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"Special Focus Teams" to Help Solve the Problems of the Anthropocene

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Executive Summary

Human society has failed to develop (much less implement) effective responses to the challenges of climate change and other problems of the Anthropocene. There are myriad policy reports and proposals, but society has been unable to develop acceptable, effective, actionable plans for solving these challenges.

Our work at Humanity 2050 now focuses on addressing the root causes of this conundrum, which include: difficulties resulting from the complexity of modern global problems, limits of the human mind, and constraints arising from the specialized patterns of thought that are used in our economic, political, and academic systems. The first parts of this paper explain how these problems lead to a “cognitive logjam” that prevents careful planning and thus prevents effective action. We then propose a new type of “special focus team” that can help develop better ways of addressing these global challenges.

As a first test case involving the use of such teams, we now are (building on the wonderful work of other groups) developing an integrated set of plans for climate engineering via the use of stratospheric aerosols. Our goal is to create plans that are thorough enough, clear enough, and specific enough so as to allow a meaningful discussion of the risks and benefits. More generally: We offer ways to dramatically improve the decision/action cycle when dealing with global challenges of the Anthropocene, allowing more careful thought and more rapid, effective action and improving the prospects for a flourishing human future.

I. Limits of Human Thought and the Challenges of the Anthropocene

As we work to understand and address the challenges of the Anthropocene, it helps to step back and see why existing patterns of thought are — so often — inadequate for the task at hand.

The human brain is an astonishingly complex and adaptable physiological system, yet it evolved to address the needs of life when our forebears lived in small bands of hunter-gatherers. We thus face several cognitive challenges when trying to address the problems of the Anthropocene:

1) **Nature fails us.** Given limits of human cognitive capacity, we tend to work with mental models that — in any given moment — just consider a few key variables (Johnson-Laird, 1983). Trying to think about a problem at a global level and look ahead several decades thus involves a level of complexity that can easily overwhelm the human mind. Our brains have no real way to track all the relevant variables in a world with nearly eight billion people and all their billions of computers.

2) **Nurture fails us.** We have trouble because our social and economic systems force most people to specialize, developing deep knowledge about some small area but making it hard for anyone to "see the big picture" and help solve these global problems. Our minds get trained as domain-specific pattern-recognition systems that can make a living by teaching biophysics, trading stocks, writing novels, becoming a doctor or a lawyer, etc. But these skills are not readily interchangeable with each other: synapses adapt to the task at hand (Rudy, 2020). And, as I know from personal experience, it can take a decade or more to switch fields, to shift focus and retrain the mind to work on these global challenges.

3) **Cultural transmission of knowledge (which works well at a historical, intergenerational level in other fields) fails us when we face these new challenges.** Due to the exponential growth in population and technology, the challenges of the Anthropocene have come on suddenly relative to human history; there is no accumulated store of wisdom showing how society might best solve these problems. Other fields have had time for gradual, incremental progress — as in physics with Copernicus, Galileo, Kepler, Newton, and Einstein. This kind of gradual, incremental progress has been crucial in almost every realm of human endeavor (Donald, 1991), but we no longer have the

leisure to work at that pace. We cannot afford to wait hundreds of years in the hope that society will gradually develop better ways of addressing the challenges of the Anthropocene.

II. A Cognitive "Logjam" Prevents Effective Action

Society can often identify key challenges, like climate change, and there is active discussion about ways to address the problems. But these proposals rarely, if ever, get sorted, double-checked, integrated, and synthesized in a way that gives some truly effective, actionable plan to solve the problems of the Anthropocene.

Conscious thought typically arises in response to awareness of some problem or some opportunity, and, ideally, continues until we enact some plan and solve the problem. The diagram below shows how this occurs in the life of the individual — with observation, experience, and theory (on the left) providing a foundation for thought, with thought then coming to a focus in action (center), and with subsequent events (hopefully) playing out in a way that solves the problem (right).

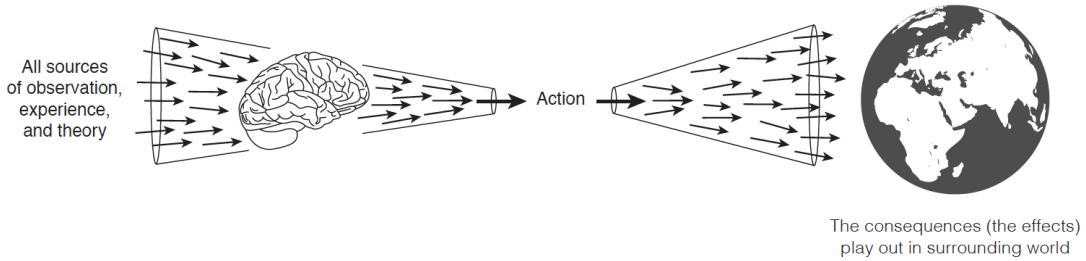

Figure 1

This same pattern remains relevant as society tries to deal with the challenges of the Anthropocene, but — in this case — we now have a set of minds (or a set of countries) on the left, and we need to come to some agreement that will allow effective, collective action. Ideally, society would collect information about a problem like climate change; would have some way to think through options and discuss possible responses; and then would develop an effective plan to solve the problem. The process would flow from one stage to the next as in the sequence below:

1) Information → 2) Thought & discussion → 3) Plan → 4) Action → 5) Safer world

In the case of climate change, unfortunately, society only gets about halfway through this series of steps. Given the wonderful work of the Intergovernmental Panel on Climate Change (IPCC) and other groups, detailed information is now available about the problem (stage #1 in the sequence above) and about potential solutions. We now have myriad books and policy reports that offer further analysis and consider potential solutions (thus reaching stage #2 in the sequence noted above). Yet, society gets stuck here. There are a lot of ideas, but they are never sorted and combined to give some clear, acceptable, suitably powerful plan (stage #3); and society has not taken any action that's sufficient (stages #4 and #5) to solve the problem of climate change and to build a safer world.

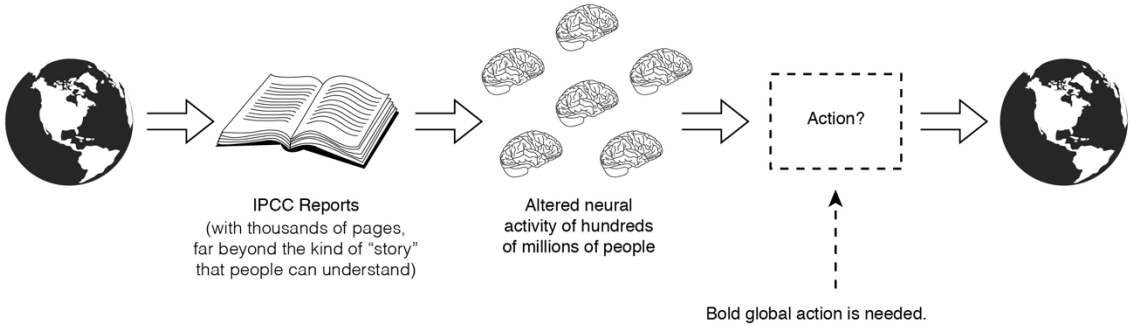

Figure 2

Thus, society is successful in getting information about the problems and starting to discuss potential solutions, reaching a stage that might be called #2a. But society fails to complete "stage #2b" — failing to sort, double-check, and integrate ideas in a way that would allow development of some suitable plan (stage #3).

