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Abstract

Human–Robot Interaction (HRI) research is starting to engage with sustainability, yet the field remains tied to economic models that assume continual growth, rapid technological development, and market expansion. This economic growth orientation raises questions about whether HRI can genuinely support ecological responsibility, given the resource intensity of robotics research, production, and deployment. In this contribution, we introduce a post-growth perspective to reframe the relationship between robotics, sustainability, and society. We argue that rather than striving for 'green growth' within existing economic structures, HRI should engage critically with concepts such as degrowth and post-capitalism. By shifting attention from growth to development, we invite the community to consider what robotic futures are worth pursuing and for whom.

CCS Concepts

• **Human-centered computing → HCI theory, concepts and models**.

Keywords

post-growth, degrowth, green growth, post-capitalism, steady-state, sustainability, human-robot interaction

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1 Introduction

In recent years, Human–Robot Interaction (HRI) research has turned its attention to *sustainability*. The term in itself means 'capacity to endure' and it only becomes meaningful if we state to what it is applied [103]. This shift is exemplified by the theme of last year's HRI conference, 'Robots for a Sustainable World', as well as the introduction of a new annual sustainability recognition, signalling a growing recognition of the field's role in shaping environmentally responsible technologies. At the same time, HRI as a research community remains deeply embedded in an economic system that prioritises growth, rapid technological innovation, and expanding markets [10, 39, 78]. This dependence on growth raises critical questions about how much HRI can truly align with principles of ecological sustainability [79]. How can a field that thrives on continuous development, resource-intensive research, and the production of ever-new robotic systems reconcile its practices with the imperative to reduce environmental impact [94], limit resource use, and move toward sustainable futures?

Several voices have already been raised about rethinking what robotic futures we want and what robotic imaginaries [30] the field is contributing to through, e.g. Feminist HRI [116], critical robotics [69], speculative design [115], and sustainable HRI [106]. By giving space to criticality, we reject the notion of technological inevitability and open up for alternatives for the development and usage of robots.

In the early days, HRI labs often developed their own robots; with the emergence of commercial social robots, academic researchers quickly became their primary customer base [4]. However, as companies sought to expand into other markets, they diverted resources toward attracting new user groups—many of which proved difficult to retain—while researchers, the most consistent users, faced increasing challenges in adapting the robots for scientific purposes. Today, many social robotics companies have gone bankrupt, and robots tied to Software-as-a-Service (SaaS) business models are now difficult, if not impossible, to operate [32]. With fewer robots available, the research community finds itself at a critical juncture: rather than being constrained by market dynamics, it must explore new pathways for conducting research, while also taking planetary boundaries into account [74].

In this paper, we propose a shift beyond economic growth in HRI. This shift replaces the economic norm of quantitative expansion (growth) with a focus on qualitative improvement (development) as the guiding path for future progress. Positioning HRI within this broader debate highlights a unique opportunity: rather than uncritically contributing to cycles of production and consumption, HRI can actively experiment with forms of robotics research and practice that support sufficiency, equity, and resilience (such as low-scale robots). By foregrounding *post-growth* as a framework, we seek to broaden the sustainable development agenda within HRI, shifting attention from simply making robotics 'greener' to questioning what kinds of robotic futures are worth pursuing in the first place, and for whom. We consider post-growth to be essential for expanding the scope of sustainability for HRI, since the term *sustainable development* has become politically ambiguous, something that garners broad agreement without necessarily driving meaningful change [9, 88].

Therefore, we introduce the *degrowth*[1] movement, and discuss it in relation to *steady-state*[2] economics and *green growth*[3]. Ultimately, we argue for the value of *post-growth*[4] and *post-capitalist*[5] for HRI. By challenging conventional market norms, we propose three points for the HRI community to act on—asking the *question zero*, adopting the *post-growth manifesto*, and reporting *sustainability statements*—which would be an important first step toward a post-growth future.

The paper is structured as follows. As an illustrative case in Section 2, we point to the social robotics market—and the growing 'graveyard' of abandoned robots it has produced—as a strikingly unsustainable trajectory. In Section 3, we examine conventional economic models and explore their consequences, leading to both economic inequity and environment devastation, and introduce post-growth philosophy as an alternative movement. We end by outlining concrete steps toward envisioning and fostering a post-growth HRI community in Section 4.

2 Problem Space: The Economies of HRI

Almost all improvements in user interactions increase energy and resource consumption. The advancement of Large-Language Models (LLMs), where training of GPT-3 is estimated to consume 1,287 megawatt-hours of electricity and emit over 550 metric tons of CO_2 [86], is one recent example. Carbon emissions from sensors and components are mainly caused by energy consumption, and tracking the environmental cost of their production and usage is essential [43, 90]. Moreover, one of the 'laws' in technology is predicting exponential continued growth [78]: Moore's Law [76] of doubling the number of transistors in integrated circuits every two years. For fields combining both software and hardware, such as robotics, it becomes even more difficult to track environmental costs. An orientation to growth is also rarely critically examined in HRI, where we often see *'feature-heavy electronic devices meeting the imaginary needs of imaginary users'* [20].

