) and Degrowth ($M = 8.45$, $SD = 2.96$) conditions did not differ significantly

Table 7. Green Consumption Values Moderation, Green Growth & Degrowth Only - Study 1.

	(1)	(2)	(3)	(4)
VARIABLES	**Purchase Intentions**	**Purchase Intentions**	**Willingness to Donate Time**	**Willingness to Donate Time**
Degrowth	0.03	-0.00	-0.23	-0.32
	(0.07)	(0.07)	(0.23)	(0.25)
Green Scale (Standardized)	0.45***	0.39***	0.32*	0.38**
	(0.06)	(0.06)	(0.17)	(0.19)
DG x Green Scale	0.18**	0.18**	0.21	0.05
	(0.08)	(0.09)	(0.25)	(0.28)
Skepticism		0.00		0.05
		(0.03)		(0.12)
Brand Ethicality		0.43***		0.13
		(0.05)		(0.17)
Political Ideology		-0.01		0.09
		(0.02)		(0.06)
Age		0.02**		0.09***
		(0.01)		(0.03)
Income		-0.00		-0.00**
		(0.00)		(0.00)
Education				
High school diploma		-0.25**		0.02
		(0.12)		(0.51)
Some undergraduate		-0.58***		-0.11
		(0.16)		(0.59)
Bachelor's degree		-0.44***		-0.12
		(0.12)		(0.48)
Post-graduate degree		-0.18		-0.20
		(0.12)		(0.52)
Gender				
Male		-0.01		-0.39
		(0.07)		(0.26)
Prefer not to say		-2.03***		-5.75***
		(0.14)		(0.51)
Constant	4.81***	2.24***	5.40***	2.20
	(0.05)	(0.46)	(0.16)	(1.71)
Observations	647	546	647	546
R-squared	0.26	0.43	0.02	0.06

Note: This table contains the results of moderation analyses where condition is the independent variable and green consumption values is the moderator. Columns (1) and (3) display regression results without covariates, columns (2) and (4) display the results including covariates. The dependent variable is listed at the top of the column. This table only includes results for comparing the Green Growth and Degrowth conditions, as the Control condition has been removed. The Green Growth condition is the omitted category for condition. For education, GCSE is the omitted category. For gender, Female is the omitted category. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

https://doi.org/10.1371/journal.pstr.0000245.t007

($p=.124$, 95% CI = [-1.48, 0.13]). Meanwhile, the question about purchasing more or less in general revealed a significant difference between groups, $F(2, 335) = 6.05$, $p=.003$, at the 1% level. Tukey's HSD test for multiple comparisons indicated that the difference between the Green Growth ($M=5.05$, $SD=2.91$) versus Degrowth ($M=3.87$, $SD=2.69$) conditions was significant at the 1% level ($p=.006$, 95% CI = [-2.09, -0.28]).

