ROBUST ACTION: ADVANCING A DISTINCTIVE APPROACH TO GRAND CHALLENGES

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ABSTRACT

Although management scholars have embraced grand challenges research, in many cases, grand challenges have been treated as merely a context for exploring extant theoretical perspectives. By comparison, our approach – robust action – provides a novel theoretical framework for tackling grand challenges. In this invited article, we revisit our 2015 model, clarifying and elaborating its key elements and taking stock of subsequent developments. We then identify three promising directions for future research: scaffolding, future imaginaries, and distributed actorhood. Ultimately, our core message is remarkably simple: robust action strategies – participatory architecture, multivocal inscription and distributed experimentation – jointly provide a means for tackling grand challenges that is well matched to their complexities, uncertainties, and evaluativities.

Keywords: Grand challenges; robust action; complexity; uncertainty; evaluativity; sustainability

Over the past several years, management scholars have produced a growing body of research on grand challenges. Although this particular label is relatively novel, the topic resonates with longstanding interest in addressing societal issues

within organization studies (Hinings & Greenwood, 2002; Selznick, 1996; Stern & Barley, 1996). We were fortunate to have published our own contributions (Etzion, Gehman, Ferraro, & Avidan, 2017; Ferraro, Etzion, & Gehman, 2015) somewhat early in this cycle. Looking back, part of what our work enabled and catalyzed – together with other early contributions – was the creation and legitimation of an intellectual space for research on grand challenges, especially for early-career researchers (Friesike, Dobusch, & Heimstädt, 2022).

When we were developing our ideas, we certainly had no inkling of the popularity the paper would achieve. Rather than providing an entirely de novo set of ideas, our robust action framework brought together several extant (and sometimes eclectic) ideas in an integrated fashion. In some instances, this involved work to translate and unpack ideas from the margins of the management field; in others it involved reimagining (and blurring) the boundaries between literatures in ways that enabled us to expand the conversation. In this article, we embrace this spirit to further advance our ideas. Specifically, the editors invited us to take stock of progress relative to our robust action approach to tackling grand challenges.

Although we have read many of our interlocutors closely, this article does not aim to provide either a systematic or comprehensive review of this work. Rather, we seek to do three things. First, we revisit our original robust action framework with an eye to clarifying selected elements, particularly areas where further elaboration seems warranted, or where our concepts have been interpreted in ways we had not anticipated. Second, we take stock of how scholars have subsequently explored and extended these strategies. Finally, stepping back from the particular elements of our framework, we revisit the core premise of our original paper – robust action – and reflect on some challenges and opportunities that scholars may wish to take up next, namely in the areas of scaffolding, future imaginaries, and distributed actorhood.

COMPLEXITY, UNCERTAINTY, EVALUATIVITY

What are grand challenges? When we were developing our ideas, grand challenges had yet to attract significant interest from organization and management scholars. Both then and now, discussions of grand challenges invoked primarily phenomena-driven definitions. For instance, George et al. (2016) described grand challenges both as "formulations of global problems that can be plausibly addressed through coordinated and collaborative effort" (p. 1880) and, following Grand Challenges Canada, as "specific critical barrier(s) that, if removed, would help solve an important societal problem with a high likelihood of global impact through widespread implementation" (p. 1881).

Given this backdrop, one of the distinctive features of our original article was an effort to conceptualize and define what we called the "analytic facets of grand challenges." Specifically, we introduced three facets: complexity, uncertainty, and evaluativity. In the remainder of this section, we revisit these three facets, expounding on our understanding of them (see Table 1).

Ultimately, we conceptualized grand challenges as matters of concern that entail complexity, evoke uncertainty, and provoke evaluativity. Although some

Table 1. Analytic Facets of Grand Challenges.

Facets	Original Definition	Commentary
Complex	The problems are characterized by many interactions and associations, and non-linear dynamics	Tackling grand challenges goes beyond a systems view of complexity wherein relationality and temporality are given and exogenous. Instead, relationality and temporality are themselves endogenized
Uncertain	The problems and their evolution are difficult to forecast for the actors, who cannot properly identify possible future states of the world	Tackling grand challenges entails future expectations, often as a means of preventing them from coming to pass, thereby undermining the possibility of falsifiability
Evaluative	The problems cut across jurisdictional boundaries, implicate multiple criteria of worth, and can reveal new concerns even as they are being tackled	Tackling grand challenges is an intrinsically values-laden endeavor. Requiring agreement on first principles as a precondition for action is likely fatal

Source: Ferraro et al. (2015) and authors' analysis in this article.

concerns may be global in scope (such as climate change), others may be more localized. Whereas some concerns may be widely accepted (such as poverty), others may not be. And whereas some concerns may be ameliorable via the removal of a common barrier, others may be much less tractable. Critically, this definition problematizes the possibility of drawing a delimited list of challenges once and for all, such as the sustainable development goals.

