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Constructing a Distant Future: Imaginaries in Geoengineering

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Constructing a Distant Future: Imaginaries in Geoengineering

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CONSTRUCTING A DISTANT FUTURE: IMAGINARIES IN GEOENGINEERING

ABSTRACT

We develop the concept of the *distant future* as a new way of seeing the future in collective efforts. While a near future is represented in practical terms and concerned with forming expectations and goals under conditions of uncertainty, a distant future is represented in stylized terms and concerned with imagining possibilities under conditions of ambiguity. Management research on future-oriented action has developed around problems of the near future. To explore distant futures, we analyze the case of geoengineering, a set of planetary-scale technologies that have been proposed as solutions to the threat of climate change. Geoengineering has increasingly been treated as if it were a reality, despite continued controversy and in the absence of any implementation. We find that societal-level imaginaries that were built on deeply-held moral bases and cosmologies underpinned the conception of geoengineering, and that a dialectic process of discursive attempts to reconcile oppositional imaginaries increased the concreteness and credibility of geoengineering so that it increasingly has been treated as an 'as-if' reality. We suggest that distant futures orient collective efforts in distinctive ways, not as concrete guides for action but by expressing critiques and alternatives, that can become treated as 'as-if' realities.

> Imagine a new world where a vast wall of mirrors is erected in outer space to protect the earth from the heat of the sun. Imagine using US Navy warships to blast trillions of tiny particles high up into the sky or deploying a fleet of modern 'steam' ships into the seven seas to spray salt water into the air 24 hours a day to create better clouds. Or how about covering vast stretches of desert with sheets of white plastic to reflect light back to the sun? What about dumping billions of tons of iron filings into the sea or building millions of chemically coated plastic trees to suck up carbon dioxide from the air? … This may all sound like preposterous science fiction - yet the debate about 'geo-engineering' a way out of catastrophic levels of climate change seems to be gaining grip in several parts of the world. (*Pretoria News*, 2009)

INTRODUCTION

Geoengineering refers to radical, deliberate, planetary-scale technological interventions into the earth's atmospheric, oceanic, or terrestrial systems in order to counteract the effects of anthropogenic (human-caused) climate change (Nicholson, 2013). Compared to predominant responses that focus on reducing greenhouse gas emissions or adapting to the effects of climatic changes, geoengineering technologies may appear at once audacious and outrageous, as if they were taken from a Jules Verne novel: sun shields in space, injecting reflective particles into the stratosphere, or large scale ocean fertilization to stimulate CO2-absorbing plankton growth. The feasibility of these proposed technologies is untested, and their consequences, even if the

interventions were to work, are acknowledged to be nearly impossible to predict. Additionally, the governance options for geoengineering remain largely unresolved as actors grapple with questions about who should be given the power to decide when and how to "adjust the world's thermostat." While geoengineering may be in the realm of science fiction (none of the technologies have been deployed), it has been progressively been taken more seriously as an option for combating climate change by an array of authoritative actors, including scientists, policy makers, and environmental activists who have called for more research into these technologies and have issued reports on geoengineering's potential and risks (Intergovernmental Panel on Climate Change, 2011; National Research Council, 2015a, 2015b; Rayner, Heyward, Kruger, Pidgeon, Redgwell, & Savulescu, 2013; The Royal Society, 2009). How was this risky, utopian solution to climate change imagined in the first place? And how has it made the leap from "preposterous science fiction" to becoming realistic enough to orient different actors, even as it remains hypothetical?

Organizational research has increasingly recognized that considerations of the future are central to organizing processes (Gioia, Corley, & Fabbri, 2002; Kaplan & Orlikowski, 2013; Garud, Schildt, & Lant, 2014; Flammer & Bansal, 2017). Yet this research has been concerned with processes that look quite different from geoengineering, such as strategic and technological change in organizations. It has suggested that acting on the future requires constructing a continuity between the present and future, for example in decision theory in the form of discount rates that integrate future expectations with present utilities (Laverty, 1996), or in strategy as temporal narratives that give accounts of how the future emerges from the past (Kaplan & Orlikowski, 2013). Implicit in this work is a uniform model of how people relate to the future –

one that does not distinguish different types of futures and mostly assumes a continuity between present experience and the future.

The case of geoengineering presents a different type of future and suggests a need to develop a new way of looking at the role of the future in organizing. We introduce the concept of *distant* future - a representation of a future state of the world that is fictional in the sense that it presents a discontinuity with present reality and is not grounded in present experience (Schütz, 1932/1967; Beckert, 2016) - to understand the case of geoengineering. By doing so we develop a differentiated understanding of the future in organizing processes. We posit that distant and near futures represent qualitatively different ways of envisioning the future and therefore entail different processes of construction and consequences for organizing. Distinguishing between the *near* future, which has been the primary focus of existing research, and the *distant* future, which is brought to the fore by the case of geoengineering, allows management researchers to expand their analytic toolkit and understand a broader range of phenomena. Geoengineering is an instance of one class of phenomena that are characterized by distant futures: collective responses to grand challenges. Grand challenges are "global problems that can be plausibly addressed through coordinated and collaborative effort." (George, et al. 2016:1880). These problems entail extreme time horizons, fundamental uncertainty, and high complexity -- conditions under which existing near future frameworks arguably break down (Ferraro, Etzion, & Gehman, 2015).

In the following, we present the results of our qualitative analysis of the phenomenon of geoengineering. Our research process was abductive, iterating between interpretation of data and theoretical development (Hanson, 1958; Peirce, 1955; Timmermans & Tavory, 2012). This process is reflected in the structure of the paper in that we present two iterations of empirical observation and theorization. We structure the paper in this way to show how engaging with a

new type of empirical phenomenon is an important part of the theoretical discovery process, prior to fine-grained data analysis. The first abductive iteration is an analysis *of* the case of geoengineering. In the next section, we first introduce the phenomenon of geoengineering as an observational prompt to assess existing theoretical frameworks. From this assessment, we then develop the theoretical distinction between distant and near futures, and a conceptual foundation for analyzing the distant future. This foundation draws on concepts about cognitive construal (Trope & Liberman, 2010; Berntsen & Bohm, 2010), collective imagination (Mische, 2009; Clarke, 2008, Beckert, 2016), and imaginaries (Anderson, 1991; Castoriadis, 1975; Taylor, 2004). The second abductive iteration is a more detailed analysis *within* the case. Informed by the conceptual foundation that we developed for analyzing the distant future, we further investigate two research questions: 1) *how* the distant future of geoengineering was conceived, and 2) how came to be treated as if it were real. We report the methods and findings of our interpretative analysis of the evolution of geoengineering and from it, develop and refine our understanding of distant futures. We close by discussing how our work contributes a "new way of seeing" the future in organizing processes in contexts in which the distant future matters, such as entrepreneurship and disruptive change.

THE CASE OF GEOENGINEERING

The ideas and basic approaches that underlie geoengineering were originally put forth by scientists in the 1970s and 1980s as hypothetical solutions to controlling the weather and addressing what was then termed "global warming" (Fleming 2010). Geoengineering technologies fall into two categories: solar radiation management (SRM) and carbon dioxide removal (CDR). SRM strategies aim to cool the earth directly by reflecting or blocking sunlight in space, injecting reflective particles into the atmosphere, or putting reflective materials on terrestrial surfaces. CDR strategies aim to halt further warming by removing carbon dioxide

(CO2) from the atmosphere and securing it in long-term storage, through mechanical CO2 "scrubbers," massive sequestration of carbon in biomass (e.g., biochar), or stimulating oceanic plankton growth to capture CO2 and release oxygen.

When first suggested, these were bold and radical thought experiments that were considered by most as not serious enough to even discuss as action strategies. Instead, climate scientists and policy makers focused primarily on strategies of mitigation, or reducing greenhouse gas emissions to eliminate the source of climate change, and adaptation, working to adjust to the impacts of changing climate. Even as the urgency of climate change has increased in recent decades and mitigation efforts have been slow to take hold, the question of whether or not geoengineering should even be considered a potential response has remained controversial. In addition to concerns of technical feasibility, many have argued that geoengineering "solutions" are morally or politically inconceivable or even dangerous. A 2007 article in *The New York Times* reflected these concerns quoting an expert in global environmental governance:

> Pursuing wacky ideas sends the wrong message… these projects could breed a dangerous complacency: Governments and companies might fail to invest in already available means of cutting emissions only to find later that promised technologies failed, or wrought unintended havoc.

Other concerns include how adjusting the climate in one part of the world might affect other regions, which has led to questions about who should be given the power to decide when and how to "adjust the world's thermostat." Thus, governance and deployment questions have remained unresolved.

While some have called for more research into proposed geoengineering solutions to prevent or counteract climate change's harshest effects (Intergovernmental Panel on Climate Change, 2011; National Research Council, 2015a, 2015b; Rayner, Heyward, Kruger, Pidgeon, Redgwell, & Savulescu, 2013; The Royal Society, 2009), all geoengineering technologies remain

purely hypothetical and none of them have been deployed or entered the stage of practical development. This is in stark contrast to mitigation strategies, such as cap and trade systems or renewable energy technologies, which are current realities, even if they are primarily aimed at solving or averting the climate crisis in the future. In the absence of practical experimentation and steps toward implementation, very little experiential evidence is available for evaluating or further developing geoengineering. It is not as if yesterday's science fiction is becoming today's or even tomorrow's reality – we are not witnessing an inevitable or gradual technological adoption with geoengineering.

However, despite remaining a hypothetical without any experience base, geoengineering has been taken more seriously over time. Table A in the Additional Materials shows a descriptive overview of the history of geoengineering. By the late 2000s some scientists, policy makers, and even some climate activists began discussing geoengineering as a superior option or a necessary back-up plan, and there is an increasing sense that geoengineering is no longer regarded as science fiction but is talked about as if it were a real option, on similar footing with more established solutions. A 2009 article in the *Sunday Times* wrote, for example, "Ideas that were once the realm of science fiction - such as creating artificial trees to absorb carbon dioxide, or reflecting sunlight away from the Earth - are coming under serious scrutiny as temperatures and CO2 emissions continue to rise." This poses an empirical puzzle: how has geoengineering come to be taken seriously as a 'real thing,' even though it retains properties of science fiction or fantasy? Geoengineering presents a particularly vivid case for examining this question as well as broader question of the dynamics of distant futures (Eisenhardt, Graebner, & Sonenshein, 2016).

THEORIZING THE CASE: NEAR AND DISTANT FUTURES

The Future in Management Research

Management research increasingly acknowledges that considerations of the future are central to organizing processes (Gioia, Corley, & Fabbri, 2002; Kaplan & Orlikowski, 2013; Garud, Schildt, & Lant, 2014; Slawinski & Bansal, 2012; 2015). Work has examined the consequences of the time horizons people employ when thinking about the future (Laverty, 1996; Flammer & Bansal, 2017) and how their constructions of perceived continuity between the past, present, and future facilitates or inhibits organizational change (Gioia et al., 2002; Kaplan & Orlikowski, 2013). Questions of how actors engage with "the future" are especially central to contexts that are overtly future oriented, such as design work and entrepreneurship. For example, Stigliani and Ravasi (2012) have found that designers within an organization were able to construct a shared view of the future by engaging in cycles of retrospective cognitive work that served to refine tentative interpretations. And Cornelissen and Clarke (2010) examined how entrepreneurs legitimate their ideas about "the future" and create opportunities through the deployment of analogies and metaphors.

However, implicit in much of this research is the idea that in order to be consequential for action, perceptions of the future must be shared and reduce ambiguity about future states. For example, in their studies of corporate responses to climate change, Slawinski and Bansal find that companies that employ long-term views of the future are better equipped to deal with uncertainty (2012) and adopt more innovative responses to climate change (2015). Slawinski & Bansal (2015) and Kaplan & Orlikowski (2013) also highlight the importance of considering multiple scenarios with long-term outcomes. Developing multiple scenarios delays action but leads to more robust understandings of the future, a greater departure from the status quo, and more nuanced strategic responses (Kaplan & Orlikowski, 2013; Slawinski & Bansal, 2015).

At the same time, much of this work tends to focus on contexts in which a future orientation is formalized through organizational structures and goals (e.g., design work in Stigliani & Ravasi, 2012, climate change adaptation strategies in Slawinski & Bansal, 2012, 2015). Or, it concerns relatively short-term and immediate projections (e.g., task forces in Gioia, Thomas, Clark, & Chittipeddi, 1994). The grounding in settings of formalized "future-oriented" action and in actors' previous experiences makes existing research ill equipped to address how actors develop and engage with more radical and even utopian futures, like geoengineering. In geoengineering, we do not see consensus in future expectations, a reduction in ambiguity, or the conversion of expectations into goals and practical actions. And yet, geoengineering has come to be taken seriously. We suggest that by largely ignoring such radical futures, organizational researchers have overlooked a consequential distinction among futures.

Time Horizon vs. Distance: The Distinctive Quality of Distant Futures

Although existing research has considered short- versus long-term time horizons, scholars have often extended standard ways of engaging with the future, such as time-discounted rational expectations models (Laverty, 1996; Frederick, Loewenstein & O'Donoghue, 2002; Beckert, 2016) or temporal narratives of continuity between the past and the future (Garud, Schildt & Lant, 2014; Kaplan & Orlikowski, 2013, Tavory & Eliasoph, 2013), to longer time horizons. Conceiving of the future in terms of time horizons sheds light on issues such as the implicit discount rates required to consider the long-term implication of present day actions (Flammer & Bansal, 2017), or the durations embedded in notions of the past, present, and future (Kim, Bansal, & Haugh, 2019). It masks, however, an additional dimension of the future that is based on the phenomenological quality of the future rather than the time horizon. We refer to this dimension as a future's *distance*, distinguishing distant from near futures.

