

Design for Sustainability Transformations: A Deep Leverage Points Research Agenda for the (Post-)pandemic Context

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ABSTRACT

This position paper presents a *prototype* research agenda for design for sustainability transformations (DfST) in the (post-)pandemic context. COVID-19 has made visible vulnerabilities, structural dysfunctions, inequalities and injustices across health, environmental, social, economic, provisional and political systems. In response to the crisis, rapid, adaptive, technological and social innovations have started to emerge across all levels of society, opening up a multiplicity of alternative futures. This is an opportune time to address long-standing and urgent sustainability challenges in ways that move beyond the ineffective and business-as-usual approaches of ecological modernism. The authors used a co-creative process to identify weak signals relevant to sustainability transformations. In alignment with the deep leverage points framework, the identified weak signals are presented under two main headings: first, social structures and institutions; and second, values, goals and worldviews. The deep leverage points form the basis of a research agenda on how DfST could contribute to sustainability transformations right now and in the longer-term.

Keywords: COVID-19, leverage points, sustainability transformations, sustainability science, sustainable design, transition design

INTRODUCTION

Following its onset in December 2019 in Wuhan, China, a global pandemic of COVID-19 spread across five continents in the span of a few months. At the intersection of health, environment, social, economic and political systems (Sahin et al., 2020), it is precisely the kind of complex and wicked problem towards which sustainable design orients itself. As the pandemic spread, the vulnerabilities and structural dysfunctions built into these systems, as well as the related inequalities and injustices, have become more widely visible and recognised. We have witnessed very rapid changes in once ‘normal’ practices, and a surge of adaptive, technical and social innovations have started to emerge and diffuse across all levels of society including households, businesses, communities and countries. Perhaps for the first time since World War II, at least in the West (or Global North), *the future* many of us have invested in shifted significantly; we have become aware of a multiplicity of *alternative futures* opening up. The present and emerging (post-)pandemic contexts are underlined by high uncertainty in regards to the functioning and organisation of social systems and (potential)

structural shifts in dominant politico-economic and values systems. Despite all of the challenges of the pandemic, this is an opportune time to act upon those emerging alternative futures. To start activating those alternative futures and to address long-pressing and urgent sustainability challenges in ways beyond the long-ineffective, business-as-usual innovation approaches of ecological modernism (Boehnert, 2018), looking beyond the immediacy of the pandemic is necessary for design scholarship and practice.

In this position paper, we present a *prototype* research agenda for design for sustainability transformations (DfST) in the (post-)pandemic context. This research agenda is an initial attempt aimed at starting discussions and collaborative interdisciplinary work between sustainable design scholars and experts from other implicated fields.

We used a combination of methods in developing the research agenda. These include environmental scanning (Gordon & Glenn, 2009) of topics we have individually observed from the start of the pandemic to identify the weak signals relevant to sustainability transformations in the pandemic context. Weak signals are emergent developments that may currently be small but have significant strategic importance in how futures might unfold should they be amplified (Ansoff, 1975). This was followed by a co-creative expert workshop participated by the authors of this article. In this workshop, each of us presented the weak signals we identified and discussed the potential implications of these on DfST. The output of this workshop was a catalogue of weak signals and discussion notes. After the workshop, the discussion notes were shared with all workshop participants and the implications of weak signals were further elaborated, second order implications of and feedbacks between weak signals were analysed through co-creative writing using an online, shared document for knowledge synthesis. This document was the first draft of this article. The first three authors then analysed this document and iteratively developed themes to group the weak signals. During this process, the authors decided to use the deep leverage points as a conceptual framework to further structure and refine the themes for its suitability to discuss the weak signals with references to DfST. Section 2 presents this conceptual framework. The weak signal themes were then grouped under the two categories of deep leverage points; they are presented, exemplified and discussed in Section 3. Section 4 presents the prototype research agenda that emerged in response to our analysis of the weak signals and our final thoughts concluding the article.

1. CONCEPTUAL FRAMEWORK

For human society to operate within the boundaries of the Earth's physical systems (Steffen et al., 2015) while ensuring social resilience and justice (Raworth, 2012) there is a need for radical transformations, requiring long-term, systemic and structural changes in society (Loorbach, 2010).