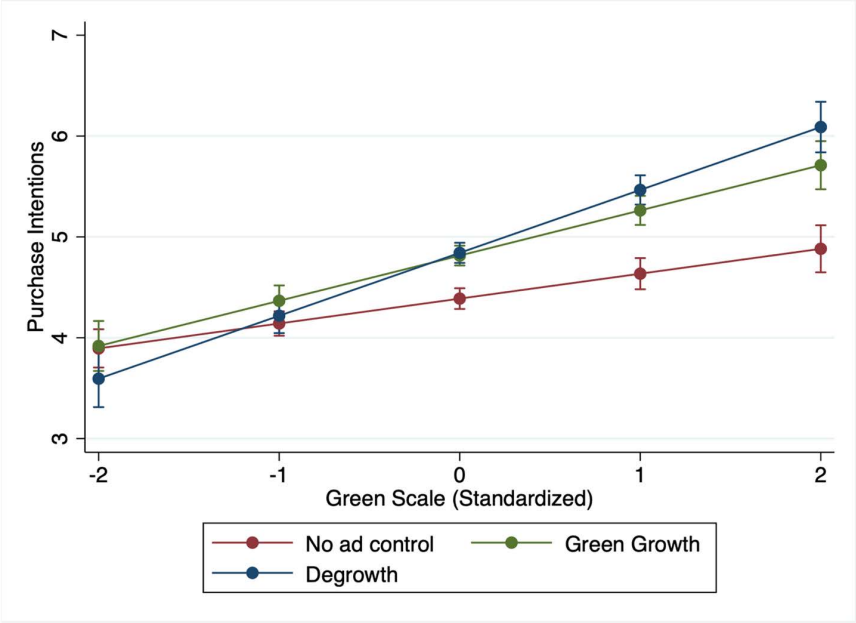

Fig 2. Green Scale Moderation – Marginal Effects Plot (Purchase Intentions) – Study 1 Note: This chart displays the predicted values of purchase intentions from the moderation analysis involving condition as the independent variable, purchase intentions as the dependent variable, and green consumption values as the moderator. The chart plots these predicted values over a range of -2 to +2 standard deviations from the mean green consumption values score, which has been standardized. Each line represents a corresponding condition, and the brackets around each point on the line indicate the 95% confidence interval of the predicted value.

https://doi.org/10.1371/journal.pstr.0000245.g002

Taken together, these results suggest that although the Degrowth framing may not be significantly more compelling for promoting lower purchasing from the brand specifically, there is evidence that respondents perceived the Degrowth ad as promoting reduced consumption of other brands and goods in general compared to the Green Growth ad.

4.3. Results: study 2

4.3.1. Manipulation check and reliability of scales. S3 Table shows the rate that participants passed the manipulation checks for each condition. The covariate scales of green consumption values (α = 0.89), utopian impulse (α = .91), and message credibility (α = 0.90) were highly reliable in our sample. The overall policy acceptance (α = .82) and green growth policies (α = 0.81) also exhibited good reliability, and the degrowth policies (α = 0.66) exhibited fair reliability.

4.3.2. Main effects. See the S15 Appendix for normality checks. Given mixed evidence regarding normality, we have included both linear and non-parametric analyses for the policy outcome variables. In the results that follow, all covariate analyses are robust to multiple imputations for missing values, included in the S18 Appendix.

The results of linear regressions for the policy outcome variables are displayed in Table 8. For the overall policy acceptance, Degrowth framing was associated with a marginally lower average acceptance for all environmental policies than the Green Growth condition, significant at the 10% level (β = -.10, p = .074). This significance disappears when including covariates. The mindset framing variable was never significant. These regression results lend weak support to H1; meanwhile, no evidence supports H2.

See **Supporting Information** S17 Appendix for non-parametric robustness checks, which confirm support for H1. Main effects results for the overall policy support variable exhibited a lower p-value than in the OLS model, suggesting the Green Growth condition garnered greater overall policy support than the Degrowth condition at the 5% significance level.

We used binary logit analyses to determine any significant differences across treatment groups for the carbon footprint outcome as shown in S16 Appendix. Though the majority completed the questionnaire (N = 704, i.e., 75.5% of the

Table 8. Main Effects Results (OLS) – Study.

	(1)	(2)	(3)	(4)	(5)	(6)
	Overall Policy Acceptance	Overall Policy Acceptance	Degrowth Policy Acceptance	Degrowth Policy Acceptance	Green Growth Policy Acceptance	Green Growth Policy Acceptance
Degrowth	-0.10*	-0.04	-0.11	-0.03	-0.09	-0.04
	(0.06)	(0.05)	(0.07)	(0.06)	(0.06)	(0.05)
Citizen	-0.04	-0.01	-0.04	0.02	-0.05	-0.04
	(0.06)	(0.05)	(0.07)	(0.06)	(0.06)	(0.05)
Message Credibility		0.15***		0.12***		0.18***
		(0.03)		(0.04)		(0.03)
Utopian Impulse		0.28***		0.30***		0.26***
		(0.04)		(0.05)		(0.05)
Perceived Status		-0.00		-0.01		-0.00
		(0.01)		(0.02)		(0.02)
Green Scale		0.16***		0.16***		0.15***
		(0.04)		(0.04)		(0.04)
Political Identity		-0.10***		-0.14***		-0.06***
		(0.01)		(0.02)		(0.01)
Age		0.00		-0.00		0.00
		(0.00)		(0.01)		(0.01)
Income		-0.00*		-0.00***		0.00
		(0.00)		(0.00)		(0.00)
Education						
High school diploma		0.08		-0.01		0.18*
		(0.10)		(0.13)		(0.10)
Some undergraduate		0.12		-0.02		0.27**
		(0.12)		(0.16)		(0.12)
Bachelor's degree		0.23**		0.13		0.33***
		(0.09)		(0.12)		(0.09)
Post-graduate degree		0.31***		0.20		0.43***
		(0.10)		(0.13)		(0.09)
Gender						
Male		0.13***		0.15**		0.12**
		(0.04)		(0.06)		(0.05)
Prefer not to say		0.64***		0.93***		0.35***
		(0.08)		(0.10)		(0.08)
Constant	5.48***	2.74***	5.16***	2.84***	5.81***	2.64***
	(0.05)	(0.31)	(0.06)	(0.39)	(0.05)	(0.33)
Observations	933	811	933	811	933	811
R-squared	0.00	0.43	0.00	0.35	0.00	0.38

