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# Titanic lessons for Spaceship Earth to account for human behavior in institutional design

Check for updates

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Combating environmental degradation requires global cooperation. We here argue that institutional designs for such efforts need to account for human behavior. The voyage of the Titanic serves as an analogous case to learn from, and we use behavioral insights to identify critical aspects of human behavior that serve as barriers or opportunities for addressing the challenges we face. We identify a set of public goods that may help us mitigate identified negative aspects of human behavior, while leveraging the positive aspects: standards and best practices, mechanisms for large-scale coordination, and curation of information to raise awareness and promote action. We use existing international organizations, providing at least one of these capacities, as cases to learn from before applying our insights to existing institutional solutions for global environmental protection. We identify institutional design features that, if adapted to better account for human behavior, could lead to more effective institutional solutions.

*“As long as man was small in numbers and limited in technology, he could realistically regard the earth as an infinite reservoir, an infinite source of inputs and an infinite cesspool for outputs. Today we can no longer make this assumption. Earth has become a space ship, not only in our imagination but also in the hard realities of the social, biological, and physical system in which man is enmeshed.”*

Earth as a Space ship, K.E. Boulding May 10 1965, Essay presented at Washington State University, for the Committee on Space Sciences.

*“The mastery of his indifference to danger, when other and less pre-tentious vessels doubled their lookout or stopped their engines, finds no reasonable hypothesis in conjecture or speculation; science in ship-building was supposed to have attained perfection and to have spoken her last word; mastery of the ocean had at last been achieved; but overconfidence seems to have dulled the faculties usually so alert. With the atmosphere literally charged with warning signals and wireless*

*messages registering their last appeal, the stokers in the engine room fed their fires with fresh fuel, registering in that dangerous place her fastest speed.”*

Speech of Senator William Alden Smith, Tuesday, May 28, 1912. Titanic Hearings US Senate.

In 1966, Kenneth Boulding used the metaphor ‘Spaceship Earth’ to capture the idea that we are all passengers on a vessel that provides fundamental support for our wellbeing<sup>1</sup>. Boulding used the metaphor of Earth as a spaceship to emphasize that Earth is not a limitless space but has definite boundaries. There is an obvious and direct analogue between Spaceship Earth and the large ocean liner Titanic, where the ocean corresponds to the vast and unknown space. Like Earth’s biosphere, the ocean liner’s hull provides a barrier between passengers and the ocean, and the vessel provides food, shelter, and support. While the voyage of the Titanic has been used as a common metaphor (e.g., in arts and the sciences for big problems and

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hubris, or to emphasize hard-to-navigate problems), we link the metaphors ‘Titanic’ and ‘Spaceship Earth’ to emphasize some specific aspects of the ‘piloting challenge’; namely that human behavior needs to be accounted for in institutional design.

In particular, we use the Titanic as an analogous case from which to draw important behavioral lessons about the challenges of piloting a large ship, what can go wrong, and what can be done to avoid icebergs. In doing so, we use the adjective ‘titanic’ to emphasize the enormity of the lessons that can be learned. We use the metaphor of Spaceship Earth to emphasize that humans are no longer passive passengers, but also crew members who steer the spaceship and thereby the future of humanity on Earth. ‘The iceberg’ here entails not only massive biodiversity loss, but also global temperatures stabilizing very likely at more than 1.5 degrees Celsius above pre-industrial temperatures, a state sometimes referred to as ‘Hothouse Earth’, in which many places on Earth could become uninhabitable<sup>2,3</sup>.

For Boulding, the piloting challenge was an engineering problem to fit the economic system into the Earth’s biophysical system. For us, the challenge also entails the fact that human decision-making is embedded in a psychological, social, technical, and biophysical context<sup>4</sup>. Our analysis adopts a complex systems perspective<sup>5</sup>. Hence, we understand all systems involving humans and human societies to be partly designed (e.g., institutions and organizations) and partly self-organizing (e.g., social interactions)<sup>6–8</sup>. The Titanic and Spaceship Earth represent two points on this continuum from purely designed to purely self-organizing. The Titanic emphasizes the power of human design capacity, yet the performance of the Titanic depended on the emergent behavior of the crew and passengers (a self-organized system) to a scenario they did not imagine. For us, the idea of Earth as a spaceship much more strongly emphasizes self-organization of the Earth system, yet human designs do impact how this self-organizing process is realized. We thus bring the Spaceship Earth together with the Titanic to think about how human behavior interacts and sometimes even collides with institutional structures such as rules, norms, and regulations. Specifically, even if all the technical information about how to navigate the ship is available—human behavior may still get in the way.

We examine the historical account of the Titanic and draw on research from behavioral economics and psychology to uncover latent aspects of human behavior that may detract from or contribute to the human capacity to process information, anticipate potential risks, and to coordinate and collectively act when risks are realized. We also highlight a critical difference between the Titanic and Spaceship Earth today: there is no captain that can enforce rules and norms. We then use these aspects of the Titanic story to motivate our investigation of potential institutional solutions to the grand environmental challenges we face.