Two of the facets we introduced – complexity and uncertainty – overlap (at least superficially) with other perspectives such as wicked problems and volatility, uncertainty, complexity, and ambiguity (Barber, 1992; Rittel & Webber, 1973). Yet, our concept of complexity is broader than common understandings of this term. Namely, most understandings of complexity assume a certain level of ontological realism; complexity is perceived as "real," and this reality is assumed to exist independent of humans, thus setting up a quest to accurately map the system and its intervention points. Such a systems approach to understanding complexity typically demands a kind of omniscience (Stacey, 2001). But in the context of sustainability and innovation, there are other understandings of complexity in which both relationality and temporality are conceptualized as endogenous, leading to different strategic, policy, and research implications (Garud & Gehman, 2012; Garud, Gehman, Kumaraswamy, & Tuertscher, 2017).

Similarly, our conceptualization of uncertainty is perhaps heterodox. We view it as a potentially innumerable set of possible futures. Ergo attempts to forecast via mathematical models and computer simulations are essentially untestable (Funtowicz & Ravetz, 1993). For example, the scientific assessment of the frequency, intensity, and damage caused by extreme weather events in a climatically changed world is a concern that can be – and is – modeled mathematically, and then transposed into financial instruments, such as catastrophe bonds (Etzion, Kypraios, & Forgues, 2019). However, such approaches to controlling, planning, adapting, or otherwise managing uncertainty are unfalsifiable:

[Catastrophe] models perform a peculiar epistemological magic. Because their object exists only in the probabilistic future, they are never absolutely falsifiable – yet by the same token, they can always be improved via the incorporation of new observations and science. (Johnson, 2015, p. 2511)

This means that our greatest achievements in grappling with grand challenges, were we to attain them, would be counterfactual – an unremarkable world that functions "normally," devoid of pandemics, failing ecosystems, and social collapse. This imaginary is striking in that it is highly uncertain and simultaneously difficult to appreciate and value because it is so quotidian and taken for granted. Earning plaudits for contributing to the creation of such a future world would be a difficult endeavor – what is there to celebrate if the status quo has been preserved?

The third facet of our conceptualization – evaluativity – is perhaps the most original aspect of our treatment of grand challenges. As we put it in the original article: "The problems cut across jurisdictional boundaries, implicate multiple criteria of worth, and can reveal new concerns even as they are being tackled" (p. 365). Implicated here are axiological commitments (i.e., assumptions about what things are good, valuable, and worth having or doing) on the part of those involved or excluded, as well as questions about the value(s) of the challenges being pursued (Gehman, 2021). Taken seriously, this formulation invites researchers and participants alike to contend with issues such as rationalities, logics, values, practices, orders of worth, and so forth – all longstanding themes in the literature (Friedland & Alford, 1991; Haveman & Rao, 1997; Stark, 2009; Thornton & Ocasio, 1999; Townley, 2002; Weber, 1946). Examples in this vein include research on the role of institutional logics in enabling and constraining efforts aimed at addressing grand challenges (Cobb, Wry, & Zhao, 2016; Gümüsay, Claus, & Amis, 2020; Lounsbury & Wang, 2020; Zhao & Wry, 2016).

ROBUST ACTION STRATEGIES

At the core of our theoretical framework are three robust action strategies (see Table 2 for an overview). The remainder of this section assumes familiarity with our original arguments and revisits them. First, we seek to clarify selected elements, particularly areas where further elaboration seems warranted or where our concepts have been interpreted in ways we had not anticipated. Second, we take stock of how scholars have subsequently explored and extended these strategies.

Participatory Architecture

There is widespread agreement that tackling grand challenges requires novel forms of engagement and collaboration among diverse actors (governments, corporations, citizens, scientists, and NGOs, as well as non-human actors such as forests, oceans, lakes, and cities) (e.g., Latour, 2017). To address such circumstances, we proposed participatory architecture, defined as "a structure and rules of engagement that allow diverse and heterogeneous actors to interact constructively over prolonged timespans" (Ferraro et al., 2015, p. 373). This structural

Table 2. Robust Action Strategies.