The most prevalent 'rescue narrative' is that productivity growth will recover through new technological breakthroughs [33, 49]. For some, this means investments in low-carbon technologies, and for others, the digital revolution ahead with increased automation, robotisation, and Artificial Intelligence (AI). Of course, HRI represents just one part of this landscape, often contributing to social dimensions of robotics through applications in education, healthcare, and domestic life [106]. Yet, automation has been a central concern since the installation of the first industrial robots in 1967 [27]—a period that also marks the most significant human-induced impact on the climate in recorded history [45]. In a recent critique [30], a collection of opening sentences of robotics papers in the ACM library starting with 'Robots are Increasingly' is used as an example of how researchers reiterate technological and growth inevitability unthinkingly. The piece calls for a collective reimagining of computing outside capitalist realism and urges computing scholars to resist simply being bystanders or enablers of dominant agendas. Similarly, recent work in Human–Computer Interaction (HCI) calls for embracing post-growth philosophy and urges researchers to engage directly with the global climate crisis [97]. In their paper, Sharma, Kumar, and Nardi describe opportunities for HCI to adopt a post-growth orientation in research, design, and practice, by reimagining sociotechnical systems to promote sustainable, just, and humane futures. Their call to action includes fostering economic literacy, mediating policy-making, evaluating political economies, normalising redesign and undesign, nurturing solidarities, and cultivating critical pedagogy within HCI.

A workshop at the HRI conference 2025 called 'Sustainability-4-HRI, HRI-4-Sustainability' invited participants to a critical examination of sustainability within the HRI field [107]. Through group activities inspired by 'science fiction prototyping' methods [84], participants reflected on the potential role of robots in achieving desirable and undesirable futures. Reflections from the work, together with results of a survey of HRI researchers, were published in [106]. The authors highlight how HRI research is strongly linked to sustainability, particularly to the 'social pillar'. However, due to a lack of shared vocabulary, researchers are often unaware of this connection. The authors list several practical recommendations for researchers in HRI, including documenting the ecological impact of one's work, following open science principles, and writing 'sustainability statements'. The authors also attempt a first definition of 'sustainable HRI': *'i) the design, deployment, and governance of human-robot systems in ways that are materially responsible, socially just, and aligned with long-term ecological and societal well-being, and ii) conducting research in a way that minimises environmental impact, promotes long-term knowledge sharing, and aligns with real user needs, without developing tech just for tech's sake'* [106, p.11]. Another venue is the 'LIMITS' workshop on computing within limits [78]. This workshop strives to be a place for envisioning technologies for pluriversal design [66], and for work that considers how visions and frameworks of degrowth and post-growth affect

[1]Degrowth means deliberately scaling down economic activity in overdeveloped economies to live better with less and within the planet's ecological limits.
[2]Steady-state aims for stability, not growth nor decline, maintaining harmony between economic activity and the environment over time.
[3]Green growth seeks to grow the economy while 'greening' it to achieve prosperity without destroying the planet.
[4]Post-growth envisions a society where economic activity supports human and ecological flourishing without depending on endless growth.
[5]Post-capitalism describes a future economic system beyond capitalism that builds on collaboration, sustainability, and shared prosperity rather than profit and perpetual growth.

computing, or how computing can grapple with digital colonialism [80]. These recent works show that HRI is beginning to question its own role within sustainability, challenging the growth-oriented assumptions that have long shaped the field.

2.1 The Unstable Market of Social Robots

At the 6th 'Furhat Conference on Social Robotics' in 2024, Bartneck presented 'Social Robots: The end of the beginning or the beginning of the end'[6] and shared that almost all social robots referenced in the *Human-Robot Interaction: An Introduction* textbook [7] were out of business. To understand why this was happening, he had contacted all social robot companies he could find, but none of them was willing to share their finances. Towards the end of the keynote, he turned to the Furhat employees in the room and encouraged them to share how they were surviving, a question which was quickly shut down. This highlights the cycle that many social robotics companies go through: rise, struggle to find customers outside academia, unable to grow/scale, and ultimately go bankrupt. Big investments have been made into these platforms over the years; but, as has been pointed out in 'the Conversation', universities face getting stuck with thousands of obsolete robots[7].

This affects academics and the public. For example, Jibo was introduced in 2014 as a family robot, designed to be in people's homes, establish social relationships, and serve as a personal assistant [40]. In 2019, Jibo was terminated, and the families that had the robot at home discovered what death through a SaaS business model does to a family friend. As the opening line of an article in 'Wired'[8] showcases; *'My Jibo talked to the wall again today'*; social robot companies going bankrupt is often the last straw of a long process of services shutting down, robots suddenly not being able to see or remember their owner's name, or mimicking an older relative floating into various dementia symptoms.