Note: Coefficients are displayed, with robust standard errors below in parentheses. Columns (1), (3), and (5) display regression results without co-variates, columns (2), (4) and (6) display the results including covariates. The dependent variable is listed at the top of the column. The Green Growth condition is the omitted reference category for environmental framing, while the Consumer condition is the omitted category for mindset framing. For education, GCSE is the omitted category. For gender, Female is the omitted category. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

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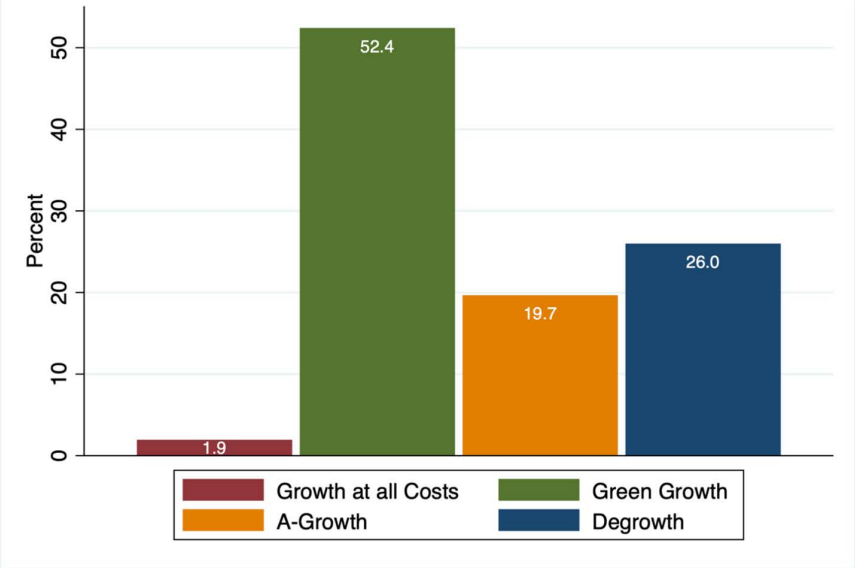

Fig 3. Support for Each Position Choice. Note: Each bar represents a position in the growth-vs-environment debate, that is to what extent public policy in rich industrialized countries should pursue economic growth versus environmental protection, adapted from Lehmann et al. (2022). 'Growth at all costs' represents the response that public policy should "further pursue economic growth in spite of its environmental impacts;" 'Green Growth' represents the response of "further pursue economic growth. There are many ways to make economic growth compatible with environmental sustainability;" 'A-Growth' represents the response of "ignore economic growth as a policy aim, that is, be completely neutral about growth. This will amplify the policy spectrum to combine well-being and environmental sustainability goals;" and 'Degrowth' represents the response of "stop pursuing economic growth. Production and consumption need to be downscaled in an equitable way to achieve environmental sustainability".

https://doi.org/10.1371/journal.pstr.0000245.g003

sample), there were no significant differences between conditions, before or after including covariates. These findings lend no further support to either H1 or H2.

For position choice, green growth was most popular, with 52% selecting this position across conditions. The second most popular was degrowth at 26%. Fig 3 shows the breakdowns across conditions. See S1 Fig for charts by condition. Ordinal logit regression results for position choice are shown in Table 9. The Degrowth condition increased the probability of selecting the a-growth and degrowth statements and decreased the probability of selecting the growth at all costs and green growth statements, compared to the Green Growth condition. The odds ratio is 1.75, significant at the 1% level ($p < .001$), which remains significant (OR = 2.00, $p < .001$) with covariates. Both results meet the Bonferroni adjustment criterion of.01 (i.e., 0.05/ 5 total exploratory hypotheses during pre-registration), providing evidence in favor of EH4a. There were no significant differences in position choice when comparing the Citizen and Consumer conditions in either model shown in Table 9.