The Titanic experience highlights a particular set of public goods—steering capacities for Spaceship Earth that may help us overcome the behavioral barriers and leverage behavioral opportunities: standards and best practices, mechanisms for large-scale coordination and emergency response, and curation of information to raise awareness and promote action. Through a comparative institutional analysis, we examine nine international organizations that may serve as models—or cases to learn from—for the provisioning of these steering capacities. We apply our insights from the institutional analysis to existing international institutional solutions for environmental protection. We identify critical institutional design features that, if adapted to better account for human behavior, could lead to more effective institutional solutions.

By combining an institutional analysis approach with insights from behavioral economics and doing so through a complex adaptive systems lens, we generate insights that are partly consistent with findings from earlier analyses on institutional design and from economics and game theory, for example, that without enforcement mechanisms, it is challenging to overcome some free-rider problems. But our analysis also allows us to extract additional insights and building blocks for exploring alternative governance models to improve our capacity for collectively piloting Spaceship Earth through the turbulent waters of the Anthropocene.

## Methods

We begin by examining the historical account of the Titanic and use insights from behavioral economics and psychology to uncover latent aspects of human behavior that are critical to consider when searching for potential institutional solutions to the grand challenges we face. We also highlight and motivate a set of public goods, or ‘steering capacities’ that could be supplied as institutional solutions addressing these latent behavioral aspects.

We next turn to existing international organizations that are (more or less) successful in supplying at least one of these ‘steering’ capacities. We use these example organizations as cases to learn from. In particular, we are guided by the following questions: (1) Are there specific institutional design features that can explain why some organizations are more or less successful at reaching their desired outcomes? (2) Are there critical unintended outcomes, resulting from human interaction with the institutional design of the organization that could be avoided or at least mitigated through changes in design?

To answer our two questions, we use Elinor Ostrom’s Institutional Analysis and Development (IAD) framework and associated Design Principles (DPs)<sup>9</sup> in combination with case-based real world outcomes for each of these organizations. The DPs were originally identified to highlight important institutional features of successful governance systems for common pool resources. We use them here not only to help answer our two questions but also to assess whether an organization is a good case from which to learn (meaning that most DPs are met). To facilitate presentation of the analysis, we provide a list of the DPs here: DP1: Clearly defined boundaries, DP2: Congruence between appropriation and provision rules and local conditions, DP3: Collective choice agreements, DP4: Monitoring, DP5: Graduated sanctions, DP6: Conflict resolution mechanisms, DP7: Minimal recognition of rights to organization, DP8: Responsibility for governance is present in nested tiers.

We chose the following organizations to learn from: Amnesty International (AI), the Federal International Football Association (FIFA), the International Monetary Fund (IMF), the International Organization for Standardization (ISO), the International Space Station (ISS), the Marine Stewardship Council (MSC), the Society for Worldwide Interbank Financial Telecommunication (SWIFT), the World Trade Organization (WTO), and the World Health Organization (WHO). Finally, we apply our insights on capacities and design features to evaluate existing institutional solutions for environmental protection at the global scale. Full details on our method and analysis of each case are presented in the Supplementary Method.

## Results

### The Titanic and us

The Titanic’s journey in 1912 and Spaceship Earth today share striking similarities. For example, despite receiving signals of imminent danger, the crew of the Titanic did not take precautionary measures. Similarly, many argue that early warning signals have not been taken seriously enough by the ‘crew’ of Spaceship Earth. Humanity has seen warning signals from the biosphere for decades. The 1972 UN World Conference on the Environment placed environmental issues at the forefront of international concerns. 50 years on, however, the situation is still deteriorating as illustrated by the frequency of heatwaves, storms, floods, melting glaciers<sup>10</sup>, and species loss<sup>11</sup>. Why did the crew of the Titanic fail to respond to warning signals and why do we, the crew and passengers of Spaceship Earth, fail to respond to warning signals from the biosphere? We explore this question by describing some commonalities between the Titanic and today’s situation, focusing on insights from behavioral research that are critical to consider when searching for institutional solutions.

One reason for failing to recognize the fragility of the biosphere and the urgency to act could be that many people lack the imaginative capacity to grasp what hitting the iceberg would mean for Spaceship Earth. Some even argue that the climate crisis is a crisis of imagination<sup>12</sup>. Although we humans are unique in our ability to imagine the future, this capacity is also limited by our experiences<sup>13</sup>. For example, for many people, climate change happens

'elsewhere'. Because we tend to estimate likelihoods based on experience of similar events<sup>14</sup>, we underestimate the consequences of climate change. Moreover, because of the tendency to search primarily for information that confirms prior beliefs<sup>15</sup>, many people lack the awareness needed to evoke the necessary visceral reactions<sup>16,17</sup>. These biases can help explain why some fail to fully comprehend the severity of today's environmental challenges, and similarly, why the crew of the Titanic could not grasp the consequences of hitting an iceberg. At the time of the Titanic's voyage, ice was believed to pose a small risk to large vessels<sup>18</sup>.