Perhaps it should not be surprising that the failure occurs in the second part of stage #2 and in this transition to stage #3. Thinking first about stage #2a, we can see that there's a relatively modest "barrier to entry" for thoughts that arise here. At this point, it's OK if some ideas emerge in a tentative, exploratory form, and it's OK if each comment or proposal provides only part of the answer.

Things get much more difficult as we try to move towards stage #3, trying to sort, evaluate, and integrate all ideas so as to develop an effective, actionable plan. Given that the plan is intended for direct, real-world implementation, the

stakes here are much higher than they were at stage #2a. Pointing out various concerns and possibilities is no longer enough. The plan must be ready for action (must be executable) and must be set up in a way that acknowledges attendant real-world constraints, real-world consequences, and real-world risks.

Note: The stance we take at Humanity 2050 does not accept excuses like, “It was a good plan; it’s just that people are too greedy.” In our own work, we assume that a significant measure of greed and selfishness is part of human nature. Any plan that does not accept this, and does not account for this, has overlooked one of the central real-world constraints that must be applied in the search for a useful solution.

Everything that we do at Humanity 2050 focuses on these critical transitions from stage #2a (with initial ideas) to stage #2b (sorting and sifting ideas) to stage #3 (offering some clear, integrated, actionable plan to solve the problem). We understand that overcoming these cognitive barriers, and moving a few steps further along, will not solve all challenges of the human future. Of course, society will still need to evaluate these new plans and is likely to make modifications before enactment. But having concrete, well-developed plans will be a huge step forward, as having a clear plan makes it easier to see all attendant risks and possible side effects. Setting out a plan will help make sure that everyone understands what they are voting on (when the time comes for a decision), and — if approved — the plan will be ready for immediate action.

III. Why Experts Cannot Break the Logjam

The proposal offered in this manuscript is novel enough that it may help to pause and look again at limits in existing modes of thought. Here, we note: given the spatial-temporal scales involved, ideas about the challenges of the Anthropocene arise in a kind of “cognitive frame” radically different from that used by experts and specialists who play such vital roles in all other aspects of modern society. Problems of the Anthropocene are global in scope, interdisciplinary in nature, and must be considered on an intergenerational timescale. The mind of the expert — typically trained to keep a narrow focus — is not well suited to work on this scale.

One of the key factors allowing the advance of civilization has been the rise of the expert. As knowledge expands, society assigns responsibility to individuals

for ever-more-narrowly defined subfields. Now, the world no longer has the “Two Cultures” — the sciences and the humanities — that C. P. Snow had described in his famous essay in 1959; we have hundreds or thousands of different cultures.

Academic departments provide a standard way of parsing the world into pieces. Each department tends to have some characteristic kind of lens, or conceptual frame, that it uses when looking at the world, and thus, each department implicitly sets a boundary or limit on the type of knowledge that its members need to master. This often allows for an odd type of arrogance or complacency; each individual can work at the very edge of their own cognitive limits, perhaps becoming a “world expert.” And they can do so without any need to recognize, or to be embarrassed by, how shockingly little they may know about the rest of the world.

There are many advantages inherent in this system, and experts serve vital roles in every part of society. But this system also leaves real challenges when problems — as with those of the Anthropocene — cut across all realms of human knowledge. At this level, there is no particular reason to assume that we can trust the experts to develop a suitable plan of action.

In short, analysis and synthesis are now badly out of balance. Most of the intellectual advances in academics come as scholars break the world into ever-smaller pieces or study the world via ever-more-specialized tools (proceeding as in stage #2a above). There is little effort and little progress in the other direction (akin to stage #2b), trying to integrate all this new wealth of knowledge — trying to develop ways of seeing the world that work at a larger scale (but with such models revised as necessary to keep them consistent with all the fine-grained details discovered by modern science).

This presents a huge risk for society: humanity may not be able to solve the challenges of the Anthropocene unless more of the people working on these challenges can invest the time and the intellectual effort needed to develop a global, pan-disciplinary, intergenerational perspective. To work at this level, one needs to see the big picture and acknowledge the full complexity of these global challenges; one needs ideas with real substance and meaning; and yet one needs to develop models that are simple enough to readily be shared with others. It’s a tall order, and this intellectual challenge contributes to the difficulty of solving the practical, real-world problems of the Anthropocene.

IV. Why Science Cannot Break the Logjam

Science has made immense contributions to the development of the modern world, but — as emphasized below — scientists cannot somehow take the lead in sorting through all possible options and developing an integrated plan to address the challenges of the Anthropocene.

The development of the scientific method, and a resultant acceleration in the development of technology, have transformed the world and dramatically improved the average standard of living. It would be almost impossible to acknowledge all the ways in which experimental data and careful calculations have helped to protect the human mind from error and helped us understand the world.

Yet, in spite of this power, it's also important to understand why science alone can never be sufficient when planning how to address the challenges of the Anthropocene.

Science has no way to see the "full world" directly; each experiment gives a partial view. As "experimental samples" become more complex, there is a rapid proliferation in the number and types of possible experiments and of the complexity of the resultant models. We see this fragmentation, for example, in current research in neuroscience. A scientist might study "synaptic plasticity and spatial representations in the hippocampus," or perhaps "the frontoparietal attention network." And yet, this expanding universe of knowledge about the brain — useful in many other contexts — offers little help as society struggles to solve the problems of the Anthropocene. Yes, thought is key, but we need much simpler models of thought (Pabo, 2018) if we want to learn how thought can be focused to better address the complex problems now facing society. Similar constraints arise in other areas of scientific inquiry and strategic planning. We often end up with the mind so full of details that it becomes hard to see the big picture.

Science has done an astonishing job in revealing the basic laws of physics and chemistry and the basic principles of biology. But the reproducibility of experiments seems to suffer as the systems under study become more complex — as with studies of cancer and as with brain scans designed to show key patterns of neural activity (National Academies of Science, Engineering, and Medicine, 2019). There are occasions in which a large complex system can be modeled in a reliable way, for example, when scientists look at the physical,

chemical aspects of global warming. But it's almost impossible to obtain meaningful, reproducible scientific data when the "system" of interest contains a large number of people going about their daily lives.

Science cannot replace our human judgment about values and morality (Bronowski, 1956; Varela, 1999). Indeed, science does not somehow "demand" an answer to the problems of climate change or other problems of the Anthropocene; the "needs" of science could readily be satisfied with a set of careful measurements recording the rising temperatures, the flooding of coastal cities, and the inability of *Homo sapiens* to mount any effective response.

