The Art of Disciplined Imagination: Prediction, Scenarios, and Other Speculative Infrastructures

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Abstract

[onl-abs] Contemporary art is brimming with images of a future shaped by environmental destruction, technological innovation, and new forms of sociality. This article looks beyond the content of such images in order to examine the infrastructures that underpin them. Paying attention to two key infrastructures in particular—the Cold War faith in prediction and the extraordinary explosion of scenario planning in the years that followed—the article explores the ways in which speculation was transformed into a tightly defined field of expertise straddling military, policy, and corporate worlds. No longer the preserve of prophets or mystics, the speculative infrastructures incubated within organizations such as the RAND corporation were underwritten by cybernetics, game theory, and systems analysis, all of which helped give prediction a veneer of scientific credibility. And yet, as the planning tools of the postwar era lost their predictive edge, new techniques came to exert influence in a world dominated by the uncertainties of looming environmental catastrophe. The future was no longer thought to emerge from the present in a linear fashion but unfold along a series of branch points that allowed decision makers to navigate through a landscape of uncertainty. Tracing the genealogy of forms of prediction and scenario planning from the mid-twentieth century to the present day, this article places futurological tools in the context of an expanded field of speculative practices that include works of art. Projects by the likes of Stephen Willats, Experiments in Art and Technology, the Harrisons, and others not only generate alternative images of the future, they also rework the infrastructures by which such images are conceptualized and produced.

Introduction

In the year 01999 Stewart Brand, editor of the *Whole Earth Catalog* and cofounder of the Long Now Foundation, offered the readers of his book a diagram which attempts to visualize the different speeds at which change takes place at a societal level.[1] At the two extremes of the figure sit fashion and nature: the former racing through rapid cycles of change and renewal, even before the advent of fast fashion; the latter creeping from one steady state to another at an almost imperceptible rate. In the middle, sandwiched between commerce and governance, sits infrastructure (fig. 1).

Although it is clear that the primary references for Brand's thinking about infrastructure are physical systems such as sewers, roads, and communication networks, he nevertheless widens his terms of reference to include the intellectual infrastructure of education and even science as a whole. This opening up of the definition of infrastructure is broadly in line with earlier academic efforts on the part of Science and Technology Studies (STS) pioneer Susan Leigh Star in the 1990s and subsequent authors such as Keller Easterling, AbdouMaliq

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[1] In an effort to preempt the deca-millenium bug in around eight thousand years' time, the foundation deliberately uses five-digit dates; see Stewart Brand, *The Clock of the Long Now: Time and Responsibility* (New York, 1999), p. 37.

Simone, and Nikhil Anand. For these authors infrastructure need not only comprise of a physical network of interlinked objects; it can just as easily exist as an immaterial series of repeatable formulas or shared standards.[2] Considered in this way, the layers of Brand's diagram start to collapse into one another. What happens to the neat division between governance and infrastructure when laws and regulatory mechanisms themselves are considered an immaterial infrastructure? More fundamentally, what becomes of the central aim of the diagram—to show varying rates of change—when infrastructure has the capacity to be the very thing that shapes and regulates the pace of change? As the COVID-19 pandemic has made abundantly clear, the institutional infrastructures that determine how organizations and individuals plan for the future exert considerable power over how social change is experienced, constituting what Tony Golding calls "great expectation machine[s]" that direct our flows of energy and attention to the future along specific pathways.[3]

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[2] See for example Susan Leigh Star and Karen Ruhleder, "Steps towards an Ecology of Infrastructure: Complex Problems in Design and Access for Large-Scale Collaborative Systems," *Proceedings of the 1994 ACM Conference on Computer Supported Cooperative Work—CSCW '94* (Oct. 1994): 253–64. Other sources that treat infrastructure as composed of elements that are immaterial as well as physical are Keller Easterling, *Extrastatecraft: The Power of Infrastructure Space* (New York, 2014); AbdouMaliq Simone, "People as Infrastructure: Intersecting Fragments in Johannesburg," *Public Culture* 16, no. 3 (2004): 407–29; Nikhil Anand, "PRESSURE: The PoliTechnics of Water Supply in Mumbai," *Cultural Anthropology* 26, no. 4 (2011): 542–64.

[3] The phrase "great expectation machine[s]" has been repurposed from the former investment banker Tony Golding; see Tony Golding, *The City: Inside the Great Expectation Machine* (Edinburgh, 2001). While Golding uses the term to talk about financial institutions as

This article seeks to expose the workings of some of these great expectation machines, chronicling their history and the effects they have on how we relate to the future. The infrastructures in question are primarily immaterial, consisting of protocols, structured conversations, corporate planning exercises and other unobtrusive forms that exist as tools in the armory of governance, defense, and business management. This highlights a more general problem that is routinely identified by those studying infrastructure: its concealed and self-effacing character. As Brian Larkin puts it, "we often see computers not cables, light not electricity, taps and water but not pipes and sewers."[4] The same could be said for infrastructures designed to support speculation. We read the latest Intergovernmental Panel on Climate Change (IPCC) report that outlines the consequences of allowing greenhouse gas emissions to continue growing without additional mitigation but think little about the speculative infrastructures of scenario planning and computer modelling that have helped climate scientists draw this conclusion. We hear the CEO of a large company talk about their entry into a new market but don't stop to consider the internal prediction market that makes it possible for them to speak with certainty about something that has yet to be confirmed.[5] Such

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machines for producing expectations about the future, here it is used in an expanded sense to consider a range of tools techniques that foster cultural relations with the future.

[4] Brian Larkin, "The Politics and Poetics of Infrastructure," *Annual Review of Anthropology* 42 (Aug. 2013): 329.

[5] Internal prediction markets encourage employees of a company to gamble using virtual currency on how they think the company will perform. See for example Google's internal prediction market, where employees are encouraged to gamble with the play money "Goobles" as a means to both map the flow of information in the company and deliver predictions on its future development (Noam Cohen, "Google's Lunchtime Betting Game,"

examples highlight the way in which infrastructure generally operates: quietly, with a disposition that downplays its powerful role in orchestrating activities that typically gain more attention than the infrastructure itself.

One arena in which speculative infrastructures are sometimes foregrounded is contemporary art, which in recent years has come to gravitate towards the theme of speculation in a variety of ways. While this upsurge of interest is not always accompanied by a similar interest in infrastructure; when it is, contemporary art is well disposed to bring the latter to the forefront of our experience. This not only because art typically operates in a public arena, in contrast to the private settings in which governments and corporations generally engage in speculation, but also because artworks can use material forms to mediate infrastructures and bring them to the representational surface of an artwork. When they do so, the discrete power that speculative infrastructures exert can become more apparent.

In what follows a path will be trodden from the cold war faith in prediction to the contemporary usage of scenario planning. At one time or another, each of these two infrastructures have been relied on by governments, businesses and militaries to yield insights about the future. They have also informed artworks from the 1960s to the present day and, considering the different visual and material strategies used to bring these infrastructures to visibility, constitute a useful first step in thinking about the ways in which our relationship to

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New York Times, 7 Jan. 2008, www.nytimes.com/2008/01/07/technology/07link.html). And for a more infamous example of the use of prediction markets, see Robin Hanson, "The Policy Analysis Market: A Thwarted Experiment in the Use of Prediction Markets for Public Policy," *Innovations: Technology, Governance, Globalization* 2 (Summer 2007): 73–88.

the future has been mediated through what the management theorist and consultant Paul Schoemaker calls "disciplined imagination."[6]

1. Early Adopters

Eindhoven, the Netherlands, 1964: a lightbox casts flashing colored light across the walls of a public art gallery.[7] Blue, red, yellow, and green squares cover bulbs at the corners of a large black rectangle, in the center of which sits a single circular light. Behind the black rectangle a circuit board switches the five bulbs on and off at irregular intervals. With enough time and concentration it seems possible to find a pattern to the flashing, and indeed this is the artist's desired response—for the viewer to find enough order in the random sequence to confidently predict what colored light will flash next.[8] Designed to be experienced by one member of the public at a time, Stephen Willats's *Visual Field Automatic No. 1* was one of several pioneering works of the 1960s that activity incorporated anticipated audience behavior into its functioning, channeling the excitement many felt about the burgeoning field of cybernetics at the time (fig. 2).