4.3.3. Interaction effects. In investigating interaction effects between the environmental and mindset framing, we hypothesized a congruence effect, suggesting a better fit between the Degrowth and Citizen manipulations, as well as the Green Growth and Consumer manipulations, respectively.

There were no significant interaction effects for the overall or green growth policy acceptance variables (see S16 Appendix). For degrowth policies, there were significant main effects of environmental framing at the 5% level (β = -.24, $p = .017$) and mindset framing at the 10% level (β = -.16, $p = .087$), and an interaction effect at the 10% level (β = 0.25, $p = .061$). Fig 4 shows that when paired with the Consumer framing, acceptance of degrowth policies was higher under the Green Growth framing ($M = 5.22$) than the Degrowth framing ($M = 4.98$). The results did not hold when covariates were

Table 9. Main Effects Results (Ordinal Logit) – Study 2.

	(1)	(2)
VARIABLES	**Position Choice**	**Position Choice**
Degrowth	1.75***	2.00***
	(0.22)	(0.28)
Citizen	1.20	1.20
	(0.15)	(0.17)
Message Credibility		1.01
		(0.08)
Utopian Impulse		1.15
		(0.13)
Perceived Status		1.03
		(0.05)
Green Scale		1.43***
		(0.15)
Political Identity		0.84***
		(0.03)
Age		1.00
		(0.02)
Income		1.00
		(0.00)
Education		
High school diploma		1.56
		(0.50)
Some undergraduate		1.23
		(0.44)
Bachelor's degree		0.89
		(0.27)
Post-graduate degree		0.97
		(0.31)
Gender		
Male		0.80
		(0.11)
Cut 1	0.03***	0.12**
	(0.01)	(0.12)
Cut 2	1.74***	12.09***
	(0.20)	(11.47)
Cut 3	4.22***	33.24***
	(0.53)	(31.66)
Observations	931	809

Note: Odds ratios are displayed, with robust standard errors below in parentheses. Analyses use an ordinal logit model given the categorical outcome of position choice on the growth-vs-environment debate. Column (1) displays regression results without covariates, column (2) displays the results including covariates. The Green Growth condition is the omitted reference category for environmental framing, while the Consumer condition is the omitted category for mindset framing. For education, GCSE is the omitted category. For gender, Female is the omitted category. Coefficients for participants who chose "Prefer not to say" for gender (N = 2) were hidden from the table in column (2) as they resulted in an extremely large odds ratio (109,175.38***) given the small sample size. Cut points 1 – 3 display the thresholds for interpreting a latent continuous variable Y*, for example, in column (1), $Y_i = 1$ if $Y^*_i \leq 0.03$, $Y_i = 2$ if $0.03 \leq Y^*_i < 1.74$, $Y_i = 3$ if $1.74 \leq Y^*_i \leq 4.22$, and $Y_i = 4$ if $Y^*_i \geq 4.22$. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

https://doi.org/10.1371/journal.pstr.0000245.t009

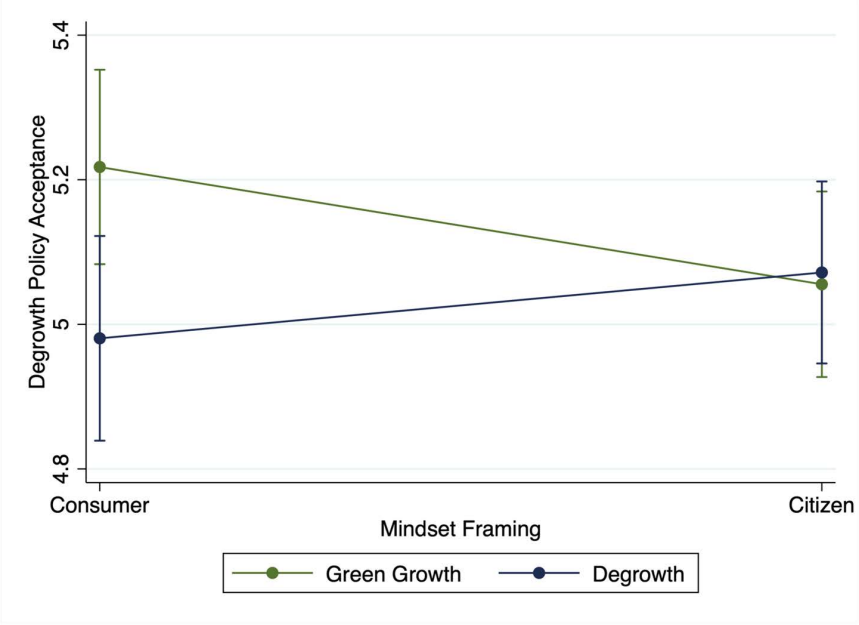

Fig 4. Interaction between Environmental & Mindset Framing on Degrowth Policy Acceptance. Note: This chart displays the predicted values of degrowth policy acceptance from the analysis interacting environmental framing and mindset framing, shown in S16 Appendix. The chart plots these predicted values for each of the four conditions. The brackets around each point on the line indicate the 95% confidence interval of the predicted value.