Characteristic	Strategy		
	Participatory Architecture	Multivocal Inscription	Distributed Experimentation
Definition	A structure and rules of engagement that allow diverse and heterogeneous actors to interact constructively over prolonged timespans	Discursive and material activity that sustains different interpretations among various audiences with different evaluative criteria in a manner that promotes coordination without requiring explicit consensus	Iterative action that generates small wins, promotes evolutionary learning and increases engagement, while allowing unsuccessful efforts to be abandoned
Dimension	Structural	Interpretive	Practice
Original foundations	Governance of the commons (Dietz, Ostrom, & Stern, 2003; Ostrom, 1990)	Interpretive flexibility (Pinch & Bijker, 1987)	Small wins (Plowman et al., 2007; Weick, 1984)
	Hybrid forums (Callon et al., 2009)	Strategic use of ambiguity (Jarzabkowski & Sillince, 2007; Sillince, Jarzabkowski, & Shaw, 2012)	Experimentalist governance (Sabel & Zeitlin, 2012)
Expanded foundations	Deliberative and integrative engagement (Bachtiger & Parkinson, 2019)	Actor-network theory and inscription devices (Akrich, 1992)	Abduction (Golden-Biddle, 2020)
	Modularity (Manning & Reinecke, 2016)		Local experimentation (Mair et al., 2016)
New directions	Scaffolding (Ansell, 2011; Casasnovas & Ferraro, 2021; Mair et al., 2016) Fictional expectations (Augustine et al., 2019; Beckert, 2016) Distributed actorhood: non-humans and cities (Gehman et al., 2021; Zuzul, 2019)		

Source: Ferraro et al. (2015) and authors' analysis in this article.

dimension is meant to capture the need to devise governance practices that could harness diverse identities, values, interests, and actions in productive ways.

We chose the term *architecture* to refer to a broad set of principles, rules, roles, and practices that guide the collective construction of policies and standards and thereby have the potential to shape behavior and action. We also built on the concept of hybrid forums that bring together scientists and citizens (Callon, Lascoumes, & Barthe, 2009), evident, for instance, in work on the governance of open source software communities (O'Mahony & Ferraro, 2007; West & O'Mahony, 2008), where actors must devise novel ways for developers and corporations to cooperate. When we wrote the original article, scholars across fields with diverse interests were already advancing our understanding of these processes across multiple contexts.

The last decade has witnessed an explosion of studies in this area, with a focus on standard-setting processes (Levy, Reinecke, & Manning, 2016; Manning &

Reinecke, 2016), national and transnational regulation and policy (Abbott, Levi-faur, & Snidal, 2017; Avidan, Etzion, & Gehman, 2019; Brès, Mena, & Salles-Djelic, 2019), cross-sectoral partnerships and multistakeholder engagement (Gray & Purdy, 2018), shareholder engagement (Ferraro & Beunza, 2018; Goodman & Arenas, 2015), and social movements (Briscoe & Safford, 2008; DeJordy, Scully, Ventresca, & Creed, 2020; McDonnell, King, & Soule, 2015), to name just a few.

Along the way, scholars studying governance and stakeholder engagement have overcome a longstanding tension between consensus and dissensus via architectures that are robust to deeply contradictory value systems. As proposed initially by scholars in business ethics and grounded in Habermas' (1996) theory of deliberative democracy, many versions of stakeholder engagement assume that corporations and other stakeholders rely on rational deliberative processes to identify legitimate solutions to the divisive issues they face (Palazzo & Scherer, 2006; Scherer & Palazzo, 2007). Yet, this reliance on rational consensus as a regulative ideal has been criticized by scholars from both a theoretical and an empirical perspective for its inability to address power imbalances between stakeholders (Banerjee, 2014; Moog, Spicer, & Böhm, 2015), and for inadequately accounting for the profound differences in values that different parties might bring to engagements (Ehrnström-Fuentes, 2016). Instead, proponents of an alternative "agonistic" approach to stakeholder engagement have suggested that parties should not avoid conflict and strategic considerations. This approach ensures that less powerful actors can participate in the process, and leaves more space for NGOs to legitimately continue their advocacy work outside of the engagement (Brand, Blok, & Verweij, 2020).

Recent integrative approaches to participatory architecture aspire to eliminate the dualism between consensus and dissensus, highlighting the need to explicitly acknowledge and manage value pluralism via modular governance architectures. Building on a study of shareholder engagement on climate change between a group of religious investors (ICCR) and two automotive companies (Ford and GM), Ferraro and Beunza (2018) developed a communicative action model of dialogue that entails both contestation (e.g., the filing of aggressive shareholder proposals) *and* deliberative processes. Similarly, Levy et al. (2016) advanced a process model of engagement that starts with more radical disruptive demands, but evolves as parties increasingly accommodate reciprocal demands in ways that accommodate others' constraints while advancing their own interests. In business ethics, Schormair and Gilbert (2021) built on the critical pragmatism of Forester (2013) to propose a five-step discursive sharing process that actors might follow in a situation of value conflict. This approach recognizes that actors might not (and should not) overcome their value differences, but should orient themselves toward sufficient justification.