In short, science itself is not an *answer* to our current problems: it's a critical *tool*, a vital source of information. Scientific knowledge is desperately needed, and yet — by itself — it's painfully insufficient, as we struggle to find ways to address these challenges of the Anthropocene.

V. Why Democracy Cannot Break the Logjam

This section offers a simple chart showing how effective society is in solving different types of problems, and the figure emphasizes that complexity is the real problem behind the problem: it's the common denominator that makes it difficult to find meaningful ways to address the challenges of the Anthropocene. Our chart highlights the problems of democracy so clearly that it's almost painful to see, yet it focuses attention in a way that will help us develop better problem-solving strategies in the face of such complexity.

The diagram below has a horizontal axis showing the cognitive challenge — increasing towards the right — involved in developing a useful long-range plan. This cognitive challenge increases when working amidst greater complexity and uncertainty, and when considering an ever-larger large number of alternative strategies.

The vertical axis shows the degree of social and economic change — increasing towards the top — that's likely to be required when implementing the plan. (And this need for more drastic changes in society makes it harder to ensure easy acceptance/compliance with proposed solutions to problems that arise in the upper half of the diagram).

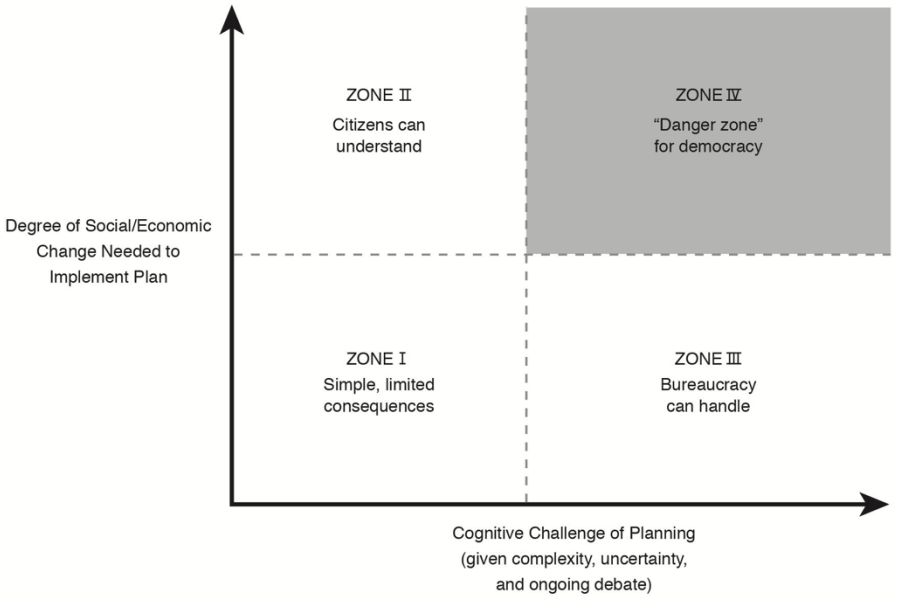

Figure 3

When problems get classified in this way, democracy has no trouble with Zone I. We may, for example, all decide to drive on the right-hand side of the road. Problem solved, and we move on. Society may struggle in Zone II, for example with decisions about same-sex marriage, or abortion rights, or the appropriate role of "family values" in public education, yet society seems to make some halting progress. Zone III includes problems that can be quite complex — problems like the approval of new drugs or the regulation of airline traffic. Work here may require extensive knowledge of medicine, or statistics, or computer science, yet most citizens seem satisfied to hand these particular, carefully delimited problems over to scientists and experts — trusting that work at the relevant agencies will help keep them safe.

But problems in Zone IV are different. Here we have problems like those of climate change, environmental degradation, population growth, regulation of the financial system, pandemics, immigration policy, and risks posed by the rise of artificial intelligence. Society struggles to address these problems because a) they are exceedingly complex and need to be considered at a global, interdisciplinary level; b) the choices and decisions needed to address the problems will affect almost everyone in society; and c) global cooperation among independent nations will be needed to implement some fully effective solution.

Society has a dismal record in Zone IV. Problems accumulate and fester in a way that involves a dangerous kind of "intergenerational risk transfer." There are occasional stopgap efforts, but — as a first-order approximation — it appears that democracy has no reliable, suitably rapid and efficient way to solve problems that arise in Zone IV.

VI. Society is Overwhelmed with Other Problems

As noted above, challenges of the Anthropocene are hard because of 1) the complexity of all the factors that must be considered when working to develop a useful plan and because 2) meaningful answers will require large-scale social and economic adjustments. And yet, this is not all. Society faces 3) a further cognitive challenge that arises because of the sheer number of problems — as on the left side of Figure 4 below — now confronting a country like the United States (with almost every other country experiencing a similar kind of "overload").

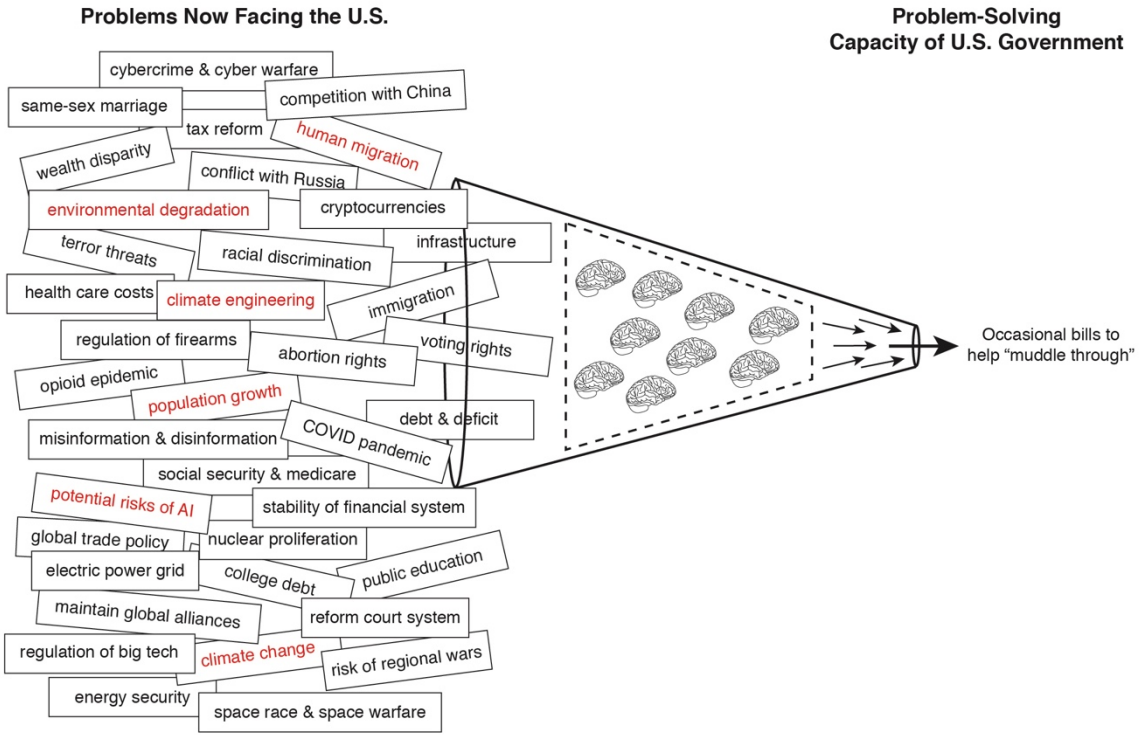

Figure 4

Unfortunately, the “central processing unit” of the U.S. government (Congress and the President) can only handle a few problems at a time (as indicated here by the few boxes just starting to enter the funnel). In describing this challenge, one might say that our system of governance in the U.S. has a finite “cognitive capacity.” This means that the Zone IV challenges of the Anthropocene (highlighted in red on the left side of this figure) must compete for attention with all the other challenges of governance.