https://doi.org/10.1371/journal.pstr.0000245.g004

included. These results offer some significant evidence related to H3d, however, while there appears to be a congruence effect for the Green Growth + Consumer condition, it is not evident for the Degrowth + Citizen condition.

For the carbon footprint variable, we used a logit regression with an interaction term, as suggested in Berry et al. (2010). However, in S16 Appendix we did not find any significant interaction effects across conditions. The main effect at the 10% significance level (β =.69, p = .092), suggests that the Degrowth condition resulted in lower engagement, offering some directional support in favor of H1 but not H3a.

5. General discussion

5.1. Discussion

In two studies, we explored whether degrowth and green growth could be translated into individually-oriented message frames and how this would impact both consumer and civic decisions. Using shallow framing via sufficiency promoting marketing in Study 1, we saw little robust evidence of a significant main effect between our Degrowth and Green Growth ads for our hypothesized outcomes, despite significantly lower purchase intentions under the Control (H1a, H1b). Among green consumers, the Degrowth ad was significantly more persuasive for purchase intentions than the Green Growth ad. Using deep framing via a non-commercial app in Study 2, there was higher overall policy acceptance under the Green Growth than Degrowth condition (H1). There was also a significant congruence effect when interacting the two experimental factors, whereby consumer framing was associated with higher overall policy acceptance under the Green Growth condition (H3b). Finally, respondents reported more growth-critical position choices under Degrowth than Green Growth conditions (EH4a). We discuss these key results in the following sections.

Study 1 Main Effects & Interaction Effects: Given the lack of robust differences between the two experimental conditions, it appears likely that our Degrowth treatment did not activate the proper frames or schema associated with

the intended message [91,138]. As such, self-orientation within limits may be difficult to convey in a consumer-oriented context. As marketing has become ubiquitous in daily life [55], even a marketing message endorsing reduced consumption conveys a well-engrained schema of consumption in the mind, revealed through purchase intentions. Further, the intended behavior suggested by reduced consumption ads, to purchase or not to purchase, appears unclear even amongst environmentally concerned individuals [90]. This is evident in the fact that the interaction effect of green consumption values switched between our preliminary study and Study 1.

These null and contradictory results may be due to our stimuli design. It is possible that a longer format or further refinement of our ads, including focus groups or pre-testing to ensure they were conveying distinct green growth versus degrowth constructs, could have more clearly and convincingly differentiated between our experimental conditions.

However, we believe these results reinforce a principle contradiction in trying to advocate for transformative changes in line with degrowth by targeting the individual level, a paradox embodied within SPM that motivated us to undertake this research. Capitalist consumers have little agency to change consumption, despite the promotion of consumer sovereignty and responsibility [4,79]. Indeed, while Frick et al. [84] found that SPM led to higher uptake of sufficiency behavior, their results only provide evidence toward short-term effects in an immediate context. From a more critical perspective, it does not appear that SPM can effectively make degrowth values relevant to individuals given the inherently consumeristic values that underpin the marketing discipline [89]. If this messaging cannot adequately or consistently convey the idea of limits to personal consumption, it is unlikely to promote widespread consumption reduction.

Our results also underscore a broader disconnect between attitudes toward consumption at the micro and macro levels with respect to climate mitigation action [9,139]. Participants may not have viewed these societal-level narratives as impacting their individual consumption activity. Perhaps this could even be characterized as an intention-action gap between societal goals and individual real-world actions to consume less. However, Carrington et al. [4] contend that fixating on an ethical consumption gap, i.e., the chasm between people's desires to consume ethically and evidence of ethical consumption in the marketplace, serves to reinforce the capitalist system. Capitalism demands persistent levels of excessive consumption to preserve economic growth [55,132], blocking opportunities to prioritize ethicality. As this need for growth is capitalism's distinguishing feature [6], attending to this gap provides a false hope that the system could ever be reformed [4].