The way that issues are framed, of course, is pivotal in enabling or curtailing collaborative opportunities between actors. These frames can operate as provisional truces and, given their multivocal nature (see below), can help parties overcome their initial adversarial stance. Yet, this is not guaranteed. To the extent that some parties gradually develop more ambitious frames, they might also generate

pushback from others with deeply incompatible values and interests. For instance, Berkowitz and Grothe-Hammer (2022) studied the International Whaling Commission, and showed how once the commission switched its goal from sustainable whaling to whale conservation, Japan perceived the new order as lacking any decision-making agency ("decidability") and thus left the Commission.

Bringing these insights together, we believe that while initial research on participatory architecture primarily emphasized the need to overcome differences in order to collaborate, theory and empirical evidence suggest that participatory architectures with the capacity to accommodate deeper value differences are more robust, thereby stopping short of delegitimating more adversarial stances and potentially facilitating progress on grand challenges (Schifeling & Hoffman, 2019). We believe a deeper engagement with the literature on deliberation in political science could enrich our understanding of these processes, and advance our ability to design more effective participatory structures (for a recent review, see Bachtiger & Parkinson, 2019).

Multivocal Inscription

Our original paper defined multivocal inscription as "discursive and material activity that sustains different interpretations among various audiences with different evaluative criteria, in a manner that promotes coordination without requiring explicit consensus" (Ferraro et al., 2015, p. 373). This definition fuses the notion of multivocality, which is a core aspect of robust action (Padgett & Ansell, 1993), together with actor-network theory's concept of inscription devices (Akrich, 1992). By combining these two ideas, we hoped to foreground the extent to which both material and discursive artifacts can have multivocal properties, and thus function as a bridging mechanism that attracts and holds together actors with different worldviews (Etzion & Ferraro, 2010). In practice, effective multivocal inscriptions enable actors to see themselves as participants in multi-actor initiatives on issues of concern. They also can serve as metaphorical speed bumps for actors that may otherwise seek to exit participatory architectures that they find constraining or alienating. Multivocal inscriptions provide interpretive flexibility (Pinch & Bijker, 1987) that enables actors to justify to themselves and others why they remain committed, while also providing hooks for eliciting engagement from others.

In many studies, multivocal inscription continues to be understood as synonymous with the strategic use of ambiguity. McMahan and Evans (2018, p. 860) reinforced Manning and Reinecke's (2016) insights by arguing that, at least in the case of scientific research, "ambiguity, and the uncertainty that follows, stimulate social learning and so … play a crucial role in … creating zones of social and intellectual engagement." More generally, the benefits of ambiguity have been highlighted in the context of corporate social responsibility (Meyer & Höllerer, 2016), the circular economy (Niskanen, Anshelm, & McLaren, 2020), social impact (Martí, 2018), urban revitalization (Jalonen, Schildt, & Vaara, 2018), and sustainability (Turnheim & Nykvist, 2019). Consequently, such ambiguity should not be foreclosed; rather, efforts should be invested in its persistence (Chliova,

Mair, & Vernis, 2020). However, too much ambiguity can be a recipe for failure, especially when participants are unable to share cognitive representations about both concepts and processes (Zuzul, 2019).

Since 2015, research has highlighted how difficult it is to truly master multivocal inscription. In the domain of nanotechnology, for example, Grodal and O'Mahony (2017, p. 1820) showed how a variety of actors employed rhetoric that "grafted the grand challenge onto their existing interests, gradually broadening the grand challenge away from [the] initial ambitions" of the domain's founders (see also Feront & Bertels, 2021 in the context of responsible investing). Multivocal inscription was instrumental in setting sustainability standards in the global coffee industry (Manning & Reinecke, 2016) by allowing actors to deliberate and negotiate around "economic benefits for farmers," a cornerstone of the Fairtrade movement. This interpretation was eventually embraced in the standards, in that 25% of the premium for Fairtrade certified coffee was earmarked for investments aimed at boosting farmers' productivity and quality – for their own long-term economic benefit, as it were. At the same time, it chipped away at the empowerment of farmers that Fairtrade was initially established to foster. Multivocality, it is clear, does not necessarily ensure optimal outcomes for all involved, and may perpetuate power imbalances.