As new challenges emerge (and continue to stack up on the left), existing problems will get less attention, and this exacerbates every other challenge that governance now faces. It’s not just that the challenges of the Anthropocene are hard. Society has so many other problems that attention gets fragmented. No one seems able to devote the amount of time and the level of attention needed to solve the wickedly complex problems arising in Zone IV.

VII. A Paradigm Shift: How “Special Focus Teams” Could Help

The problems of the Anthropocene have come upon us so suddenly, and have such overwhelming complexity, that our existing educational, social, and political systems are unprepared for the task at hand. Humanity 2050 thus proposes a new approach to help in this transitional phase in the continued growth and maturation of civilization: assembling “special focus teams” that can — for months or years at a time — work with the requisite focus and intensity, helping to develop effective plans for solving these Zone IV problems.

At first, democracy’s inability to address Zone IV challenges may seem like an intractable problem. There is no chance to somehow bring a majority of citizens “up to speed” on all the issues involved with these Zone IV challenges. Many people will lack the requisite scientific and technical background that is needed (involving statistics, systems theory, science, technology, computer science, etc.). And few people will have the spare time between their jobs and family life to start studying a dozen or so wickedly complex problems.

Our leaders face much the same kind of cognitive challenge. Few have a relevant scientific background, and most are busy enough that they have no effective way to solve Zone IV problems. And yet it’s dangerous to try making snap judgments about any of these global challenges. Zone IV problems cannot

be addressed in the same manner as those in Zone II, where public opinion helps inform political action.

At Humanity 2050, we offer a new strategy that could help in addressing Zone IV challenges. It involves letting a small team focus and study a Zone IV challenge in detail — working in great depth for months or years, sifting and sorting ideas, considering myriad risks, contingencies, and alternatives, then proposing a solution simple enough so that their plan can be evaluated almost as if it had "Zone II" level of complexity.

This idea may sound fantastical at first, but there are several historical precedents for work that has successfully proceeded in this way. Perhaps the best-known example — at least in the United States — involves the Constitutional Convention that was held in the summer of 1787. This group had been assigned the task of proposing some revisions to the Articles of Confederation, but they secretly set out on a much broader mission and adopted conditions that allowed for the careful development of thought. James Madison had spent years thinking about ways in which a new government might best be structured; and the delegates had the chance to focus and work together for months at a time without interruptions or distractions.

The delegates engaged in open-ended debate and gradually moved through all the intermediate stages in a complex decision-making process (as recorded in the contemporaneous notes of James Madison). Yet, when the delegates finished and presented their plan, the states were left with a much simpler question as they considered ratification: "Can you read these 4,500 words and decide whether this is an acceptable way to set up a constitution?" Supporting explanations and arguments were offered in various newspapers (eventually collected and published as *The Federalist Papers*), so that interested citizens could follow the reasoning behind each of the main decisions implicit in the structure of the proposed Constitution.

This left the rest of the country with a far simpler problem of "planning": They just needed to decide whether to accept, reject, or modify the proposed document. It was almost (as noted above) as if everything had been moved to a Zone II level of complexity:

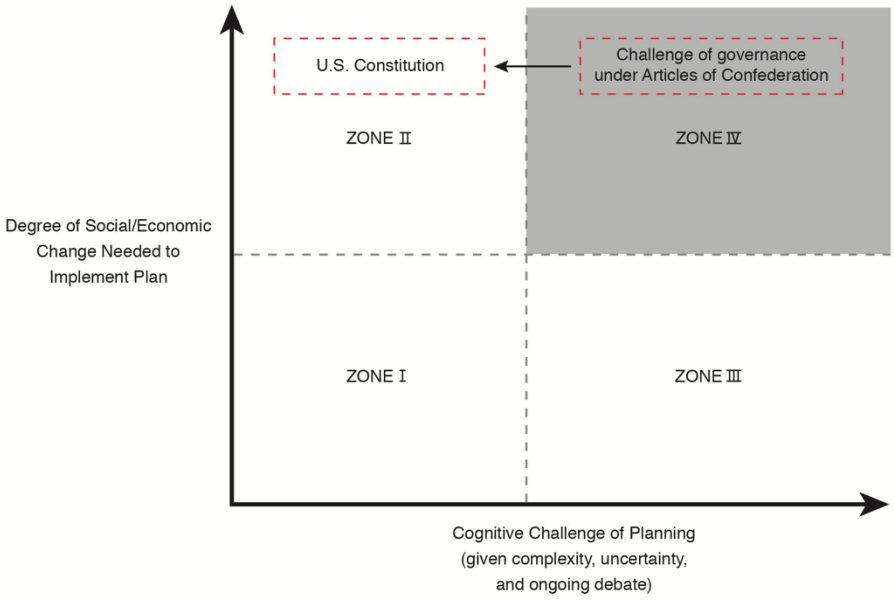

Figure 5

VIII. How the U.S. Constitutional Convention of 1787 Gives Hope

As above, the U.S. Constitutional Convention of 1787 shows how a "special focus team" addressed the complex challenge of designing a new form of governance. Their example serves as a useful guide in the development of our own plans to create special focus teams to address challenges of the Anthropocene.

The Constitutional Convention of 1787 can be described in many different ways, but I focus here on features that led to a very productive problem-solving environment:

1. The delegates had a broad view of world affairs, world history, and human nature; and they understood the limits of the Articles of Confederation.
2. Delegates had enough time for careful discussion, and they worked in a setting that limited the number of interruptions.
3. They had a common goal, and there was no shame in changing one's view after a month or two if persuaded by the arguments of others (Bowen, 1986; Madison and Koch, 1966).

I propose using similar cognitive patterns — similar problem-solving sessions — to help address our current challenges. In the "ideal scenario," each team (focusing on a particular problem) would have core members with a broad view of the world, spanning theoretical and practical perspectives across a wide range of disciplines. Each team would work full-time on its assigned problem for months or years at a stretch (thus mimicking, or exceeding, the time commitment that delegates made in 1787). The teams could vary in size, but — building on research, studies, and proposals already offered by other groups — each team would work to develop a clear, coherent, actionable plan that could then be considered by society.