Our research advances another contradiction in sustainable consumption: profit-oriented firms encourage people to buy more sustainable goods, when we ultimately need to limit overall consumption and production [79]. SPM does not present a solution to this contradiction. Instead, it reinforces profit-orientation and growth by touting benefits of enhanced brand equity and customer loyalty [85–87]. Any form of marketing from a brand, even when endorsing reduced consumption, is still likely marketing toward a purchase [84,88]. Environmentally-conscious consumers may have thought the most sustainable behavior was to purchase more from the brand, as people systematically prefer changes that are additive (i.e., doing more) and not substractive (i.e., doing less) [140]. Applying a balancing heuristic based on reciprocity to their relationship with the environment motivates individuals to do something active to assuage their guilt [141]. This impulse to consume more, even for sustainable reasons, continues to drive profits and economic growth [82]. Without adopting new business models and operations practices that build in sufficiency [64], let alone more structural changes to production and consumption systems, efforts to translate more transformative agendas like degrowth into marketing interventions may only reinforce capitalism and exacerbate excessive consumption.

Policy Acceptance in Study 2 – Main Effect and Interaction: Study 2 shifted focus to explore the use of persuasive communications about degrowth outside the market setting. The difference between the two environmental framing conditions for overall policy support suggests that the Degrowth communications made people less likely to support both degrowth policies (to facilitate limits at a structural level) and green growth policies collectively. The Green Growth condition may have empowered people to bring about moderate shifts within our current system. This condition may have been perceived as more familiar and cognitively easier than the Degrowth one, as people often lack appropriate frames

needed to engage with problems at the system-level [91]. The frames typically available in people's minds reinforce an unregulated, free market ideology [91], which relates more closely to Green Growth. These schemas are only bolstered by media discourse on growth, strengthening the frame of growth as 'progress' [8,91]. Their prevalence impedes our ability to convey a system-level approach to sustainability by relying on existing industries and institutions (e.g., brands and corporations).

The fact that Green Growth framing was more persuasive in garnering policy support uncovers a potential obstacle for degrowth's focus on the system level. The emphasis in our Degrowth account on blaming the system appeared to be less motivating toward tackling systemic problems through public policy, which is one of degrowth's main levers of change [52,142]. By blaming a more amorphous "system" for environmental damage, degrowth messaging may reduce one's sense of agency to make meaningful changes [143] without appropriate skills [70]. Our degrowth account that targeted individual actions by focusing attention primarily on downscaling, reductions, and "less" consumption may therefore have distanced or *disengaged* individuals from mobilizing, given the fragmented and loss-oriented vision of change we presented [144]. The ideal mobilization behaviors for enabling systemic change, that do not involve material consumption, may not appear as personally or immediately rewarding either. That is, policy support or advocacy may not provide the same tangible manifestation of one's action, which serves to assuage feelings of guilt or anxiety, as purchasing material goods [70,141].

This is further complicated by the difficulty of thinking about system-level changes and their connection to individual daily actions [91]. Greater knowledge of capitalism's shortcomings might cause further tension or paralysis in enacting sustainable practices [145]. These psychological forces might block individuals from adopting more sustainable lifestyles and, more importantly, may further demotivate the necessary political will to enact system-level changes [146]. Instead, people may be more motivated by degrowth messaging focusing not only on a more positive and unified vision of the future [24,144], but also one that connects the individual level with collective actions and the community level [147], which is more consistent with the degrowth movement [148].

Main Effect on Position Choice in Study 2: Position choice offered the most statistically significant and intuitive result, providing evidence that people can distinguish between the implications of green growth and degrowth, and in the hypothesized direction. It appears our use of deep framing to characterize two opposing paradigms on growth and the environment influenced political values and worldviews. This evidence is encouraging for the literature on promoting positive attitudes toward growth-critical stances like degrowth. Indeed, it appeared that the citizenship context was more appropriate for engaging people with ideas around limits to consumption and production [3], suggesting that the nuances of each paradigm are less influential on consumption decisions. Our work provides empirical justification for using persuasive communications outside market-based settings for influencing values and beliefs [9], but not yet influencing consumption behavior or policy support. However, seeing a positive reaction to the degrowth argument, without using the word 'degrowth', is notable within an explicitly pro-growth political landscape like the U.K. [Scotland's COP26 summit, just a few months before Study 2 data collection, was mostly characterized by support for green growth [149]. Both parties of the UK government at the time also held firmly to growth-based economic objectives [150,151].]