Of course, few grand challenges are politically neutral, and powerful incumbents might have a strong interest in maintaining the status quo (Benschop, 2021). It is therefore important to explore how multivocal inscription legitimizes the status quo or slows down action to address the challenge. In the case of fossil fuel companies, for instance, scholars have analyzed the utility of clever wordplay (e.g., see Lefsrud, Graves, & Phillips, 2017 on "ethical oil"), façades (Cho, Laine, Roberts, & Rodrigue, 2015), and communication strategies that deflect attention toward individual responsibilities (Supran & Oreskes, 2021). More generally, multivocal inscription cuts both ways; it can promote both activism and inactivism (Mann, 2021).

Thus, it is important to emphasize that multivocal inscription is not a catch-all for any kind of utterance in a post-truth world. Baseless assertions (e.g., "vaccines cause autism") aimed at tribalism are not multivocal. Landing a zinger on a social media platform or otherwise "pwning" an ideological adversary are unlikely to lead to enrollment or engagement. Propaganda, it goes without saying, is not multivocal. (Neither is hype.) Such efforts, indubitably, can be effective at rallying support, applying pressure, and clarifying positions; however, as they are directive and non-ambiguous, these efforts do not conscript new actors. From a network perspective, rather than facilitating dialogue or forging alliances across multiple nodes, such inscriptions tend to close ranks and create cliques, reducing robustness (Padgett & Ansell, 1993).

In addition, multivocality is not "anything goes" or a call for relativism. It reflects an onto-epistemological understanding that the sciences (plural) construct many facts (plural) and these facts may neither converge nor be commensurable (Etzion & Gehman, 2019; Mol, 2002; Sarewitz, 2004). Often, of course, the underlying value systems driving a multivocal inscription are not proclaimed or used as justification, yet a factual case is employed. In this way, multivocal

inscription does not collapse under scrutiny. It withstands repeated probing by multiple audiences that embrace different value systems and deploy different sets of social facts. As such, multivocal inscription is both a precursor and an outcome of sustained engagement.

At the same time, further research is needed to clarify why some multivocal inscriptions are more likely to prompt engagement, whether by enabling or thwarting progress. Is it possible to predict in advance the likelihood that certain inscriptions will achieve multivocality? One possibility is that the presence or absence of intentionality is a missing factor. Padgett and Ansell (1993) concluded that the Cosimo de' Medici was an effective practitioner of robust action, not just because others could not decipher his intentions, but because he himself was not quick to determine his own intentions. Is there a paradox that the more goal-oriented (or managerialist) people are, the easier it is for others to "see through" them and their objectives, and the less likely it is that multivocality will be successfully employed?

Distributed Experimentation

Despite the complexity, uncertainty, and evaluativity endemic to grand challenges, a robust action approach does not shy away from the need to take action. In such circumstances, abduction provides actors with the capacity to infer plausible explanations by forging connections between specific observations and general principles (Bartel & Garud, 2003; Golden-Biddle, 2020; Mantere & Ketokivi, 2013). In keeping with these insights, the third robust action strategy that we proposed emphasized a practice dimension in the form of distributed experimentation, defined as "iterative action that generates small wins, promotes evolutionary learning and increases engagement, while allowing unsuccessful efforts to be abandoned" (Ferraro et al., 2015, p. 376). Distributed experimentation contributes to robustness by enabling actors to potentially solve specific, urgent problems while improving (or at least not impairing) their capacity for subsequent problem-solving.

In our original article, we pointed out several instructive examples. For instance, despite long standing criticisms of US climate policy at the federal level, a plethora of local climate change efforts, including city, state, and multi-state initiatives, have been claimed to be as potent as more top-down approaches when considered collectively (Lutsey & Sperling, 2008). Distributed experimentation also can generate novel institutional arrangements, such as the Forestry Stewardship Council and the Fair Labor Association (Bartley, 2007). One reason why distributed experimentation can be so potent is the positive feedback loop that is created as one small win generates momentum, often making the next small win evident, and shifting resources in the direction of winners (Plowman et al., 2007; Reay, Golden-Biddle, & Germann, 2006; Weick, 1984). Even when particular experiments do not work out, these can be generative, for instance, prompting additional stakeholder involvement, setting in motion a search for alternative solutions, or promoting a redefinition of the problem itself (Callon, 2009; Sabel & Zeitlin, 2012).