It may seem onerous and unrealistic to demand full-time concentration on the problem, with team members spending all day reading books and papers, talking among themselves, sketching out plans and options, and calling experts when there are specialized technical questions. And time pressures of the modern world may mean that the first experiments with this new approach may need to use much smaller, more loosely coupled teams — perhaps letting them work for a longer time but insisting on this kind of intense focus. This level of concentration is the only way to help the mind address problems as hard as those we now face; it's the only way to "prime the pump" for fresh ideas that later come as a "flash of insight" — overnight, or when taking a shower, or when going out for a walk.

It also is important to note that this approach will demand special, intense effort from the team but — at least initially — will require little change amidst any broader sector of society. Members of the team may need to learn how to think more clearly, but there is no immediate expectation or demand imposed on anyone else in society. No meaningful portion of the populace ever needs to work in Zone IV; society will only need to evaluate some final proposal. And — as with the U.S. Constitution — this should be much easier than the task involved in developing the proposal. Again: it will be as if a Zone IV challenge (as faced by the team) gets moved over to Zone II (when considered by society).

Given the immense amount of work around the world that's already been invested in various reports and policy proposals for specific challenges, any such team would have ready access to a large body of prior work. And, after reading all the key papers in this field, the team could, as needed, reach out to these authors, and to other experts, for clarification and advice.

As soon as a draft proposal was ready, experts from every relevant discipline

and stakeholders from every realm could then comment and suggest changes. Society would retain full freedom to accept, reject, modify, or ignore plans developed by any such group. Yet challenges of the modern age are so pressing, and so difficult to address, that any clear, well-formulated plan would quickly get attention and would have some reasonable chance of getting enacted.

IX. Special Focus Teams Will Work in Parallel with Existing Efforts

We expect — as above — that ideas developed by these special focus teams will have a profound global impact in helping society address the challenges of the Anthropocene. We think that such teams can do this at remarkably low cost, and — as explained below — can do this without requiring any immediate change in other scientific and public policy efforts in the relevant area.

Figure 6 (below) helps explain how this would work — giving maximal benefit, while requiring minimal interference or change in any of our existing academic, social, political, or philanthropic systems. The left side of this diagram shows the prototypical pattern of events that occur when complex decisions are made in a democratic system. There's an initial stage with relatively open consideration of a wide range of options (corresponding to stage #2a as discussed in section II of this manuscript).

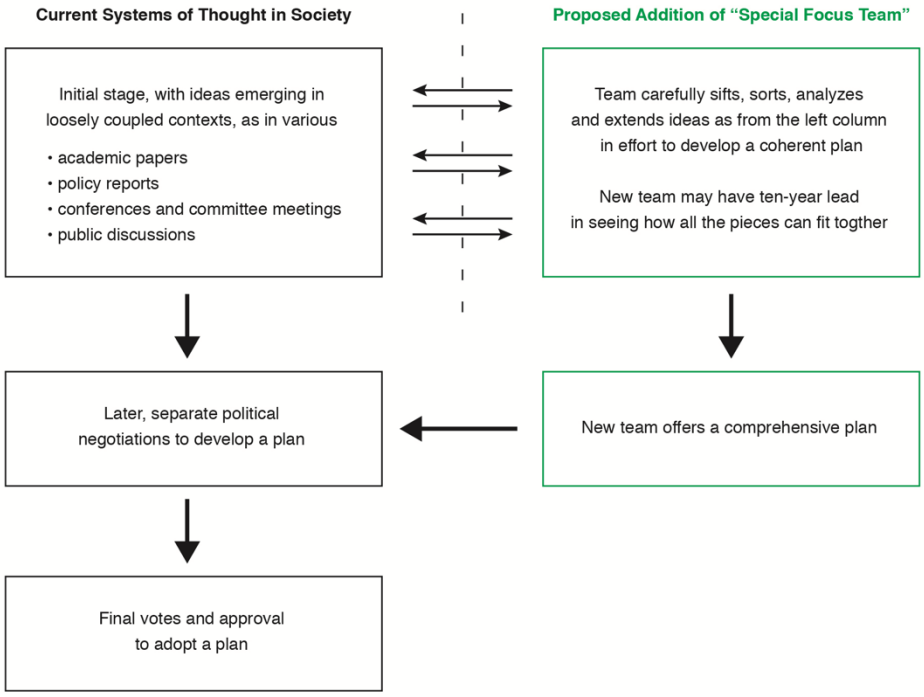

Figure 6

However, ideas arising via standard systems of thought (as in the box on the upper left side of this diagram) rarely seem to coalesce to give some clear, coherent plan; society often has academic papers, policy reports, conferences, committee meetings, and public discussions without ever actually developing some final, actionable plan. If/when pressure mounts — as with the Dodd-Frank Wall Street Reform and Consumer Protection Act that was passed in 2010, trying to address Zone IV challenges of the U.S. financial system — the final plan often is assembled in such haste that there's little time for careful consideration of details (Kaiser, 2013).

The right side of this diagram shows how the special focus teams could be added in a way that would allow an easy, collaborative interaction with all existing efforts focused on problems of the Anthropocene. That is, such teams can be added without the need to remove or replace anything on the left; we simply add a special focus team (one team per problem) to undertake a fresh analysis of all key issues and all the previous work in the field.

These teams on the right will have a challenging task as they try to compare, integrate, and extend ideas so as to develop some practical plan, and — given the scope and complexity of their task — they will need some freedom from the

time pressure characteristic of so many other efforts in modern society. Humanity 2050 will need funding from people and groups who are smart enough to understand that: 1) there may be no “instant answers” showing the best way to address these long-term challenges, but who also understand that: 2) having a capable, dedicated team that’s focused on this problem can substantively improve the odds of success.

Each group will, from the very start, work to sift through all the puzzle pieces (as offered by work on the left) and will try to develop a coherent, actionable proposal — always working to offer a plan that would be clear, acceptable, and powerful enough to really solve the corresponding problems. This kind of effort, obviously, will require funding, but — in a democratic system — it will NOT require any prior political authorization, and it’s probably good that the team needs to work without any such promise that their plan will get used. This will help to ensure that the team will keep a relentless focus on 1) developing a practical, acceptable, actionable plan as quickly and carefully as possible, 2) getting advice from every possible perspective, and 3) updating/revising their proposed plan at intervals until society is ready to act.

Teams will need to focus as carefully as if engaged in a high-wire act — trying to cross a chasm of uncertainty, doubt, and complexity — to get over to the other side with a useful answer. The team fails if they cannot achieve this, and thus the risk and the pressure are good: they help ensure that everyone on the team will always work hard, stay focused, and seek out advice whenever they can.

X. Double-checking the Rationale for this New Paradigm

Our proposal — this plan to try using special focus teams to help address the challenges of the Anthropocene — is novel enough that it’s worth pausing to double-check the idea from a variety of different perspectives.

Everything about our proposal is based on a few simple notions about problem-solving amidst complexity:

1. Thought takes time and attention, needing some buffer against distraction.
2. These problems of the Anthropocene are hard enough that any team working in Zone IV will need team members with exceptional talents, training, dedication, and perseverance.