Another recent example is Moxy, a social robot designed to be a 'friend' for children with autism spectrum disorder, which was discontinued four years after its release. The sudden announcement of Moxy's death stirred up an online movement by upset parents who had to tell their children that their friend would soon die[9]. As a response, the company behind Moxy, Embodied, released guidelines on how to share the important lesson that everyone dies, resulting in families sharing on social media how their children were crying, saying goodbye to the robot, and Moxy replying *'I love you… goodbye'*.

These examples show how social robots are not ready for expanding markets, continuos venture capital, and economic growth[10]. One counter argument is that this is just how the capitalist economic system is built, and the situation for the market will change with time when social robots are more developed and will replace the old ones through *creative destruction*[11]. Even so, looking at the customer base and the value they brought, both private owners and HRI researchers have relied on these companies and platforms. Researchers need them to keep researching, and people that were promised a family friend need the robots to function until their children grow up.

Furthermore, none of these robots were built with adaptability in mind, which is tied both to the usage of SaaS business models[12], and constrained by hardware limitations. When Aldebaran filed for bankruptcy in February 2025, research labs were left with few options to continue using their robots and associated software services. Even during the robot lifetime if, e.g. a NAO robot broke down—which happened quite often, e.g. for RoboCup competitors—long transportations to France, weeks of downtime, and receiving malfunctioning robots on return were a regular occurrence. Some researchers chose to repair the robots themselves despite losing their warranty[13]. However, even self-repair would no longer be possible if Choregraphe and the NAOqi SDK were permanently shut down.

Robots becoming obsolete or unsupported when companies go bankrupt illustrates one aspect of the current unsustainable model of social robotics. Another issue regards the traceability of robot components throughout their lifecycle, as highlighted in recent research [107]. Ensuring such transparency would also be in line with the upcoming EU's 'Right to repair Act' (effective in 2026), but tracking a robot's journey from production to disposal, and finding ways to preserve or repurpose robots from defunct companies, remain difficult tasks. One solution could be the use of open-source low-scale robots, enabling greater awareness of component origins and more control over the sustainability measures taken across a robot's lifecycle, as described below.

2.2 Self-Built and Low-Scale Robots

In the early days of the field, HRI labs often developed their own robots, such as Kismet and iCub [13, 75]. Numerous EU-funded projects, with the ambition of building new robots, were also common, such as FEELIX-GROWING [77], Giraff [34], and Robot-Era [81]. As described above, the rise of commercial social robots led to a decline in researchers building their own. This is understandable, as polished plug-and-play robots for a decent price were suddenly available, allowing researchers to dive straight into research. Yet this pursuit of efficiency can also become a trap, replacing creative, meaningful labour with dependency on generic platforms. As a result, we risk losing opportunities to develop smaller-scale robots tailored to specific groups and contexts.

One of the first self-built open source platforms available was InMoov[14], a full size humanoid robot. A more recent example is Epi [53], a humanoid platform for developmental robotics which also gives access to an open infrastructure for system-level cognitive modelling. Blossom [101] is a handcrafted robot whose structure is 3D-printed or laser-cut, while the outer cover of the robot can

[6]https://www.youtube.com/watch?v=UleTbu3DufU
[7]https://theconversation.com/universities-face-getting-stuck-with-thousands-of-obsolete-robots-heres-how-to-avoid-a-research-calamity-256829
[8]https://www.wired.com/story/jibo-is-dying-eulogy
[9]https://www.popsci.com/technology/moxie-robot-offline
[10]Unlike small and medium-sized robot enterprises, larger corporations' investments in social robots are often a marketing strategy to benefit growth on the stock market and maintain shareholder trust in their development, also known as 'robotwashing' [47].
[11]Creative destruction is a concept introduced by Schumpeter that describes a process in which new innovations replace and make obsolete older innovations [96]. The concept is used to explain innovation-driven economic growth [1], which in 2025 was awarded the Nobel Prize in Economics.
[12]Note that there are also Robot as a Service (RaaS) business models sharing the same issues, e.g. the AV1 robot primarily used in schools [28].
[13]Many robot companies are also, in principle, opposed to researchers modifying their robots due to proprietary restrictions.
[14]https://inmoov.fr/

be knitted or crocheted, thus allowing for adaptability and personalisation. Shutter [104] (a low-cost, flexible social robot platform, developed for studies in the wild) and Robotic Study Companion [6] (a customisable, open-source social robot developed with cost-effective off-the-shelf parts) are other examples.

Apart from open source platforms, there is also a surge in the development of specific robots for specific purposes, such as projects from the Robot Studio[15] at the University of Michigan. For example, they developed FLEX-SDK [3] and YOLO (Your Own Living Object) [2]. Other specialised robot platforms include Poppy [62], SnuggleBot [8], Moffuly [83], Ommie [73], and companies like Bitcraze[16] developing Crazyflie [31]. New possibilities for HRI also include working with new materials beyond plastic or rubber. For example, the development of biodegradable drones that dissolve in contact with water, leaving minimal waste if lost in the field [16], which also spur speculative thinking about future possibilities of eating robots, explored through tangible design fiction [114].