The history of research in design that deals with long-term societal sustainability transformations goes back more than two decades, but the topic has recently become more popular among design research, education and practice communities (Gaziulusoy & Erdoğan Öztekin, 2019). DfST is situated at the spatio-social, socio-technical and socio-ecological-technical innovation levels of the design for sustainability field (Ceschin & Gaziulusoy, 2020). This emerging field is considered to be transdisciplinary; it learns from and contributes to multiple and expanding areas of theoretical and practice-relevant literature. These include but are not limited to: collaborative and participatory design, policy design and design for

government, systemic design, more-than-human design, decolonial and pluriversal design, indigenous and non-Western ontologies and epistemologies, solution-oriented sustainability science, sustainability transitions, complex systems theories, futures studies, transformative sustainability innovation in business, practice theory, alternative economies, critical urban research and feminist theory. Within DfST, expert and diffuse design (in the sense described by Manzini, 2015) co-exist, and expert design plays a multiplicity of roles including but not limited to those traditionally attributed to design (Gaziulusoy & Ryan, 2017). In addition to integrative, facilitative and communication roles, non-traditional roles for expert designers include intermediation between actors and processes of transitions (Hyysalo et al., 2019) and pushing boundaries of what is considered possible/plausible by transition actors (Boyer, Cook & Steinberg, 2011).

Although both historically and in contemporary society design has been contributing to significant changes at micro (artefact/technology) as well as at macro levels (culture) there is not a design-specific theory of social and systemic change. DfST borrows models from the literatures it learns from. For the purposes of this article, we use the leverage points model originally developed by the renowned systems scientist Donella Meadows (1999). This model identifies twelve leverage points to change systems (Figure 1). From top to bottom, the potency of leverage points to change systems increases. The *shallow* leverage points are about parameters and feedbacks in systems (such as subsidies, standards, taxes, and quantity and timing of material flows). These points represent measurable and mechanistic characteristics of systems and are easier points at which to intervene. Therefore these leverage points are popular among policy makers. The *deep* leverage points, on the other hand, are about social structures and institutions, and values, goals and worldviews held by system actors who shape the (emergent) direction of systems (such as criteria for success, how power is distributed, perspectives on system purpose). Abson et al. (2017) argued that, so far, both research and practice have primarily focused on the shallow leverage points and this has resulted in society failing to leave unsustainable trajectories behind. They suggested that, instead, we should intervene into the deep leverage points to create transformational systemic change.

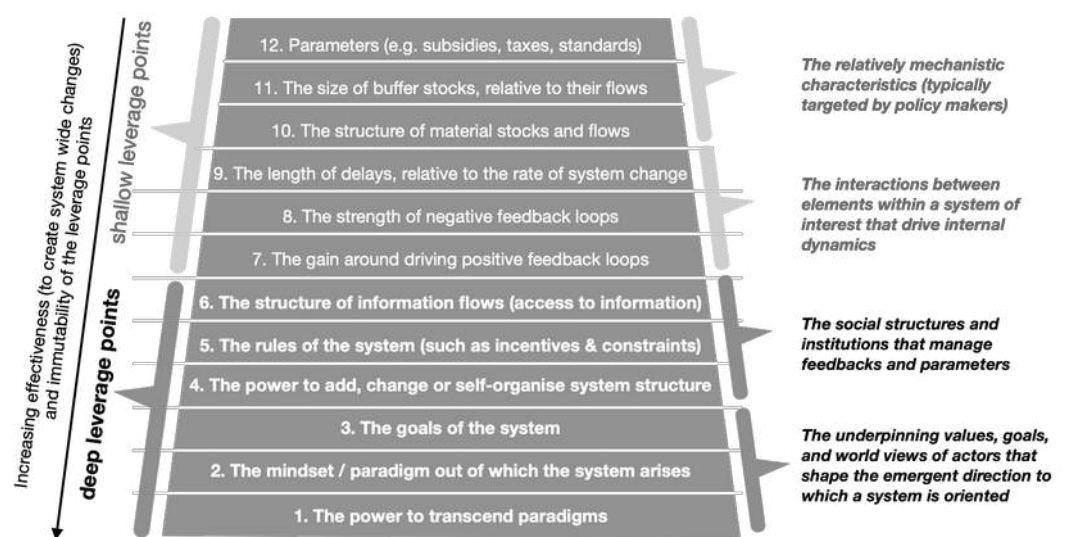


Figure 1. Leverage points to intervene in a system (adapted from Meadows, 1999 and Abson et al., 2017).