3. And these problems are challenging enough that the team must be ready to consider ideas from any source; the team must be able to keep working steadily even in difficult times, always ready to adjust and reconsider plans as new data becomes available.

These basic principles seem so fundamental that it would be hard to argue with any of them, yet the idea of setting up dedicated special focus teams, working with this kind of intensity, is novel enough that it's worth pausing and double-checking the plan. One might, as on the next several pages, raise several questions, first asking:

How are these special focus teams different than other domain-specific teams working in think tanks, NGOs, governments, or academia?

We applaud the work of the many talented and dedicated individuals and organizations around the world who have contributed to a better understanding of the challenges of the Anthropocene and who are (as on the left side of Figure 6) working to help society address these problems.

Our approach is complementary — building on everything that other groups have done — but our strategy involves a kind of paradigm shift: a new approach designed to help deal with the crisis of complexity now facing humanity.

And we have such clear ideas about the conditions required for optimal thought (Newport, 2016; Pabo, 2018), and we are so concerned about the limited progress that's been made in addressing these challenges of the Anthropocene, that our approach breaks with several key features characteristic of modern public policy development (Booher and Innes, 2018*).* Thus:

1) We focus on picking team members with an unusual capacity for careful, deliberate thought. We try to ensure that they are aware of, and respectful of, the needs and concerns of all other groups, but: *We do NOT try to assemble a team that is itself directly representative of all sectors of society or all special interest groups.*

2) *We do NOT try to look for an idealistic, "optimal" outcome, but adopt a kind of "realpolitik" perspective*. We thus try to take full account of human greed, selfishness, and the constant struggle for power as we work to find the most plausible, most realistic way to address the challenges of the Anthropocene.

3) *We do NOT try to solicit broader public input or feedback at intermediate stages in the planning process*. We want — as it were — the right to keep the doors of the convention hall closed during deliberations. This will help ensure that ideas can get a fair hearing (amidst the internal deliberations of the team) even when the ideas first arise in some early, embryonic stage of development (and thus are not yet ready to withstand public scrutiny). There will be plenty of time for public comments and feedback when society is ready to make a decision and the special focus team offers its best, final proposal.

* * * * *

Dropping these standard constraints helps us keep focused on the immense challenge of complexity and gives us freedom to work in ways that offer better prospects for developing important, novel ideas. As we focus on conditions that will allow for the optimal development of thought:

1) We WILL always think and act as if "the buck stops here," insisting that special focus teams work with an intensity and a sense of moral and intellectual purpose as serious as if they were responsible for the entire future of humanity.

2) We WILL start each project with what appears to be a secondary or auxiliary role (right side of Figure 6). Yet this will allow access (left side of Figure 6) to the best ideas currently available anywhere on the planet, letting us begin in a way where we can "stand on the shoulders of giants." We will then move to a new, previously unexplored level as our special focus teams work to pressure test, integrate, and extend all existing ideas in the field.

3) We WILL develop action plans, not just policy recommendations, and we'll always work in a way that integrates ideas about science, governance, and operations and that looks ahead over several decades. Such action plans must be concrete enough to let us begin to foresee many of the unintended consequences and (otherwise) "unexpected" side effects, and simple enough to be considered by society as if everything had been moved from Zone IV to Zone II.

Why try something this different?

Obviously, the main incentive comes from the fact that existing systems have failed. The COVID-19 pandemic is the most recent, shockingly painful example of a broader failure in society that provides the backdrop for everything discussed here. If there's a plausible argument for a new approach to the challenges of the Anthropocene, there is a powerful incentive to give it a try. It's a bit like the kind of impasse that opens the way for a paradigm shift in science (Kuhn, 1962). Radical new ideas, like those of quantum mechanics, only come to the fore when there is some breakdown or failure in the existing set of models.

This new approach also is vital because it acknowledges deep trends now seen in the modern world. As discussed in my essay "Civilization and the Complexity Trap," the challenge of Zone IV problems will only continue to multiply as time goes on — as the global population, the number of computers, and the pace of change all continue to increase; as knowledge expands and each expert sees an ever-smaller portion of the whole; as disinformation further corrupts the process of public discourse; and as attention spans shrink in a world where every electronic medium, every pop-up ad, and every app is fighting for our attention. Society desperately needs a strategy that can help us surmount these challenges.

How would this help with the underlying challenges of cognition?

Zone IV problems are so challenging that they will need a carefully trained team. Members of these teams will require: a) years of specialized study to develop a relevant knowledge base; b) potentially months or years of intense, uninterrupted intellectual work on each new problem; c) a carefully crafted strategic approach to problem solving; d) careful notes to track intermediate stages in the decision-making process; and e) access to rich sources of relevant data and advice at every stage of the work. Team members must be humble enough to constantly seek advice and constructive criticism and also patient, with a kind of "negative capability" allowing them (like Charles Darwin) to work for long periods of time without any way of knowing whether they are right or when the answer may come into view.

In short, problems here involve so many different variables (i.e., the problems arise in such "high-dimensional spaces") that they are radically different than the type of problem often cited when discussing the "wisdom of crowds." Unlike trying to estimate the number of jelly beans in a jar, a challenge like climate

change requires a carefully trained team that can work in a coordinated way, not just a plan to average the guesses of everyone who walks by the booth.

In thinking about the complexity of the problems that now face society, I'm reminded of a fascinating distinction that appears in the introduction to Hal Abelson and Gerry Sussman's book on *The Structure and Interpretation of Computer Programs*. They make a profound point about different levels of complexity when they distinguish two types of knowledge. In much of our educational system, and in most standard patterns of discourse, we tend to rely on a kind of *"declarative epistemology"* (implicitly assuming that fixed, declarative sentences — or a few key equations — can provide a suitable vehicle for conveying the key information that we need to tell one another about the world).

Yet, with events now unfolding dynamically all over the world, we need a kind of *"procedural epistemology"* (reflecting the same kind of dynamic complexity that arises during the execution of a computer program). That is: we may need knowledge of interactions so complex that they must be represented by algorithms that no longer fit directly in the human mind, but instead must be outsourced to our computers. And this same kind of complexity — allowing for constant dynamic adjustment of key variables — will be needed by any plan designed to address the challenges of the Anthropocene.

This point forces us to look again at one of the most fundamental challenges of the Anthropocene: We do not live in some static system, with some fixed set of problems, or live in a world with simple, repeating annual cycles. Everything is undergoing rapid, dynamic change; and our minds must be at least equally supple. We need models and ideas and plans that will incorporate this kind of procedural epistemology as we work to address these challenges of the human future.

Has anyone else suggested this type of approach?

The approach offered here — letting a small "special forces unit" try to tackle the challenges of the Anthropocene — aligns in a striking way with comments that Jean-Jacques Rousseau had made in one section of *The Social Contract* (1762). These comments arise in a section entitled "Of the Lawgiver" and seem to anticipate the approach used at the U.S. Constitutional Convention of 1787.