Whether the 'crew' of Spaceship Earth will act in time is also related to perceptions of the scale of problems. One can speculate about what errors and mistakes were made by the crew of the Titanic when the danger of hitting the iceberg was imminent. However, once they decided to actively steer away it was too late: they hit the iceberg, and at an unfortunate angle<sup>18</sup>. Like a big vessel, the climate system also has inertia: even if we stop emitting carbon dioxide today, global temperatures will continue to rise for decades, maybe even centuries<sup>19,20</sup>. The inertia of the climate system motivates early and substantial mitigation efforts, especially in a world with uncertainty<sup>21</sup>. However, because stock effects are easily misperceived<sup>22,23</sup>, people underestimate the urgency of actions needed to avoid disasters.

Although some of the crew members and passengers aboard Spaceship Earth may comprehend the implications of colliding with the iceberg, most of them do not take necessary actions. Although the Titanic did not try to set a speed record, time was still a priority, much like the short time revenues generated by the resource-intense and carbon-based engines of our economies. Overconfidence and optimism bias can emerge in competitive settings<sup>24</sup>, and may have contributed to the widespread belief that the Titanic was 'unsinkable'<sup>18</sup>. Moreover, in a context when short term revenues are valued and prioritized, we are prone to delaying costly behavior (e.g., mitigation actions) and prioritizing immediate rewards over long term benefits, often inconsistently<sup>25,26</sup>.

Differences in survival rates between first-, second-, and third-class passengers of the Titanic tell an uncomfortable story, where the future did not hold equal promise to all passengers<sup>18</sup>. Similarly, in present times, the bulk of impacts of environmental change is expected to amplify existing imbalanced socio-economic structures<sup>27,28</sup>. A large part of the population in the poorest economies depends directly on resources provided by nature, which are being affected by environmental degradation and rising temperature<sup>29</sup>. The ability to adapt to environmental degradation and climate change effects is also more challenging for the poorer parts of the population<sup>30</sup>. The type of 'sacrifices' needed to curb emissions hardly matches the type of sacrifices people had to make to save lives on the Titanic, sometimes with their own lives. Yet, it is unclear if the wealthier passengers of Spaceship Earth, who, so far, have contributed the most to a fragile biosphere and a warming climate, are willing to bear the necessary costs and make the necessary investments in for example technologies to secure the livelihoods of more vulnerable populations. For Spaceship Earth, the main group of beneficiaries of such actions are typically temporally and personally removed from today's decision-makers, creating a psychological distance and an additional barrier to altruistic actions<sup>31</sup>.

This value-based dimension of the behavioral barrier to adequately respond to warning signals interacts with the cognitive dimension of failing to recognize the severity of the environmental situation. Values can be thought of as guiding principles in people's lives<sup>32</sup>. They help us in prioritizing actions and goals and also influence how we interpret and understand information<sup>33</sup>. At the same time, our values are not only influenced by current norms in society, but also by our beliefs and by our awareness of the situation<sup>34</sup>. Hence, the values leading to an unwillingness to take necessary actions can be regarded as a consequence and a cause of not recognizing the urgency of the problem.

The Titanic illustrates negative aspects of human behavior that led to disaster for those on the ship. But there were also signs of emerging prosocial values and altruistic actions (e.g., manifested by the motto 'women and children first'), and willingness to take action, leading to a more or less coordinated emergency response. Survivors of the Titanic also testified

about remarkable stories of sacrifice, heroism, and cooperation<sup>18</sup>. Moreover, following the Titanic, major improvements in maritime safety were made with the establishment of the International Convention for the Safety of Life at Sea (SOLAS) in 1914, which still governs maritime safety. Perhaps a better preparedness for the environmental challenges will follow due to the increased number of local and regional environmental disasters we have witnessed over the past years, and in particular in the most recent year<sup>35</sup>?

Signs of an increased awareness are for example the level of concern about the state of the planet expressed by citizens of the world in surveys<sup>36,37</sup>. Other signs are grassroots movements, like Fridays for Future<sup>38,39</sup>, the increasing number of businesses investing in green practices<sup>40</sup>, governmental investments in green technologies<sup>41,42</sup>, the granting of fundamental rights to nature<sup>43</sup>, and collaborative initiatives between governments, like the European Green Deal aiming to make the EU climate neutral by 2050<sup>44</sup>. Can some of these trends be leveraged to turn the ship in time?

While there are commonalities between the Titanic voyage and our current situation, there are also differences. Perhaps the most important is the fact that there is no captain for Spaceship Earth. At least everyone who boarded the Titanic opted to trust the captain. Decisions for Spaceship Earth are taken by representatives of passengers (in some cases self-elected leaders) ('the crew'), as well as by passengers themselves (sometimes quite powerful). Members of the crew do not always agree, and if they agree they do not always manage to coordinate around agreed-upon actions. They spent years discussing if there is an iceberg, finally reaching a consensus that there is an iceberg, but then moved on to discussing how potentially damaging it is, and when the ship needs to be turned, but not necessarily *how* to best turn the ship. If it takes as long to agree on how to turn the ship as it has taken to agree that it needs to be turned, it will likely be too late. The crew faces the additional challenge that the passengers also influence the direction of Spaceship Earth through their individual actions. This creates collective action problems in the form of social dilemmas, in addition to the coordination problems already mentioned. Even if crew members and passengers of Spaceship Earth would benefit from environmental measures, no individual actor or nation state has sufficient incentive to act alone, a challenge exacerbated by the time lag which exists between the cost of environmental protection measures and some of the benefits, which will accrue to future generations.