2. WEAK SIGNALS AT DEEP LEVERAGE POINTS

In this section, we present a synthesis of the weak signals we have identified so far in the context of the COVID-19 pandemic. As these are weak signals they are neither unequivocally widespread occurrences nor are they indisputable evidence of future forces of global or local change. However, in our opinion, discovery-based research in DfST could strive to further understand the significance and implications of these weak signals while the interventionist research in DfST could usefully work to find ways to scale up and amplify these signals. In alignment with the deep leverage points framework, we present the key weak signals under two main headings: social structures and institutions; values, goals and worldviews. In each sub-section, we list the weak signals and then provide some contextual clarification and examples.

2.1. Social Structures and Institutions

The weak signals:

- Roles of national governments and attitudes towards democracy and transparency during complex, systemic disruptions;
- Rapid pace of adaptive political, technological and scientific innovation across different levels of society during dynamically changing, highly uncertain situations;
- Broader visibility and increased awareness of structural inequalities;
- Broader visibility and increased awareness of vulnerabilities regarding production-consumption systems;
- Increased understanding of the shortcomings of the dominant, neo-liberal and global economic system in creating value for all and evaluating all value created;
- Activating and appreciating the benefits of mechanisms of self-organisation in response to crisis.

The pandemic has been significantly challenging to manage for governments. National responses have revealed differing priorities and ideologies, notably around the valuing of human life, economic stability, equality and personal freedoms (Strang, 2020, Weible et al., 2020). Governments have had to balance the need for rapid and wide crisis response with core values of democracy (Greer et al., 2020). In some instances, the balance shifted towards authoritarianism and low levels of trust were observed between governments and citizens, particularly on topics of surveillance and privacy (e.g. Couch et al., 2020; O’Sullivan & Thoele, 2020). While some leaders have shown a complete disregard for science (e.g. Keith & Gharib, 2020), most have been challenged to balance rapidly changing scientific knowledge with social and economic needs (e.g. Black, 2020; ‘Govt Grapples with Restaurant Re-Openings and Support Package’, 2020). Regional and local governments have had to balance state-wide regulations and local, contextual needs (e.g. Hill, 2020). Some government leaders (e.g. Jacinda Ardern, Prime Minister of New Zealand and Sanna Marin, Prime Minister of Finland (Español Olivian, 2020; YLE News, 2020)) have been praised for their innovative, transparent and inclusive communication with citizens (McGuire et al., 2020).

As lock-downs were imposed, self-organised, community-led responses were in many instances faster and more effective than those of government. Uncertainty ignited bottom-up

organization, social innovation, and novel business models. For example, in Helsinki, neighbourhood-based responses to care for the vulnerable came two to three weeks before the City Council sent information leaflets to households. Meanwhile, in the South American context, with a seemingly growing gap between decision makers and vulnerable populations, new collaborations are emerging, with municipal and state-level policy labs cooperating and strengthening relationships with communities. These observations are aligned with earlier research counting self-organisation as a key strategy for societal resilience in the face of adversities, rapidly emerging or slowly unfolding alike (Wilkinson, 2011).

The pandemic also foregrounded several important inequalities in occupational and socio-economic structures. It highlighted a reliance on a class of workers who have now been recognized as essential, for example, in healthcare, agriculture, food retail and logistics (e.g. Browne, 2020; Corkery et al., 2020). Many of these jobs are precarious, underpaid and often done by minorities or migrant workers without adequate protection from various risks (e.g. Soric, 2020). Many in service industries, especially tourism and hospitality, have lost their jobs altogether (Heinonen et al., 2020). Meanwhile, many in less essential, more privileged positions have shifted to remote working while retaining their safety, pay and healthcare benefits (Heinonen et al., 2020). These developments question the roles of some sectors and professions in the economy and society. Moreover, the pandemic revealed challenges in healthcare systems, their capacity, organization, resilience and ability to protect vulnerable and marginalized populations (Furlong & Hirsch, 2020). Some national approaches to medical care, e.g. in the USA and India (Gaffney, 2020; 'How the Coronavirus Crisis Exposes India's Social Inequalities', 2020), have exposed racial and class divides, the limits of private health care and the insurance industry. In Nordic countries, the uneven spread of the virus across social and ethnic groups calls for attention to the need for responsive and effective governance based on representation and understanding of cultural differences (e.g. Hirvonen, 2020).