The difference between near and distant futures is not a matter of time horizon. Instead, distance suggests that there are qualitatively different ways of representing and experiencing the future. Distant futures raise a set of different concerns from most existing organizational scholarship, concerns that are central to understanding cases such as geoengineering. Prior research has predominantly focused on near future concerns such as uncertainty, risk of choices, and the challenge of forming expectations with partial knowledge. Distant futures, however, are characterized by ambiguity or 'radical uncertainty' and focus on the question of how alternatives are imagined in the first place, and the corresponding problem of how such largely hypothetical possibilities may orient collective action. Table 1 summarizes the characteristics of distant compared to near futures.

*** Please insert Table 1 about here ***

Temporal construal level theory (Liberman & Trope 1998, Trope & Liberman 2003, Berntsen & Bohn, 2010) suggests that the distinction between near and distant futures is one of the level of construal, which reflects how psychologically distant a future state is from lived experience. In this perspective, futures that are represented as more psychologically near are construed in more concrete terms using more detailed situational features, while distant futures are construed in more abstract terms, using more stylized essential features of a situation (Liberman & Trope 1998, Trope & Liberman 2003, Berntsen & Bohn, 2010). The concrete concepts that are used to construct near futures are connected to sensory observation and the degree of practicality of proposed actions, which relate the future to present or personal experience, while the abstract concepts used in envisioning distant futures are tied to broader theories, ideologies, and desired identities (Medin, 1989; Trope & Liberman, 2003, 2010; Berntsen & Bohn, 2010). As a result, people relate to near and distant futures in qualitatively

different ways. Empirical research has shown that near futures are evaluated on their feasibility (which is tied to the concrete features of experience) while distant futures are evaluated more on their desirability (which is tied to the abstract features and the belief systems that are used in constructing them) (Liberman & Trope 1998). An important implication is that the value people attach to near futures is discounted when they appear more remote, as is assumed in rational decision making models, but the value of distant futures is actually augmented with greater distance because their desirability is less tapered by concerns of feasibility (Liberman & Trope 1998). The dimensions of psychological distance and time horizon are analytically distinct even though they are often correlated in practice. For example, demographers can make very long-range projections of population growth, a society's age distribution and urbanization, yet such futures are not distant from present experience but directly generated from it. Conversely, geoengineering represents a distant future, even for people that hope to implement the technology within a decade, because it represents a break from present understandings.

These differences of construal also manifest themselves in collective phenomenologies and social practices of envisioning futures. For example, Beckert (2013, 2016) as well as Clarke (2008) suggest that distant futures often arise from social processes that involve expressing fantasy and fictional hypotheticals rather than from negotiating consensual expectations and calculated extensions of the present, such as forecasts. Work on the collective nature of futures highlights two aspects of distant futures that arise from the social context in which cognitive processes are embedded. The first is that distant futures are distant not only in terms of abstraction, but that this abstraction also allows them to be more discontinuous with present day conventions and institutionalized beliefs. Distant futures are focused on possibilities rather than probabilities (Clarke, 2008), and thus often offer alternatives that critique present day social

reality (Mische, 2009: 695; 2014). The articulations of distant futures are thus commonly triggered during crisis or alienation, when people turn to ideologies, identities, and theories for guidance (Swidler, 1986). The second insight from the study of the social dynamics of distant futures is that they are often constructed in contexts that are overtly future oriented. Mische (2009, 2014), for example, examined the qualities of such 'sites of hyperprojectivity' in the context of UN summits on sustainable development, where there is deliberate focus among participants on envisioning alternative futures.

As-if Reality: When Distant Futures Orient Action

Given the distinctive qualities of distant futures as ambiguous, abstract, hypothetical, removed from experience, and representing a break from collective beliefs and conventional practice, it is not clear when and how distant futures would orient people's actions. In fact, distant futures can simply remain fantasies that are known to be unrealistic, playful thought experiments without a claim to actionability, or utopias that are *deliberately* constructed to be unreal and unattainable. Thus to orient human effort, distant futures must at the same time be seen as fictional and yet be taken seriously enough to inspire action towards realizing them. Drawing on Beckert (2013, 2016), we conceptualize this quality as distant futures taking on an 'as-if' reality, which he defines as the "inhabitation in the mind of an imagined future state of the world" (Beckert 2013: 219). When a distant future takes on 'as-if' reality, people begin to see themselves in the future state, which orients their actions towards (or away from) this future. 'As-if' reality is what distinguishes distant futures with social consequences from pure fantasy or playful imagination. Table 2 contrasts the characteristics of 'as-if' reality versus fantasy.

*** Please insert Table 2 about here ***

Distant futures are not automatically taken seriously, and gaining 'as-if' reality is in fact a challenge precisely because of the way that distant futures are construed in the first place.

Psychological research suggests that distant futures in general do not guide behavior very well. For example, McCrea, Liberman, Trope & Sherman (2008) show more distant futures to generate less urgency towards action (and instead engender more procrastination), and Oettingen (2012) shows that fantasies (desired futures without likelihood judgments) impede effort and have less of an effect on behavior. Similarly, Bloch (1923/2000) has suggested that utopias, which are quintessential distant futures, give shape to desires but are rarely realized, and even when they are they normally only give rise to small social enclaves (Levitas, 2013).

However, this work also suggests that the concreteness of a future may change as fantasies can be cognitively transformed to resemble less distant futures that have a closer association with experiential reality (Oettingen, 2012:31, Kappes & Oettingen, 2014). This insight mirrors predictions from construal level theory that when abstract futures become represented through increasingly concrete and detailed concepts, they will be seen as more near and hence more actionable. 'As-if' reality is thus generated by making distant futures more *concrete* (in terms of construal). And it is also generated by making the future more *credible*, in terms of taking it seriously enough to consider its possible consequences and its role in goal pursuits or expressions of identity. People glean the credibility of a future from how easily they can make sense of it in relation to personal experience, and from social cues, such as the behaviors of others. Both concreteness and credibility make a future more plausible (Weick, 1995) and serious (Beckert, 2016) than mere fantasy.

Imaginaries in Constructing Distant Futures

There is a body of research on "imaginaries" that illuminates where distant futures originate, and how and when they may become treated as a reality that orients action. The concept of imaginaries has been developed by social theorists and philosophers to describe broad shared conceptions of the world and humanity's place in it (Castoriadis, 1975/1987; Bloch,

1923/2000; Laclau & Mouffe, 1985). Imaginaries are deep cultural structures (Sewell, 1992) that form the pervasive and often unarticulated backdrop to more tangible knowledge, norms, and institutions; they provide a moral orientation and epistemological underpinning of reality (e.g., Castoriadis, 1975/1987). The imaginary refers to the phenomenological reality of images, or mind-made coherent objects that do not require language for their representation; they arise as much from desires as from sensory observation and experience. Imaginaries are thus fictional (not mere representations of reality), tacit (not fully articulated and discursively accessible), and psychologically distant (stylized, not concrete). It is because of these image-like qualities that imaginaries can orient the collective construal and affect the degree of 'as-if' reality of distant futures. Imaginaries encompass basic *cosmologies* of the world as well as a *moral basis* for evaluating action. Cosmologies are the belief systems regarding the foundational premises for making sense of the world, such as the origin, components, and mechanics of the social and material world (Douglas, 1970). Castoriadis (1975/1987), for example, contrasts fundamentally different views of the origin of the world, out of chaos in Greek mythology versus as a divine creation in Judaism, and their corresponding cosmologies. The moral order is the idealized character and underlying attitude that people seek in themselves and others (Geertz, 1957; Voronov & Weber, 2016). Charles Taylor (2004) has written extensively about the imaginary of Western Modernity, for example, and emphasized that Modernity is premised on a morality that evaluates societal norms and values in light of their benefit to individuals.

While imaginaries are not exclusively future-focused, they do map on to distant futures, either as an ideal or feared state. On the one hand, at their core is a cosmology that includes assumptions about the course of history (such as a march towards progress), which acts as a symbolic resource for the creation and interpretation of images of the future (e.g. Levitas, 2013).

On the other hand, the moral dimension of imaginaries means that they include ideals about the self, social group, and humanity that are aspirational rather than realized (Gaonkar, 2002; Appadurai, 2004). These desires guide the process of imagination (what is likely to be imagined in the first place) and vests people emotionally in realizing or preventing a distant future.

The limited work on imaginaries within management research has evoked imaginaries as a source of contestation (Levy & Spicer, 2013), to characterize broad societal models (e.g., the "capitalist imaginary" in Wright, Nyberg, De Cock, & Whiteman, 2013) or as an interpretive frame (e.g., views of permaculture in Roux-Rosier et al., 2018), but not in the context of constructing futures. Existing work also shows that imaginaries can stimulate and coordinate action at a collective scale, including underpinning revolutionary projects (Castoriadis, 1975/1987), the creation of nation states (Anderson, 1991), or the expansion of modern rationality into everyday life (Taylor, 2004). Beckert and Bronk (2018) highlight the importance of imaginaries particularly for envisioning and realizing futures under conditions of high uncertainty and disagreement. The moral bases and cosmologies of imaginaries make the future relevant, even when an imaginary suggests a radical alternative to the present. The connection is established not by a narrative of continuity, but by a normative critique of the present state.

METHOD FOR ANALYZING THE DISTANT FUTURE

Within-Case Data

To analyze dynamics of the distant future in geoengineering, we assembled a longitudinal database of documents. We gathered an extensive number of key documents on geoengineering across multiple types of actors and discursive spaces, including texts produced by climate scientists, social scientists, activists, journalists, and policy makers. Our database includes the following types of sources: 1) highly-cited scientific articles; 2) popular press books; 3) governmental reports and hearings; 4) recorded speeches and debates; 5) press releases, online

articles, and websites from non-governmental organizations; 6) reports from conferences; and 7) newspaper articles. For the newspaper articles, we developed a set of geoengineering-related keywords and gathered all news articles that included them through 2016 in the *LexisNexis Academic* database.[1] Table B in the Additional Materials summarizes the data, which include over 2,500 documents totaling over 12,000 pages of text and 23 hours of video.

Analyses

To answer our empirical research questions, how a distant future is conceived and how it acquires greater as-if reality, we performed a multi-step, abductive analysis of the evolution of geoengineering, in which we iterated between interpreting data and developing theory, such that our analyses were informed by theoretical frameworks, and the choice of theoretical frameworks was guided by our data (Peirce, 1955; Snow, Morrill & Anderson, 2003; Timmermans & Tavory, 2012). Abductive research is designed to discover new patterns of explanation, acknowledging explicitly that the appreciation of observational data is shaped by the researchers' frameworks and exposure to existing theories (Hanson, 1958). Our analysis in this within-case abductive iteration was guided by the theoretical building blocks of the distant future discussed above. We then proceeded to formulating the empirical questions, examining data to inform or modify theoretical understandings, and then integrating what we uncovered in the case to build a theoretical model of how people collectively engage with and organize around a distant future.

Identification of imaginaries and dimensions. To better understand our setting and case, we first asked: what imaginaries exist in the context of geoengineering? In our research team, we began with each co-author independently reading a sample of the non-news documents and

[1] The article search keywords include: 1) albedo modification; 2) carbon dioxide removal; 3) cirrus cloud modification; 4) climate engineering; 5) direct air capture and sequestration 6) geoengineering; 7) geo-engineering; 8) marine cloud brightening; 9) ocean iron fertilization; 10) solar radiation management; and 11) surface albedo.

noting how geoengineering was portrayed. We then met as a group and discussed evidence of imaginaries in the data. We utilized the two dimensions of imaginaries that we derived from existing literature, namely a *moral basis* and *cosmology,* to distinguish potential imaginaries in the texts. In reading the texts for imaginaries, we proceeded through two refinements: first, we found additional dimensions of imaginaries in the data on geoengineering: a *present-to-future link* and a *stance* (which we identified inductively from our analysis), and second, we also recognized a set of sub-components within each dimension, which we were then able to identify and code. Equipped with this refined set of dimensions and components, we iteratively identified five imaginaries within the non-news data: 1) *Technofix*; 2) *Human Hubris*; 3) *Plan B;* 4) *Governance First; and 5) Conspiracy of Elite Control*. To validate the imaginaries, two co-authors and one research assistant coded a subset of the news media articles across our period of study. This analysis provided support for the five imaginaries as being robust across different data sources as they were identified first in one set of texts (the non-news archival data) and then examined in a distinct set of texts (the news articles). Data exemplars for the imaginaries are included in Table C of the Additional Materials.

Descriptive temporal mapping of imaginaries. In our analyses, we noticed that the prominence of different imaginaries changed over time. To perform a more formal analysis of these changes, we looked for contextual markers of different phases to temporally organize the data and link trends in the discourse to broader changes. We identified several events, such as the publication of a watershed article on geo-engineering by a prominent climate scientist, Paul Crutzen, in 2006 and a report on geoengineering by the U.K.'s premiere scientific body, the Royal Society, in 2009. We also tracked the first appearance of new imaginaries, changes in actors' involvement, and variation of imaginaries in the media sources. From this, we identified

five phases in the discourse about geoengineering: phase 1: pre-1990; phase 2: 1990-2005; phase 3: 2006; phase 4: 2007-2009; and phase 5: 2010-2016.