The difference between our two decision-settings suggests that public sector communications from non-commercial messengers are better suited for promoting degrowth than the private sector. We cannot just applaud firms for proposing a solution to the climate crisis, but we must evaluate if that solution is consequential. Our research suggests that SPM may not just be ineffective at climate mitigation, but its associated frames may even undermine it [89,91,145].

5.2. Limitations

These studies have several limitations. By focusing on individual behavior, our research design may have made it difficult for participants to engage with degrowth at the macro level [29,79]. Using an online study to promote a hypothetical company and app prevented longer-term behavioral measures and may have distanced participants from the true nature of the settings we were studying. Our within-study manipulation checks are robust to detecting that individuals were paying

attention to our stimuli [152], but more subtle protocols would be necessary to compare participants' thought processes when exposed to the different stimuli. More generally, our self-reported measures may have suffered from social desirability bias [153]. Many of our significant results do not hold when including covariates, indicating a lack of robustness. While our focus vis-à-vis degrowth is on affluent societies within the Global North, messaging around and intentions toward consumption reduction may be more effective outside our limited sample. That is, millennials within a highly consumeristic context of the U.K. may not be generalizable to other countries or age groups. Further, the positioning of luxury products related to beauty, relating to the need for identity and desires for personal expression, may have introduced a self-esteem bias at odds with ecological values toward sustainable consumption or degrowth [154,155]. Finally, choosing a quantitative over a qualitative methodology does not allow for a more nuanced understanding of people's willingness to engage in consumption behaviors associated with each agenda.

6. Conclusion

Our research investigated how to make two opposing sustainability agendas, degrowth and green growth, more relevant to individuals. We explored how these message frames, through the constructs of self-orientation within and without limits, would influence intentions, values, and behaviors. We have further contributed insight into the best messengers for communicating about degrowth, suggesting that the public sector is more appropriate. Our exploration of the paradox surrounding sufficiency-promoting marketing also contributes a critical lens to this literature, exemplifying the contradiction in for-profit firms promoting consumption reduction.

Employing shallow framing via brand marketing in Study 1, we found little difference in our outcome variables following degrowth (i.e., self-orientation within limits) versus green growth (i.e., self-orientation without limits) ads. In short, we assert that sufficiency-promoting marketing alone is unlikely to promote self-limitations or consumption reduction, making it incompatible with any degrowth agenda. More generally, our research highlights that private sector and individual-level interventions will not be sufficient for consumption reduction, without broader changes to our economic system [59,156].

Our results lend credibility toward calls for regulations on advertising, not just for traditional marketing campaigns, but also the more attractive "sufficiency-promoting" appeals. While limits to advertising, e.g., of meat, flying, or ads located in public spaces, have been outlined in degrowth literature [54,130,132,157], they require more nuanced thinking and detail. [A Dutch city banning meat ads [158] and a proposal in France banning certain fast fashion ads [159] show progress on the legislative front.] More extensive research is needed to design and assess the most effective policies for meeting wider post-growth objectives (e.g., shifting advertising labor and capital to meet societal needs). Other degrowth policies such as work-time reductions and restrictions on fossil fuels [5,20], will be necessary alongside to ensure downscaling of both consumption and production is feasible [132], such that self-limitation is enabled by public policy. We hope these findings direct efforts toward research and advocacy related to regulations on advertising, along with other means of preventing the co-optation of degrowth that would undermine system change [19,30].

When employing deep framing by a non-commercial messenger in Study 2, our environmental framing conditions had significantly different influences on a) people's values and worldviews toward supporting alternatives to economic growth and imposing limits to growth, and b) structural changes via policy support.

To inspire individuals to embrace more convivial, equitable, and environmentally protective values, persuasive communications related to degrowth may be an avenue worth exploring further. Future studies might explore different populations within the UK (e.g., Gen Z), less consumeristic populations of the Global North (e.g., southern Europe), and product categories less aligned with self-esteem to determine generalizability of the findings. Other methodological approaches, such as qualitative analysis of people's willingness to embrace green growth or degrowth agendas, can provide further insight into their individual-level relevance. While commercial actors appear to be inappropriate messengers, these communication strategies may be employed by non-profits, NGOs, and even growth-critical policymakers to start building up suitable mental schema to challenge the dominant growth imperative [160,161]. Future research should explore formats and

opportunities for disseminating alternative frames, e.g., through stories or educational environments that allow degrowth to be communicated via a more elaborated and coherent vision [144].