### Highlighting key steering capacities

To address cognitive inability to fully comprehend the urgency of the problem and the fragility of the planet, standards in the form of targets and best practices (informal or formal behavioral rules) could be used. These can be regarded as tools to facilitate adequate actions by reducing the cognitive loads for actors<sup>45</sup>, also taking into account our limited cognitive capacities<sup>46</sup>. Concretely formulated targets and best practices make it easier for actors, irrespective of their level of understanding of the problem, to implement effective measures<sup>47</sup>. Targets and best practices, if properly designed, do not require imagination as they are merely supporting behavioral guidelines or rules. Standards can be seen as comparable to the code of conduct for maritime safety, which were updated following the Titanic disaster.

The number of environmental hazards e.g., in terms of floods, storms, heatwaves and wildfires are predicted to increase in the decades to come<sup>48</sup>. Such events can have severe adverse consequences for example in displacement of people, the destruction of buildings and infrastructure and stunted agricultural production which in turn can lead to famine, and armed conflicts<sup>48</sup>. Capacity for coordinating emergency responses to such events (like the one taking place on the Titanic) will be required, not only to prevent urgent suffering, but also for rebuilding communities and for strengthening community based environmental protection measures<sup>49</sup>. Effective coordination of emergency responses but also of long-term large-scale environmental protection requires committed actors that trust and legitimize the coordinating node, which in turn implies a need for stable cost-sharing agreements that dictates the responsibilities and rights of each actor<sup>50</sup>. This is also true for coordinated environmental protection.

The capacity to curate information, spread awareness and promote action is needed not only for raising awareness about the extent of the current environmental challenges humanity is facing but also about potential solutions. Both are needed for addressing the hesitancy to take necessary actions. If people could comprehend what's at stake and how it could be addressed, they might be more inclined to take the necessary actions<sup>51</sup>. Moreover, people may hold values that align with a willingness to take necessary action, but if the context in which they live does not evoke/trigger these values they may not be acted upon<sup>33,52</sup>. Raising awareness could thus serve as a reminder of pro-environmental and altruistic values that people already hold. This last capacity becomes especially critical considering the collective action nature of the problem, the need to rely on voluntary but costly action in the presence of potential free-riders.

The capacities we have identified are thus (1) standards and best practices, (2) mechanisms for coordination and emergency response, (3) curation of information to raise awareness and promote action. These capacities could address the failure to recognize the fragility of the biosphere, the urgency to act, and the hesitancy to take the necessary actions. They could also create institutional incentives to leverage pro-social and pro-environmental values. We regard these public goods/steering capacities as one set of potential solutions. This implies that they may not be the only set of steering capacities that could help to address the behavioral obstacles and opportunities. Moreover, they may not be sufficient for avoiding hitting the iceberg. However, we recognize that these capacities are plausible institutional solutions as there already are international organizations providing them successfully.

### Learning from international large-scale organizations

MSC, the FIFA, and the ISO are examples of global organizations that provide different types of standards and best practices. The MSC standard signals to consumers and other food system actors that MSC certified products come from a sustainable stock of seafood. FIFA provides rules for how the game of football should be played, allowing different teams from different places to compete. The ISO provides consensus-based standards resting on expert knowledge about, e.g., the most effective or cost-efficient way to produce a good or service, to manage a process, or to provide a service for specific aims. Our analysis of the case-based outcomes shows that these organizations may be associated with unintended behaviors and outcomes that may threaten their effectiveness in the long run. For FIFA, for example, corruption scandals regarding the decision about the location of World Cups is an unintended outcome, where one explanation is the financial benefits attached to the standard in addition to the value of the public good itself, combined with the non-transparent process for how actors can access these additional benefits (DP2). These features result in the manipulation of the 'one country one vote system' and the coercion of small nations with no aspirations sports-wise to tilt the results in favor of certain interests<sup>53,54</sup>. Moreover, these organizations may reinforce existing inequalities. In the case of MSC, a cost is attached to obtaining a license. Since the standard in itself can increase market shares, it attracts more profit to already established actors in the system, thus cementing existing inequalities<sup>55</sup>. Corruption and a reinforcement of existing inequalities do not seem to be prevalent in the case of ISO. One explanation can be the high transparency that exists around 'qualification processes' and little potential for financial gain from manipulating the system.