Then, we measured the temporal prominence of the imaginaries within these phases, noting their relationship to one another and the actor that each mention of an imaginary was attributed to in the text. We did this by first constructing a corpus from a purposeful temporal sample of news articles that included one news article on the 1st and 15th day of each month, or next closest day, following the sampling strategy outlined in Grodal (2018).[2] The general news media only began notable coverage of geoengineering after 1990 (phase 1), but this was preceded by discourse in scientific circles. Therefore, we drew on scientific articles for the pre-1990 phase. Because these early scientific articles may not have used the term geoengineering, we retrieved all articles referenced by the two most highly cited scientific articles on *Google Scholar* related to geoengineering (Keith, 2000; Marchetti, 1977) and the highly cited article by Crutzen (2006). We coded this full corpus of scientific and news articles for instances that reflected any dimension of the five imaginaries. This resulted in 647 instances of imaginaries.

We then examined the co-occurrence of imaginaries within each source, measuring this as the number of times that two imaginaries were mentioned in the same article, divided by the total number of co-occurrences across all pairs of imaginaries. Then, to attribute each instance of an imaginary to an actor, we coded each text excerpt with the name of the individual or organization that invoked it. For example, if an imaginary was referenced in a quote from a climate scientist, it would be attributed to the scientist, whereas if it was discussed in the body of

[2] The limited news coverage on geoengineering before 2006 constrained the sample sizes for Phase 1 (3 articles) and Phase 2 (65 articles with an average of 4 articles/year). The sample from Phase 3 was 33, Phase 4 was 131, and Phase 5 was 164 articles. The resulting corpus reflected diverse regions, including Europe (31%); North America (31%); Australia (19%); and others (19%); as well as national (e.g., *The New York Times*) and local (e.g., *St. Louis Post-Dispatch*) news outlets.

a news article without any attribution, it was attributed to the journalist. Our actor analysis resulted in six actor types: 1) climate scientists; 2) activists and non-governmental organizations; 3) social scientists; 4) conspiracy theorists; 5) journalists; and 6) businesses. We cross-tabulated the coded imaginaries and their co-occurrences by actor and by phase.

Interpretation: Increasing 'as-if' reality and dialectic process. In addition to our descriptive analysis of the changing frequencies and patterns of co-occurrences in the discourse, we also began to note that geoengineering was increasingly being talked about more as if it were real in the discourse. This is despite the fact that our deep contextual understanding of the case verified that no significant implementation had taken place. The descriptive analysis also indicated that the changing co-occurrence pattern of imaginaries reflected more substantive relationships between the imaginaries. To move further from data to theory development, we again adhered to an abductive approach, abstracting up from fine grained coding to a recognition of larger patterns and explanatory processes. In doing so, we first revisited the literature on how futures take on 'as-if' reality (Mische 2014; Beckert 2013) and in parallel refined our analyses of our data. We then recognized two components of 'as-if' reality that connected our empirical patterns to the notion of 'as-if' reality in prior theory: *concreteness* and *credibility*. Concreteness is captured by the discourse around geoengineering moving from an abstract idea or ideal to one with more specificity, detail, and nuance reflecting a more concrete ontological reality. Credibility, we find, is shown through the diversity of actors that deem it worthy of engagement and further elaboration (this is distinct from the idea that geoengineering is positively valued).

In addition to an overall increase in 'as-if' reality over time, we also saw a pattern of continued contestation with an increasingly differentiated system of perspectives on geoengineering. We saw that some imaginaries were strongly linked to pervasive cosmologies

and moral orders that extended beyond the geoengineering context, while others were developed within the domain. The relationships between imaginaries over time in our descriptive analyses prompted us to look for interpretive frameworks that could explain this pattern. We found dialectic analysis particularly apropos for integrating the observed temporal changes, capturing the diverse relationships between imaginaries and reflecting the ongoing contestation in the discourse on geoengineering. Dialectical analysis offers a structural framework for understanding manifest patterns of change that involve controversy and conflict (e.g., Greenwood & Suddaby, 2006; Seo & Creed, 2002; van de Ven & Poole, 1995). Dialectical analysis examines change processes as sequences of the progression of theses, logical antitheses, and possible syntheses. In the last step in our analyses, we carried out a dialectic mapping of the imaginaries and found it to be a good fit for how imaginaries were in evoked by actors in debates, and how they co-occurred in the news articles. Finally, we consolidated and connected the concepts we identified through our abductive analyses into a general model of the dynamics of how a distant future is imagined and moves towards an increasing 'as-if' reality.

FINDINGS: THE DYNAMICS OF DISTANT FUTURES

Dimensions and Dialectics of Imaginaries in Geoengineering

Through our analyses of the discourse surrounding geoengineering we identified five imaginaries: 1) *Technofix*; 2) *Human Hubris*; 3) *Plan B*; 4) *Governance First*; and 5) *Conspiracy of Elite Control*, which are summarized in Table 3. As we identified these imaginaries, we found that they were each comprised of a set of high-level "dimensions" and underlying "components" within those dimensions.[3] The first dimension, an imaginary's Moral Basis, connects to deeply-held cultural values through three components: 1) an Ethos, 2) Corresponding Values, and 3)

[3] Throughout the findings, we capitalize and italicize the names of imaginaries, e.g., *Technofix*, and capitalize but do not italicize constituent dimensions and components, e.g., Moral Basis, Ethos.

Evaluation Criteria. The second dimension is an imaginary's Cosmology, which is the knowledge that is considered central to its worldview; it includes two components: 1) Privileged Epistemic Domains, and 2) Authoritative Actors. The next two dimensions emerged inductively through our analyses of the discourse surrounding geoengineering and represent more specific applications of cosmologies and moral bases to geoengineering. The first is the Present-to-Future Link, which includes the components of 1) A Situational Diagnosis and Metaphor of the Present Situation; 2) A Positive Vision of the Future; and 3) A Narrative of How to Get There. And the final dimension is the Stance, which includes 1) The Argument about the Role of Geoengineering; 2) The Position (for, against, etc.) Toward Geoengineering; and 3) the Proposed Solution. Examples of each dimension are in Table D in the Supplemental Material.

*** Please insert Table 3 about here ***

We found that the constellation of discourse and actors surrounding the distant future of geoengineering followed a dialectic process that led to an increased differentiation of imaginaries and corresponding understandings of geoengineering. This process was driven by imaginaries that represent theses, antitheses that oppose those theses, and syntheses that attempt to resolve these underlying oppositions. The first imaginary that was articulated in the discourse, the thesis that gave rise to the initial idea of geoengineering, was that of *Technofix*. *Technofix* views the earth as something that can be engineered and geoengineering as just another logical step in the progress of man's domination over nature. It encompasses a metaphor of geoengineering as a thermostat for easily adjusting the earth's temperature. We also find that *Technofix* was imported from broader society to the specific context of geoengineering, which we discuss in more detail in the following section. After it was imported, it attracted opposition, based on different ideals and belief systems, in the form of the *Human Hubris* imaginary, an imaginary found in many

other discourses and not confined to the geoengineering context. *Human Hubris* is grounded in the idea that man has a history of failed attempts to dominate nature and sees geoengineering as not addressing the root cause of climate change, which is lifestyles that do not respect planetary boundaries. *Human Hubris* contains an argument that even discussing geoengineering poses the moral hazard of distracting from the real work of climate change mitigation efforts.

The fundamental incompatibility between these first two imaginaries arises from their cosmological and moral bases, and represents the beginning of a dialectic process, with *Technofix* as the thesis and *Human Hubris* its antithesis. *Technofix* advocates for a conquering of this latest frontier of man's domination over nature, assessing climate change as a technical problem and offering geoengineering as a solution that requires little change to existing lifestyles. *Human Hubris* critiques man's historical attempts to dominate nature, highlighting ways in which this has backfired, and assesses climate change primarily as a social problem grounded in moral failures such as greed and egotism.

Over time there were attempts to resolve this deep opposition through a synthesis of the imaginaries. The first attempted synthesis occurred during Phase 3 when a different imaginary, *Plan B*, gained prominence. *Plan B* set forth the idea that geoengineering should be treated as a backup option in case all other attempts at addressing climate change fail. While *Plan B* addressed some of the underlying opposition between the existing imaginaries, it did not completely resolve them. We therefore see an additional attempted synthesis through the introduction of *Governance First*, which emphasizes the failure of climate negotiations and argues that comprehensive, accountable governance systems need to be in place before geoengineering can even be researched, or else geoengineering will be unilaterally deployed by a single individual or nation. Finally, during the last phase of our study, we see the importation of

one additional societal imaginary, the *Conspiracy of Elite Control*, as an antithesis to *Governance First*. This imaginary is based on the claim that geoengineering is already being deployed covertly and argues that we need to move towards a future in which its use is discontinued by taking power back from elites. The full dialectic process is shown in Figure 1. We discuss this process in the following sections, and connect it to our research questions of how distant futures are envisioned in the first place and how they take on 'as-if' reality.

*** Please insert Figure 1 about here ***

Imagining a Distant Future: The Importation of the *Technofix* Imaginary (pre-1990)

Our analyses suggest that the distant future of geoengineering initially arose from the importation of a societal-level technocentric imaginary of scientific progress and human mastery of nature into the domain of climate change, which offered a break from the long-standing approaches of mitigation and adaptation**.** The original propositions for even considering geoengineering were motivated and justified by a broader societal imaginary regarding humanity's rational and technological capacities and relationship with nature that can be traced back at least to the advent of Western Modernity (documented, e.g., by Gaonkar, 2002; Jasanoff & Kim, 2015; and Taylor, 2004). We term this imaginary *Technofix*. This societal-level imaginary was applied to the domain of climate change to envision geoengineering. Through *Technofix*, nature is viewed as a machine-like system that can be manipulated and improved for human progress. Nature can accordingly be managed through the use of technical knowledge, enabling a progression towards greater control (Jasanoff & Kim, 2015).

During this phase, discussions of geoengineering occurred primarily in scientific articles. Until 1990, geoengineering received almost no coverage in the news media, which indicates that it was not reaching a broader public. In this early discourse, geoengineering was almost exclusively envisioned through the *Technofix* imaginary. The content of two dimensions of

Technofix, its Moral Basis and Cosmology, are largely imported from the societal-level technocentric imaginary. And the other two dimensions, the Present-To-Future Link and Stance, are foremost logical extensions of the Moral Basis and Cosmology to the domain of climate change. This importation and extension underpinned the initial imagining of a distant future of geoengineering and the initial steps of concretizing a broader societal-level imaginary within a more specific domain. The Ethos of *Technofix* is that humanity rules over nature thanks to scientific genius, rationality, and ingenuity. Early discourse on geoengineering reflected this Ethos, talking about geoengineering as a matter-of-fact solution to was then called the "greenhouse problem," for example claiming that "the basis for a technologically and economically feasible operation does exist" (Marchetti, 1977). A 1989 article in *Nature* discussed the option of a sunshade in this manner:

> This difficulty may be overcome, and the 3.5% reduction achieved, with a minimum mirror area of 4.5 x 10^6 km, by positioning a satellite in such a way that it will always stand between the sun and the earth, permanently casting its shadow on the Earth.

Within the *Technofix* Cosmology, knowledge of science, technology, and engineering is most privileged, and during this phase actors from these disciplines are the primary ones discussing geoengineering and referenced in discussion of it. Articles focused on the *technical* feasibility of geoengineering, but not its ethics, desirability, or political feasibility. When actors invoked the Present-to-Future Link of *Technofix* they often employed a Metaphor of turning down the temperature on the Earth's thermostat. Additionally, a Positive Vision of the Future was constructed that illustrated that with this simple tweak the earth and humanity will have been saved from catastrophe. For example, the single news article in this phase that discussed geoengineering stated, "mankind may be able to counteract these potentially catastrophic

changes in the global climate in a rather simple, if ingenious, way" (*The Guardian*, 1987). The *Technofix* Stance was largely in support of geoengineering.

In this phase, we find that the distant future of geoengineering is initially generated from the importation of a societal-level imaginary that is reduced to its central tenets, in the form of its Moral Basis and Cosmology. Given the content of *Technofix*, it is not surprising that geoengineering was at first imagined by scientists and engineers. The linkage between the distant future of geoengineering and the powerful societal imaginary of technological progress and human ingenuity afforded the idea of geoengineering some initial credibility with those most ideologically committed to this societal-level imaginary (e.g., scientists). Yet, the distant future of geoengineering is at first vague and incomplete, focused on relatively simple hypothetical calculations and not concerned with practical actions toward implementation.

Increasing 'As-if' Reality via Opposition: Importation of *Human Hubris* (1990 - 2005)

Opposition to the *Technofix* view of geoengineering began to appear in the early 1990s. This opposition did not simply take the form of a more negative stance toward geoengineering. Rather, it was more fundamental, grounded on the importation and articulation of a societal-level ecocentric imaginary that has long stood in logical opposition to *Technofix*. The ecocentric view is deeply skeptical of human rationality and technological solutions (Brulle, 1996; Oelschlaeger, 1991). It is based on the idea that nature is a complex system that humans depend on but can never fully know, manipulate, or control (Eckersley, 1992; Oelschlaeger, 1991). It offers a critique of rational-scientific and anthropocentric views as having a "mechanistic, atomistic, and empiricist framework for understanding nature," as well as being guided by "technocentric ideologies that promote efficient, scientific ways of doing things, neglecting both care for nature and human well-being" (Garforth, 2018: 56; 61). In the ecocentric imaginary, there is an intrinsic moral value in nature, beyond its use for humans. Humans must respect nature, or face

catastrophic consequences. The deep-seated and pervasive opposition of *Human Hubris* to *Technofix* prompted this critique to be raised almost reflexively about geoengineering. Controversy over geoengineering was not a practical debate about feasibility and functionality (as would be expected for a near future), but instead largely a reflection of deeper philosophical oppositions between imaginaries.