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[6] Paul J. H. Schoemaker, "Disciplined Imagination: From Scenarios to Strategic Options," *International Studies of Management & Organization* 27 (Summer 1997): 43.

[7] See Frank Popper, "Kunst-Licht-Kunst," Stedelijk Van Abbemuseum, Eindhoven, 25 Sept.–4 Dec. 1966.

[8] Or in the artist's own words, "A game of prediction is set up where the observer tries to impose an order, and work out the probability of an occurrence of events" (Stephen Willats, *Stephen Willats: Visual Automatics and Visual Transmitters* [exhibition catalogue, Tate Gallery, London, 22 Oct.–16 Nov. 1968], p. 3).

Willats was exposed to some of these ideas early on, encountering an exhibition by the French-Hungarian pioneer of cybernetic art Nicolas Schöffer at the ICA in 1960, before going on to study on the "Groundcourse" at Ealing School of Art—a Fine Art degree program that actively embedded cybernetic principles into the curriculum.[9] From this vantage point it is possible to envision how the artist imagined *Visual Field Automatic No. 1* operating, not as a discrete artwork largely indifferent to the observer, but as an open system that folded an ideal viewer's cognitive and perceptual apparatus into its very functioning. Here biological brain functions and randomly programmed electronics conjoin to form a temporary circuit between the artwork and the viewer, playing into an emerging "cyborg discourse" that reworked popular understandings of the mind through computational metaphors operative at the time.[10]

The use of computational, cybernetic, and scientific metaphors was something that Willats's tutor at Ealing, Roy Ascott, was very much attuned to in the 1960s. In an essay from 1964, Ascott discusses the relationship between his artwork and pedagogic activities in cybernetic terms of feedback.[11] This is one of many affinities between art and cybernetics

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[9]Adrian Glew, "Transmitting Art Triggers: The Early Interactive Work of Stephen Willats," in *White Heat Cold Logic: British Computer Art 1960–1980*, ed. Paul Brown et al. (Cambridge, Mass., 2008), p. 20.

[10] Paul N. Edwards, *The Closed World: Computers and the Politics of Discourse in Cold War America* (Cambridge, Mass., 1996), p. 2. See also Donna J Haraway, "A Manifesto for Cyborgs: Science, Technology, and Social Feminism in the 1980s," *Socialist Review* 15, no. 2 (1985): 65–107.

[11] See Roy Ascott, "Behaviourables and Futuribles," *Telematic Embrace: Visionary Theories of Art, Technology and Consciousness*, ed. Edward A. Shanken (Berkeley, 2003), p. 99.

sketched out in his essay, and Ascott is clear that for him any engagement between the two must go beyond "a spurious scientism" and instead focus on how such concepts affect the pragmatics of an artwork's performance.[12] A concern with predictive instrumentalities accompanied this exciting new conceptual tool kit unleashed on the students, which mixed the twin disciplines of cybernetics and behaviorism, and in 1967 Ascott formalized some of his ideas on prediction in a short essay entitled "Behaviourables and Futuribles." Here the artist layers speculation upon speculation:

> Maybe the behaviourist art object will come to be read like the palm of your hand. Instead of figuration—prefiguration: the delineation of futuribles. Pictomancy—the palmistry of paintings—divination of possible futures by structural analysis. Art as apparition? Parapsychology as a Courtauld credit?[13]

Like many of the artist's other writings, the text combines a rigorous engagement with systems-based thinking and an interest in metaphysics, spiritualism, and non-Western epistemologies. In works such as *Parameter V* (1967) and *Table Top Strategies* (1971), one is as likely to find references to the *I Ching* as the game theory of John von Neumann. The essay speaks in the future tense about possible directions in art practice and pedagogy, while suggesting a range of heterodox methods that they might employ, from palmistry to analytic methods.

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[12] Ibid., p. 102.

[13] Ibid., p. 158. The text was originally designed as a poster in 1967 and subsequently published in the magazine *Control* established by Willats. See Ascott, "Behaviourables and Futuribles," *Control* 5 (1970): 3. It's interesting to note that "futuribles" was also the name of a Paris-based project established in 1960 by Bertrand de Jouvenel, which brought together social scientists to discuss methods for generating knowledge about the future.

As well as Ascott and Willats, there were countless other artists in the 1960s who saw the potential of cybernetics to revolutionize their practice. In France, Jacques Gabriel exhibited paintings such as *Cybernétique I* and *Cybernétique II* in 1962; in Germany artists associated with the ZERO group such as Günther Uecker and Otto Piene experimented with preprogrammed lighting; and in Finland Erkki Kurenniemi brought a futurist sensibility to his autoarchival practice.[14] The surge of interest was equally powerful in the US, as Jack Burnham chronicled at the time in his essays and exhibitions.[15] By the late sixties, there were enough artists engaging in the nascent field for the exhibition *Cybernetic Serendipity* to provide the first large overview of art and cybernetics for international audiences. The decision to focus on Ascott and Willats here is not because their work was unique in its ability to build bridges between the two worlds—although it many ways it was pioneering—it is because their differing approaches to prediction can be indexed to a more general shift in how cybernetics was approached in the postwar period. This was a time in which disagreements broke out between those who thought cybernetics should be restricted to primarily diagnostic applications and others who sought to develop its broader utility as a means of predicting future events. This story weaves its way through academic conferences,

[14] See Andreas Broeckmann, *Machine Art in the Twentieth Century* (Cambridge, Mass., 2016), and *Writing and Unwriting (Media) Art History: Erkki Kurenniemi in 2048*, ed. Joasia Krysa and Jussi Parikka (Cambridge, Mass., 2015). Cybernetics also influenced artists in sections of the former USSR, albeit through a different path. See Slava Gerovitch, *From Newspeak to Cyberspeak: A History of Soviet Cybernetics* (Cambridge, Mass., 2002).

[15] See Jack Burnham, *Dissolve into Comprehension: Writings and Interviews: 1964–2004*, ed. Melissa Ragain (Cambridge, Mass., 2015).

Cold War think tanks, and back into the broader cultural sphere in the 1970s, where forms of prediction emerge in altered form.

2. Questions and Answers

The drive to predict the future accompanies the birth of cybernetics in the 1940s, when Norbert Wiener and Julian Bigelow developed an antiaircraft (AA) predictor to plot the flight path of enemy planes several seconds in advance based solely on the past maneuvers of the pilot. For such an influential invention, it is perhaps surprising that Wiener and Bigelow's AA predictor was never deployed in the second world war or indeed in any war subsequently. When they came to test the device in 1942 using flight data, the results were distinctly underwhelming.[16] Despite these failings, for Wiener the significance of cybernetics was indisputable, and in the two decades that followed the invention theorists applied cybernetic principles to everything, from simple assemblages of elastic and beads, to entire social systems and national economies.[17] Together with systems analysis and game theory, it also

[16] As documented by Peter Galison, the AA predictor barely had the same accuracy as two predictive devices developed at Bell laboratories by Hendrik Bode that used simpler, geometric analysis of the flight path; see Peter Galison, "The Ontology of the Enemy: Norbert Wiener and the Cybernetic Vision," *Critical Inquiry* 21 (Autumn 1994): 228–66.