Building on these ideas, several scholars have made important contributions to our understanding of how distributed experimentation can contribute to tackling grand challenges. One interesting study in this regard is Porter, Tuertscher, and Huysman's (2020) examination of Save Our Oceans, an initiative within the maritime industry aimed at improving the health of oceans and fostering more sustainable shipping practices. Central to this initiative was a crowdsourcing platform. Porter et al. (2020) identified several ways in which crowdsourcing proved effective in tackling ill-structured problems via distributed experimentation. First, the focus on crowdsourcing encouraged participants to create and maintain a large variety of different options. Second, crowdsourcing facilitated co-creation between those contributing ideas and those who would end up implementing candidate solutions, resulting in "a highly adaptive process that supported different groups of participants in acting while learning" (p. 271). Third, crowdsourcing allowed collaboration to occur, even as actors came and went or changed their roles or levels of engagement.

> Making the ideation activity persistent and visible for the actors in the later phases informed subsequent experimentation efforts by enabling participants to follow interactions they were not directly involved in. (p. 272)

Fourth, the platform enabled ongoing experimentation, even at the level of problem definition. According to Porter et al., this served as a temporal coordination mechanism "by encouraging experimentation that is inclusive of the actors who will potentially be important for experimentation in the future" (p. 274). Beyond these insights on the role of crowdsourcing in fostering distributed experimentation, Porter et al. also highlighted how crowdsourcing platforms provide a means of "keeping novel ideas alive, so that actors in subsequent phases can take them up in their experimentation efforts" (p. 275). They dubbed this "reaching back" as a way of going forward (see also Garud & Gehman, 2012). For instance, the crowdsourcing platform served as "a valuable collective memory by enabling new participants to review and reflect on past experimentation" (p. 275).

Local experimentation was an important feature of the setting for Mair, Wolf, and Seelos's (2016) study. "Centering on small-scale societies opens up possibilities for organizations to engage deeply with local realities and to experiment with multiple villages" (p. 2022). In essence, Mair et al. leveraged the fact that the organization they studied – Gram Vikas – had been experimenting with different approaches to transforming inequality for years. Specifically, the program they analyzed was "the result of many years of experimenting, failing, and learning" (p. 2036), much of which took place independent of their fieldwork. But it was this ongoing program of distributed experimentation which provided the backdrop for the key insight to emerge from their study, namely the process of scaffolding, which the authors reported "was remarkably robust across villages" (p. 2037).

Similarly, Busch and Barkema (2021) studied an organization engaged in providing training and development programs for drug addicts and other vulnerable populations in Africa. Like Gram Vikas, the organization's headquarters

provided heuristics and simple rules, but encouraged local experimentation to promote cross-unit innovation and learning (Busch & Barkema, 2021). However, as highlighted in our original article, and consistent with extant understandings of innovation journeys more generally (e.g., Van de Ven, Polley, Garud, & Venkataraman, 1999), not all experiments are successful. In this regard, distributed experimentation is not only an approach for finding "what works" but also "what does not work" in contexts characterized by uncertainty and turbulent, non-linear dynamics (Furnari, 2014; Reay et al., 2006). Moreover, embracing experimentation requires actors to appreciate that failures are in fact a good measure of effort and ambition (Etzion, 2018).

Although copious evidence demonstrates the benefits of distributed experimentation, some questions remain. How many experiments is too many? How is learning from both success and failure shared? Is there a point at which making use of such a strategy can veer into splintering and fragmentation? Can or should distributed experimentation be structured, and if so, how?

RETHINKING OUR PRAGMATIST ROOTS

We developed our model of robust action starting from a pragmatist theory of action. Since then, scholars have added to our understanding of the mechanisms we proposed, in part by leveraging them in various empirical projects. In reflecting on this collective work, we realize that our embrace of the pragmatist principle was rather selective, and a more radical approach could be fruitful in at least two ways. First, pragmatism views problem-solving – inasmuch as it is attainable – as provisional closure achieved through the decision-making of actually existing human communities engaged in ongoing inquiry (Prasad, 2021). Consonant with this understanding, in our framework we claimed that repeated use of the three robust action strategies would generate novelty and sustain engagement, but did not delve deeply into specific mechanisms and processes. Second, pragmatism views ideas as instruments for action (Farjoun, Ansell, & Boin, 2015; Peirce, 1878). Although our three robust action strategies assume a recursive interplay between ideas and action, we did not explore the interplay between them and different types of ideas (e.g., beliefs, expectations, and imaginaries about the future). Finally, we see opportunities to more fully embrace pragmatism's processual and relational ontology (Emirbayer, 1997), and to overcome a tendency to think in terms of actors rather than relationships. Embracing a truly flat ontology would encourage researchers to directly study the role of non-human actors, which seems increasingly crucial to our understanding of phenomena such as climate change (e.g., Haraway, 2016; Latour, 2017).