Human Hubris was thus imported and applied to the domain of climate change as an antithesis to *Technofix*. The Ethos of *Human Hubris* is that humans are dilettantes when it comes to nature, a humble "guest" of nature, without the capacity to fully understand or control it. Hence, human attempts to intervene in nature generally backfire. The *Human Hubris* Cosmology privileges the epistemic domains of ethics, social science, and ecology. For example, one article that articulated the *Human Hubris* imaginary raised the question of the "ethics of geo-engineering, or even of conducting research toward that goal," and then quoted an oceanographer who said, "It's so naive to think that we can do one thing and it's going to have a predictable effect. The arrogance of human beings is just astounding" (*Science News*, 1995). The other two dimensions - the Present-to-Future Link and the Stance - were articulated as *Human Hubris* was specified to geoengineering. The Diagnosis for the Present Situation is that the cause of climate change is humanity's modern lifestyles that do not respect planetary boundaries. Hence, geoengineering is viewed as a proposal that does not address the root cause of the problem. Rather, it is a foolish and potentially dangerous distraction. We find these themes throughout the discourse. For example, as early as 1994, one article stated:

> If people think there may be simple technical solutions for problems like global warming, they'll be much less likely to tackle the underlying causes -- by drastically cutting back their use of fossil fuels, for instance. In addition, any attempt to control climate could have serious unforeseen side effects, some of which may be irreversible. (*Mercury News*)

In this early discourse surrounding geoengineering, *Technofix* and *Human Hubris* appeared frequently in the same source, indicating that they were being debated as a central opposition, rather than being produced through separate discourses or employed by actors who were talking past one another. For example, within the same article from *The Observer* in 2003, at first *Human Hubris* was invoked, through a quote from an expert who stated that geoengineering "would be folly on a global scale." In that same article, *Technofix* was brought in, in the voice of prospective entrepreneurs who were arguing for action to be taken to realize geoengineering and envisioned "tracts of sea being seeded with soluble iron compounds." At the end of the article, it returns to concerns based on *Human Hubris*, stating that geoengineering "could be well under way before it was realized that an ecological disaster had been triggered."

Before 1990, *Technofix* was the only imaginary discussed by climate scientists. In this second phase, however, some scientists began to invoke *Human Hubris* in debating the distant future of geoengineering. For example, in 1991 an atmospheric scientist raised the *Human Hubris* argument, stating that some people may be "concerned about the potential irreversibility of any intervention… others simply do not trust technology can extract society from a problem that technology created" (MacCracken, 1991). This debate amongst scientists was reflected in the news media as well. For example, another atmospheric scientist invoked the *Human Hubris* Diagnosis of the Present Situation, saying, "the danger in proposing quick-fix schemes is that people will continue to ignore the source of the problem" (*St. Louis Post-Dispatch*, 1994). Yet, the critique of *Human Hubris* did not supplant *Technofix* but prompted proponents to further elaborate and provide vivid images of the geoengineering options. This made the distant future more concrete, as a 2001 article illustrates:

> Scientists have proposed fleets of Mylar balloons and giant orbiting mirrors. Other ideas make use of an air pollutant called sulfate that reflects sunlight. One scientist has suggested

> giant guns that shoot sulfate particles into the atmosphere; another would send up a fleet of extra-dirty jets to spew sulfate into the sky, forming a planetary sunscreen (*USA Today*).

The contestation of geoengineering within the still central group of scientists on the one hand signaled that scientists considered the distant future of geoengineering as credible enough to be worthy of their debate. It also shows that the opposition between imaginaries cannot simply be attributed to oppositions between different interest groups, but that it instead has its roots in a more pervasive opposition at the level of a deep cultural structure.

In this phase, the discourse also expanded from scientific articles to the news media, often in the context of the controversy between *Technofix* and *Human Hubris*. In their coverage, journalists still primarily quoted climate scientists, but invoked *Technofix* and *Human Hubris* as opposite poles for assessing geoengineering. Geoengineering also began to be considered in policy documents within the scientific community, reflecting an engagement in discursive action toward a distant future of geoengineering by additional groups beyond climate scientists. For example, a 1991 National Academy of Sciences report discussed geoengineering options alongside other means of addressing global warming and noted (mostly through a *Technofix* lens) that "Geoengineering options appear technically feasible in terms of cooling effects and costs on the basis of currently available preliminary information" (The National Academy of Sciences, 1991). News and policy coverage broadened the audience and invited engagement from actors beyond the climate scientists that were original proponents of geoengineering. It also signaled that a broader audience of authoritative actors were taking the distant future of geoengineering seriously enough to engage with it, which, even when they critiqued it, signaled to others that it was credible. This contestation within this central actor group indicates that the actors were treating the distant future of geoengineering as real enough to be worthy of their attention and debate beyond a single imaginary, again lending it credibility.

In sum, during this phase, the fundamental opposition between *Technofix* and *Human Hubris* imaginaries as dialectic thesis and antithesis played out as Human Hubris provided a vivid alternative for the distant future of geoengineering. This debate occurred both within and outside of the scientific community, leading to more concrete geoengineering proposals. Additionally, it increasingly appeared in news and policy discourse, reaching and engaging with a more diverse group of actors, which in turn lent the distant future of geoengineering greater credibility through debate. The distant future of geoengineering thus had increased in 'as-if' reality precisely because it attracted opposition (which made this distant future actually more, not less, ambiguous and unclear), and in the absence of practice implementation.

The Contribution of Synthesis to 'As-If' Reality: Articulation of *Plan B* (2006)

In the third phase we find the first attempted synthesis of the opposition between *Technofix* and *Human Hubris*, through the articulation of a new imaginary termed *Plan B*. Unlike the previous two imaginaries, *Plan B* is not imported from the societal level, but rather it is locally articulated within the domain of climate change. We consider this to reflect the further concretization of the distant future of geoengineering, as actors are not just incorporating imaginaries from outside of this context, but they are also working to resolve the oppositions within the domain and articulate a new imaginary that is specific to geoengineering.

The Ethos of *Plan B* is that humans are prudent pragmatists with responsibility for the planet, and an (imperfect) capacity to manipulate nature. Because of these imperfections, humans have a moral responsibility to be resourceful and identify solutions to try to solve problems with nature. Therefore, *Plan B* advocates a Position Towards Geoengineering of proceeding with research and experimentation. The Argument of *Plan B* is that although the preferred response to climate change is mitigation, it is unlikely that mitigation will happen fast enough or at the scale that is needed to avoid catastrophic climate change. *Plan B* therefore calls for a backup option,

although it acknowledges, like *Human Hubris*, that geoengineering may have unintended negative consequences. However, *Plan B* advocates that these can be better understood through further research, while *Human Hubris* argues for a pre-emptive moratorium on field experimentation and implementation research, seeing them as a distraction from the real problems driving climate change. As *Plan B* incorporates some elements of *Human Hubris* and others from *Technofix*, we see it as concretizing the distant future of geoengineering by offering an imaginary that partially overcomes some of the underlying opposition between these views: geoengineering is potentially risky and not the ideal solution, but it is necessary as we are running out of time to address the climate crisis, so we need to explore all the options.

The local articulation of *Plan B* also indicates that the distant future of geoengineering was perceived as more credible, as it was worth working towards overcoming the underlying incompatible elements of the existing imaginaries in this space. Interestingly, climate scientists in this phase transitioned from raising concerns about geoengineering through invoking *Human Hubris*, to raising them by invoking *Plan B.* Many started to label themselves "reluctant supporters" of geoengineering, which we interpret as a way to reclaim a moral imperative from critiques of reckless hubris. A seminal article that articulated the *Plan B* imaginary was a 2006 publication on geoengineering by Nobel Prize-winning climate scientist Paul Crutzen. In the article, Crutzen stated the *Plan B* Position that mitigation was the preferred option, but that it was unlikely to be enough, writing, "…the very best would be if emissions of the greenhouse gases could be reduced so much that the stratospheric sulfur release experiment would not need to take place. Currently, this looks like a pious wish" (Crutzen, 2006: 216). The Crutzen article is firmly rooted in a scientific Cosmology, like the *Technofix* imaginary, but is skeptical of human rationality and motivates the Stance from a pragmatist Ethos. It reflects the *Plan B* imaginary as

an attempt to resolve the opposition between *Human Hubris* and *Technofix*. Even the fact that Crutzen would engage in this debate was surprising at the time and added credibility to the distant future of geoengineering. As Crutzen later noted, the article served to "break the taboo" around talking about geoengineering. After the publication of the article, it became a touchpoint in the media through mentions such as the following in *The Guardian*:

> But, as Crutzen says, given the 'grossly disappointing international political response' to the idea that humans should reduce their greenhouse-gas emissions, it might be a good idea to start thinking now about climate engineering against some future emergency… Crutzen is really asking us to imagine the unimaginable, in the hope that we might wake up to the reality and start reducing carbon emissions.

*** Please insert Figure 2 around here ***

Plan B represented more than one third of the imaginaries reflected in the media articles in this phase, as shown in Figure 2. Additionally, 86% of coded mentions of *Plan B* co-occurred with another imaginary. The most frequent co-occurrence was between *Plan B* and *Technofix* (35%). Even though *Plan B* was articulated as a proposed synthesis of *Technofix* and *Human Hubris*, these two imaginaries were the second most frequently combined in the discourse (29%), showing that the introduction of *Plan B* did not provide a synthesis that fully resolved the underlying thesis and antithesis. An article in the *International Herald Tribune* provides an illustration of this, as it first introduced geoengineering from the perspective of *Plan B* and then provided the opposition from a lens of *Human Hubris:*

> Few journals would publish [research on geoengineering technologies]. Few government agencies would pay for feasibility studies. But now, in a major reversal, some of the world's most prominent scientists say the proposals deserve a serious look… Worried about a potential planetary crisis, these leaders are calling on governments and scientific groups to study exotic ways to reduce global warming, seeing them as possible fallback positions if the planet eventually needs a dose of emergency cooling. [*Plan B*] … Many scientists still deride geoengineering as an irresponsible dream with more risks and potential bad side effects than benefits; they call its extreme remedies a good reason to redouble efforts at reducing heat-trapping gases like carbon dioxide. [*Human Hubris*]

The distant future of geoengineering gained greater 'as-if' reality in this phase through the articulation of *Plan B* as a domain-specific imaginary that attempted to synthesize the opposition between *Technofix* and *Human Hubris.* Within the discussions that invoked *Plan B*, there is the assumption that a distant future of geoengineering has enough 'as-if' reality that we should start preparing today for that possible eventuality. However, *Plan B* still enables a consideration of geoengineering as (hopefully, or ideally) never ultimately needing to be deployed. *Plan B* is established primarily through its introduction by a prominent climate scientist, which lends credibility to the distant future of geoengineering. Despite the articulation of *Plan B,* however, the original two imaginaries, *Technofix* and *Human Hubris,* were not superseded or replaced after this proposed synthesis; instead, they remained integral to the discourse of geoengineering. In this phase, we begin to see an ecology of imaginaries of the distant future of geoengineering.

Unresolved Opposition and New Attempted Synthesis: The Articulation of *Governance First* (2007 - 2009)

A second proposed synthesis was put forward in the form of a new imaginary in the discourse surrounding geoengineering, *Governance First*. Because *Plan B* retained core assumptions and ideals of *Technofix*, the opposition with *Human Hubris* was not fully resolved. *Governance First* was articulated, therefore, in an attempt to reconcile and transcend the opposition between *Plan B* and *Human Hubris*. This further distillation of the dialectic process indicates continued concretization of a distant future of geoengineering, as it is articulated further in the specific domain. Additionally, the content of the *Governance First* imaginary itself is a sign of further concretization. While the previous imaginaries were primarily concerned with *whether or not* the distant future would include the deployment of geoengineering, *Governance*

First prioritizes the question of *how* a future with geoengineering would plausibly be governed, signaling greater treatment of geoengineering 'as-if' it were going to occur.

The Ethos of *Governance First* is that humans have the scientific capacity to preserve the planet, but that they are often unable to cooperate for the common good. Unless these social flaws can be resolved, large-scale technological interventions are at risk of unilateral, and nefarious, deployment. The *Governance First* Ethos was reflected in a 2008 *Guardian* article about an assessment from a climate scientist at Stanford University:

> In an overall assessment of the geo-engineering challenge, he notes that critics ask whether it is socially feasible to expect the many centuries of international political stability and co-operation that would be needed to operate global scale schemes. He adds that the potential also exists for conflicts between nations if geo-engineering projects go wrong.

Governance First is built on the Corresponding Values of justice, equality, and collective solidarity by its insistence on the idea that the common good of humanity has to be governed by participatory political institutions. Like *Plan B*, *Governance First* recognizes that technological solutions are feasible and will likely be needed: this imaginary was more widely found as scientists increasingly reported that climate change was happening faster and at a more alarming rate than what had originally been predicted. Like the *Human Hubris* imaginary, *Governance First* also emphasizes the enormous risk to tinkering with the climate. The concern in the *Governance First* imaginary, however, is not that humans do not have the capacity to safely control the climate system (the primary premise of *Human Hubris)*, but rather that they should not attempt to experiment or deploy these changes without a robust governance system in place. *Governance First* puts forth an Argument about the Role of Geoengineering that the barrier to moving forward is not a lack of knowledge about the planetary system, but rather a lack of operative global governance systems to oversee geoengineering. *Governance First* is still an

incomplete synthesis because the core assumptions of technological solutions remain in opposition to *Human Hubris.*

In this phase, the frequency of news articles per year on geoengineering increased substantially, with over four times as many articles per year compared to the previous phase. We also see greater involvement of other actors in the discourse. Social scientists, policy experts, and activists all increasingly voiced imaginaries related to geoengineering in the news media. Credibility was also enhanced through the publication of governmental and non-governmental reports on geoengineering, which often invoked the *Governance First* imaginary. In 2009, climate and social scientists from the U.K.'s premier scientific association, the Royal Society, published a 98-page assessment on geoengineering which primarily emphasized aspects of the *Governance First* imaginary. For example, stating the following:

> It would be highly undesirable for geoengineering methods which involve activities or effects that extend beyond national boundaries (other than simply the removal of greenhouse gases from the atmosphere), to be deployed before appropriate governance mechanisms are in place (The Royal Society, 2009: ix).