[17] See Roy Ashby, "The Physical Origin of Adaptation by Trial and Error," *Journal of General Psychology* 32 (1945): 13–25. Gregory Bateson and Margaret Mead used cybernetic principles of feedback to think through particular social formations and together presented at the first Macy conference in cybernetics in 1946. Bateson also wrote the essay "Bali: The Value System of a Steady State" in 1949, later reprinted in Gregory Bateson, *Steps towards*

contributed towards the creation of a new logical framework used by national governments to tackle problems that grew in number and diversity as the Cold War progressed. As well as providing tools for analyzing the present and immediate future, this new technocratic rationality was seen by some to harbor an ability to formalize predictions concerning the long range. If the movements of an enemy aircraft could be plotted ten seconds in advance, perhaps the probable bombing targets of World War III could also be anticipated with a degree of accuracy using the same tools?

In *Control: Digitality as a Cultural Logic*, Seb Franklin accounts for the way in which the predictive range of cybernetics was progressively extended in the mid-twentieth century.[18] Franklin revisits some of the interdisciplinary discussions that took place at the influential Macy conferences in cybernetics in the ’50s and ’60s between Wiener, Gregory Bateson and Margaret Mead, John Von Neumann, and F. S. C. Northrop among others.[19] Here a noticeable schism emerged between those, such as Wiener, who thought that cybernetics’ predictive utility was only applicable to situations where the variables of behavior and technical performance were severely constrained, and others who sought ways to circumvent these formal limitations and extend the reach of cybernetics to deal with increasingly complex systems and longer time spans. This expansionist tendency in cybernetics was driven, according to Franklin, by the irresistible promise of its socioeconomic application: “It

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an Ecology of Mind (Chicago, 1972), pp. 107–27. For more on cybernetics and economics, see Philip Mirowski, *Machine Dreams: Economics Becomes a Cyborg Science* (New York, 2008).

[18] See Seb Franklin, *Control: Digitality as Cultural Logic* (Cambridge, Mass., 2015).

[19] For further discussion on the Macy conferences, see N. Katherine Hayles, *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics* (Chicago, 1999).

is the prospect of modeling and forecasting (and thus valorizing) social behavior that drives the desire for a universally applicable cybernetics."[20]

In what can be considered the archetypal think tank, the RAND corporation, there was an insatiable appetite for cybernetics, game theory, and systems analysis, with the former stripped of some of the formal limitations imposed on its predictive use by originators such as Wiener.[21] Regular reviews of Soviet Cybernetics were compiled at RAND, and cybernetic principles found their way into numerous reports, even as the field itself morphed and merged with a number of related approaches to strategic thinking.[22] Systems analysis was one of these fields, developed by Edward Paxton in the late 1940s and sharing a common root in Operations Research (OR), which involved viewing war through the prism of rational (typically mathematical) analysis. Whereas OR limited itself to problems grounded in observable data, for RAND's vice president Lawrence Henderson, writing in 1949, "systems analysis seeks to cover the full range of possible future weapons characteristics and simultaneously analyze each set of possible characteristics in all possible tactics and strategies of employment."[23] Here again it is possible to discern a shift from the diagnostic to

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[20] Franklin, *Control*, p. 44

[21] See Alex Abella, *Soldiers of Reason: The RAND Corporation and the Rise of the American Empire* (Orlando, Fla., 2008). While critical of attempts to extend the predictive range of cybernetics, Wiener did promote diagnostic applications in broader social contexts. See Norbert Wiener, *The Human Use of Human Beings: Cybernetics and Society* (Boston, 1954).

[22] See for example Roger Eli Levien and M. E. Maron, *Cybernetics and its Development in the Soviet Union* (Santa Monica, Calif., 1964).

[23] Quoted in Sharon Ghamari-Tabrizi, 2005. *The Worlds of Herman Kahn: The Intuitive Science of Thermonuclear War*. Cambridge, MA: Harvard University Press, p. 138.

the predictive, a shift in many ways necessitated by the nature of the Cold War itself. As Paul N. Edwards points out, one of the key differences between operations research and its outgrowth in systems analysis and game theory is that OR techniques used real combat data. The strategists at RAND, on the other hand, relied on games, simulations, and models precisely because the third world war they were planning supplied no quantitative information for analysis, for the simple reason that it had not yet taken place.[24]

As both Willats's artwork and the backdrop of this new Cold War rationality suggest, in the 1960s predictions were not the preserve of individual mystics or prophets; they operated as end products of larger infrastructures that directed speculation along certain pathways, underwritten by epistemic cultures that helped give prediction a veneer of scientific credibility.[25] Even when predictions were meted out by charismatic individuals such as Herman Kahn, or members of what Sharon Ghamari-Tabrizi calls the "cold war avant-garde," these individuals acted as representatives of research organizations that served as the bridges between corporate, academic, and policy worlds.[26]

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[24] See Edwards, *The Closed World*, p. 119.

[25] See Karin Knorr Cetina, *Epistemic Cultures: How the Sciences Make Knowledge* (Cambridge, Mass., 1999).

[26] Sharon Ghamari-Tabrizi, *The Worlds of Herman Kahn: The Intuitive Science of Thermonuclear War* (Cambridge, Mass., 2005), p. 128. Pamela M. Lee also looks at this avant-garde sensibility at RAND, investigating the ways it contributed to a sense of military planning as a creative pursuit; see Pamela M. Lee, *Think Tank Aesthetics: Midcentury Modernism, the Cold War, and the Neoliberal Present* (Cambridge, Mass., 2020).

Take the "Delphi method" as an example, a technique developed at the RAND Corporation in the late 1950s by Norman Dalkey, Nicholas Rescher, and Olaf Helmer.[27] Although named after the famous Greek town in which the oracle Pythia delivered her prophesies, the Dephi method couldn't be more different in how it generated predictions. It is, at base, a way of structuring questions and answers into a series of rounds where a number of experts are encouraged to offer their predictions first independently and then refine their judgments based the opinions of others. In the first stage in its development, Helmer and Rescher convened a series of expert panels in 1946, in which participants were asked for predictions on which US cities the Soviets would attack during a nuclear war.[28] A few years later, both the subject range of questions and the number of rounds were greatly expanded, and by the 1960s, Helmer, together with a number of other RAND employees, began to convert predictions into probabilistic values that could be plotted on graphs.[29] This was speculation held to the highest standards of rigor and scientific method, or so its authors claimed. No longer the specious proclamations of mystics with the God-given ability to see into the future, the Delphi method harvested information that could be carefully sorted into deciles and medians, accompanied by the implication that this represented predictive

[27] Nicholas Rescher, *Predicting the Future: An Introduction to the Theory of Forecasting* (Albany, N.Y., 1998), p. 96.

[28] See Olaf Helmer, *An Experiment in Estimation* (Santa Monica, Calif., 1947), and Norman Dalkey and Helmer, *The Use of Experts for the Estimation of Bombing Requirements: A Project Delphi Experiment* (Santa Monica, Calif., 1951).