While standards can facilitate coordination, on their own, they may not provide the necessary coordination. Some organizations, such as the WTO, ISS, IMF, SWIFT and WHO are more actively working to provide coordination. The WTO coordinates international trade, the ISS is a platform for international research collaboration in fields such as astrobiology, astronomy, physical sciences and materials sciences, the IMF works to harmonize its members' monetary policies, and to maintain exchange stability, SWIFT coordinates financial messages, and WHO coordinates emergency responses around health issues. Also, for this group of organizations the perception of success can mask unintended consequences and outcomes, e.g., power asymmetries can lead to adverse outcomes. In the case of the

WTO, majority voting (DP3) is likely to improve efficiency when making decisions, however, most powerful members could exert pressure to influence decisions. The IMF has been criticized for imposing economic policies (as a condition for lending) that have not always been in the best interest of a particular country<sup>56</sup>.

These organizations illustrate that we can achieve large-scale coordination, at least when the coordination benefits clearly outweigh the cost of actions and moreover, when the costs and benefits are fairly distributed among the members. It could be far more challenging when this is not the case. How can we achieve large-scale coordination when more costly actions are needed? The WHO coordinates such costly efforts around health emergencies. Two recent examples illustrating this role of the WHO are the COVID-19 pandemic and the war in Ukraine. In both cases, the WHO managed to leverage the empathy people felt for the vulnerable and coordinate large-scale prosocial actions. However, one design principle that stands out that is not met for the WHO: the graduated sanctions (DP5) which is the DP that can mitigate or attenuate selfish behavior under scarcity (rushing for scarce lifeboats), in which case we have a social dilemma problem (a collective action problem). This was highlighted during the pandemic when governments chose to prioritize second doses of vaccine for their already vaccinated population before sharing their supply, hoping to free-ride on other countries' good will. Moreover, attention and empathy have a short time span<sup>57</sup>, as shown by the war in Ukraine where media attention and voluntary contributions have decreased as a result of 'compassion fatigue'<sup>58</sup> although the war and the suffering continue.

AI and WHO curate information and raise awareness to promote action. WHO for example collects data on global health issues, and serves as a forum for scientific and policy discussions related to health. It tries to raise awareness around different health issues to promote healthier lives (insights about WHO as an organization can be found above). The stated goal of AI is to create a future where human rights (by the Universal Declaration of Human Rights) can be enjoyed by everyone. To this end they raise awareness, engage in advocacy, human rights research, and education. AI is a global independent non-governmental organization. The organization has existed for more than 50 years and is widely recognized for its work (e.g., as a recipient of the Nobel Peace Prize). There have, however, been some controversies and criticism of the organization. Criticism has included claims of institutional discrimination within the organization<sup>59</sup> and of associating with organizations with a dubious record on human rights protection<sup>60</sup>. When looking at the design features of the organization, the structure for monitoring of activities and sanctioning of members (DP4, DP5) seem weak, which could be a contributing factor for such outcomes.

### Insights for existing environmental institutions

Perhaps the closest candidate providing the set of steering capacities at the global level is the United Nations Environmental Program (UNEP). Established in 1972, it hosts the secretariats of many research bodies and multilateral environmental agreements such as the Convention on Biological Diversity (CBD), the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), and the Intergovernmental Panel on Climate Change (IPCC). These collaborations are in turn outcomes of coordination and dictate the responsibility of each signee. As such UNEP offers coordination.

The UNEP and associated bodies also curate information, offer guidance and best practices, and aim to raise awareness of the causes and consequences of global and regional environmental problems, with the purpose of enabling nations and people to effectively protect the environment. It also operates globally to respond to natural disasters<sup>61</sup>. In these roles the UNEP has been successful, considering the impact of the Assessment reports from IPCC<sup>48,62</sup>, the Millennium Ecosystem Assessment report<sup>63</sup>, and the Our Common Future report<sup>64</sup>. When it comes to promoting action, it has also been successful in some areas, with the adoption of the Kunming-Montreal framework<sup>65</sup>, and the Montreal protocol<sup>66</sup>, the only protocol with universal ratification, leading to the phasing out of ozone depleting substances as a prominent example. UNEP was also instrumental in the global

environmental discussions that led to the establishment of the United Nations Framework Convention for Climate Change (UNFCCC), the parent treaty to the Paris Agreement and the Kyoto Protocol. UNFCCC has its own secretariat (that among other things help organize the Conference of the Parties (COP) of these agreements), however, UNEP supports the implementation by providing scientific research, policy advice, and facilitating cooperation among nations.

Despite these achievements, given the state of the planet, it is clear that the actions taken are not sufficient and that in this respect the UNEP does not (yet) reach desired outcomes. Part of this explanation could be that UNEP, unlike the UN agency WHO, was established as a program, not a specialized agency, placing it lower in the UN hierarchy, which could limit its coordination abilities<sup>67</sup> (DP7, DP8). Its performance is probably also hampered by the funding model, depending solely on voluntary contributions, where the majority of its budget is provided by a small group of around 15 countries, leading to significant fluctuations in funding based on these countries' priorities and their recognition of UNEP's efforts<sup>67</sup> (DP2).