In this section, Rousseau acknowledges the special cognitive challenges

inherent in setting up the first legal system for a country — a task requiring great intellectual discipline and demanding a mental framework that rises far above the political concerns of the day. Among other examples of lawgivers, Rousseau mentions the Decemvirs (a commission with ten members) who had set out the first legal system for Rome, as developed over several years and then inscribed on twelve bronze tablets around 450 B.C. And Rousseau specifically quotes these Decemvirs as saying to the people of Rome: “Nothing we propose to you can become law without your consent. Romans, be yourselves the authors of the laws that are to make for your happiness.”

Note: There were some stunning twists and turns (not mentioned by Rousseau) in the final stage of this process (Cornell, 1995). A second set of Decemvirs tried to introduce a few laws more favorable to the patricians (and then hoped to stay in power themselves), but a general strike by the Roman populace in 449 B.C. forced a compromise that provided the foundation for Roman law and thus for much of civil law down through the centuries.

Are there other clear historical precedents for this type of approach?

There certainly are other examples in which careful, uninterrupted work of a committee has yielded lasting results — as with the previously cited Constitutional Convention and with the Bretton Woods Conference that met for a month in New Hampshire in July 1944 and set up rules for the operation of the international monetary system after World War II (which worked well until Nixon took the United States off the gold standard in August 1971). As another example, one might consider the United Nations Conference on International Organization (the “San Francisco Conference”) that met from April 25 to June 26 of 1945 and led to the drafting and signing of the United Nations Charter.

My proposed plan seeks this level of careful thought and discussion but involves a distinctive feature, as I allow for the prospect of a “decoupling” between the actual intellectual effort involved in developing a plan and any official politically assigned responsibility when starting this project (or any political assurance that the plan will be accepted when finished).

In principle, this independence from political constraints should give a wonderful “operational freedom,” allowing each team to work in whatever way seems most productive. But it also leaves an immense pressure on the team to come up with an acceptable, actionable, functional plan. The plan needs to be so good — so much better than anything else yet proposed — that it will be adopted even

when offered to a world that never authorized or commissioned this team to address the problem. Any substantive mistake in reasoning, any unfair bias that ignores the needs of key stakeholders, any overly cynical or overly idealistic view of the world will reduce the chance that the team could develop an acceptable, practicable, actionable plan.

In this sense — thinking about the fundamental issues but doing so without any prior political "authorization" — there would be some parallel with the work of Hugo Grotius, who had published *On the Laws of War and Peace*. This book, published in 1625, offered ideas that played a critical role in the several treaties that ended the Thirty Years' War and led to the Peace of Westphalia in 1648. As explained by Henry Kissinger in *World Order* (2014), these treaties shaped Western conceptions about the appropriate role of the state, and thus the ideas of Grotius still leave their traces in the very structure of our modern world order. Good ideas matter and can change the world.

XI. Where Can Such Teams Help the Most?

Since the idea of special focus teams holds up against all these initial questions, it seems appropriate to start testing the plan — applying this strategy in situations where ideas generated by these teams are most likely to have the largest, most immediate practical benefits for society as a whole.

Our approach should have broad applicability, but we've decided to focus initial efforts by carefully picking projects that maximize the prospects for synergy with other work around the world.

Given our relentless focus on the need for action, and given the complex forces at play in society, we have decided to look for emerging issues that 1) are critically important for the human future, 2) are beginning to get more global attention, and 3) lie in areas that are likely to demand (and likely to allow) some decisive governmental action.

Choosing projects this way avoids the need to "do everything ourselves." We can focus on bringing added value as we expand on, evaluate, and integrate ideas offered by others. To do this, we need to get into a field early enough to absorb ideas from world-class experts and advisors (as on the upper left side in

Figure 6), while still allowing ourselves time, as needed, to rethink and reframe all key issues and to search for unintended consequences or unexpected side effects that might arise with each potential course of action.

As our ideas in a particular area begin to consolidate, as we see actionable strategies for society to implement (and start to find that our ideas survive the scrutiny of others), we intend — as noted near the bottom of Figure 6 — to share our proposals with outside groups working to draft relevant legislation. This means that there will be an immense benefit — for us and for society — if we can keep the timing, selection, and resourcing of our projects well-aligned with a prioritized list of the toughest problems that society will soon need to tackle.

Later stages of work at Humanity 2050 may consider other ways of addressing the challenges of the Anthropocene, but — at least for the time being — we want to avoid any projects that would require some fundamental paradigm shift in the structure of society. We see little practical advantage in playing the role of some lonely prophets, pointing out long-range existential risks, or proposing "solutions" — as with ideas about global governance — that are so idealistic that there's no meaningful chance they'll be adopted in time to solve our other problems. We don't plan to scout decades ahead, looking for other places where carts might get stuck in the mud. We just put our shoulder to the wheel, helping with ongoing efforts by showing how thought can be empowered to help society develop better plans and thus act more effectively to solve some key challenges of the Anthropocene.

XII. Climate Engineering as a First Test Case

We selected climate engineering as the initial test case, and we've made immense progress as we've worked on this project for the past year. We now are seeking financial support to expand this work and to further develop the use of special focus teams as a platform strategy for solving the problems of the Anthropocene.

Climate change is one of the toughest challenges of the Anthropocene, and decisions here become more difficult as the situation becomes more desperate. Indeed, society may soon face a "devil's choice" — a choice between accepting

the risks of runaway climate change (Steffen et al., 2018), and the risks of using some kind of climate engineering to help control the temperature while society struggles to find a more permanent solution.

Several methods have been proposed for mitigating the rate of global warming, with most attention on the possibility of spraying aerosols in the stratosphere, reflecting about 1% of incoming sunlight back into space (National Academy of Sciences, Engineering, and Medicine, 2021). These aerosols would be similar to those released by major volcanic eruptions (which can temporarily cool the earth if they are violent enough to force sulfur dioxide up into the stratosphere), and it appears that deliberate distribution of such aerosols could provide a relatively rapid, cost-effective way to slow the rate of global warming. However, there are many unknowns and many risks, with some key concerns involving the risk of reducing rainfall in some areas, questions about international cooperation and the risk of conflict over decision-making authority, potential effects on the ozone layer, risks that climate engineering might discourage or delay efforts needed to control emission of carbon dioxide and other greenhouse gases, and the risk of a very dangerous, very rapid increase in mean global temperature if the program ever were halted abruptly.

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As we started working on this project, we did an initial review of the literature and had conversations with several key leaders in the field. It's clear that experts have discussed most component pieces of a climate engineering plan — giving a huge stack of books, papers, and policy proposals. And the U.S. National Academies recently issued a report (looking about five years ahead) with "Recommendations for Solar Geoengineering Research and Research Governance."

Thus, there are rich sources of data and ideas available. Yet, no one has made a systematic effort to see how all these pieces might fit together in an integrated plan that could — as needed — be run in a stable way for the rest of the century. No one has yet moved through stage #2b, working to assemble a plausible action plan that is ready to be debated by scientists, policymakers, and the broader public.