[29] See Abraham Kaplan, A. L. Skogstad, and M. A. Girshick, "The Prediction of Social and Technological Events," *Public Opinion Quarterly* 14 (Spring 1950): 93–110.

accuracy.[30] As this example attests, during the Cold War predictions emerged from infrastructures that consisted of research institutes that could draw on the expertise of a great many individuals with specialist knowledge and structure these insights according to principles drawn from the epistemic culture of the day. The role of expert opinion in this infrastructure highlights one of the key characteristics of Cold War prediction: its faith that enough knowledge of the present can pave the way for insights about the future.

An artwork from the time that combined systems aesthetics with the kind of predictive rationality embodied in the Delphi method was a project conducted by the group Experiments in Art and Technology (EAT) in 1971. Founded just five years earlier by a Swedish electrical engineer working for Bell laboratories, Billy Klüver—together with Fred Waldhauer, Robert Rauschenberg, and Robert Whitman—EAT had already garnered international acclaim for its ambitious Pepsi-Cola Pavilion at the World Expo in Osaka in 1970. For *Utopia: Telex Q&A* (1971), EAT used the international telecommunications network to facilitate exchange among participants in New York, Tokyo, Ahmedabad, and Stockholm. As the project's name implies, these exchanges were structured as questions and answers, inviting participants to imagine what life would be like in the year 1981, ten years into the future.

Over the month-long duration of the project, around four hundred and fifty questions were transmitted among the four locations via Telex. The majority of these were answered by participants at the other terminals, which were stationed in public places such as an exhibition space in the Sony Building in Tokyo and the Moderna Museet in Stockholm, whose

[30] For a further discussion of Dalkey, see Jenny Andersson, *The Future of the World* (New York), p. 89.

exhibition *Utopier & Visioner* provided the initial impetus for the project.[31] However, as one of the group's descriptions of the project states, a selection of these questions was also directed towards a group of "wise men" that included Kenzo Tange, Buckminster Fuller, Ingmar Bergman, I. G. Patel, and Milton Freidman.[32]

This reliance on the predictive expertise of a handful of experts (and exclusively male experts at that) brings *Utopia: Telex Q&A* into alignment with other infrastructures of speculation such as the Delphi method, and in many ways seems to run counter to the otherwise democratic sprit of the project. The significance of this was to extend the speculative infrastructures developed at RAND, countering the cloistered Cold War planning apparatus with a global and publicly accessible exercise in looking ahead.[33] In *Utopia: Telex Q&A*, as in the Delphi method, predictions were formalized according to a preestablished pattern of distribution, as can be seen in archival documentation of the piece, which diagrams various options for the transmission of questions and answers via telex. Here the peer-to-peer nature of the technology and the time differences provided a limited range of formal possibilities for how the exchange could be carried out. Feedback mechanisms also featured as participants were exposed to the questions and answers produced by those that had engaged with the work before them. These similarities aside, *Utopia: Telex Q&A* also departs

[31] See *Utopier & Visioner, 1871–1981* (exhibition catalog, Moderna Museet, Stockholm, 1971), pp. 1–15.

[32] See Experiments in Art and Technology, "Utopia: Question and Answer: A Project for the Exhibition *Utopia and Visions: 1871-1981* at the Moderna Museet, Stockholm," 30 May 1971, Daniel Langlois Foundation archive, CR+D Code number: EAT C13-5.

[33] Among others, Alvin Toffler was critical of the closed nature of the government planning apparatus at the time. See Alvin Toffler, *Future Shock* (New York 1971), p. 406.

from the rigors of the Delphi method in significant ways, insofar as the former did not encourage individual participants to revise their predictions in light of those made by others, and these were not processed mathematically. In fact, the project places as much emphasis on asking questions as generating accurate predictions about the future. A press release from 28 August 1971 explains how visitors to the terminals would not only be encouraged to address questions to one another but also "give opinions of how their consciousness of the possibilities of 1981 has been altered by this project."[34]

The significance of *Utopia: Telex Q&A* is in how it widens the parameters of prediction, mapping perceptions, rather than offering concrete forecasts that could be used for planning purposes. Here it is notable that EAT actively eliminated inquiries that one could answer by going to a local library. Questions such as *How large will the population be?* which could be satisfied by extrapolating from current reproduction rates, were filtered out of the project, with more emphasis placed on openly speculative, if not unanswerable, questions that covered topics of governance, (*How many people can democracy handle?*), the arts (*In 1981 will most poetry be published in print or on electronic tape in the poets own voice?*), and an emerging ecological consciousness (*Will continuous deforestation kill off several species of birds?*).[35]

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[34] Experiments in Art and Technology, "Press Release," 28 Aug. 1971, Papers of Experiments in Art and Technology, Tate Archive Reference: TGA 9121/247, p. 1. Predictive accuracy was not completely irrelevant to the group, who compared the answers from 1971 with news stories from the *New York Times* ten years later.

[35] Experiments in Art and Technology, "Utopia: Question and Answer: Sample Questions and Answers," 31 Aug. 1971, Papers of Experiments in Art and Technology, Tate Archive Reference: TGA 9121/248, p. 14.

3. The Socialization of Prediction

Utopia Q&A can be taken as evidence of a general diffusion of predictive thinking, carried on the winds of systems-based rationality and cybernetics, and amounting to what we might call the socialization of prediction during the Cold War. This can be understood in at least two senses. One the one hand, it captures the sense in which confidence in the new social technologies of speculation grew to such an extent that they could be applied to an increasingly wide range of topics and social formations. No longer limited to calculating the flight path of an enemy aircraft, or the possible bomb targets of a future nuclear war, tools such as the Delphi method were used to make predictions that dealt with a diverse range of subjects, from technological innovation to economic affairs, at a range that could move from small groups to the global population. In a second sense, the socialization of prediction designates a process in which the speculative infrastructures developed within organizations such as RAND found their way into wider public consciousness, influencing both art production and providing important templates for how environmental futures would be imagined over the coming decades.

Contrary to what the term *cold war avant-garde* might imply, this was not always a one-way process in which ideas slowly trickled down from the civilian defense intellectuals of RAND into the art world. As befits the intellectual models popular at the time, there was a degree of feedback at play, with organizations such as EAT brokering exchanges between the two worlds and early placement schemes such as LACMA's Art and Technology program organizing residencies for artists at organizations that included RAND and the Hudson

Institute.[36] In *Think Tank Aesthetics,* Pamela M. Lee exposes the diverse entanglements between the Cold War think thank and the art and visual culture of the era. As well as internalizing the methods of the think tank at a "procedural, strategic, or even operational level," art also fed into a larger interdisciplinary network of actors, both institutional and extra-institutional, that "triggers a recursive relationship to collective knowledge production."[37] The knowledge that emerges from this constellation of actors in the postwar period is decisive in shaping how the future itself is constituted as an object of inquiry, and positioned as something that can be the focus of knowledge and experience in the present.

In an article that seeks to distinguish the military logic of the Cold War from a subsequent logic that underpins the war on terror, Brain Massumi writes of the former that it "operates in an objectively knowable world in which uncertainty is a function of a lack of information, and in which events run a predictable, linear course from cause to effect."[38] This was no less so in the business world, where prediction typically passed under a different name: forecasting. Against an economic backdrop characterized by a prolonged period of prosperity, fixed exchange rates, and relatively stable trade between nations, forecasting

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[36] See *Art and Technology*, ed. Maurice Tuchman (exhibition catalog, Los Angeles County Museum of Art, Los Angeles, 1971). John Chamberlin was the artist placed with RAND, with James Lee Byars at the Hudson Institute. The latter is discussed in the context of scenario planning at length in R. John Williams, "World Futures," *Critical Inquiry* 42 (Spring 2016): 473–546.