The benefits of building robots for specific purposes are (perhaps) obvious: researchers maintain control over the software and hardware, have insights into component origins, and can repair or modify the system as needed. Such robots can also be modular, e.g. changing embodiment, appearance, interfaces, to suit specific contexts. However, even low-scale and open-source robots are not exempt from the material dependencies of the broader growth paradigm. Their microcontrollers, sensors, and actuators often rely on global supply chains and resource-intensive manufacturing processes—e.g. in the production of microchips, rare earth elements, and plastics. As Valdivia points out, the growth of AI must be addressed from an EcoFeminism standpoint pointing precisely towards the need to, e.g.: *'examine power structures within the climate crisis'* and *'consider digital materiality and its supply chains'* [109]. In a post-growth context, this reminds us that sustainability cannot be reduced to scale alone; rather, it requires careful tracing, looking 'vertically and laterally' [67]. Consideration to the entangled dimensions of systemic issues is also a necessity, often obfuscating relationships between computing supply chains and social inequity [67]. For example, the will to de-couple from global chains in the USA has paradoxically led to intensified extraction of rare materials [70], thus highlighting how even attempts to localise production remain tied to unsustainable practices. This shows the complexity of finding a sustainable product chain for robots in research labs, and that labs that make their own are not necessarily being more sustainable than off-the-shelf options.

Moving beyond robot development and the intricate robot market, in the following section we present the background on economic growth and some alternative economic models that could apply to the HRI community.

3 Background: Economic Growth and Alternatives

Neoliberalism portrays capitalism as the best system equipped to deliver near-utopian socioeconomic conditions, positioning market freedom and competition as pathways to collective prosperity [25]. Economists commonly assume that economic growth is inherently beneficial and that, over time, its rewards will extend to all of humanity [102]. Capitalism is thus often defended as the most effective economic model available, especially when compared to alternatives such as socialism or communism, which are criticised for their failures during the twentieth century.

However, this long-standing faith in perpetual growth raises the question of whether capitalist market economies can intentionally degrow and stabilise into a steady-state without crisis or collapse. The likelihood appears low. In response, emerging frameworks such as degrowth and post-growth challenge the growth imperative itself, envisioning societies that prioritise ecological sustainability, social equity, and human well-being over the pursuit of Gross Domestic Product (GDP) expansion.

3.1 Economic Models and Inequality

Economic models shape not only how societies understand wealth creation but also how they justify its distribution. From classical liberalism to contemporary neoliberalism, each model carries implicit assumptions about efficiency, merit, and fairness. While capitalism is often credited with driving innovation and lifting millions out of poverty, it has also deepened social and economic inequalities, concentrating wealth and power in the hands of a few. Neoliberalism, in particular, reinforces market mechanisms as the primary means of allocating resources, promoting competition and deregulation under the promise that prosperity will 'trickle down' to all. However, this notion is increasingly challenged [38], revealing widening income gaps, declining social mobility, and the erosion of public welfare systems [15].

There is also a long-held assumption that citizens of poor nations will not support efforts to protect the environment, since they are too preoccupied with meeting basic needs. This has been disputed by Dunlap and York, who showed that citizens of poorer nations were equally, if not more, concerned about the environment than citizens in wealthier countries [19]. Also, climate beliefs shape engagement with climate action. A recent paper, using survey data from 110 geographic areas, shows that the global north presents higher density networks, where climate beliefs are more tightly correlated, while many global south areas have positive but less interconnected beliefs [64]. Inconsistency appears in geographic areas where opposition to reducing fossil fuel use conflicts with support for renewable energy and government prioritisation of climate policies.

3.2 Impact on the Environment

Climate research has pointed out economic growth as a root cause of environmental devastation [92]. In 2019 and 2021, more than 11,000 climate researchers from 153 countries warned about the climate crisis [93]. The IPCC's (the Intergovernmental Panel on Climate Change) sixth assessment report shows that the global surface temperature increased by 1.1°C in 2011-2020 compared to 1850-1900, and that this observed warming is driven by emissions from human activities (specifically, greenhouse gas emissions) [45]. The Club of Rome released the book *The Limits to Growth* in 1972 [74], highlighting planetarian limits in limitless growth forecasts. At the time, these new ideas on limits spurred the transition to renewable energy sources. 30 years later, a report compared the

[15] https://robotdesign.studio
[16] https://www.bitcraze.io

scenarios from the book with 30 years of real data and found that the historical data matched with the so-called 'standard run' scenario, which results in collapse of the global system midway through the 21st century [108]. Now, more than 50 years later [21], movements such as green growth have taken hold in the political agenda, often facing accusations of greenwashing, since they do not account for planetarian limits. Rather, green growth is an aspiration for continuous growth while protecting the environment. Yet economic growth inherently demands increased throughput[17], and greater throughput inevitably leads to greater environmental impact. In this sense, truly 'green' growth is an illusion, as unrestricted economic expansion continues to degrade the very ecosystems on which human life depends.