The pandemic has highlighted the reliance on and lack of resilience in global supply chains (Gereffi, 2020). The challenges of obtaining needed resources have made the geographies of production more visible and have increased discussion in post-industrial regions about self-sufficiency, reshoring and building stronger regional trade alliances (Taplin, 2020). Debates about hoarding and stockpiling have centred on individually motivated consumption and collective disaster preparedness, raising questions about where resources should be concentrated, how they should be distributed and by whom (e.g. Anderson et al., 2020; Dai et al., 2020). Price gouging and extortion for essential goods (e.g. Johnson, 2020) has required state intervention, demonstrating the limits of the market into meeting human needs in a crisis (Subramanian, 2020). Governments have also been forced to rapidly develop new supply chains, resulting in competition and unusual alliances between private and public actors (e.g. Deschamps, 2020; Goodman et al., 2020). Rapid responses to personal protective equipment shortages by maker spaces, schools, and local factories have shown that it is possible for different scales of production to co-exist leading to greater awareness of open design and small-scale producers as viable alternatives to business-as-usual (Armani et al., 2020; Emergency Design Collective, 2020).

The pandemic is perceived as an opportunity to roll out dedicated policies for green transformations and economic revitalization through "green recovery" (Pantsar & Tynkkynen, 2020). Pushing further, the pandemic has inspired many to re-imagine 'the' economy and consider alternative models (Foundational Economy Collective, 2020).

Maintaining economic growth has been at the centre of dominant policies globally since World War II despite long arguments related to the unsustainability of continuous economic growth as a destructive system (see for example D'Alisa et al. 2014). However, the response to the pandemic has challenged and shifted many of the economic practices that have been considered unchangeable, thereby limiting the rights of capital and strengthening the role of national governments. Rents have been resisted or pardoned (The RHJ Editorial Collective, 2020), basic income has been introduced in some regions (Sánchez Nicolás, 2020), and state debt has increased (UN Department of Economic and Social Affairs, 2020). In the Netherlands, 170 academics proposed a five-point plan to create a sustainable and fair society in the post-pandemic context (European Environmental Bureau (EEB), 2020). Major journalistic outlets, such as Deutsche Welle (Russell, 2020) and BBC (Mair, 2020), have published stories about the need for economic restructuring. Significant financial losses by the complex network of businesses reliant on tourism ('Global Travel and Tourism Projected to Shed 174 Million Jobs', 2020; UN Chief, 2020) have been a reminder that sustainability transitions require long-term thinking to envision how livelihoods can adapt to lifestyle changes required for the mitigation of climate change.

2.2. Values, Goals and Worldviews

The weak signals:

- Increased realisation of the interconnectedness of ecosystems and social systems;
- Increasing realisation that human capacity and legitimacy to dominate nature is limited;
- Growing emphasis on the importance of nature for psychological well-being and social and climatic resilience;
- Greater awareness of race, age, ability and gender-based inequalities and increasing desire to address systematic, normalised, invisible and built-in prejudices and discrimination;
- Observed prioritisation of human and societal well-being over economic gain in innovation.

Research on the origins and evolution of the SARS-CoV-2 virus is ongoing, however, it has been established that coronaviruses are zoonotic and occur in wild animals such as bats and pangolins. For coronaviruses to infect humans the most likely scenario is that some animal species which are handled by humans play the role of intermediary hosts (Cyranoski, 2020). As the COVID-19 pandemic is the first global coronavirus pandemic, it has demonstrated once again, but perhaps more widely, that human systems and ecosystems are tightly entangled. In addition, the virus particle, a submicroscopic nonhuman agent, has disrupted all levels of society from individuals and communities to global political and economic systems. As a result, practices, policies and mindsets have rapidly shifted to consider this nonhuman stakeholder as an integral part of decision making, putting into question the *human-superiority-over-nature worldview* that has been so predominant in Western cultures (Zylstra et al., 2014). As human economic activity has slowed down, various natural systems have responded to the slowing of human activity during the pandemic, with cities reporting cleaner air and unusual sightings of wildlife (Chalasani, 2020; Regan, 2020).