[37] Lee, *Think Tank Aesthetics,* p. 28. Lee elaborates a greater number of associations between art and the Cold War think tank than can be summarized; see pp. 41–42.

[38] Brian Massumi, "Potential Politics and the Primacy of Preemption," *Theory & Event* 10, no. 2 (2007)

embodied a faith that the future would continue to develop out of the present along a more or less linear trajectory.[39] When this assumption was proved to be false, errors become all the more costly for the fact that they were not foreseen—a situation that was subsequently given the name "black swan" by Nassim Nicholas Taleb.[40]

The faith in a linear and predictable sequence of cause and effect that animated Cold War strategy and business forecasting is, on the face of it, what unites artworks such as *Visual Field Automatic No. 1* and Ascott's vision for a prefigurative art. While the historical sequence of the two is anachronistic when placed in the context of a later set of shifts away from prediction, it is however notable that Ascott's willingness to place the intellectual tools of cybernetics and other fields in the service of long-range predictions gives way to something altogether more modest in Willats's work, a point also made in an essay the artist produced many years later, where prediction constitutes a key part of how we form everyday cognitive representations of the world.[41] The claims made for prediction are scaled back, stripped of anything resembling clairvoyance or mysticism. And while *Visual Field Automatic No. 1* may distill the elaborate predictive logic of the Cold War to a psychological game of trigger and response, it can also be seen to undermine this very logic simultaneously. As soon as the viewer becomes aware that the flashing lights are designed to encourage them to predict what comes next, a second order reflection is set in motion that causes them to

[39] See Melinda Cooper, "Turbulent Worlds: Financial Markets and Environmental Crisis," *Theory, Culture and Society* 27, no. 2 (2010): 167–90.

[40] Nassim Nicholas Taleb, *The Black Swan: The Impact of the Highly Improbable* (New York, 2010).

[41] See Stephen Willats, "Speculative Modelling with Diagrams," *Art, Society, Feedback*, ed. Anja Casser and Philipp Ziegler (Nürnberg, 2010), pp. 514–21.

consider the futility of this effort in the face of a sequence that turns out to be random after all. It is, at this level, the impulse to predict that becomes the object of reflection, an impulse that Willats simultaneously triggers and frustrates.

In this work and others, the art gallery served as an arena in which prediction could be publicly considered—in contrast to the secretive worlds of military strategy and business forecasting—its function as a space for questioning these logics foreshadowing a more general shift away from prediction in business and governance. In an era of capitalogenic climate change, global instability, and tectonic shifts in the axes of power, the faith in prediction—even when it is has the resources to draw on expert consensus—suddenly appears misplaced, and new speculative infrastructures are required to help decision makers grapple with uncertainty.

4. One or Many Futures

A small collection of unspectacular crops fills two greenhouses in the grounds of Zurich's old botanical gardens. Rather than devoting the growing space to rare cultivars, endangered species, or carnivorous oddities, the plants on display include a common variety of potato, sweetcorn, and two varieties of wheat, all of which are known to grow in Switzerland with reliable success. Despite its unremarkable appearance, *Climate Garden 2085* is a space filled with drama, played out through the fate of these individual plants as they adapt to a warmer environment (fig. 4). The artists responsible for the work, Juanita Schläpfer-Miller and Manuela Dahinden, have fitted the interior spaces with temperature control systems, which alternately heat and cool the air to a constant 2 degrees Celsius above the average outdoor temperature in one greenhouse, and 4 degrees Celsius in the other. These two temperatures gesture towards different climate futures, the first informed by the UN Framework

Convention on Climate Change's 2016 Paris agreement, the second to a projection of the temperature rise in Switzerland if warming continues at its present rate.[42] Further differentiations are made to watering regimes within the greenhouses themselves, and a final collection of plants grow in the present, planted outside the greenhouses in soil that is carefully monitored for temperature and moisture variables.

In making these small adjustments to temperature and water, *Climate Garden 2085* reaches out towards a set of futures filled with drought, crop failures, and, in a minority of cases, increased yields. What is significant here, in contrast the artworks discussed above, is that this public experiment trades not on the prediction of *one* future but in mapping multiple futures through scenarios that fan out from the present. The word *scenario* in this context has become so ubiquitous that it is easy to forget its history. Now a common feature in climate change research, its role as a mediator of cultural relations with the future has never been more important.

What came to be known as *scenario planning* represents a distinct speculative infrastructure that has been in the making since the middle of the twentieth century.[43] As a key protagonist in this story, Herman Kahn is widely credited with laying the foundations of

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[42] See *Climate Garden 2085: Handbook for a Public Experiment*, ed. Juanita Schläpfer-Miller and Manuela Dahinden (Zurich, 2017), p. 5.

[43] Writers such as Renata Tyszczuk, Matthew J. Spaniol, and Nicholas J. Rowland trace the prehistory of scenario planning to the sixteenth century Italian commedia dell'arte, where scenarios provided a basic outline of the play for improvised performances; see *Culture and Climate Change: Scenarios*, ed. Tyszczuk, Joe Smith, and Robert Butler (Cambridge, 2014), and Matthew J. Spaniol and Nicholas J. Rowland, "Defining Scenario," *Futures & Foresight Science* 1 (Mar. 2019): 1–13.

the method while conducting work with RAND on America's Air Defense System Missile Command.[44] For Kahn and others, scenario planning does not aim to accurately predict one likely future, or distill a large number of speculations into one forecast, but instead orders perceptions of the future into a range of different possibilities. This subtle but important distinction decisively shifts the focus away from producing one *probable* image of the future to mapping a multitude of *possible* scenarios that inform decision-making. "Scenarios," wrote Kahn in 1966, "are one way to force oneself and others to plunge into the unfamiliar and rapidly changing world of the present and the future."[45] They constitute a "structured set of explicit assumptions, definitions, typologies, conjectures, analyses, and questions."[46] A scenario, it was repeatedly stated, is not a prediction; "it is an explication of possibilities."[47]

Plausibility was not irrelevant for Kahn, but, as he and Jerome Weiner argued "it is important not to limit oneself to the most plausible, conventional, or probable situations and behavior."[48] In this respect scenario planning represented a rejection of realism, epitomized

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[44] See Ron Bradfield et al. "The Origins and Evolution of Scenario Techniques in Long Range Business Planning," *Futures* 37 (Oct. 2005): 795–812.

[45] Herman Kahn, "A Methodological Framework: The Alternative World Futures Approach," in *The Essential Herman Kahn: In Defense of Thinking*, ed. Paul Dragos Aligica and Kenneth R. Weinstein (Lanham, Md., 2009), p. 195.

[46] Kahn, "The Objectives of Future-Oriented Policy Research," in *The Essential Herman Kahn*, p. 160.

[47] Daniel Bell, "Twelve Modes of Prediction: A Preliminary Sorting of Approaches in the Social Sciences," *Daedalus* 93 (Summer 1964): 866.

[48] Kahn and Anthony J. Wiener, "The Use of Scenarios," *Hudson Institute*, 1 Jan. 1967, www.hudson.org/research/2214-the-use-of-scenarios

in Kahn's famous imperative for Cold War decision-makers to think the unthinkable and actively imagine what life would be like in a world traumatized by nuclear conflict. The book that journeyed furthest into the unthinkable was Kahn's *On Thermonuclear War*, which plunged readers into a range of alternative futures characterized by cataclysmic events that included evacuations, mass starvation, and multigenerational genetic defects arising from nuclear war.[49] Scenario planning was a method that provided some of the underlying architecture for the book, although as befits any intellectual infrastructure, its role was largely overshadowed by the content it subtends—in this case terrifying visions cast in the cold light of technocratic indifference.