In June 2020, we thus started a pilot project designed to begin integrating and synthesizing all these ideas about climate engineering. Working with an amazing intern (Aurelia Moriyama-Gurish) that summer, we first set up a rough "blueprint"

to show how the program might operate. Thereafter, I began drafting an "operator's manual" for the program, with notes assembled as if written for a future CEO who might take over the climate engineering project in 2035 and who would need to know the key challenges facing the organization. This draft version of the operator's manual was set up to include social, political, scientific, technical, economic, moral, legal, and managerial concerns, and a substantive portion of the report then focused on risks of unexpected/unintended side effects. In writing this, I soon realized: operational risks will be so daunting that the program — as currently conceived by the climate engineering community — may not be stable enough (last long enough) to do any substantive good for the planet.

Over the past year, this project has received phenomenal help from a brilliant, recently retired engineer (Ken Patterson). We have been reshaping the climate engineering report so that it begins with an analysis of the initial, idealistic, most commonly discussed way of setting up the climate engineering program (i.e., trying to set it up as an open, cooperative, international effort). We then consider various ways of modifying the climate engineering program, working to see how such changes might affect the overall efficacy of the program.

Note: In the stance that we take, the scientific, technical risk is just one part of the analysis. Risk, as more broadly conceived here, is the risk that the whole program collapses, and this could easily happen because of problems involving damage claims, lawsuits, cyberattacks, or by misinformation campaigns that rally public support against the program.

At this stage, we are far enough along, and we've had enough conversations with groups working on climate engineering, so as to see some of the ways in which our careful patterns of thought already begin to pay off. We now seek financial support so we can: 1) finish our report; 2) introduce our new methods for evaluating risks to the stability of the program; 3) offer a list of potential problems with climate engineering that are not yet receiving adequate attention; and 4) point out ways in which plans for the climate engineering program will need to be restructured.

* * * * *

In undertaking this project, Humanity 2050 did not begin with any preference for a given approach or any presumption about the final decision. We are not "for"

or “against” climate engineering, or any specific strategy via which this might be achieved. We just work to help society overcome the cognitive barriers involved in integrating and synthesizing ideas so as to develop a concrete plan, and we expect that this work will be useful in two ways:

1) There will be critical contributions to discussions of climate engineering: having a plausible, well-defined plan on the table is vital, for it will help highlight any key questions that remain and will make it easier for others to evaluate prospects for climate engineering.

2) This project will offer a critical real-world test of our new approach, allowing an opportunity to extend, adjust, and refine our strategies for making the kind of “Zone IV to Zone II transition” that is needed to help society address the challenges of the Anthropocene.

With financial support, our work at Humanity 2050 can have a powerful, positive impact on the field of climate engineering. Our analysis will allow society to make a more careful go/no-go decision about prospects for climate engineering deployment. And, if a climate engineering approach is deployed, the work of our special focus team — with years of effort devoted to thinking about potential unintended consequences and unexpected side effects — will give the program a better chance of avoiding potential hazards, allowing the program to be run in a way that will dramatically improve the prospects for a successful outcome.

XIII. Special Focus Teams for Other Challenges of the Anthropocene

The use of special focus teams will help with many other challenges of the Anthropocene, and our work at Humanity 2050 may expand next to consider: 1) other aspects of climate change; and/or 2) problems of misinformation and disinformation that now threaten the very fabric of society.

This kind of work will require team members who are humble, brilliant, endlessly curious, and compassionate, who have good judgment, who are focused, who are willing to change their mind, who strive for a pan-disciplinary worldview, and who are ready to devote their lives to the service of others. Perhaps these individuals will not be easy to find, but these projects will offer them the opportunity to work with other equally talented and passionate people, and

there is the thrill of working at a level that will help address some of the most pressing challenges now facing the planet.

Everyone joining the team will need to undergo thorough training. There is — as yet — no formal textbook for work in these realms, but everyone should be a voracious reader — easily able to read and understand all the dozens of policy reports pertinent to their own current project, and able to understand and try using all the new "modes of thought" developed for use at Humanity 2050 (as discussed in more detail in a 2018 draft manuscript entitled *Mind in the 21st Century: Human Thought for a Human Future*).

We need to be honest about the cognitive challenges inherent in developing plans for the Anthropocene. And we need to distinguish carefully between methods (who is selected to be on the team) and goals (who the team works to help). Love and compassion, and some version of the golden rule, will always be at the center of our work at Humanity 2050.

The cognitive challenges involved in long-range planning are so profound (Tetlock and Gardner, 2015) that finding people who can think clearly amidst all the complexities of a new procedural epistemology will be, by far, the hardest part of recruiting a team. Prioritizing the recruitment of people who can rise to this challenge — who will find it invigorating rather than burdensome — will allow us to make a useful, distinctive contribution in helping to address the challenges now facing humanity.

Ultimately, this team, like everything that we do at Humanity 2050, will focus on the desperate need for action that will help solve the problems of the Anthropocene. We have no intention of somehow replacing or supplanting all the wonderful work of technical experts and policy experts that occurs in the upper box on the left-hand side of Figure 6. We just bring added value with a new mode of thought (as on the right-hand side of Figure 6), helping society move more reliably and safely from left to right in the sequence below:

Information → Thought & discussion → Plan → Action → Safer world

Society will need to move through this sequence dozens of times in the decades ahead — working, turn and turn about, to address each of the many challenges of the Anthropocene. Each individual problem will require intense intellectual effort, and will need separate, specially trained teams (each team working as on the right-hand side of Figure 6, continually updating, revising, and double-

checking plans until society is ready to act).

We are confident that our first test case in climate engineering will make contributions that are important enough so as to highlight the power and utility of our new approach. This approach will offer new ways to think, new ways of orchestrating thought that can be tested over the next few years. We need financial support and hope you will join us as partners for change. Please send queries, comments, and advice to carl@humanity2050.org. With your help, we can accelerate progress across many challenges of the Anthropocene, helping to ensure a thriving future for our children and grandchildren.

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About the Author

Dr. Carl Pabo's curiosity has led him to develop a kind of "pan-disciplinary worldview." His early research in biophysics, working on the structure and design of DNA-binding proteins, led to a series of academic appointments and honors, with his election to the American Academy of Arts and Sciences and the U.S. National Academy of Sciences. However, impelled by deeper questions about the meaning and limits of human knowledge, and concern about prospects for a livable human future, Dr. Pabo resigned his tenured faculty position at MIT to work on these much harder, much more important problems.

After years of work needed to develop a better way of modeling and monitoring thought (with a Guggenheim Fellowship and with appointments as a Visiting Professor at Caltech, Stanford, Berkeley, and the Harvard Medical School), Dr. Pabo returned to Caltech again in 2017, teaching a course on "The World in 2050." That same year, he founded Humanity 2050, an institute that uses his theories of thought to help find practical solutions to some of the most wickedly complicated challenges of the modern world.

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