Urban planning, and the value of green space and nature in cities, have emerged as important topics and sites of action during the pandemic with potentially lasting results. The rise in remote working and schooling, and the perceived risk of infection in confined areas, have contributed to the valuing of open-air spaces such as parks (Bäckgren, 2020; Lufkin, 2020). Likewise, more time spent at home has fuelled a new enthusiasm for urban gardening and a chance to learn about and care for nature in the city (Chandran, 2020). With less commuting and shorter travel distances, walking and cycling have become popular alternatives to indoor exercise and public transport (e.g. Benecke, 2020; Davey & Taylor, 2020). Underlining this shift in priorities, several European cities have taken the opportunity to put in place long-discussed policies that prioritise the use of roads by bicycles and pedestrians (UN COVID-19 Response, 2020).

These types of potential sustainability gains are, however, both fragile and unequally distributed. The pandemic has exposed widespread inequalities and made clear that global crises are not experienced in the same way by all. For example, data emerging in North America and Europe show racialized, immigrant, aging and economically disadvantaged populations have been disproportionately affected (Centers for Disease Control (CfDC), 2020; Saini, 2020). Concerns have been expressed that indigenous communities, along with the survival of their worldviews, cosmologies and ontologies, as well as their economies and practices have been threatened by the virus (de Dios, 2020). Women have been more adversely impacted than men through increased economic insecurity, unpaid care work and gender-based violence (UN Women, 2020). In academia, this has resulted in a sharp drop in publications submitted by women (Fazackerley, 2020). Making these discussions even more urgent, the death of George Floyd (Cobb, 2020) ignited the global Black Lives Matter movement, which despite lock-downs, has been supported by protests world-wide (Liubchenkova, 2020). The pandemic has therefore been marked by demands for and debates about systemic change related to inequalities rooted in race, gender, white supremacy, colonialism, oppression, extraction and economic disparity.

Despite discussions on the pandemic as an opportunity to promote sustainability transformations, governments have been challenged when prioritizing economy or environment. Governments have supported failing sectors, such as the aviation industry, that contribute to environmental and/or social degradation. France was the only country to make government support to a national airline conditional on the company not competing with trains, which means that the company would have to cull its domestic flights should the policy come into effect (Derrick, 2020).

3. FINAL THOUGHTS AND A *PROTOTYPE* RESEARCH AGENDA

DfST is premised on the possibility that climate change and other sustainability challenges can be addressed in a timely manner, collaboratively with other disciplines, to engender radical and systemic transformations. At its core, DfST is about identifying opportunities to intervene in support of the necessary transformations and acting upon them through designerly capacities, both traditional and emerging. In this position paper, we have scanned the complex and dynamic context of the COVID-19 pandemic for key weak signals that we see as potential seeds for transformative change. Of course, reflecting the mixed and often contrasting experiences of the pandemic we outlined above, counter forces may dilute the potency of these weak signals or make them redundant once a sense of ‘normality’ is again

established, particularly if arguments that the pandemic is an opportunity to reimagine and remake our society are disregarded. This is indeed a high risk based on historical evidence from the financial crisis of 2008. For this reason, it is our conviction that design, as a major societal and cultural influence, has an important role to play. In addition, certain discussions relevant to sustainability transformations, such as debates around decolonisation and more-than-humanist worldviews, are already influencing design while mainstream research in sustainability science and sustainability transitions have yet to engage in these discussions. The signals we identified are situated at the deep leverage points for systemic change; as such, they are a few degrees away from what design research and practice are immediately interested in and have power to directly influence. Nevertheless, it is these leverage points that require urgent attention from all actors of society with an interest and stake in sustainability transformations. Here, we formulate some preliminary research questions that arise from these weak signals that are relevant to design. We present this set of questions as a prototype for readers to discuss, build on and use as inspiration for research collaborations.

To develop the prototype research agenda, we use a heuristic framework from transdisciplinary research identifying the three types of knowledge required for changing systems (Pohl & Hirsch-Hadorn, 2007) and map the research questions onto each type of knowledge (Table 1). These three types of knowledge are:

- Systems knowledge: knowledge about the genesis and possible further development of a problem, and about interpretations of the problem in the life-world;
- Target knowledge: knowledge that relates to determining and explaining the need for change, desired goals and better practices;
- Transformation knowledge: knowledge about technical, social, legal, cultural and other possible means of acting that aim to transform existing practices and introduce desired ones.