The task of imbuing Kahn's visions of nuclear apocalypse with the terror they entailed would be left to a young film director a few years later. Peter Watkin's *The War Game* (1966) is singular in unspooling the consequences of a nuclear strike on the population of the UK, and its exploration of a near future is structured around unpacking one scenario in all its gory detail. Depicting widespread death and disease, the armed looting of government food supplies, and execution by firing squad as the police seek to impose order, the film was deemed it too inflammatory to show on national television—a decision that violated the BBC's own charter of political neutrality insofar as it involved prior consultation with the British government.[50]

Exploring the future in the singular, I would argue, does not automatically imply the film operated in the register of prediction. Much of the action and commentary is voiced in

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[49] See Kahn, *On Thermonuclear War* (New Brunswick, N.J., 2007).

[50] This decision to restrict release of *The War Game* was investigated in detail in a radio documentary in 2005; see "Archive on 4: The War Game Files," *BBC News*, 6 June 2015, www.bbc.co.uk/sounds/play/b05xcktx

the future conditional tense of if / then, a grammatical form proper to scenario planning.[51] It is perhaps unsurprising that references to Kahn, by then a global celebrity, pepper Watkins's *The War Game*. The film constantly pulls back from the future of nuclear Armageddon to examine the words of leading establishment figures in the present. One such monologue, "based on the recorded statements of a leading American Nuclear Strategist," appears on screen to speculate that after World War III, "both sides could retire for a period of ten years or so of postattack recuperation, in which World Wars IV–VIII could be prepared."[52]

Although Watkins's film would not reach its intended audience on British television until 1985, its commissioning twenty years before is indicative of the influence of scenario thinking in the 1960s. The near future fictions of this period, which also included the apocalyptic science-fiction illustrations of Chesley Bonestell and the writing of Nevil Shute among others,[53] were later joined by other engagements with scenario planning, such as

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[51] Williams points out that many of Kahn and Weiner's scenarios in *The Year 2000* are narrated in the present tense. This, I would argue, is primarily a rhetorical strategy to heighten dramatic effect. At its core the logical structure of the scenario remains future orientated and conditional, regardless of the language in which it is conveyed to a reader; see Williams, *World Futures*, p. 522.

[52] *The War Game*, dir. Peter Watkins (London, 1965). Another reference to Kahn is the inter-title "Would the Survivors Envy the Dead," which is also a chapter title from *On Thermonuclear War*.

[53] Chesley Bonestell produced both techno-utopian visions of unmanned space flight and dramatic images of nuclear explosions over European and American cities for magazines such as *Colliers*. Nevil Shute's *On the Beach* (1957), later adapted on film, also peddles a future characterized by nuclear apocalypse.

Buckminster Fuller's *World Game* (1970), which can be aligned to the nascent environmental arts movement at the time (fig. 5).[54]

In 1973 the artist duo Helen and Newton Harrison were among the first to connect scenario planning to an emerging discourse on climate change. Having already made a political commitment to devote their work to ecological issues, the Harrisons had stumbled upon two publications that seemed to point towards very different futures. The first, by Reid Bryson, argued that the world was currently enjoying an interglacial period and that it would not be long before a great chill descended on the planet once again. The second, by the physicist Gilbert Plass, was one of the first to correlate CO2 emissions with global warming, foretelling a future in which the planet would warm by 1 degree Celsius by the year 2000 if emissions continued to rise at the present rate. Summarizing this research in handwritten notes, the work overlays a text that is part proposition, part poetry on top of a cartographic projection of the world with San Diego at its center.[55]

The sources the Harrisons used for the work were drawn from different scientific fields, operated across different timescales, and proposed radically divergent futures. One thing they had in common was that they were predictive, and, in Plass's case, predictive with

[54] See Williams, *World Futures*. Williams cuts against the grain of the usual origin story of scenario planning with a speculation that Fuller may have coined the term before Kahn; see p. 523.

[55] According to Newton Harrison, the map that forms the basis of the piece was one that was used by pilots, with all the written information removed; see Newton Harrison, interview with the author, 26 Nov. 2020.

remarkable accuracy.[56] Through a simple act of summary and combination, the Harrisons transform these predictions into scenarios, opening up the future to a range of possibilities. This is reflected in the title of the piece, *San Diego as the Center of a World* (1973), in which the artists' hometown served as a linguistic and visual anchor connecting multiple future worlds to the here and now (the emphasis very much being on *a* world, rather than *the* world) (figs. 6–10). The branching of possible futures was also positioned as the object of planning in the present, and the last of the five paper sheets that comprise the work contains a number of if/then statements, culminating in a proposition that in the absence of certainty around which future would come to pass then both long- and short-range planning could begin.

San Diego as the Center of a World is remarkable not only because it is an artwork made about climate change years before the issue had entered public consciousness but also because it adopted a scenario approach five years before the first climate scenarios were even published, without for that matter the Harrisons having any knowledge of the practice.[57] Given the extent to which scenario planning has now become so embedded within climate science and policy, featuring in regular reports published by the IPCC, it is perhaps surprising that a key thread in its historical evolution passes through the oil and gas giant Shell.

Propelled to fame following the publication of *On Thermonuclear War*, Kahn made scenario planning the keystone methodology of his new think tank the Hudson Institute, which introduced the technique to the corporate world through a three-part program designed

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[56] See Gilbert N. Plass, James Rodger Fleming, and Gavin Schmidt, "Carbon Dioxide and the Climate," *American Scientist* 98 (Jan.–Feb.2010): 58–62.

[57] The first scientific article to use scenario planning to think about climate change was Hermann Flohn, "Climate and Energy: A Scenario to a 21st Century Problem," *Climatic Change* 1 (1977): 5–20.

to initiate company executives in the dark arts of planning for multiple futures. Shell, already attuned to the significance of managing uncertainty, was among many other organizations that took up this opportunity. Within its London headquarters Shell established a division dedicated to "Long-Term Studies," in which Ted Newland recalls he was "told to think about the future, with no real indications of what was required."[58] After visiting Kahn a year later in 1966, Newland together with his French counterpart Pierre Wack would go on to form a team at the company's London headquarters dedicated to preparing detailed scenarios dealing with a range of possible shifts in world commodity markets. In an account that would be repeated in management literature several decades hence, Newland and Wack's scenarios of 1971 and 1972 suggested one possible future in which the power of oil-producing nations to determine prices eclipsed that of consumers, preparing managing directors for an eventuality that would come to pass merely a year later with the 1973 oil embargo.[59]

Many directly attributed Shell's ascendency in the 1970s to its embrace of scenario planning, but the reality is perhaps more complex than is often suggested. The company's experiments with the futurological tool did not predict the oil crises of the 1970s, its proponents maintained, for business forecasting and scenario work were two fundamentally different activities.[60] As a widely circulated business studies book on scenarios describes, using the approach simply "allowed the company to override the domination of the credible,

[58] Quoted in Angela Wilkinson and Roland Kupers, "Living in the Futures," *Harvard Business Review* 91 (May 2013): 1.

[59] See Kees van de Heidjen, *Scenarios: The Art of Strategic Conversation* (Chichester, 2005), pp. 5–6. The scenario that described the refusal of oil producing nations to continue to increase the oil supply was initially one of six discussed at Shell known as the crisis scenario.