News articles would later credit this report as a turning point in the discourse, for example stating, "As concerns about global warming mount, the idea of deliberately altering the climate has been moving out of the realms of science fiction partly thanks to a 2009 report by the Royal Society" (*Daily Telegraph*, 2010). In parallel with this report, in 2009 social scientists published five high-level principles for the governance of geoengineering, called the "Oxford Principles, which emphasized that deployment should only occur "within an appropriate governance framework." Activists, who had previously primarily utilized the *Human Hubris* imaginary, began to also invoke *Governance First*, as reflected in this quote by a leader of the ETC Group, a Canadian nongovernmental environmental organization:

> In one technological controversy after another, it has become clear that governance processes that privilege techno-scientific knowledge and perspectives above all other forms of knowledge often deliver inequitable, unsafe and poorly informed judgments. (2009)

We see an increasingly differentiated ecology of imaginaries. At the same time that *Governance First* took off between Phase 3 and Phase 4 (>95% confidence level), discussions of *Plan B* decreased (>85% confidence level). This second attempted synthesis was gaining traction at the expense of the previously proposed one, which again reflects the ongoing dialectic process. The most common co-occurrence of imaginaries was the use of *Plan B* with *Technofix*; although there was a significant decrease (>95% confidence level) in frequency of this co-occurrence from the previous phase. Figure 3 shows co-occurrences of the imaginaries from Phases 3 to 5. We see a significant increase (>95% confidence level) of *Governance First* co-occurring with other imaginaries as 98% of occurrences of *Governance First* in the news co-occurred in the same article with another imaginary. As an example, in an article in *The Guardian* in 2009, *Technofix* was first invoked to vividly introduce possible geoengineering technologies and describe them in an almost "inevitable" manner: "The ideas, some of which, similar to cloud-seeding, involve firing massive amounts of chemicals into the atmosphere, can sound far-fetched, but they are racing up the agenda as pessimism grows about the likely course of global warming." Next, in the same article, a policy expert voiced concerns aligned with *Governance First*: "Logic points to a big risk of unilateral geoengineering. Unlike controlling emissions, which requires collective action, most highly capable nations could deploy geoengineering systems on their own."

*** Please insert Figure 3 about here ***

We also found that climate scientists began to invoke *Governance First*. This is a continuation of the dialectic process, as we saw this actor group first discussed the distant future exclusively through the *Technofix* imaginary, then juxtaposed it with *Human Hubris* as an

imaginary of critique, then broadened their discourse to include discussions of *Plan B*, and eventually came to invoke the imaginary of *Governance First.* Thus, the dialectic process and the change in imaginaries was not only occurring across actor groups, but also within them.

In this phase, the distant future of geoengineering gained greater 'as-if' reality as *Governance First* was generated as an attempt to resolve the continued opposition between *Plan B* and *Human Hubris*. Both the prominence of *Governance First*, along with its content of being concerned with *how* geoengineering could be governed in advance of its deployment, further concretized the distant future of geoengineering. Further concretization was also reflected in the fact that climate scientists continued to engage in the dialectic process that attempted to resolve underlying oppositions between the existing imaginaries. Additionally, we see greater credibility of this distant future reflected in the wider group of actors articulating imaginaries as well as through the publication of reports by governments and non-governmental agencies that increasingly treated geoengineering and its governance as worthy of their attention.

From Synthesis to New Antithesis: *Conspiracy of Elite Control* (2010 - 2016)

In the last phase of our study, we find an increased prominence of a new imaginary, *Conspiracy of Elite Control*. While in the previous two phases, *Plan B* and *Governance First* were locally articulated, being based primarily on attempted syntheses between existing imaginaries within the domain, *Conspiracy of Elite Control* reflects a wider societal-level imaginary, as was the case with *Technofix* and *Human Hubris*. The Privileged Epistemic Domain in *Conspiracy of Elite Control* is the rejection of scientific knowledge and political authority and an elevation of lay expertise as an equally valid alternative to experts. While the imaginary's Position, which is opposed to geoengineering, is similar to others', its Diagnosis of the Present Situation is very different. It proposes that geoengineering is already happening and its Proposed

Solution is to empower people to expose this secret and disrupt existing power structures. *Conspiracy of Elite Control* treats the distant future as if it were a present-day reality.

When this imaginary appeared in the news, it was primarily through letters to the editor rather than articles by journalists. Even though *Conspiracy of Elite Control* increases in this phase (confidence level >90%), it remains largely outside of the primary, or multi-actor, sites of discourse; additionally, it is rarely mentioned in relation to other imaginaries. However, central to this imaginary is a critique of institutional actors, especially the governmental actors that are central to *Governance First*. For example, one article started by noting "alarm over the CIA's part-funding of a National Academy of Sciences report," then discussed historical British military trials "to produce artificial clouds to bamboozle German flying machines during World War I" and the US military's previous "Operation Popeye [that] increased rainfall by about 30% over Vietnam," before ending by noting theories that a US "secretive Alaskan facility has manipulated weather patterns with its investigation of the ionosphere" (*Mail & Guardian*, 2015).

Conspiracy of Elite Control was articulated in detail by organizations such as Geoengineering Watch, a group founded in 2010 based on the idea that "Volumes of data, lab tests and video footage, from all over the globe, make clear the conclusion that aerosol spraying has been an ongoing lethal reality." The group remained active throughout the remainder of our period of study and it continued to argue that geoengineering was already being deployed and needed to be stopped. In a 2014 speech, the leader of Geoengineering Watch stated:

> This is going on right now. We've verified this again and again. The global elite and the bankers are involved with this. People ask, who is doing this? I say, who is doing everything? Who prints the money? It all goes back to the money (Wingington, 2014).

The ecology of imaginaries persisted in this phase as different actor groups invoked different imaginaries. There were an average of 233 articles on geoengineering published per

year, the greatest number thus far, which indicates further credibility of the distant future of geoengineering. The publication of popular press books by prominent climate and social scientists, as well as by journalists, conveyed the idea that geoengineering futures were taking on more of an 'as-if' reality that deserved to be in the public sphere. We identified 12 books that were explicitly focused on geoengineering, and they were all published in this phase.

Another prominent change during this time was the decrease in the *Plan B* imaginary (99% confidence level) and the growth in *Governance First* (95% confidence level). In fact, mentions of *Governance First* surpassed those of *Plan B*, reflecting that this second attempted synthesis was gaining more traction in the discourse than the previously proposed synthesis, which again indicates further concretization of a distant future of geoengineering. Additionally, imaginaries of geoengineering moved beyond policy and scientific circles and were increasingly present in wider debates that included non-governmental organizations, activists, ethicists, lay citizens, journalists, and entrepreneurs. In this phase, there was a decrease in the reference to climate scientists in the news media (99% confidence level), while social scientists' involvement in the discourse increased (95% confidence level). Social scientists often focused on *Governance First*. For example, in a 2012 speech, the author of the Oxford Principles argued that the acceptability of geoengineering is "highly dependent on resolving the serious and complex governance issues." Activists continued to primarily utilize the *Human Hubris* imaginary, occasionally paired with a critique of *Technofix*. For example, climate activist and author Naomi Klein invoked *Human Hubris* in a 2012 op-ed in the *New York Times*, writing:

> The risks are huge. Ocean fertilization could trigger dead zones and toxic tides. And multiple simulations have predicted that mimicking the effects of a volcano would interfere with monsoons in Asia and Africa, potentially threatening water and food security for billions of people.

The top co-occurrences in this phase were both with *Governance First* (with *Technofix* and *Human Hubris*). *Governance First* was found the least on its own in the news articles. Together, these findings indicate the continued debate between this proposed synthesis and other imaginaries. Figure 3 visually shows the transition as the most frequent co-occurrences in the media shifted from *Plan B* in Phase 3 to *Governance First* in Phase 5. Despite the temporal changes in the discourse through the local articulation of two proposed syntheses (*Plan B* and *Governance First*) as well as the importation of an additional societal-level imaginary (*Conspiracy of Elite Control)*, the underlying opposition between *Technofix* and *Human Hubris* persisted. As an example, in a 2013 debate at the University of Oxford between a climate scientist who espoused a *Technofix* imaginary and a social scientist, the social scientist invoked *Human Hubris* through the following:

> I don't believe the real climate will behave like the model climate at scales that matter for people and at which the political, legal, and ethical repercussions are felt… Geoengineering would be like playing a game of Russian roulette.

In this phase, we also see the first attempt to test the assumptions of some geoengineering technologies outside of simulations and laboratories. Off the coast of Canada, an entrepreneur attempted to spread 100 tons of iron sulfate in the Pacific Ocean to examine the technological and commercial viability of ocean fertilization as a carbon dioxide removal method. The attempt was met with immediate pushback and ruled illegal by a Canadian court before it could be fully executed. Protests blocked another experiment, which would have pumped water droplets into the atmosphere from a tethered balloon.in the U.K., before it even commenced. There is of yet, a moratorium on even small-scale experiments that would create an experiential basis for geoengineering. Nevertheless, in this final phase, geoengineering continued to gain ‘as-if’ reality as a new imaginary imported from the societal level, *Conspiracy of Elite Control* treated geoengineering as if it were already happening. Additionally, during this phase, debate continued

to broaden, not only within and across actor groups, but also across individuals who discussed multiple imaginaries. Finally, there was evidence of increased credibility of the distant future of geoengineering, through the publication of popular press books on the subject and independent actors pursuing experiments of the associated technologies.

THEORY DEVELOPMENT: INTEGRATION AND IMPLICATIONS

We have developed the concept of *distant future* as a new way of seeing the future and its connection to orienting action. Distance refers to how close a future is to experience and convention, not to the time horizon of when it is envisioned to materialize. We argue that previous management research has largely treated the future in an undifferentiated way and implicitly focused on variants of the near future. The phenomenology of the near future is characterized by uncertainty and risk and correspondingly is focused on problems of expectations and prediction based on existing knowledge and experience. Yet, some future-related problems, such as grand challenges, extend beyond near future concerns and require an understanding of distant future processes. The distant future is characterized by ambiguity and hence poses the problem of imagining what hypothetically might be and raises the question of how such imagined possibilities may ever be considered real enough to orient collective action. The distinction between near and distant futures is thus not a matter of just extending the time horizon, but it points to qualitatively different processes of envisioning the future and acting on it. Through the case of geoengineering, we find that societal-level imaginaries influenced the initial development of a distant future and that the projection of that future was followed by a dialectic process that attracted oppositional imaginaries and attempted syntheses. The controversy that came about from these oppositions prevented immediate coordinated action, but at the same time it made the distant future of geoengineering increasingly concrete and credible, allowing it to acquire an ‘as-if’ reality in the absence of any substantial implementation.

A Model of Creating 'As-If' Reality for a Distant Future

To integrate our empirical observations at a more abstract level, we present a model of how a distant future is imagined and gains 'as-if' reality at the collective level. The model is shown in Figure 4. Our first research question corresponds to the first step in the model: how do distant futures come to be? As shown in the left half of the figure, this initial imagining of a distant future comes about through the importation of a societal-level imaginary to the domain level. Initially, actors draw on societal-level imaginaries that reflect deep, pervasive ideas about humanity in the form of a cosmology and moral basis, but lack explicit statements related to potential futures within a specific domain. Why do we observe imaginaries as central to this process, over other concepts, such as identities or goals? The key is their ability to coordinate *collective* imagination under conditions of high ambiguity: as deep cultural structures (Sewell, 1992) imaginaries are pervasive and orient imagination through moral cosmologies, yet diffuse enough to afford flexibility in imagining by diverse individual actors. The societal level imaginary allows actors to "make the leap" into seeing a distant future that breaks from current discourse and experience within a domain (which might have been previously focused on near future processes such as extrapolation of past practices and risk assessments). The cosmology and moral basis of the societal-level imaginary are applied to a domain through the articulation of a present-to-future link and a normative stance towards the future. Imaginaries thus reduce an issue to its moral and cosmological assumptions, and then extend these out to alternative possibilities, a process that corresponds to the model of generating new concepts in cognitive psychology (e.g. Ward, 1994) and alternative futures at the societal level (Levitas, 2013). The importation and articulation process highlights that distant futures are constructed as domain-specific but that they are still abstract and stylized representations hinged to cultural structures.

*** Please insert Figure 4 about here ***

Our second research question corresponds to the subsequent step in the model: How does a distant future gain 'as-if' reality? Our central insight is that a dialectic process is the engine for the increasing 'as-if' reality of a distant future. We find that a distant future acts as a motivational pull or repellent to other actors, prompting them to think through a hypothetical future, or critique it if it conflicts with their morality and cosmology. One would normally expect a future to become more concrete and credible through gradual implementation via robust action (Ferraro, et al., 2015); but for distant futures there is no experience upon which to build. Instead, 'as-if' reality is advanced by the often oppositional structure of elementary social imaginaries (documented in anthropological work by Levi-Strauss (1966/1962) and Douglas (1966)) and actors work to propose alternatives, articulating new imaginaries in opposition to, or as proposed syntheses of, existing imaginaries, which then result in new interpretations and critiques. Ironically, debate and critiques add specificity and nuance to the distant future, thus making it more concrete, and it draws in responses from new participants, making it more credible.