Our analysis of existing organizations highlights the importance of transparent and fair processes and outcomes around who contributes knowledge, time and money in the formulation of environmental standards and best practices, and around monitoring. They also illustrate the need to avoid power asymmetries between different members regarding who decides on the best procedure for structuring coordination efforts. This would mitigate potential problems of inequality cementation and corruption. Although the UN as an organization has been criticized on some of these accounts<sup>68</sup>, it may not necessarily spill over in the formulation of standards and best practices of UNEP. Treaties like the Paris Agreement and the Kunming-Montreal Biodiversity Framework stipulate targets but these agreements also specifically include mechanisms for transparency, accountability and compliance, potentially mitigating problems of inequalities and corruption (see for example the Enhanced Transparency Framework of the Paris Agreement<sup>69</sup>). They also emphasize the importance of transferring technology and knowledge and supporting infrastructure between countries with different abilities and constraints (see e.g. the Paris Agreement<sup>70</sup>).

In relation to targets and best practices, there is nevertheless room for improvement. Existing targets stipulated in the treaties may not fully address the cognitive barriers to action. For example, the 1.5-degree target in the Paris Agreement is problematic as it requires *imagination* to completely grasp what it means to cross the 1.5-degree target. An agreement in the form of a 'safety standard', like an emission cap, would provide a standard where lack of imagination may not necessarily pose the same problem as it is an easier behavioral rule to follow (it may even allow for norms to emerge beyond committed environmental stewards). A global 'carbon law' (halving carbon emissions every decade) that has been proposed<sup>71</sup> is an example of such a standard, which could be accompanied by a reduction target for each nation<sup>30</sup>. However, we have yet to see real world cases of such standards (emission caps) at the global level.

The most critical weakness of the UNEP and associated entities is, however, the absence of a global enforcement mechanism (DP5). At the global level targets are ultimately non-binding and thus require the type of collective action, which we are hesitant to take at the global level. The absence or weakness of global enforcement mechanisms is a well-recognized and general feature of global organizations and of international environmental agreements, they must be self-enforcing: no country can be forced to sign an agreement and they can always withdraw from the agreement. Countries must view them as attractive enough to sign and be willing to voluntarily fulfill the terms of the agreements<sup>72</sup>.

On a regional level, however, there may be 'captain substitutes' with enforcement mechanisms. Consider for example, the European Union (EU). The European Climate Law, adopted in 2021, is a central element of the European Green Deal and sets out a legal framework for the EU to achieve its climate objectives, including fulfilling the Paris Agreement. It is legally binding for the member states. If member states fail to comply with EU law, the European Commission can initiate infringement procedures.

These can ultimately lead to cases being brought before the Court of Justice of the EU, which can impose fines on member states<sup>73</sup>.

The European Green Deal has more precise targets (compared to the Paris Agreement) aiming for climate neutrality by 2050. This is accompanied by a plan, the 'fit for 55', implying a reduction of net greenhouse gas emissions by at least 55% by 2030 compared to 1990 levels and includes a mechanism for emission reduction through the EU Emission Trading System (ETS)<sup>74</sup>. The EU ETS operates on a "cap and trade" principle, where a cap is set on the total amount of certain greenhouse gases that companies covered by the system can emit. Companies receive or buy emission allowances, which they can trade with one another as needed. Current sectors affected include the energy sector, the manufacturing industry, and aviation, and from 2024 also maritime transport and the incineration of municipal waste. A new separate ETS (ETS 2) for buildings, road transport, and additional sectors will be introduced in 2027 or 2028 (depending on the level of energy prices) to further broaden the scope of emissions trading within the EU<sup>75</sup>. By this mechanism, the European Green deal avoids the imagination problem but there is room for improvement also here. Besides criticism related to caps being set too high, and that there are too many exceptions<sup>76</sup>, the Green Deal's commitment to "no person or place left behind" is an acknowledgment of the need to address social disparities, yet, specific strategies to tackle this issue have been less pronounced<sup>77</sup>.

A bridge between the UNEP and the EU initiatives could be a climate club. Based on insights from game theory, climate clubs have been put forward as a potential solution to help address the social dilemma problem associated with climate change. The climate club solution would entail a coalition with a smaller number of devoted actors (the EU, for example), for which it also makes economic sense to punish non-participants together<sup>78-80</sup>, thereby overcoming free-rider problems. This proposed incentive structure would enable a larger stable coalition with high levels of abatement. Analyses suggest that such climate clubs could attract new members<sup>72</sup> once the first coalition has proven to work, thereby offering a potential to cover most of the relevant actors in a longer term.