As such, the call to action in this paper includes an explicit move away from the dangers of 'greenwashing', i.e. the practice of presenting technologies or practices as environmentally sustainable as a motivation for their growth, while masking their limited or even harmful impacts. Amazon's Scout and Starship's delivery robots exemplify this dynamic: marketed as green innovations, they promise enticing futures while offering only marginal or unverifiable gains. Their metrics assume that every robot trip replaces a car trip[18], but in practice many robot trips replaced pedestrian trips or consolidated deliveries, thus the net benefits are overstated. More importantly, they recast sustainability through an individualised lens of package delivery, replacing collective urban visions of equitable growth with the narrower logic of personalised convenience. In fact, the consideration here should be on whether we should be turning away from these services altogether.

Despite a high level of public awareness of the environmental impact of human activity, there is a significant gap between people's attitudes and their actual behaviours. A worldwide survey on the public understanding of climate change showed that most people recognise that climate change is happening (91% in France, 90% in the United Kingdom, 80% in the United States), but only a small percentage are ready to take action to reduce it (21% in France, 17% in the United Kingdom, 20% in the United States) [65]. People may refrain from taking action when they feel they lack the knowledge needed to protect the environment, find it hard to change their existing habits, or perceive the costs of adopting new behaviours as too high [61]. Additionally, social norms and the influence of others can discourage behavioural change. Finally, some people believe their current efforts are sufficient, and choose not to do more (a phenomenon known as 'tokenism'). People who recognise environmental problems but fail to act often experience discomfort. To ease this, they may use rationalisation strategies that justify their inaction and allow them to maintain their current behaviours [11]. Many psychological barriers to environmental action can thus be seen as forms of rationalisation used to reduce cognitive dissonance [23]. Therefore, it is vital to develop economic literacy to gain understanding of what to change together as a collective [97].

[17]Throughput refers to the materials and energy a society extracts, processes, transports, and consumes, returning them to the environment as waste [17]; it has also been described as the 'food' of the social body's metabolism [71].

[18]https://www.starship.xyz/press/starship-technologies-announces-new-sustainability-achievements/

3.3 Degrowth as an Alternative Movement

Some economists claim that degrowth is a prerequisite to reach a post-growth society [57]. Sustainable degrowth can be defined from an ecological-economic perspective as *'a socially sustainable and equitable reduction of society's throughput'* [55, p.874]. Degrowth can be regarded as an 'eco-socialism', through the lens of Gorz, who define socialism as *'the positive response to the disintegration of social bonds ensuing from the commodity and competitive relations characteristic of capitalism'* [35, p.30].

These ideas are familiar to ecological economists engaged with steady-state economics, yet sustainable degrowth pushes the debate further. Firstly, it raises the question of whether a transition to a steady-state can be achieved primarily through economic reforms such as cap-and-trade mechanisms [111], which steady-state economics often promotes [18]. Secondly, while steady-state thinking emphasises investments in natural capital [17], degrowth extends the discussion to include the selective reduction of certain forms of man-made capital. Remaining within ecological boundaries requires scaling down expansions of new airports, space tourism projects, and factories producing superfluous goods [55]. Conversely, society may need to expand renewable energy systems, improve education and healthcare, create more public spaces, and strengthen localised organic food production and retail networks. Thus, what is needed is 'selective degrowth' [63], which reallocates resources between public and private consumption as well as across generations. Such redistribution cannot be left solely to market mechanisms but necessitates political restructuring. Thirdly, the extension of the steady-state argument is the possible incompatibility between core market institutions and the goal of degrowth. Degrowth, although socially sustainable, reduces private profits, redistributes costs between capital and labour, and thus faces resistance from those in power [99]. This resistance is not only due to corporate influence over politics and media, but also to the fact that growth itself is a structural feature of capitalism [38]. It does not arise from individual greed, but from institutions that demand expansion with private property as collateral [110], debt and credit systems [52], and competitive pressures where companies that stop growing are eliminated [113].

Hence, degrowth suggests to collectively manage a *'prosperous way down'* [82] by renouncing GDP. However, the goal of sustainable degrowth is not to degrow GDP per se, as GDP will inevitably decline as an outcome of sustainable degrowth [55]. GDP has also been questioned as a metric in a post-growth future, since it includes many activities that reduce the quality of life while excluding many that really matter to us. Already in 1968, Robert F. Kennedy famously critiqued the economic growth system: *'It measures everything in short, except that which makes life worthwhile'* [see 48]. Also, with the current climate impact trajectory, The Swiss Re Institute estimates that the cost of climate change and the loss of biological diversity alone will impact 18% of global GDP by 2050 [44] if no action is taken.