However, our study uncovers how degrowth's transformative agenda may be restricted by the difficulty in connecting economic growth and environmental protection at the individual level. It is therefore important to strike a balance between motivating individuals as political agents whilst not casting consumer behavior change as the main mechanism for transformation. Instead, group-level or collective approaches may be necessary to overcome these tensions [68,162,163]. Future research should more directly test whether placing blame on the system has the unintended consequence of disengaging people from more active and political forms of participation with degrowth, e.g., through activism, information seeking, or policy advocacy. As the transformations envisioned by degrowth become increasingly necessary to avoid ecological collapse, this barrier to engaging with system-level change under capitalism must be addressed by concentrating on strategic communications to expand the movement's reach.

Supporting information

S1 Appendix. Preliminary Study (i.e., Study 0).
(DOCX)

S2 Appendix. Prevention and Promotion Moderation Analysis & Materials – Study 0.
(DOCX)

S3 Appendix. Exploratory Moderation Analyses from Study 0.
(DOCX)

S4 Appendix. Study 0 Non-parametric Robustness Checks – Kruskal Wallis and NP Kernel Regression.
(DOCX)

S5 Appendix. Multiple Imputation – Study 0.
(DOCX)

S6 Appendix. Study 0 & 1 Variables.
(DOCX)

S7 Appendix. Power Analyses – Study 1 & 2.
(DOCX)

S8 Appendix. Study 0 Normality Checks of Dependent Variables – Probability Plots & Shapiro-Wilk Test.
(DOCX)

S9 Appendix. Study 1 Normality Checks of Dependent Variables – Probability Plots & Shapiro-Wilk.
(DOCX)

S10 Appendix. Study 1 Other Results Tables.
(DOCX)

S11 Appendix. Moderation Analysis Study 1 - Political Ideology x Framing Interaction.
(DOCX)

S12 Appendix. Study 1 Non-parametric Robustness Checks – Kruskal Wallis and NP Kernel Regression.
(DOCX)

S13 Appendix. Multiple Imputation – Study 1.
(DOCX)

S14 Appendix. Study 2 Variables.
(DOCX)

S15 Appendix. Study 2 Normality Checks of Dependent Variables – Probability Plots & Shapiro-Wilk.
(DOCX)

S16 Appendix. Study 2 Other Results Tables.
(DOCX)

S17 Appendix. Study 2 Non-parametric Robustness Checks – Kruskal Wallis and NP Kernel Regression.
(DOCX)

S18 Appendix. Multiple Imputation – Study 2.
(DOCX)

S19 Appendix. Supplementary Reference List Used in Supporting Information.
(DOCX)

S1 Fig. Percent of Selected Position Choice by Condition.
(DOCX)

S1 Table. Summary Statistics of Participant Sample - Study 1.
(DOCX)

S2 Table. Summary Statistics of Participant Sample - Study 2.
(DOCX)

S3 Table. Study 2 Manipulation Check Success Rate.
(DOCX)

S1 File. Experimental Stimuli – Study 2.
(DOCX)

S2 File. Transparent Changes from Pre-registrations.
(DOCX)

Acknowledgments

Our preliminary study (i.e., Study 0) was supported by Francesca Johnston, as part of her MSc dissertation at the LSE. Stimuli design was supported by Zoe Davies and EPO Creative. We would also like to thank Claire Monari for assistance in the marketing studies.

Author contributions

Conceptualization: Dallas O'Dell, Frédéric Basso, Ganga Shreedhar.

Data curation: Dallas O'Dell.

Formal analysis: Dallas O'Dell.

Funding acquisition: Ganga Shreedhar.

Investigation: Dallas O'Dell.

Methodology: Dallas O'Dell.

Project administration: Dallas O'Dell.

Resources: Dallas O'Dell, Frédéric Basso, Ganga Shreedhar.

Software: Dallas O'Dell.

Supervision: Frédéric Basso, Ganga Shreedhar.

Validation: Dallas O'Dell.

Visualization: Dallas O'Dell.

Writing – original draft: Dallas O'Dell.

Writing – review & editing: Dallas O'Dell, Frédéric Basso, Ganga Shreedhar.

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