Table 1. A prototype research agenda for DfST in the (post-)pandemic context

Type of knowledge	Research Questions
SYSTEM KNOWLEDGE	<p>What can the COVID-19 pandemic teach us about large-scale and possibly comprehensive societal change?</p> <p>What kind of changes in 'meanings', 'materials', or 'competences' have occurred during the COVID-19 pandemic that resulted in the evolution, disappearance and persistence of some practices and not others? What can DfST learn from this?</p> <p>How did governments make policy decisions and enforce policies? How have societies reacted to these decisions and enforcement measures? What can DfST learn from these?</p> <p>In which domains of living and working, and by which social groups, have changes and adaptations been taken up smoothly during the pandemic? What can DfST learn from this?</p> <p>Which social groups are vulnerable to large-scale and comprehensive change processes and in what ways? What can DfST learn from this?</p> <p>How were the strengths and weaknesses of current production-consumption systems surfaced during the pandemic and what impacts might this have on future priorities? What can DfST learn from this?</p> <p>Which government-citizen engagements worked best during the pandemic? What can DfST learn from this?</p> <p>What can DfST learn about the cooperation between different levels of government when faced with a crisis shared by all but experienced differently?</p> <p>In what ways has cooperation between governments been successful in limiting the spread and impacts of the virus (e.g. decision making, knowledge sharing, resource distribution)? What can DfST learn from this?</p> <p>What can DfST learn about preparedness, response times, ability to take decisions and act, by comparing responses and different styles of governance?</p>

Type of knowledge	Research Questions
TARGET KNOWLEDGE	<p>How can DfST assist in managing different concerns, expectations, needs and desires of multiple stakeholders in sustainability transformations based on learnings from the COVID-19 pandemic?</p> <p>How can DfST assist in identification of changes that are desirable and make explicit the 'desirable by whom'?</p> <p>Which futures would make resilient locales and communities? What roles can DfST play in communication and negotiation of these futures among all stakeholders?</p> <p>What values should be foundational for DfST in the (post-)pandemic context? What does sustainability, resilience and justice mean in (post-)pandemic context?</p> <p>What does a DfST that accommodates anti-racism, decolonization, non-Western ontologies and epistemologies, and human-nature entanglement look like?</p> <p>How can DfST assist in envisioning new political, economic and provisional systems that are sustainable, resilient and just?</p> <p>What does a positive vision of global cooperation effective in achieving sustainability transformations look like? What roles can DfST play in the development of this vision?</p>
TRANSFORMATION KNOWLEDGE	<p>How can DfST operationalise learnings from the COVID-19 pandemic and develop capacities for transformation, adaptation and learning to address sustainability challenges?</p> <p>In what ways can DfST use learnings from the COVID-19 pandemic to assist in building resilient and sustainable production-consumption systems?</p> <p>In what ways can DfST assist in ensuring that questions of inter- and intra-generational as well as inter-species justice are not absented from sustainability transformations?</p> <p>What new research approaches, methods and tools are needed for DfST?</p> <p>How should the DfST theories, approaches and methods evolve in relation to shifting and emerging values, mindsets and worldviews?</p> <p>How could DfST facilitate the scaling up or transfer of context-specific social, technological and policy learning that emerged during the COVID-19 pandemic that support sustainability transformations?</p> <p>Based on the learnings from the COVID-19 pandemic, how could DfST assist in the development of the institutions, networks, relationships, policies and resources needed for effective global responses to climate change and sustainability challenges?</p>

We acknowledge that this research agenda is high-level and incomplete given the multitude of research questions that can be formulated based on the weak signals presented. In doing so, we also note that research agendas which deal with systemic, complex and real-life problems have to remain dynamic and open. In addition, as such problems manifest themselves with high levels of nuances in specific spatio-temporal contexts, fine-grained research questions should be developed after operationalising the generic concepts that apply such as sustainability, resilience, justice etc. We close this position paper with the hope that this *prototype* research agenda becomes a living entity among design researchers who - like us - spend much of their waking time thinking about and acting on the most pressing challenge of our times: putting in place some foundational stones for the roles design research can play in creating desirable-for-all futures.

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