Concrete policies for degrowth [26] include a reduction of working hours [35, 112], institutions guaranteeing minimum health and economic security to all, such as a basic income [91], labour policies that allow for less productivity and more employment in sectors where human contact adds value, such as in health or education

[48], and salary caps [63]. Redistributive taxation, taxes on international capital movement, and stricter controls on tax havens are expected to generate sufficient funds to support high-welfare public investments, such as community education [46], healthcare, and convivial goods [63].

During the second Trump presidency, mainly due to the global trade war, US citizens will be paying more and buying less. This might be considered the first large scale degrowth movement[19]. Statements by the president such as *'Maybe the children will have two dolls instead of 30 dolls, you know? And maybe the two dolls will cost a couple of bucks more than they would normally'*[20] are in the spirit of degrowth. However, this economic change is not coupled with investments in the social system, which is crucial to the degrowth movement [59].

3.4 A Post-growth Future

Post-growth philosophy is fundamentally concerned with redefining the values that underpin life beyond the pursuit of perpetual economic expansion. As Jackson reflects in *Post Growth: Life after Capitalism*, *'the pandemic provided an object lesson in the art of the possible'* [50, p.148]. The pandemic-induced abrupt slowdown of production and consumption revealed both the fragility of growth-dependent economies, and the potential for alternative modes of living. Similarly, *The Case for Degrowth* [58] also calls for a deliberate reorientation of societal priorities toward well-being and ecological balance. This reorientation resonates with the insights of Arendt, who emphasised the value of meaningful labour and creative work as central to *The Human Condition* [5]. Arendt's vision contrasts sharply with the modern fixation on productivity and efficiency, inviting a return to forms of work that cultivate purpose and connection rather than mere output [50]. In this spirit, the post-growth perspective privileges cooperation over competition, framing human flourishing as a collective rather than individual achievement. These principles are also gaining public support: on average, among 34 European countries, 60.5% of people are in favour of post-growth [87], and a recent study looking at the population in the UK and USA, showed that a full degrowth proposal was accepted by a majority [60].

Within this framework, happiness and prosperity are not contingent on endless material growth. The broader discourse on welfare economics has long questioned the correlation between GDP and well-being [51, 72]. This shift finds expression in alternative measures, such as Gross National Happiness (GNH), which seeks to capture a more holistic sense of societal prosperity [56]. Finally, the post-growth society places care at its centre. As Jackson and others argue, the 'care economy' represents a domain of human activity that sustains life, relationships, and communities as an essential counterpoint to the extractive logic of growth [50, 58].

Many post-growth sceptics argue that degrowth and post-growth is 'anti technology'[21]. This is not the case. Of course, post-growth would be reached faster if development and consumerism altogether stopped, but this is not a feasible option. But compared to green growth ideas, post-growth acknowledges that technological solutions alone, no matter how far-reaching they may be, cannot prevent a collapse of the system [74]. As Hickel recently commented in the 'Better Futures with Michael Mezz' podcast[22], technological development, including AI, is strongly linked to capitalist mechanisms of influence. Thus, it is not the technology itself that present an issue for post-growth, but the economic system driving its development.

Figure 1: Growing robotic snails.

The snail has become a common symbol for degrowth and post-growth movements, as first illustrated by Illich:

> *'A snail, after adding a number of widening rings to the delicate structure of its shell, suddenly brings its accustomed building activities to a stop. A single additional ring would increase the size of the shell sixteen times. Instead of contributing to the welfare of the snail, it would burden the creature with such an excess of weight that any increase in its productivity would henceforth be literally outweighed by the task of coping with the difficulties created by enlarging the shell beyond the limits set by its purpose'.* — Ivan Illich [41, p.53].

Illich warns that certain technologies, if left unchecked, could have destructive consequences, which aligns with how post-growth redefines work by honouring authentic paces and sustainable living. Besides being the symbol for alternative economies, the snail has also been adopted by the slow movements, such as slow food [98], slow living [12] and slow science [100] (which could even lead to more impactful science[23]). In Figure 1, we reuse this metaphor and add a new ring on the snail's shell—a layer of automation, artificial intelligence, and robotics, built upon already complex structures. While intended to enhance efficiency and productivity, this continual layering risks creating fragility, dependence, and ecological or social imbalance. Just as the snail becomes encumbered by its own shell, society may find that its technological and economic growth generates problems that outpace its capacity to manage them. The metaphor thus warns of the limits of accumulation and invites reflection on how to achieve balance for HRI.