This model suggests that the dialectic process does not produce a consensus or compromise for implementing the distant future. Rather, the dialectic process is ongoing within the domain, and creates a proliferation of interim positions, without producing a true synthesis in the dialectic sense that would resolve the opposition of the initial imaginaries. We observed empirically in the case of geoengineering that proposed syntheses addressed aspects of the opposition but left others unresolved. For example, *Plan B* and *Governance First* maintained the *Technofix* core - the underlying belief that technology can effectively address the climate crisis. We suggest that one reason for the absence of a true synthesis in the dialectic sense is that such a synthesis cannot arise within the domain (in our case climate change), but only at the societal level of elementary imaginaries. Because imaginaries of geoengineering remain hinged to

societal imaginaries, local syntheses are necessarily incomplete. In addition, the gradual increase in the distant future's 'as-if' reality invites new critiques through the importation of additional societal-level oppositions, which we saw through the importation of the imaginary of *Conspiracy of Elite Control* in response to the proposed *Governance First* synthesis.

The dialectic process, therefore, results in an increasingly differentiated ecology of imaginaries (shown on the right in figure 4). This ecology of imaginaries further prompts more fine-grained discourse and increases the salience of concrete concerns and the credibility of the future as more people relate to it. In our case, we saw, for example the expansion of discourse from scientific articles, the original site of geoengineering discourse, to government reports, popular press books, and public debates. The discourse around the imagined future gradually shifted from ideological and principled concerns, which are central to evaluating distant futures, to also include questions of feasibility and practicality that are central to near futures. The distant future (of geoengineering) is increasingly being talked about 'as if' it were a reality.

Implications for Studying the Future

Our study extends research on organizing for future-oriented action. By identifying and focusing on distant futures, we complement work that has typically employed concepts associated with the near future, such as legitimating temporal narratives or applying discount rates to future options (e.g., Gioia, Corley, & Fabbri, 2002; Kaplan & Orlikowski, 2013; Garud, Schildt, & Lant, 2014; Flammer & Bansal, 2017). Our work proposes that futures can be constructed for alternative purposes, and that in turn there is a need to revisit and broaden how knowledge relates to envisioning the future as well as how controversy and consensus can play a role in realizing futures in action.

Instrumental and expressive roles of the future. The focus on the near future as an attempt to optimize choices between alternative options under conditions of incomplete

knowledge is well represented in existing management research. Garud et al. (2014), for example, emphasize the centrality of entrepreneurial narratives that set cognitive expectations (about future states of the world) and pragmatic expectations (about the value of those states to the firm) for nascent ventures' legitimacy and ability to acquire resources. Similarly, Flammer and Bansal (2017) show that incentives for executives to consider longer time horizons leads them to pursue more long-term investment strategies, presumably because they discount expected return in the future less than they would otherwise. And Slawinski and Bansal (2015) identify practices that allow some firms to manage the tensions between short-term and long-term expectations in their decision making.

A view of the distant future suggests, however, that futures are not only considered for the purpose of forming expectations and managing uncertainty. They are also constructed as expressions of values, beliefs, and desires, giving shape to hopes and fears and making sense of moral ambiguities. The importance of imaginaries in envisioning and making sense of the distant future shows that people relate to the future not only in an instrumental way, but also in an expressive way, to affirm and give shape to collective hopes, fears, and desires that are affectively salient but practically remote. Distant futures thus do not reduce but increase uncertainty about future states. They expand a diverging set of possibilities, which makes forming expectations about them more complex, and they introduce higher level principles and assumptions, which can unsettle conventionally agreed upon goals and preferences. Giving consideration to the distant future thus brings into focus the generative effects of engaging with the future in organizations.

Envisioning radical alternatives and critique. The expressive purpose of distant futures is particularly salient in envisioning alternatives that critique the status quo. These critiques are

the precursors for processes such as breaking away from institutionalized practices, which is central to institutional entrepreneurship and the emergence of new fields (Battilana, Leca & Boxenbaum, 2009; Zietsma, et al., 2017). This is especially true for more radical change efforts, such as alternative forms of capitalism (Adler, 2016), systemic sustainability in the anthropocene (Ehrenfeld & Hoffman, 2013), breakthrough solutions to grand challenges (Ferraro, et al. 2015), or radical innovation and disruptive entrepreneurship (Alvarez & Barney, 2007; Fisher, 2012).

The construction of more distant futures and their taking on an 'as-if' reality is a precondition for these projects, yet the existing research says very little about how such alternatives are conceived of and considered in the first place. Previous work identifies as conditions for more radical entrepreneurial projects a systemic understanding of problems (e.g. Schad & Bansal, 2018) and a deep understanding of tensions (e.g. Raisch, Hargrave, & Van de Ven, 2018). At the same time, much of the corresponding research employs models grounded in near future processes, such as the recombination of existing knowledge and learning from experience. These processes draw on rather than question institutional contexts. For example, work on effectuation processes locates the source of entrepreneurial efforts in individual and organizational experience (Fisher, 2012), which ignores the orienting role of societal imaginaries in coordinating these efforts at the collective level. Research on cultural entrepreneurship (Lounsbury & Glynn, 2019) on the other hand, does take such cultural context into account, but until very recently has equally focused on symbolic resources and cultural legacies that are experientially accessible in the present, over the more projective quality of distant futures.

The distinction can be illustrated in the domain of climate change. Many mitigation strategies, such as the advancement of renewable energy production or smart metering, develop through incremental changes to existing processes and learning from previous experience. Even

when proposals are bold in scale or aggressive in timescale, they develop near futures that are construed in continuity with experiential knowledge. At the surface, many other types of proposed technological solutions can be seen as aligned with the *Technofix* imaginary that also gave rise to geoengineering. However, while both mitigation strategies and geoengineering often focus on technology as part of the solution, the types and use of the potential technologies in geoengineering represent a discontinuity from experience, which is not the case with mitigation.

The distinctive phenomenology of distant futures thus offers a stronger foundation for understanding the distinctive emergence of critiques and true alternatives that are at the heart of systemic alternatives and radical innovation in a variety of contexts. The hypothetical and fictional nature of distant futures may not have immediate value for action or uncertainty reduction, and it is thus tempting to dismiss distant futures as inconsequential fantasy or utopia. But they are crucial for breaking with experiential knowledge and conventional practices, for seeing problems and opportunities that do not fit existing frameworks. Existing work on imaginaries has acknowledged their role in divergent evaluations of existing practices (Levy & Spicer, 2013; Roux-Rosier et al., 2018; Wright, et al., 2013), but research on their origins within a domain is extremely limited (for an exception in the context of permaculture, see Roux-Rosier, et al, 2018). One effect of even unsuccessful entrepreneurial efforts based on distant futures is to articulate an implicit critique of the status quo that may undermine its legitimacy and pave the way for change. Even if geoengineering were to be ultimately discarded, it has, by acquiring an 'as-if' reality, offered a critique of mitigation strategies that may lead to more radical changes.

Forms of knowing in future-oriented action. The collective knowledge that supports constructing a distant future goes beyond the forms of knowledge normally considered pertinent to action. The expectations of the future that are central to near futures are based on declarative

forms of knowledge, knowledge that can be communicated and processed as stable facts, rules and attributes. Constructing the distant future, by contrast, relies on deep moral bases and cosmologies that reflect belief systems, ethos and values that are difficult to articulate analytically; they are represented and accessed more as feelings and images than as articulated in concrete form (Lizardo, 2017; Castoriadis, 1975/1987). Imaginaries encapsulate knowledge in the form of ideals based on fiction and fantasy rather than practical experience or analytic knowledge. Imaginaries are particularly important at the collective level, whereby the moral basis and cosmology enables many people to coalesce around a shared distant future, even in the absence of action towards it.

The ethos and values at the center of imaginaries also bring attention to the moral underpinnings of changes and innovation. Radical entrepreneurship, regardless of whether it is institutional, technological, or commercial, is tied to moral ideals, through an entrepreneurial ethos that is derived from societal imaginaries (Voronov & Weber, 2016). A moral and ideological grounding makes distant futures deeply emotional, which has implications for how people mobilize to act on them. For example, a near-future focus within the domain of climate change can be found in many of the approaches that have been taken to date, such as the Intergovernmental Panel on Climate Change (IPCC) reports and climate forecasting, and in innovations that fall in line with the dominant ideological beliefs about the climate and the economy, like carbon taxes or markets. We are thus not arguing that near future thinking is not able to lead to innovation. However, for an approach to break with a domain's institutionalized assumptions, it is likely to be grounded in distant futures that are fueled by moral ideals rather than in near futures that are derived from assessments or extrapolations. Such radical thinking may be a necessary component of making the leap towards addressing large-scale, complex,

multi-actor grand challenges like the climate crisis, but this also means that solutions will be evaluated on moral grounds and are not reducible to scientific assessments based on objective measures. One implication of the form of knowledge used in constructing distant futures is that futures are evaluated based on ideology and resonance with moral and cosmological principles rather than factual and practical considerations. This may be one reason why conventional models of science communication that rely on rational persuasion and scientific evidence have not been fully successful in the context of climate change (Hoffman, 2011).

The role of consensus and controversy in future-oriented action. Existing work on future-oriented action in management focuses on the necessity of developing consensus and a shared understanding of goals and how to accomplish them to generate coordinated action (e.g., Stigliani & Ravasi, 2012; Cornelissen & Clarke, 2010). For example, while opposition was highlighted by Kaplan and Orlikowski (2013) as a component for catalyzing greater strategic shifts, eventual agreement amongst actors, even if temporary, was key to action. Thus, for near futures, debate may well improve the quality of ultimate action by stimulating a more thorough evaluation of the feasibility and consequences of action, and facilitate the search for alternative solutions. But work to date has emphasized that consensus or compromise is necessary for mobilizing collective action around a path forward. For acting on a near future, controversy is thus assumed at best of temporary value, but primarily as leading to paralysis.

In contrast, for distant futures, the challenge for collective action is not so much deciding on which of several options to pursue, but around whether a proposed idea should even be considered an option in the first place. In this context, debate is a process that propels the distant future toward becoming part of the set of possible solutions in the domain. Contestation prompts elaboration of hypothetical possibilities, increasing concreteness. Through multiple actors

entering debate, the distant future gains credibility as a potential solution that should be considered, even when actors disagree. Our empirical case does not show the emergence of a dominant imaginary (as in Levy & Spicer, 2013), nor does it show a plurality of juxtaposed imaginaries (as in Roux-Rosier et al., 2018). Instead, we find that an ecology of imaginaries develops through a co-constructive, dialectic relationship. Thus, as an unintended consequence of contesting the initial interpretation of geoengineering, debate actually increased 'as-if' reality, even in the absence of actual realization and when many people were strongly opposed to any implementation of the proposed ideas. To contest and debate a proposed distant future, opponents have to relate the future to their own morality, cosmology, and experience, so that they begin to "inhabit it in their mind," to use Beckert's (2016) words. In advocating for a distant future, it may thus be beneficial to stimulate debate and different perspectives rather than suppress them in the interest of urgency or ideological closure.

Controversy and opposition may be particularly important in moving a distant future towards action in settings without central authority (i.e., outside of the hierarchical control of organizations) or in the absence of settled knowledge (e.g. grand challenges). The scale, complexity, radical uncertainty, and ambiguity of grand challenges require sustained efforts that go beyond single actor groups, technologies, or organizations (Ferraro, et al., 2015; Howard-Grenville, et al. 2016). Ferraro and colleagues (2015) argue that addressing grand challenges requires robust action: a participatory architecture of diverse actors, discursive material that sustains different interpretations and evaluation criteria, and distributed experimentation. They suggest robust action is a deliberate strategy that organizations can develop and employ. Given the lack of clarity or knowledge of potential responses to grand challenges, we see contestation and debate about the distant future as potentially central to robust action and radical solutions.

And the dialectic process that enables an ecology of imaginaries to develop in a given distant future, set in motion by the oppositional structure of societal imaginaries, is likely to be central to building the discursive material through which diverse actors negotiate oppositions within a domain. The process of articulating theses, antitheses, and syntheses of the distant future builds the 'as-if' reality that is needed to allow the tempered experimentation required for robust action.

Towards a Research Agenda on the Distant Future in Management

In building theory around the distant future and identifying the role of imaginaries in it, as well as in outlining the dimensions and components that make up imaginaries, our work opens up new paths for future research. As we consider the distinction between near and distant futures, it will be worthwhile to further explore their relationship and interplay. For example, within the domain of climate change, the distant future of geoengineering is prompted by and relies on the near future of climate forecasts and models. In many cases, it is likely that the same domain could prompt both near and distant futures. For example, on the one hand, an issue like population growth reflects a relatively straightforward near future based on a long-range forecast (e.g. population projections for 2060), but on the other hand, it prompts an uncertain distant future based more on ideologies and identities, an image of a more crowded world, even at a shorter timeframe (e.g. sprawling cities that are over capacity by 2030). It is possible that we would find more utopian or dystopian futures in a post-truth era that places value on belief systems and ideologically-driven evaluations.