[60] See Wilkinson and Kupers, "Living in the Futures," p. 12.

popular but very wrong imagined future."[61] This echoes many of Wack's pronouncements on scenario planning, which warned against producing increasingly sophisticated forecasts and instead "accept uncertainty, try to understand it, and make it part of our reasoning."[62]

The explanation for the rapid spread of scenario planning in the '60s and '70s is explained by Melinda Cooper using the concept of turbulence, which is understood to operate in both meteorological terms and metaphorically as a way of characterizing uncertainty.[63] Cooper suggests that as the international economic order established at Bretton Woods came to an end so too did a period of relatively stable trade between nations, conducted using currencies backed by the gold standard. In response to this increasingly unpredictable global trading environment, there was an urgent need for tools that would facilitate decision-making under conditions of uncertainty. These tools, according to Cooper, were built upon "a model of strategic power that aspires to harness 'whatever' happens . . . a power of all possible worlds."[64]

Cooper's arguments concerning turbulence run against the grain of those keen to position scenario thinking as an intrinsically open, if not utopian mode of relation to the future.[65] Situating the growth of scenario planning in a wider socioeconomic context allows

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[61] Van de Heidjen, *Scenarios*, p. 6.

[62] Pierre Wack, "Scenarios: Uncharted Waters Ahead," *Harvard Business Review* 63 (Sept. 1985): hbr.org/1985/09/scenarios-uncharted-waters-ahead

[63] See Melinda Cooper, "Turbulent Worlds: Financial Markets and Environmental Crisis," *Theory, Culture and Society* 27 (May 2010): 167.

[64] Ibid., p. 184.

[65] Management Strategist and former CEO Clem Sunter is one of many people who make grand claims for scenario planning, arguing that it helped end apartheid in South Africa

us to see that despite these claims, it is nevertheless a tool that facilitated the exercise of corporate power under conditions of uncertainty. No longer confident of their ability to anticipate the future in an increasingly volatile world, the power wielded by corporations such as Shell functioned through modulating sequences of events in order to steer them in a direction amenable to ever growing profits. For however much scenario planning was able to stretch the imaginative capacity of Shell's upper management, it did not prompt them to envisage the possibility of acting in a way that would place the wellbeing of the environment and people before profit. As early as 1989, the company produced a sustainable-world scenario, in which the global environment shifts towards an outlook considered "seriously green."[66] Despite the fact that all top-level decisions had to be justified against the company's global scenarios, including this one, the "seriously green" vision has not ended the toxic plundering of areas such as the Niger Delta, which was awash with accusations of complicity in the murder of those fighting to protect the environment, such as Ken Saro-Wiwa, later executed by the Nigerian state. Nor has the company's internal acknowledgement of its contribution to climate change as early as 1991 prevented the continued expansion of its fossil fuel infrastructure, including billion-dollar investments in artic oil drilling.[67]

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because "it changed the conversation of an entire nation" (quoted in Thomas J. Chermack, *Foundations of Scenario Planning: The Story of Pierre Wack* [New York, 2017], p. 146). See also Sunter, *The New Century: Quest for the High Road* (Cape Town, 1992).

[66] Van de Heidjen, *Scenarios*, p. 9.

[67] See Damian Carrington and Jelmer Mommers, "'Shell Knew': Oil Giant's 1991 Film Warned of Climate Change Danger," *The Guardian*, 28 Feb. 2017, www.theguardian.com/environment/2017/feb/28/shell-knew-oil-giants-1991-film-warned-climate-change-danger

5. Participatory Planning

Its ability to incorporate nonlinear temporarily, together with its subtle positioning of the present as a space of decision, is what we could call, following Easterling, the disposition of scenario planning. As she writes in regard to infrastructure space, "the crucial information about a political bearing is often found not in declaration but in disposition—in an immanent activity and organization."[68] Perhaps then, it is possible to look past the usefulness of scenario planning to the fossil fuel industry and instead discover in its underlying disposition opportunities for creativity and participation.

This would seem to be the unspoken proposition animating a number of recent artworks that employ scenario planning, including *Climate Garden 2085* and more recent work by the Harrisons. Their project *Greenhouse Britain* in particular invited audiences to cast their gaze to a future in which entire towns and cities are engulfed by the sea due to the impact of climate change. Providing a scenario backdrop from which user-generated responses might emerge, the Harrisons's stated aim was to democratize information about sea level rise so that "every person facing this emergent event could become their own planner, or join groups to do so."[69] Such initiatives are aligned with the efforts of researchers such as Renata Tyszczuk, whose multifaceted work on the cultural dimensions of climate scenarios includes publications, commissioning programs, and partnerships underlining the need for

[68] Easterling, *Extrastatecraft*, p. 214.

[69] Helen Mayer Harrison and Newton Harrison, *The Time of Force Majeure: After 45 Years, Counterforce is on the Horizon*, ed. Petra Kruse and Kai Reschke (New York, 2016), p. 346.

collectively generated scenarios "fleshed out through collaborative practices of experimentation and improvisation."[70]

Placing these recent artistic engagements with scenario planning alongside its systematic application by civilian-defense intellectuals, corporate managers, and climate scientists, further exposes what could be called an *expanded field* of scenario thinking, explored in mediums including film, installation, and social practice. The way in which the IPCC in particular has handled scenario planning has been criticized for its conservatism, only dealing with "policy-relevant" scenarios, and "excluding most futures as too utopian and dystopian."[71] For some, the IPCC's focus on the most-likely and middle-of-the-road scenarios strip scenario planning of the very thing that distinguishes it from prediction,[72] and in much scientific literature scenarios are now objectified as "stand-alone scientific

[70] Tyszczuk, "A Brief History of Scenarios," *Culture and Climate Change*, p. 22. See also Kathryn Yusoff and Jennifer Gabrys, "Climate Change and the Imagination," *WIREs Climate Change* 2 (July/Aug. 2011): 516–34.

[71] Lauren Rickards et al., "Opening and Closing the Future: Climate Change, Adaptation, and Scenario Planning," *Environment and Planning C: Government and Policy* 32, no. 4 (2014): 598. See also Mattias Hjerpe and Björn-Ola Linnér, "Utopian and Dystopian Thought in Climate Change Science and Policy," *Futures* 41 (May 2009): 234–45.

[72] See Rickards et al., "Opening and Closing the Future," p. 597, and Suraje Dessai, Xianfu Lu, and James S. Risbey, "On the Role of Climate Scenarios for Adaptation Planning," *Global Environmental Change* 15, no. 2 (2005): 87–97.

'products.'"[73] Equally worrying is that that some of these stand-alone products are being used to drive specific agendas linked to geoengineering and large-scale technofixes for problems associated with climate change.[74]

To this end, artistic responses are all the more important, not only insofar as they lend themselves to participatory approaches, but as a means to bring the disposition of scenario planning to greater visibility. A recent film that deals explicitly with the politics of scenario planning is by Lena Dobrowolska and Teo Ormond-Skeaping (figs. 11–13). Part of a larger project entitled *Future Scenarios* (2019) that consists of photographic work, research documents and texts, the three-screen film installation uses footage that speaks of the myriad effects of climate change, from natural disasters to food security.[75] This footage is punctuated by a series of intertitles that contain a calendar moving forward from year to year, a colored dot fading from yellow to dark red, and a list of bleak statistics and possible events slowly appearing by their side. Inspired by Shell's Future Energy Use scenarios and The UN Framework Convention on Climate Change's RCP scenarios, the work operates in a similar

[73] Mike Hulme and Suraje Dessai "Negotiating Future Climates for Public Policy: A Critical Assessment of the Development of Climate Scenarios for the UK," *Environmental Science and Policy* 11 (Feb. 2008): 64.