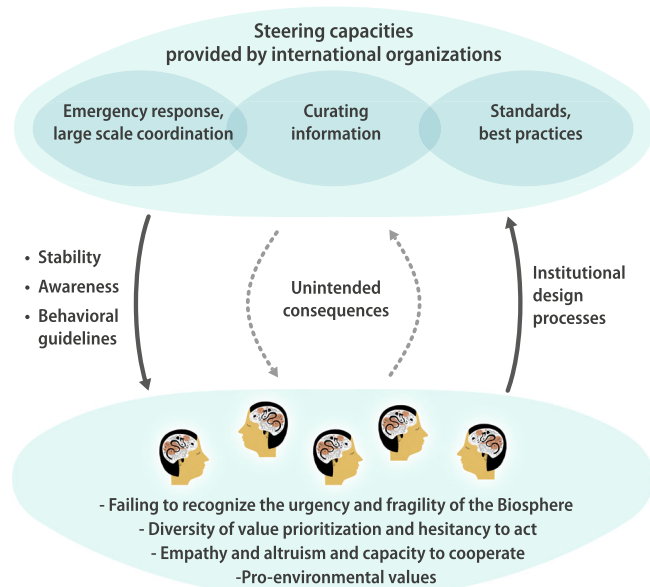
Could the European Green Deal and the US Inflation Reduction Act (IRA) be the start of such a climate club? This would be in line with a shift in focus advocated by some state and non-state actors, a shift from a reliance on global full coverage treaties to a bottom-up approach where existing efforts at multinational, national, and subnational levels are linked<sup>81</sup>. However, potential obstacles to such linkage have been pointed out, for example, different levels of ambition, regulatory coordination, and competing domestic policy objectives<sup>82</sup>.

This could indeed be the case here. The main aim of the EU Green Deal is to become climate neutral by 2050. The US IRA has multiple aims, but the two main aims are to combat inflation by reducing purchasing power in the US economy and to contribute to climate change efforts. Unlike EU measures, it relies heavily on tax subsidies. Although praised by some, it has also been criticized for its potential negative impact on EU exports and economy. So far the EU has reacted by adjusting its State aid rules and the Green Deal Industrial Plan proposals to mitigate the IRA's effects on its economy<sup>83</sup>. Considering these differences and concerns, and the absence of other big emitters, a climate club in the near future seems unlikely.

This example highlights that we need to pay attention to how cooperation emerges. Even if one could design an institution that, once in place, could overcome the climate social dilemma, human behavior may still get in the way. The first obstacle may be to even get to the drawing table for such an agreement, simply because of different value prioritization by different world citizens (reflected not only in different mitigation ambition levels, but also in different types of environmental policies).

## Discussion

While it is easy to dismiss current environmental organizations and treaties, like the UNEP, the UNFCCC, and the Paris Agreement, because they currently fail to protect the life-support system of Spaceship Earth, we here highlight the important fact that these entities still maintain some key essential functions in captaining Spaceship Earth. Figure 1 is an illustration



**Fig. 1 | Conceptual framework guiding our analysis.** Institutional design processes can provide necessary steering capacities in the form of emergency response and large-scale coordination, curation of information, standards, and best practices. These public goods - steering capacities - provide, in turn, stability, raised awareness, and easy-to-follow behavioral guidelines, which in turn are important for addressing behavioral barriers to change, namely a failure to recognize the fragility of the Biosphere and the urgency of the problem, the diversity of value prioritization, and hesitancy to act. Raising awareness can also leverage and influence our pro-environmental and prosocial values and behaviors (altruism, empathy and capacity to cooperate), making them more aligned with necessary actions. However, unintended consequences (e.g., corruption) can emerge if institutional design does not account for human behavior. Image credit: Azote.

of the conceptual framework that has guided our analysis. It emphasizes that institutions can be designed to provide important steering capacities – public goods—that, in turn, can help to address behavioral tendencies such as misperceptions, confirmation biases, and a lack of imagination about what hitting the iceberg really could be like with the help of curated information, and shared information on best practices for environmental protection. These public goods, or steering capacities, raise awareness about environmental and social issues and provide easy-to-follow behavioral guidelines. Organizations taking the lead in coordinating actions also provide organizational stability and in so doing can leverage existing pro-environmental and altruistic values and awareness which may, in turn, promote needed collective action across scales and levels of organization. We started our journey by explaining that we see all systems involving humans and human societies as partly designed and partly self-organizing. We argue here that design can also embrace the self-organization part, by accounting for the diversity of human values and behavior, leading to more effective institutional solutions.

Current environmental collaborations have an important role to play for steering Spaceship Earth towards a more sustainable trajectory. However, our analysis suggests areas for improvement in terms of institutional design. Such improvements could for example include modifications to the funding model of an organization like UNEP, making it less vulnerable to short-term variation in members ambitions towards the stated goals of the organization. Other potential changes include transparency regarding distribution of costs and benefits and influence. Efforts could also be made to increase the ‘status’ of the organization, making sure it is well-recognized by members and non-members. These adaptations could lead to more effective institutions and could mitigate unintended outcomes such as corruption and a reinforcement of existing inequalities. Improvements in environmental agreements can also be made in terms of making standards and best

practices cognitively easier to follow, hence less dependent on our imaginative capacity.