Future research could also explore the pace and roadblocks of moving towards 'as-if' reality. What moves the progression of attempted syntheses along or enables them to more or less overcome underlying oppositions? When may a distant future reflect shorter or longer phases of attempted resolution? Our work suggests that pressure from the domain level, in our case the growing scientific evidence that climate change is occurring faster and more intensely

than initially thought, may have triggered proposed resolutions of oppositions. Alternatively, one could imagine a more extended dialectic process could have unfolded if revised climate models had shown that the impacts of climate change were projected to be slower. Importantly, there also remains an open question of how a future transitions from distant to near. As we study geoengineering, we observed its transition from fantasy to gaining greater 'as-if' reality. As climate change impacts escalate, and geoengineering debates continue, when and how might the dynamics change to prompt action on a large scale?

Our work shows that the process of imagining a distant future is strongly shaped by societal-level imaginaries, yet what prompts and enables the construction of a distant future remains an open question. For example, is dissatisfaction with the present or expected near future needed to begin to imagine a distant future? And is some degree of social closure needed for radical alternatives that run counter conventional views of the future to gain momentum? Our case suggests that imaginaries related to geoengineering emerged in part because scientists were concerned that climate change impacts could not be sufficiently addressed through traditional mitigation efforts such as reduction targets and switching fuels. This idea is aligned with work on imaginaries that suggest that crises and dissatisfaction with the status quo are precursors to building alternative imaginaries of the future. And geoengineering technologies also were initially proposed in the relatively closed community of scientific experts, with norms of counterfactual thinking and protection from immediate scrutiny over practicality or societal implications. Whether conditions like these are common or necessary for the emergence of distant futures is a matter of empirical research. In this regard, it is important to contextualize the insights of our study of geoengineering by researching the dynamics of distant futures in other settings and theorizing differences and parallels. Distant futures are created and pursued in a

variety of domains and settings. These include the 'sites of hyperprojectivity' described by Mische (2014), which involve deliberate gatherings by futurists, but they are also relevant within audacious 'moonshot' commercial entrepreneurship such as Elon Musk's private space exploration venture, and the development of futuristic technologies like artificial intelligence or bionic enhancement. Many of these phenomena share with geoengineering an appearance of being bold and audacious but also disconcerting and morally objectionable to some audiences.

Management research should grapple with such unconventional phenomena, and begin to see them as central to theories of management and organizations, rather than exceptional or exotic. The constant imagination and pursuit of distant futures has been repeatedly identified as a central dynamic of capitalism and in need of more study (Schumpeter, 1934; Beckert, 2016). Neither pure fantasy nor extrapolations of reality, the concept of the distant future provides a lens into how utopian proposals, like geoengineering, matter for creating our actual future.

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Table 1. Characteristics of the Distant Future

Characteristics	Distant future	Near future
Knowledge limitations	Ambiguity, radical uncertainty, unknown possibilities	Uncertainty, risk, probability of different known states to occur
Construal level	High level, abstract, stylized	Low level, concrete, practical, nuanced
Temporal representation	Leap, discontinuity from present and past experience	Continuity, future extends from present and past experience
Conception (processes for generating future states)	Imagination based on ideologies, desired identities, principles	Extrapolation, predictions based on assessment of the present, calculation and forecasts
Evaluation (set of futures considered)	Possibilities, what might be, fantasy and fictional hypotheticals	Probability, confidence of happening, feasibility, practicality of accomplishing

Table 2. From Fantasy to 'As-if' Reality

	Fantasy	'As-if' reality
Purpose	Expressive role in giving shape to ethos, ideals, desires, and myths; no expected action to realize it	Practical role in orienting action to accomplish goals and create/prevent consequences; creates desire to act
Orientation toward the future (Credibility)	Playful, without consequence, hypothetical thought experiment	Serious as a possibility, consequential and demanding a response, consequences of realization deserve assessment
Representation of the future (Concreteness)	Image-like (vivid but vague, stylized and incomplete), disassociated with experiential reality	Embedded in knowledge systems (analytic, complete, detailed), associated with experiential reality, discussed alongside other options

Table 3. Typology of Imaginaries

Dimension	1. Moral Basis (Motivational and evaluation principles)			2. Cosmology (How the world can be explained and experienced)		3. Present-To-Future Link (How to get from here to there)			4. Stance (Towards the future)		
Sub-Component	**Ethos**	**Values**	**Evaluation Criteria**	**Privileged Epistemic Domains**	**Authoritative Actors**	**Diagnosis and Metaphor for the Present**	**Positive Vision of the Future**	**Narrative of How to Get There**	**Role of Geoengineering**	**Position toward Geoengineering**	**Proposed Solution**
Technofix	Humanity as rational and competent custodian of earth. Rule over nature thanks to scientific genius and human ingenuity. Nature as malleable and a resource in the service of humanity. Experts with knowledge and the faculty for rational action (scientists, engineers) have a moral responsibility to step in.	Progress; human agency; rationality	Status of the actor (expert, esp. scientific); consistency with basic scientific principles and method; rationality of arguments (non-emotional); elegance, boldness and efficiency of technological solutions	Science, technology & engineering	Scientists & engineers	Climate change is a technical problem whose root cause is human emissions into the atmosphere; the amount of emissions and the pace of climate change make alternative ways of addressing emissions less expedient. Metaphor: Thermostat of earth needs adjusting	Earth and humanity have been saved from catastrophic climate change; people have gained greater control over the environment	Experts develop rational solutions to a technical problem, which are implemented to overcome the challenge facing humanity without requiring sacrifices to modern life.	Geoengineering can solve climate change with human ingenuity and technology. Humanity can achieve climate control. Geoengineering is in principle no different than the emissions that caused climate change, both are human interventions. Hence, we have already 'engineered' the climate and there is no pre-human state to go back to.	Acceleration: In favor of near-term development and deployment.	Large scale interventions in the atmosphere. Scientifically, they are expected to work. To develop corresponding technologies, we need research and experimentation today, to move to near-term "controlled" implementation.
Human Hubris	Humanity as a dilettante when it comes to nature, a humble 'guest' of nature, without a capacity to fully understand or control it. Nature as independent of humanity, a self-regulating system that has created a favorable equilibrium for humans (human dependence). People's moral responsibility is to limit the impact of their activities (minimal footprint), to allow nature to take care of itself.	Purity of nature; modesty; precaution; preservation	Minimizing human footprint on nature; systemic analysis and understanding of effects; reversibility of technological solutions	Ethics, philosophy of science, social science, ecology	Social movements, ethicists, social and natural scientists, policy makers	The root cause of climate change is humanity's modern lifestyles that do not respect planetary boundaries (consumption, technological intervention). Technological fixes do not address the systemic causes, and often times make them worse. The risks of geoengineering are unknowable, incalculable and irreversible. Metaphor: Pandora's box, Frankenstein's monster	Nature is restored to equilibrium	Without the distraction of geoengineering technologies (or silver bullets), humanity returns to more aggressive efforts to reduce and limit its climate footprint, and to adapting to any temporary changes until those efforts bear fruit.	Geoengineering interventions might address symptoms of climate change, but they compensate for human impacts rather than eliminate the causes. The effect of human intervention in complex natural systems is always unpredictable, because humans cannot fully understand and control them. So interventions cause unanticipated new problems. The only way to address human-caused changes is to reduce human impact to enable natural systems to return to equilibrium.	Moratorium: Geoengineering represents a moral hazard in distracting from much needed mitigation efforts.	Re-focus attention on mitigation through behavior and policy changes. We already have many technologies to reduce emissions - we need to focus efforts on these instead of placing false hopes in a future technology that is potentially dangerous and most likely ineffective.

Plan B	Humanity as a prudent pragmatist with responsibility for the planet, and an (imperfect) capacity to manipulate nature. Nature is viewed as a precious resource to humanity that has been knocked out of equilibrium by human activity. Because of human imperfection, we have a moral responsibility to be identify many solutions so that one of them may solve the problem. Not considering alternatives bears great risk and is irresponsible.	Pragmatism; security; pursuit of knowledge	Empirical support and data-driven evidence; undogmatic pragmatism; innovation and resourcefulness; practicality, comprehensiveness and likelihood of success of technological solutions	Science, technology & engineering, policy	Scientists, engineers and policy makers	Climate change is a technical and societal problem whose root cause is human emissions into the atmosphere; the pace of climate change requires fast coordinated societal responses; such responses have not been accomplished at sufficient scale in mitigation efforts. This slowness risks missing a point of no return for climate change. Metaphor: The 11th hour savior; an insurance policy	Earth and humanity have been saved from catastrophic climate change. This temporary relief gives them time to develop more long term solutions.	Gradual research increases knowledge about tech options and their feasibility. Cost and effectiveness can then be rationally assessed in compare-son to alternatives. If geo-engineering technologies are needed, they can then be used.	While the preferred response to climate change is mitigation (through significant emissions reduction), it is now clear that it is uncertain or even unlikely that sufficient action for mitigation will happen in time. We need a backup option, or Plan B, in case other efforts fail. The stakes are too high not to prepare a Plan B, even if it is never used.	Experimentation: Proceed with caution, but need for more research and empirical experimentation to find feasible solutions before possible deployment.	Explore the possibility of large-scale interventions in the atmosphere, oceans, and land, to assess their promise. We need research to understand the options, but nothing should be implemented unless all other efforts fail.
Gover-nance First	Humanity as scientifically capable of preserving the planet, but unable to cooperate rationally for the common good. Unless institutions resolve these social flaws large-scale technological interventions are dangerous. Nature as threatened by humanity, and humanity dependent on nature (interdependence). People have a moral responsibility to recognize human limitations and exercise self-constraint. Humanity cannot be left in the hands of technical experts, but has to be governed by participatory political institutions.	Justice; control of knowledge; equality; risk aversion; collective solidarity	Pluralistic participation and consensus; international and distributional equity; political and social realism and responsibility; institutional feasibility and social justice of technological solutions	Politics, social science, law	States and inter-national organi-zations, inter-national non-govern-mental organi-zations	Climate change is a problem of governance at the international level because it requires coordinated political action. Without effective governance, new technologies can be subverted by private interests, remain ineffective, or create undesired climate effects. No effective global governance systems are currently in place to adequately guide and regulate geoengineering technologies. Metaphor: Slippery slope	Countries and people come together for the common good and agree on regulations of the technologies in the context of comprehensive climate change actions.	A combi-nation of self-restraint by scientists and oversight by policy makers and stakeholders that represent the common good creates an infra-structure within which research and governance is carried out in a prudent and responsible way, prior to deployment of any radical technologies.	We must not pursue geoengineering solutions until we have solved the question of the global governance of any interventions. Technologically, geoengineering may well be feasible, but without an effective regime for controlling its development and deployment, the outcome would be detrimental. The risks of unregulated geoengineering are substantial and therefore prohibitive. The governance argument extends to the exploration and development of technologies, not only to their deployment.	On Hold: Should not proceed even with research and experimentation until governance issue is resolved, because once the technologies are developed they could end up in the wrong hands.	Moratorium until governance systems are in place. We should proceed neither with researching geoengineering technologies, nor experimentation with solutions, until those efforts can be governed as a public good by the international community.

Conspiracy of Elite Control	Humanity as fragmented into those who are in control and those who are excluded or oppressed. Nature is used as an instrument by those with power in the pursuit of their political ends. People's moral responsibility is to resist technologies that are put forward to these ends, to "reveal elites' lies and interests" in order to ultimately "take back" control.	Egalitarianism; transparency; libertarianism; independence	(Hidden) interests and agendas of actors; centralization and scale of control and power; individual and local rights to opt out/in; distributed control of technological solutions	Rejection of scientific experise and political authority; elevation of lay knowledge & beliefs	Outsiders, lay people, elites	Geoengineering is already happening, deployed covertly by elites in science, politics and business to further their aims. Just like with climate change, the real problem is manipulation by those in power, and in that regard, climate change and geoengineering are no different. Metaphor: Conspiracy by secret society, resistance fight	People have taken back power. There is an end to clandestine climate manipulation and the deployment of simpler and more transparent technologies.	Through the revelation to the public of secret information about geoengineering by activists, people realize what is going on. They resist and mobilize to force transparency and reduce the control of elites.	Geoengineering represents yet another form of elites controlling and manipulating regular citizens' lives under disguise. This is not about climate change. Instead, governments, scientific elites and big business collude to manipulate the climate in order to control people. Any such attempts must be resisted and the knowledge the elites produce must be distrusted. The solution is to not only prevent geoengineering, but to also undermine the authority of those who are controlling the system.	Opposed: Strongly opposed to geoengineering and the actors pursuing it.	Empowerment of the people and disruption of existing power structures. We need to inform everyone that geoengineering is already being deployed and that it has consequences that favor elites at the expense of the people.