4 HRI for Post-growth

As one possible way forward for post-growth perspectives in HRI, we suggest three actionable points that members of the research community could incorporate in all stages of their projects—from formulating an idea, to grant applications, and reporting. These

[19] https://www.theatlantic.com/economy/archive/2025/08/trump-economy-productivity-prices/683807/
[20] 0.25 seconds in: https://www.youtube.com/watch?v=2eJv810QWOs.
[21] https://monthlyreview.org/2023/07/01/on-technology-and-degrowth/
[22] https://open.spotify.com/episode/0BnuThT2X6VNRbiyAU2P6v?si=9fee8f39cc15418a
[23] https://www.nytimes.com/2025/10/09/science/nobel-prizes-science-basic-research.html

considerations build on Latouches' eight 'R's [63], which should be seen as independent objectives that can trigger a virtuous circle of serene, convivial [42] and sustainable contraction. The 'R's are: re-evaluate, reconceptualise, restructure, redistribute, re-localise, reduce, re-use and recycle [63]. We call the actionable points *question zero*, *post-growth manifesto*, and *sustainability statement*.

4.1 Question Zero

The first action point is inspired by question zero for the use of AI: *'why AI?'* [68]. This question makes us reflect on the need to re-evaluate, reconceptualise and reduce some kinds of HRI research by asking: *'Should we adopt a robot in the first place [for this user/context]?'*. Asking this question in the beginning of a project while formulating the idea or doing initial testing forces criticality and more detailed motivation for why a robot is needed and for whom. This is a process where one should stay opened-minded to the possibility of cancelling the project and not moving forward with unjustified implementations of robotic technology. The core of question zero is to play with the thought *'Am I fabricating situations for the sake of research or am I investigating something valuable for people and society?'*, boiling down to *'why am I doing this?'*, *'who am I doing it for?'*, and *'what is the cost?'*. By cost we mean the social, environmental and economic cost, which combined would limit the amount of valuable projects in a post-growth future.

Within HCI, this approach gained traction during the past decade through calls for *undesigning* [89], including self-inhibition, exclusion, removal, replacement, restoration, and safeguarding, and *(in)actions* [95], arguing that informed and carefully crafted not-doings should also be considered valid acts. Examples of not-doings should be increasingly visible in HRI as the field grows from being exploratory—testing contexts where a robot could be used—to a more mature field where some areas can be rejected. As an example, we use a study that investigated whether the Furhat platform would be suitable for older adults with dementia in care homes [105]. During the initial pilot study, participants were negative towards the general idea of humanoid robots in care homes, the Furhat robot itself, and the idea that this uncanny floating head would be suitable for people with dementia. After reflecting on this feedback, the research team decided to cancel the long-term study that had been in the making for over a year. Asking this question zero is one way for HRI to adopt post-growth ideas.

Question zero can also inform research that examines real-world applications in need of critique. Beyond refusal, the question seeks to find cases in need of assessment and possible exnovation [37], where the capitalistic drive was a motivator. Such research makes visible inequity and gives voice to alternatives to robotics. For example, a study on Google Wing's launch in Australia showed that the most common drone delivery was for one cup of coffee, prompting the formation of a community action group against drones [117]. Investigating such cases and revealing underlying capitalist drivers is a central task of critical robotics [69].

4.2 Post-growth Manifesto

As a working tool, we suggest a manifesto (accompanied by a glossary, see Table 1). This approach is inspired by Dunne and Raby who explain their design approach in an A/B manifesto [20][24]. They use a series of words or statements in contrasting dichotomies. Here, we list a number of mainstream understandings of robots in HRI based on our reading of the field (part A), in opposition to a list of important notions within post-growth for HRI (part B) stemming from the eight R's and the theory we describe in this paper. We imagine this manifesto to be used in the formulation and argumentation of the research at hand. It can be a tool to locate, discuss, and negotiate ongoing research on a spectrum between these semantic differentials. In doing so, we encourage leaning into the B list to support a post-growth orientation. Hence, the manifesto[25] does not present a binary choice, but rather a gradient between the two approaches on each line.

Table 1: Post-Growth A/B Manifesto for HRI, inspired by [20].

Conventional HRI (A)	**(B) Post-Growth HRI**
Proprietary	Open Access
Obsolescence	Repairability
Efficiency	Sufficiency
Growth	Resilience
Scale	Localism
Centralised	Decentralised
Consumer	Community
Tech-Centric	Social-Centric
Expansionist	Steady-State
Extraction	Conviviality
Economic Prosperity	Prosperity
Labour Replacement	Meaningful Labour
Tech-Optimism	Criticality
Disposable	Recyclable/Reusable

Accompanying the manifesto, we provide explanations of each word on the B side in relation to HRI:

Open Access: Many robots used in HRI studies rely on technology, software, and knowledge that is privately owned, with restricted access and use. Post-growth emphasises free availability for anyone to use, modify, and share, fostering collaboration and collective innovation.

Repairability: The majority of consumer products are designed to aim at limited lifespan, often encouraging frequent replacement and consumption through planned obsolescence. Repairability prioritises the ability to fix, upgrade, and extend the lifespan of devices, reducing waste and environmental impact, and more democratic access to repair.