However, as we have pointed out, existing environmental treaties may still fail to solve global environmental challenges that require large-scale cooperation (so that we can overcome the social dilemma at the global level). A recent meta-study, covering over 200 primary empirical studies of international treaties confirms our observation<sup>84</sup>. Hoffman and co-authors<sup>84</sup> find that while international treaties enabling coordination with respect to trade and financial flows succeed in reaching their intended goals, for other areas involving cooperation problems, e.g., international environmental challenges, treaties without enforcement mechanisms are, as theory predicts, less likely to succeed in reaching desired outcomes.

Current organizations are snapshot images of what we up to now have been able to negotiate about at the international and global levels. Therefore, they represent the lowest common denominator of common values. Perhaps if the existing values of all world citizens were more aligned with the situation we are in, an agreement in the form of a climate club would be more feasible? But (how) can we change our values and value prioritizations? Once values are formed, they are believed to be relatively stable<sup>85,86</sup>. This would suggest that one attempt to strengthen pro-environmental and pro-social values could be through the educational system<sup>87–89</sup>. Moreover, some studies suggest that values may change later in life if initial values are challenged repeatedly<sup>85</sup>, suggesting that we should also repeatedly challenge values and behavior that hinder sustainability efforts.

We can also think about organizational designs that better reflect the current diversity of values that exists around the globe and that would enable actions reflecting existing pro-environmental and pro-social values. For this, it makes sense to distinguish between different shared values implied by cross-cultural work<sup>90,91</sup> on the one hand, and domain-specific sustainability-related values implied by the challenge of governing Spaceship Earth, driven by the recognition that we are all in the same boat. While ‘imagination about what hitting the iceberg really means’ is important for all world citizens, one size (solution) may not fit all, because our societies are all relational in slightly different ways. For instance, inducing the Chinese population to work to avert the iceberg, can most certainly not proceed in the same way as inducing the US population to do so, and likewise populations in EU countries.

Our analysis therefore supports the idea that there is not one organizational solution that will solve global environmental problems<sup>92</sup>. Instead, we need organizational solutions providing different public goods (steering capacities) at different scales. In the absence of a global enforcement mechanism, we also need organizational forms that can support existing ongoing local solutions and initiatives. For example, by enabling emergence of different types of committed agents and actors in various places and across different cultural contexts to connect and take actions for sustainability. A similar line of thinking was also highlighted as one key feature needed to make the UN function better, pointed out by all three winning ideas in the New Shape Prize - awarded to innovative ideas for new and improved global governance models (New shape prize). One of the winning contributions suggested having a civil society-focused chamber instead of the current one which gives additional power to certain nations (especially in the UN Security Council).

Examples of such emerging committed actors that could be part of a civil society chamber are for example La via Campesina, an international movement bringing together millions of peasants, indigenous people, pastoralists, fishers, small and medium-size farmers, working for food security. Other examples include groups of actors working outside their mandate to make a significant change. SeaBOS provides such an example. This science-business experiment with keystone actor dialogs reveals how a deeper understanding and a shared vision for biosphere stewardship can redirect major actors such as transnational companies, towards collaboration aimed at enhancing the resilience of Spaceship Earth for human wellbeing<sup>93</sup>. Another example is SWIFT, an enabler of global cooperation that can work outside of its mandate. The membership in SWIFT is a mix of nations and financial institutions. In this regard, both private and public interests are

mixed within the membership and governance of the cooperative. Nation members can thus be sanctioned when global matters threaten certain planetary or geopolitical affairs. Most recently, Iran and Russia have been sanctioned, as nations, by suspending their financial institutions the access to SWIFT, making it harder for them to make financial transactions internationally. Sanctions can also happen to members' financial institutions and the governance structure has very clear aspects of monitoring, sanctioning and conflict or dispute resolutions.

So how do we move forward, as advocates for the need to reach a more sustainable trajectory for Spaceship Earth? We can continue to build awareness around the need to rethink organizational design by taking into account how organizational structure interacts with human behavior, while looking for alternative organizational forms that can support existing local solutions and work outside of their mandates. As a first exercise and thought experiment we could ask ourselves: if we could redesign the organization of the Titanic voyage - what would it look like?

### Data availability

The data that support the findings of this study is available in the Supplementary Method.

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### Author contributions

T.L., J.M.A., A.S.C., K.J., C.S., J.C.C., C.F., G.J.H., M.A.J., J.D.M., and S.P. contributed equally to idea formation and the conception of the work. T.L., J.M.A., A.S.C., K.J., C.S., J.C.C., J.D.M. coded the organizations. T.L., J.M.A., A.S.C., K.J., and C.S. synthesized the findings from the coding. T.L. led the writing process and drafted the text together with J.M.A., A.S.C., K.J., and C.S.; T.L., J.M.A., A.S.C., K.J., C.S., J.C.C., C.F., G.J.H., M.A.J., J.D.M., and S.P. critically revised the work for important intellectual content. T.L., J.M.A., A.S.C., K.J., C.S., J.C.C., C.F., G.J.H., M.A.J., J.D.M., and S.P. approved the completed version. T.L., J.M.A., A.S.C., K.J., C.S., J.C.C., C.F., G.J.H., M.A.J., J.D.M., and S.P. are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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### Competing interests

The authors declare no competing interests.

### Additional information

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