Figure 1. Dialectic process

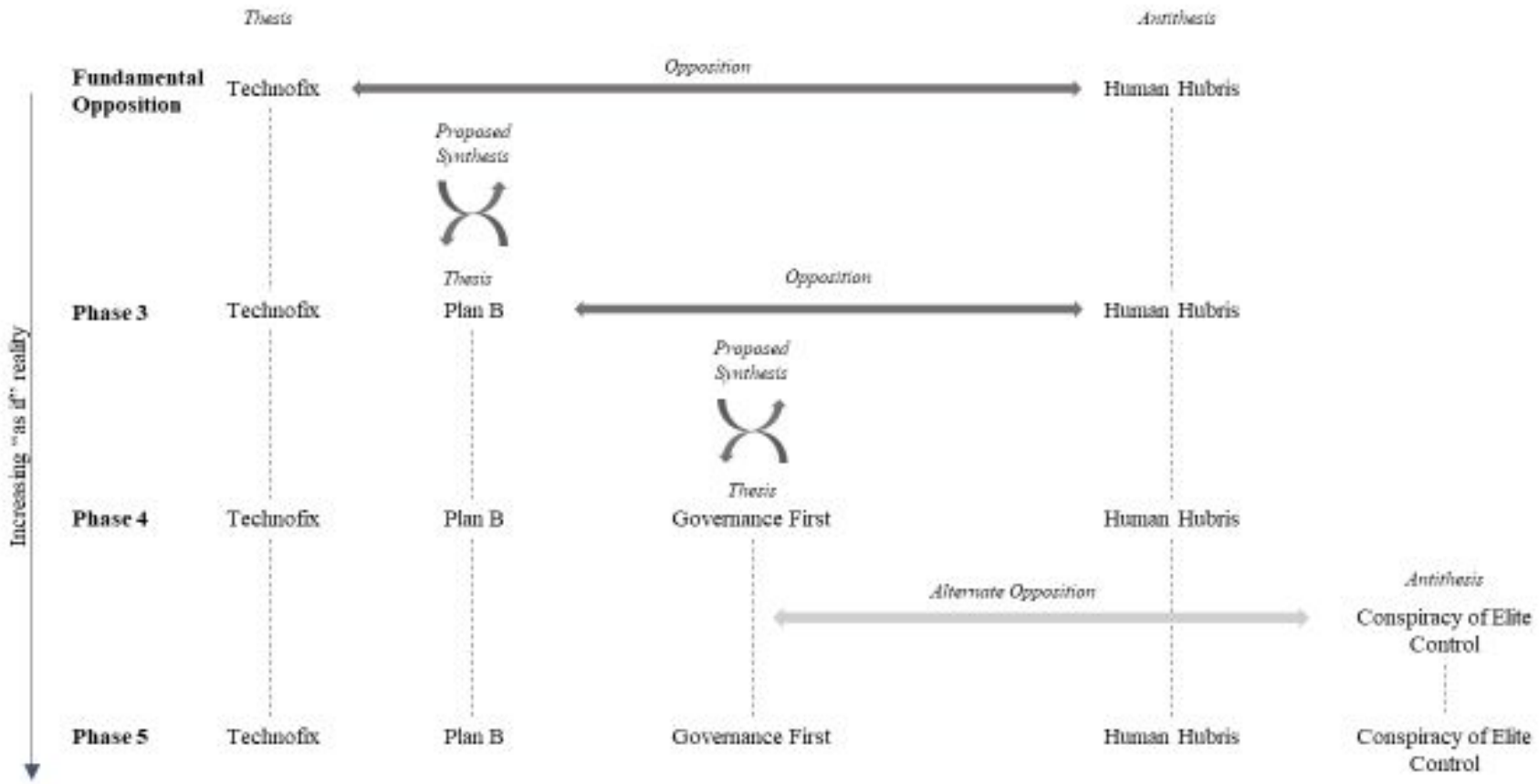


Figure 2. Proportion of the imaginaries reflected in the news media during later phases

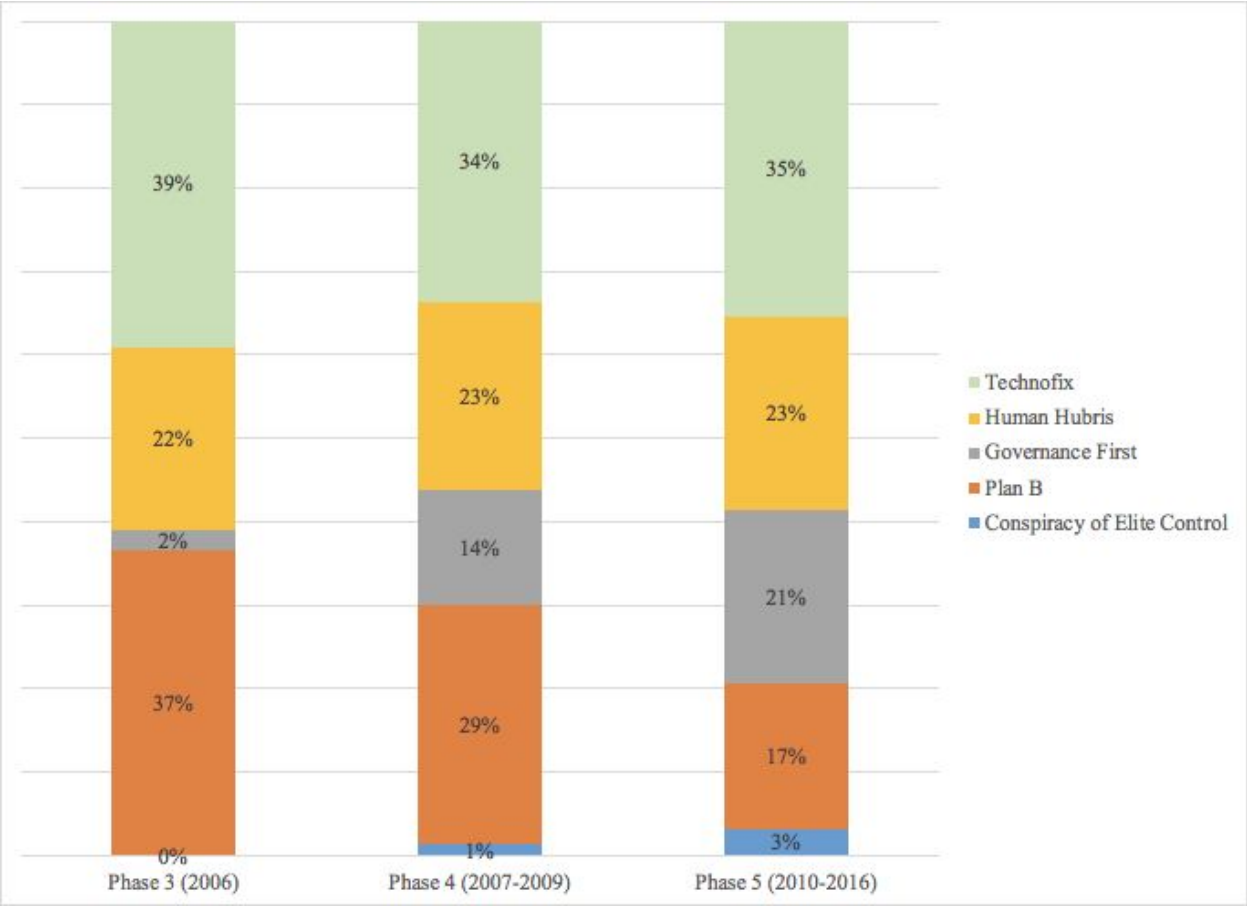


Figure 3. Co-occurrence of imaginaries in the media

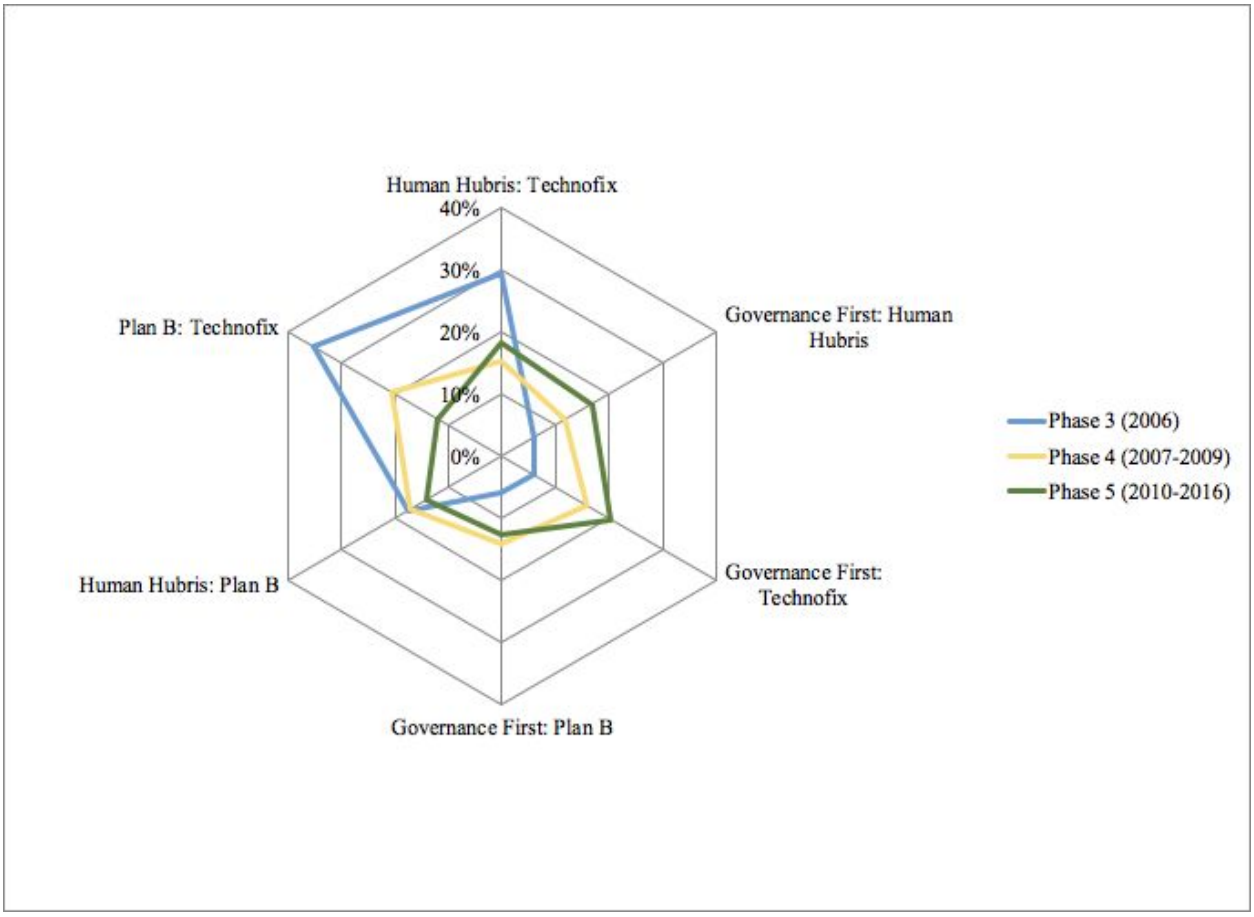
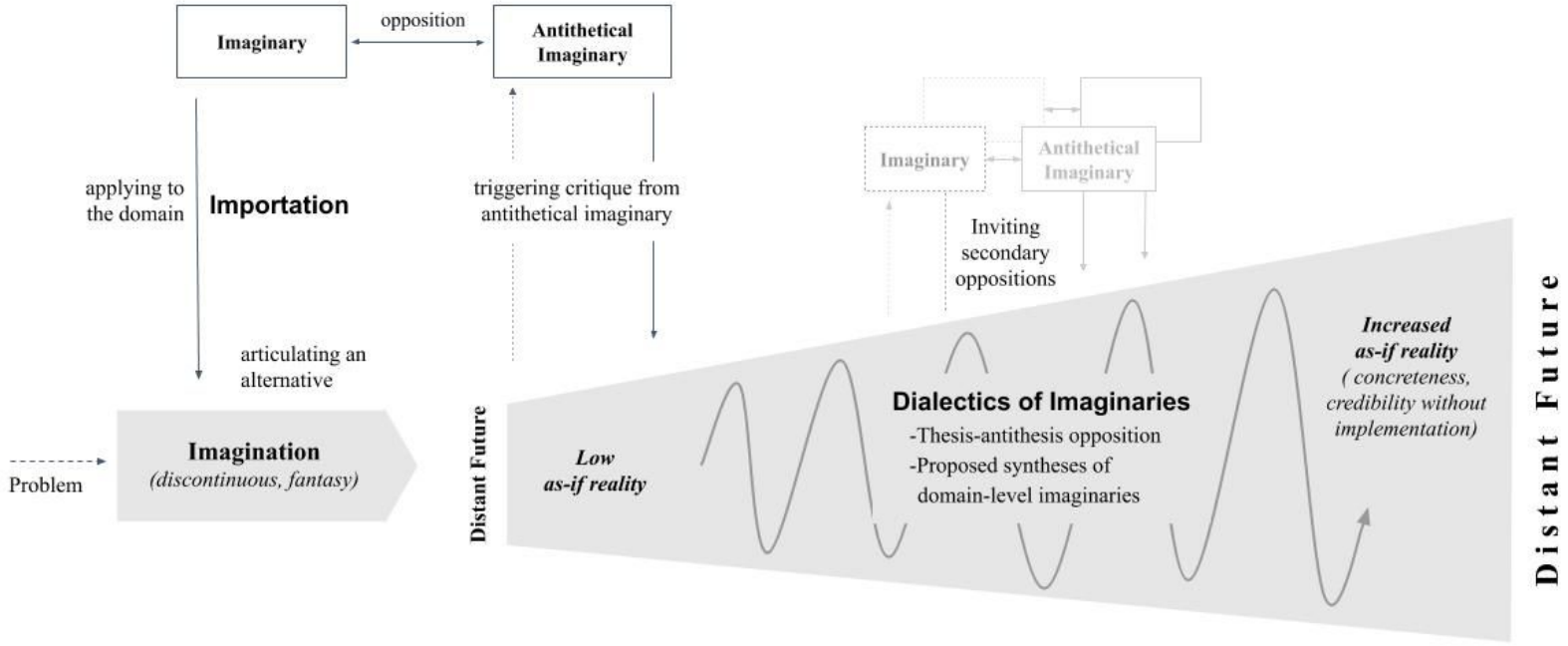


Figure 4. Conceptual model of creating a distant future with 'as-if' reality



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