[74] See Reto Knutti, "A Wider Role for Climate Scenarios," *Nature Sustainability* 1 (May 2018): 214. For an argument in favor of "normative" or prescriptive scenarios, see J. A. Ogilvy, "Future Studies and the Human Sciences: The Case for Normative Scenarios," *Futures Research Quarterly* 8, no. 2 (1992): 5–65.

[75] See *Future Scenarios*, dir. Lena Dobrowolska and Teo Ormond-Skeaping (2020), www.futurescenarios.co.uk

manner to *The War Game*, insofar as it imbues neutrally worded scientific and policy documents with a sense of urgency.

As well as its textual component, the film makes visible the infrastructure of scenario planning through the spatiality of its installation. The multichannel video installation, a common display strategy in contemporary art, here becomes loaded as a spatial metaphor for the relationship between the present and the future. The footage on each of the three screens positions the viewer slightly differently, and while they are not used to demarcate three discrete future scenarios, the division in perspective is nevertheless enough to create a visual analogue for the dynamics of scenario planning, in which the future branches away from the present along multiple pathways.

The positioning of the viewer as the point of division in this spatiotemporal arrangement has the secondary effect of attributing agency to the present—the first node in a decision tree from which possible scenarios start to branch out. In an interview the artists point to the fact that for many in the West, and the UK in particular, "climate change remains a distant, far away, future that will largely happen to someone or something else in a landscape of which most of us have never visited."[76] By using footage shot predominantly in the global south, based in part on field research studying how Lao, Bangladesh, and Uganda are leading the way in their response to climate change, the filmmakers add a twist to William Gibson's famous quote that "the future has arrived—it's just not evenly distributed

[76] Dobrowolska and Ormond-Skeaping, "Lena Dobrowolska and Teo Ormond-Skeaping," interview with Kozlowski Kris Moore, *Palm Studios*, June 2019, palmstudios.co.uk/feature/lena-dobrowolska-teo-ormond-skeaping/

yet."[77] In this way, *Future Scenarios* complicates the narrative of a single future for a single planet, further shattering the fantasies of the predictive rationality that dominated thinking during the Cold War.

6. Conclusion

As the climate crisis makes disastrously clear, infrastructures tend to ossify over time, their resistance to change stemming from a series of interdependent "lock-in" effects that restrict our capacity to bring about meaningful transformation.[78] Outside of the climate crisis such lock-in effects have been observed across a variety of infrastructures, from the digital architecture of the internet, to the dimensions of railway tracks determining the size and speed of trains centuries after their construction.[79] The same kinds of path-dependent features can be seen in both of the speculative infrastructures discussed in this article, with a certain approach to scenario planning in particular becoming entrenched within a wide range of institutions. Before the institutional lock-in of such speculative infrastructures is established, it is first necessary for a set of cultural practices to become formalized into a discrete method or technique belonging to a defined field of expertise. In this way, the phrase *disciplined imagination* does not only describe what may be a desired outcome of a scenario exercise—a product of the imagination tidied up and packaged for decision makers—it designates processes by which the soft edges of cultural production are sharpened and transformed into

[77] William Gibson, "The Science in Science Fiction," interview with Brooke Gladstone, *NPR*, 30 Nov. 1999, www.npr.org/2018/10/22/1067220/the-science-in-science-fiction

[78] See Karen C. Seto et al., "Carbon Lock-In: Types, Causes, and Policy Implications," *Annual Review of Environment and Resources* 41 (Nov. 2016): 425–52.

[79] See Jaron Lanier, *You Are Not A Gadget* (New York, 2010).

disciplinary borders and the associated methods cocooned within the worlds of corporate, scientific, and public policy research.

These mutually reinforcing processes often come at the expense of an expanded field of speculative practices. This article has attempted to open the methodological brackets of two of the more prevalent speculative infrastructures to show that at every step of their development they can be placed within a wider arena of cultural production. When the frame of reference is broadened to encompass other mediums such as literature, computer modelling, and simulation, the variety of infrastructures multiplies greatly. At times the borders between these infrastructures come to appear less distinct, creating a patchwork of different tools, techniques, and approaches that overlap to create hybrid approaches to constituting the future.

The role of art in this mixture can be to work at the unstable borders, or it can be to pull apart these patches, isolating specific infrastructures, and bringing them into greater visibility. A third approach is exemplified in the work of Black Quantum Futurism (BQF), comprised of Camae Ayewa and Rasheedah Phillips. The pair not only expose the disposition of dominant futurological methods and resist their lock-in effects but pioneer speculative infrastructures of their own that are used in performances, participatory workshops, and interactive installations. Their particular brand of community futurisms, using such devices as "quantum event maps" and "oral futures booths" realize the participatory potential of scenario planning but crucially move beyond it.[80] As well as treating the future as multiple, contingent, and impossible to fully predict, they extend such a disposition towards the past,

[80] Rasheedah Phillips, "Communal, Quantum, & Afrofutures: Time & Memory in North Philly," in *Space-Time Collapse II: Community Futurisms*, vol. 2 of *Black Quantum Futurism* (Philadelphia, 2020), pp. 17, 18.

amounting to what the writer Sofia Samatar calls an "entanglement of the tenses."[81] Because ultimately, art can do more than isolate, scrutinize, and open up preexisting speculative infrastructures drawn from the corporate, academic, and policy worlds, it can produce new infrastructures that leverage a greater coefficient of possibility.

[fg]FIGURE 1. Stewart Brand, "The Order of Civilization," diagram that appears in *The Clock of the Long Now: Time and Responsibility* (New York, 1999), p. 37.

[fg]FIGURE 2. Stephen Willats, *Visual Field Automatic No.1* (1964). Plywood, wood, plastic, metal, light bulbs and circuit board. Dimensions: 1910 × 1220 × 220 mm. Copyright Stephen Willats.

[fg]FIGURE 3. A graph measuring "prediction precision" from a wide-ranging Delphi exercised documented in Olaf Helmer and Theodore Gordon, "Report on a Long Range Forecasting Study," in *Social Technology* (New York, 1964), p. 87.

[fg]FIGURE 4. Juanita Schläpfer-Miller and Manuela Dahinden, *Climate Garden 2085* (2016). Photo: Schläpfer, Zurich-Basel Plant Science Center.

[fg]FIGURE 5. Chesley Bonestell, Atom Bomb Hits New York City: Illustration for "Hiroshima, U.S.A.," in *Colliers*, 5 August 1950, cover; oil on paper laid on board.

[fg]FIGURE 6. Helen Mayer Harrison and Newton Harrison, *San Diego as the Centre of a World* (1973).

[81] Sofia Samatar, "Toward a Planetary History of Afrofuturism," *Research in African Literatures* 48 (Winter 2017): 187.

[fg]FIGURE 7. Helen Mayer Harrison and Newton Harrison, *San Diego as the Centre of a World* (1973).

[fg]FIGURE 8. Helen Mayer Harrison and Newton Harrison, *San Diego as the Centre of a World* (1973).

[fg]FIGURE 9. Helen Mayer Harrison and Newton Harrison, *San Diego as the Centre of a World* (1973).

[fg]FIGURE 10. Helen Mayer Harrison and Newton Harrison, *San Diego as the Centre of a World* (1973).

[fg]FIGURE 11. Stills from Lena Dobrowolska and Teo Ormond-Skeaping, *Future Scenarios* (2019).

[fg]FIGURE 12. Stills from Lena Dobrowolska and Teo Ormond-Skeaping, *Future Scenarios* (2019).

[fg]FIGURE 13. Stills from Lena Dobrowolska and Teo Ormond-Skeaping, *Future Scenarios* (2019).

Biography

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