The Nature and Value of Diversity: Going beyond Business (as usual)
Provocations from participants of the 2022 Meeting of Minds

Participants of the 2022 Meeting of Minds prepared written provocations related to their unique expertise in advance of the discussion. These were used to seed the conversation and enable focus on points of intersection, commonality, and debate across fields. A summary of the discussion can be found here.

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Section I: Biology, evolutionary science, neuroscience

Promoting Innovation and Discovery in Experimental Evolution — Richard Lenski

I'm an evolutionary biologist. Unlike most evolutionary biologists, I study evolution as an ongoing process rather than an historical science. I do this by conducting experiments with fast-evolving systems including microorganisms (bacteria and viruses) in the laboratory and digital organisms (programs that replicate, mutate, and compete) in virtual worlds. These experiments shed light on some of the factors that can promote or impede innovation and discovery.

From the suggested readings for this meeting, I think we are mostly on the same page with respect to the potential benefits of diversity. We may use different words in our respective fields, and we face different challenges in trying to measure the benefits and quantify potential costs. The benefits of diversity revolve around ideas like robustness, stability, resilience, exploration, adaptability, and innovation. Broadly construed, I think they fall under two overarching themes: (i) Diversity can help *avoid bad outcomes*, including the extinction of a species or the collapse of an economy. (ii) Diversity can *promote good outcomes* by facilitating innovation, such as by discovering new resources for an organism or new opportunities for a business. My focus here is on the latter.

Biological adaptation by natural selection requires genetic diversity. Without heritable differences, adaptive changes cannot persist and accumulate across generations. However, a random mutation in an organism's genome is more likely to be harmful than beneficial, and so there is also selection to avoid making mistakes. Indeed, organisms have evolved elaborate mechanisms for proofreading their DNA during replication, thereby limiting mutations. Yet, when organisms encounter changed conditions or new environments, the rare beneficial mutations take center stage. Thus, there is a fundamental tension in evolution between minimizing mistakes and promoting innovation. What are some factors that evolving systems—or we, as experimentalists—can tweak to shift the balance toward innovation and discovery?

Embrace uncertainty and serendipity: We always include replicate populations in our microbial and digital experiments. The replicates are identical at the start, they face the same challenges, and the organisms mutate at random (without foresight). Invariably, however, some populations solve hard problems that others do not; and if a problem is easy, then some populations solve it faster or more efficiently than others. Our experimental systems allow us to preserve intermediate states, and so we can *travel back in time* to examine the causes of these differences. With easy problems, it might simply be a matter of finding a suitable mutation as fast as possible. With harder problems, though, we see the emergence of *historically contingent* outcomes, in which a lineage's previous steps open or close the door to future opportunities by changing the *adjacent possible*, sometimes even before those opportunities become visible to selection.

Reward incremental steps: Some problems are hard. When faced with a complex Boolean logic problem that requires the coordinated execution of many instructions, none of a large number of populations of digital organisms were able to solve that problem, even though a solution would have provided a large fitness advantage. However, many otherwise identical populations solved the same hard problem when the environment was structured to provide the organisms with small fitness benefits for solving other, simpler problems along the way. No two populations solved the hard problem in the same way, and no particular simple problem had to be solved before eventual success on the hard problem.

Resist the temptation to allow only uphill moves: In our experiments with digital organisms, we saw that deleterious mutations sometimes occurred on the line of descent leading to the solution of hard problems. We sought to understand whether these missteps were inconsequential noise or, alternatively, contributed substantively to the eventual solutions. We found that a common motif was *one step backward before a larger step forward*—that is, a mutation that disrupted the solution to one problem was followed by another mutation that solved a more rewarding problem (and, in some cases, by yet another mutation that restored the previously disrupted solution). It's important to understand that natural selection is not usually an instantaneous live-or-die process owing to *genetic drift* (stochastic effects in finite populations). Thus, some deleterious mutations get lucky and persist for a while, just as some beneficial mutations will die out before gaining an adequate foothold. To examine this issue further, we conducted experiments that either allowed or prevented deleterious mutations (by pre-testing each and