Scaffolding to Generate Novelty and Sustain Engagement

Our framework posits that participatory architecture, multivocal inscription, and local experimentation generate novelty and sustained engagement. In essence, we theorized how bringing together diverse actors, allowing for plural understandings,

and fostering collective experimentation and learning could catalyze progress in tackling grand challenges. However, our original framework underspecifies how these mechanisms operate dynamically, and the pragmatist understanding of collective learning at the core of our model is not explicitly articulated (Ansell, 2011; Dewey, 1938).

Germane to the question of sustained engagement and novelty generation, several recent studies have investigated the notion of scaffolding, a term first used in the context of learning theory to describe a process of providing students with temporary problem-solving frameworks as a way of enabling them to develop more sophisticated ones (Wood, Bruner, & Ross, 1976). More generally, higher-order skills can be scaffolded by lower-order ones. In the context of institutionalization, Ansell (2011) suggested that lower-order institutions become scaffolds for higher-order institutional change, and further differentiated upward scaffolding, or the conception of "broader and more ambitious institutional goals," from downward scaffolding, which entails "the development of specific concepts and practices" (p. 37). For instance, Mair et al. (2016) concluded that scaffolding helped transform inequality patterns in small-scale societies by mobilizing resources, stabilizing new interactions, and concealing goals. Studying the emergence of social and impact investing in the UK from 1999 to 2019, Casasnovas and Ferraro (2021) showed how these markets developed as the result of a recursive process of cultural and material scaffolding, through which diverse actors envisioned possible futures, and developed material practices that allowed them to be built. However, once actors started to experiment with concrete practices, the natural centripetal tendencies of the process led to a split in the emerging market.

Overall, scaffolding points to a collective but distributed learning process. Those involved are likely to attain different learning outcomes: some might learn to rig up scaffolds for future projects; others might connect dots in new and innovative ways. Actors do not need to know the same thing (i.e., canonical knowledge), but they do need to know and create their own knowledge for the success of their own projects and how it connects to the larger enterprise. As emphasized by Dittrich (2022), scaffolding and other non-linear pathways to impact are in fact numerous and widely available, if actors relieve themselves of accepted paradigms about scaling up. Arciniegas-Pradilla et al. (2022) similarly highlighted a learning process: as actors encounter new manifestations of a problem, new causes are discovered or new experiences can confront them with new realities, setting in motion repeated cycles of learning. In our view, the key question for future research is to explore whether and under what conditions scaffolding and other pathways to sustained engagement lead to meaningful impact relative to the challenges being pursued.

Building Desirable (and Robust) Futures: The Role of Fictional Expectations

One important area of research on robust action is to better understand how the way we think about the future shapes action in the present. This is particularly important in the context of grand challenges, as it requires actors to think not

only beyond the time horizons they are comfortable with, but also to imagine how the future might differ from the present.

Several theoretical perspectives are contributing ideas to this important debate. In economic sociology, for instance, Jens Beckert has led an important departure from the dominant tendency to envision present outcomes as resulting from past events, instead proposing a theory of fictional expectations to explain how the future looms as large as the past in shaping our actions (Beckert, 2016, 2021; Beckert & Bronk, 2018). This theory, building on the pragmatist idea of ends-in-view (Dewey, 1922, p. 225), posits that actors have a unique capacity to imagine their (economic) futures, and these imaginaries support the creation of expectations that in turn shape decision-making. Beckert (2016) suggested that economic action revolves around fictional expectations – that is, "the images actors form as they consider future states of the world, the way they visualize causal relations, and the ways they perceive their actions influencing outcomes" (p. 9). As expectations reflect a shared understanding about future economic actions, they help actors coordinate their efforts and, in so doing, affect the future (p. 11). Fictional expectations must be credible to shape decision-making, because credibility is central to the operation of the capitalist economy and represents the capacity to inspire beliefs in a specific future (p. 273). Financial investment, for instance, is oriented toward future economic profit, and investors commit with no guarantee by building upon imaginaries of the future (p. 132). Despite uncertainties, no investment would occur without expecting economic benefits based on credible expectations. Positing investments as based on "imaginaries of the future" might sound counterintuitive because investors strive to decrease risk by using financial calculative devices (Callon & Muniesa, 2005). These devices support the creation of beliefs about future outcomes and legitimize decisions; they are an instrument of the imagination that aids decision-making (Beckert & Bronk, 2018). Yet, on their own, calculative devices cannot fully support decision-making, especially when essential information is missing. Investment decisions, therefore, involve narratives that help actors envision how a future economic story might end (Beckert, 2016, p. 167).