Sufficiency: While efficiency aims to maximise output and performance, often without regard to environmental or societal limits, sufficiency looks at only as much technology, energy, or resources as is necessary to create a sustainable approach to needs.

[24]Work in progress available at: http://dunneandraby.co.uk/content/projects/476.
[25]We acknowledge that this manifesto goes beyond HRI and could be applicable to other technology-oriented fields, such as HCI and software engineering.

Resilience: Rather than assuming the need for continuous expansion of economic output, production, and consumption, resilience works on the capacity of systems, communities, or technologies to adapt to shocks and stresses while maintaining function and well-being.

Localism: A large body of HRI work relies on generalisability towards big systems, expanding production and infrastructure to maximise reach (and profit). Localism focuses instead on local production, resources, and community-centred technological systems.

Decentralised: A mainstream view of HRI emphasises concentration of control, decision-making, and power in a few entities. Whereas a decentralised view considers distributed governance and operation of systems—reducing dependence on single points of control.

Community: The users often considered in HRI are seen as individuals primarily positioned as users in a market system. Seeing users as community requires instead technology and systems designed to support collective use, cooperation, and social well-being.

Social-Centric: Rather than designing technologies with performance or novelty as the primary focus, post-growth favours designing technology with people, relationships, and societal needs at the centre; considering at times refraining from design or the introduction of new technologies.

Steady-State: An expansionist economic model assumes continual growth and accumulation, whereas a steady-state model prioritises stable consumption and resource use over growth.

Conviviality: The tech-industry focuses on exploiting natural resources and labour for profit, while conviviality looks at developing technology designed to empower users, enhance social connections, and allow autonomous, cooperative engagement based on happiness and thriving.

Prosperity: Rather than focusing on quantitative measure of economic activity, emphasising material production and consumption, prosperity logics consider holistic understandings of human well-being and societal flourishing beyond material growth.

Meaningful Labour: Many uses of robots seek to use automation and technology primarily to replace human workers. HRI should investigate work that contributes to community and personal fulfilment.

Criticality: A tech-optimist stance relies on the belief that technological progress will automatically solve social and environmental problems. A post-growth attitude needs criticality and the conscious evaluation of technology's role, questioning assumptions of constant progress and economic growth to ensure ethical and sustainable deployment.

Recyclable/Reusable: Many robots are designed as products and devices for a short lifespan, generating waste and encouraging constant replacement; ending up gathering dust in lab's shelves after studies or decommissioning. A post-growth attitude incorporates designing robots to be repaired, reused, or recycled, extending their useful life.

4.3 Sustainability Statement

As we argued, HRI research must acknowledge and work with the urgent global climate crisis we are facing. In recent work [106], researchers call for the need for a sustainability statement when reporting studies and projects. In line with our critique of the lack of explicit economic reasoning, we see these statements as a way of openly discussing and expressing post-growth intentions. Much like the ethical [14, 24] and positionality [54] statements have become standard in HCI and HRI, sustainability statements encourage transparency, accountability, and reflexivity within research teams. Importantly, such statements situate technical contributions [36] within a value-sensitive framing [29]; leaping beyond mitigating harm towards actively contributing to more sustainable futures. We suggest that our manifesto is a tool for articulating these statements, particularly when contemplating the economic part. In Table 2, we present a template as support for sustainability statements.

Table 2: Sustainability statement template.

Environmental Sustainability
- Outline expected or actual environmental impacts of the research (e.g., energy consumption, material use, lifecycle of prototypes, emissions from data/model training [43]). - Report mitigation measures (e.g., dataset reuse, low-power models, recycled materials, minimising travel).
Social Sustainability
- Describe how the research addresses inclusion, equity, accessibility, and planetary/social wellbeing. - Reflect on who benefits, who may be excluded, and how participatory/critical approaches were integrated.
Economic Sustainability
- Reflect on implications for labour, long-term viability, and economic justice. - Clarify whether the work contributes to sustainable employment, affordability, or equitable distribution of resources, beyond simple efficiency or growth metrics.

5 Conclusion

In this alt.HRI contribution, we have argued for a shift beyond economic growth in HRI (both research and practice). This includes re-imagining which robotic futures are worth pursuing and for whom with economic sustainability in mind. By challenging the market norm, the three suggested actionable points by asking the question zero, incorporating the post-growth manifesto and reporting sustainability statements, would encourage HRI to take a first step towards a post-growth future.

We acknowledge that there may be obstacles to engage with post-growth, and we need to overcome them collectively. One such obstacle is that research labs are not independent from market mechanisms that make robots accessible to us; another one is unequal distribution of resources to build vs. purchase robots; and finally *publish or perish*. HRI practitioners might also feel limited or constrained when trying to integrate post-growth principles into their work [22], but as Pargman and Eriksson argue, it is crucial *'to ask better questions, and to help others ask better questions'* [85, p.2]. We encourage other researchers to engage in this discussion for a better HRI.

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