In the case of grand challenges, one promising avenue for research is to better understand how the imagination of distant futures might affect the structure of participatory architectures, the role of multivocal inscriptions, and the shape of distributed experimentation. For instance, one recent study that tackled this question explored the construction of the distant future in geoengineering, and suggested that these futures become an "as-if" reality through a dialectical process of oppositions of conflicting imaginaries that reduce the issue to "its moral and cosmological assumptions" and thus invite opposition and articulation of new imaginaries, and eventually a synthesis (Augustine, Soderstrom, Milner, & Weber, 2019, p. 1952). This process generates an increasingly differentiated ecology of imaginaries and a more fine-grained discourse that makes those futures more credible. Others have highlighted notions such as "even-if" (Sarasvathy, 2021) and possibilistic thinking (Grimes & Vogus, 2021) as particular approaches to the future.

Actorhood: The Assemblage is the Actor

Building on the philosophical assumptions of pragmatism, our original paper explicitly took a distributed view of actorhood, and more generally shifted the gaze from individual heroic actors to the network of actors and their relationships. This also implied that corporations, especially large ones, were not our focal actors.

Relative to a traditional systems view of complexity, such an understanding of actorhood offers several important correctives. For instance, selection environments need not be taken for granted (Garud & Gehman, 2012). Instead, it is worth examining how and to what extent humans shape our selection environments (Garud, Gehman, & Giuliani, 2016). Even the particular form humans take (e.g., homo economicus) can be understood as a sort of genetically modified organism (Latour, 2017). Understood in terms of Gaia, terrestrial life shares an existential demand to carve out a territory for itself, a feat that must be accomplished under the noses of other terrestrials seeking to do the very same thing. This sets in motion a massive web or network of relationality (Ergene, Banerjee, & Hoffman, 2022; Harman, 2018; Latour, 2005). At the same time, humans are temporal beings, and our intertemporality is thought to be core to our beingness (Heidegger, 1962). We have the ability to wait, to delay gratification, to sacrifice in the present for the sake of some future good; we also have the capacity to imagine different futures along with pathways that might allow their realization, whether utopian or dystopian (Garud & Gehman, 2012; Gümüsay & Reinecke, 2022).

For grand challenges researchers, apprehending actorhood in decentered ways remains a key theoretical frontier (Gehman, Sharma, & Beveridge, 2021). Field studies that explore particular issues and contexts appear to enable greater acuity than case studies focused on specific organizational actors, and managers in particular. Our review has identified several such contexts, many of which focus on multisectoral initiatives (Berkowitz & Grothe-Hammer, 2022; Manning & Reinecke, 2016; Porter et al., 2020). This decentralization of the subjects and objects of research can be extended even further, for instance as in the case of nanotechnology (Grodal & O'Mahony, 2017), a more porous and diffuse context.

Building on Zuzul (2019), another appealing contextual nexus might be cities, which offer many affordances for researchers studying grand challenges. Many cities with pressing problems are tackling grand challenges rather urgently. From coastal and river-adjacent cities needing to adapt to climate induced rise in water levels, to cities tackling perennial grand challenges (such as homelessness, education, and policing), cities are at the forefront. By their very nature, cities are polycentric. City councils (typically) are helmed by elected officials, but are subordinate to higher-level officials on many issues and tend to be constrained and enabled by sprawling organizational bureaucracy. Civic engagement often involves numerous organizations. Key actors in many cities include universities, hospitals, corporate headquarters, cultural centers, and other autonomous organizations. This tapestry lends itself particularly well to research on participatory architecture and distributed experimentation.

Because city evolution appears to take on a life of its own, cities as sites of analysis also can provide useful contexts for studying multivocal inscriptions. Consider the notion of "smart cities" (Saxe, 2019), a powerful inscription that can recruit a diverse architecture of technological innovators, social crusaders, urban futurists and others pursuing diverse, yet not unrelated imaginaries. Importantly, a smart city, served by smart cars, at times tethered via a smart grid to smart homes, and at other times moving through a smart transportation network, clearly dismantles any preconceptions we might have as to actorhood being exclusively human.

CONCLUSION

In less than a decade, grand challenges research has moved from a mere possibility to a major focus. At one extreme, grand challenges are little more than a Rorschach blot, a context for applying extant theories. This approach risks taming grand challenges into rational problems, amenable to conventional managerialist toolkits and prescriptions. Our formulation differs significantly. Instead, we conceptualize grand challenges as matters of concern that entail complexity, evoke uncertainty, and provoke evaluativity. To tackle such concerns, we have articulated three robust action strategies – participatory architecture, multivocal inscription, and distributed experimentation – positing their joint capacity to foster novelty generation and sustained engagement.

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