every mutation's fitness effect before placing it in an evolving population). Preventing deleterious mutations actually tended to impede adaptation over the long run, which implies that enough of them served as useful *stepping stones* to overcome their short-term disadvantage. Similarly, in a 75,000-generation experiment with bacteria, only one of the 12 populations evolved the ability to use a secondary source of carbon and energy that was present throughout the experiment. In fact, when this new ability first appeared in that singular population, it was so inefficient that it provided no measurable fitness advantage. However, the lineage with this incipient novelty got lucky and persisted until it acquired another mutation, one that refined the new ability and gave the cells a tremendous benefit.

Avoid winner-take-all outcomes: Genetic variation is necessary to fuel adaptation by natural selection. However, the very process of selection also reduces diversity within a population, as the winners displace losers during *selective sweeps*. However, diversity can be sustained by *negative frequency-dependent selection*, which occurs when the advantage of a new mutation declines (and may disappear) as the mutant type becomes more common. This feedback prolongs the persistence of the more diverse ancestral population from which the beneficial mutation arose. In experiments with digital organisms, we accelerated the discovery of solutions to hard problems by reducing the advantage of having solved simpler problems as more and more members of the population had that ability. In effect, the fitness peak associated with solving a problem became flattened under the growing weight of individuals with that ability. This flattening propelled populations to explore more of the adjacent possible, thereby promoting the discovery of valuable solutions to other problems. Adversarial interactions may also promote innovation, as we've seen in experiments with viruses that infect bacteria. In that work, some virus populations discovered a new way of infecting bacteria via a coevolutionary trajectory that required genetic changes in both populations. Recombining genomes (as occurs in sexual organisms) can also ameliorate the diversity-purging effects of selective sweeps. With recombination, a beneficial mutation can spread at one locus (gene), while variants at other loci behave more or less independently depending on their physical linkage to the beneficial mutation.

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Emergent behavioral diversity – Corina Tarnita

Across biological systems, there are so many sources of individual variation (differences among individuals[1]) that one can always easily argue that all individuals are different and, thus, that all groups are, to some degree and in some dimension, diverse. Research over the last decade has, perhaps most surprisingly, revealed that even clonal (genetically identical) individuals will differ in some respects, e.g., in their response thresholds to environmental stimuli. Just as easily, one could pick any one dimension of diversity to focus on and argue that most social groups are not diverse. For instance, genetic diversity is thought to be destabilizing to social groups by fostering free riding, an argument that is often invoked when hypothesizing why all highly complex multicellular organisms (animals and plants) are clonal and why all highly complex social groups are comprised of a mother (or one mating pair, as is the case of termites) and her offspring. In that sense, advanced multicellularity/sociality is not genetically diverse.

I will, however, not focus my provocation on such pre-existing differences among individuals, but instead on emergent behavioral diversity—the kind of "latent potential" or "diversity of outcome" that can only be unlocked when individuals are part of a social group, under the right conditions. Such behavioral diversity can arise even when individuals are otherwise very similar, and it likely played a critical role at the origin of several major evolutionary transitions (multicellularity, eusociality) [2], when small groups of (nearly) identical individuals had to somehow outcompete a solitary ancestor that had successfully been around for a very long time. Importantly, even in a social group facing the same context, an individual can spontaneously take on different roles depending on the composition of the group.

In a recent op-ed on DEI efforts in US higher education, Robbert Dijkgraaf—the former director of IAS and the recently-appointed Dutch Minister of Education, Culture and Science—emphasized what he called "diversity of destinations"[3] as a fundamental but underappreciated and underdiscussed goal. His use of "diversity of destinations" to contrast "diversity in background" parallels the distinction I draw above between emergent behavioral diversity and pre-existing diversity. When it comes to such emergent individual behaviors/outcomes/destinations, I think there is much to learn from biology about how one could construct the ripe conditions for fostering and creating value from diversity.

Behavioral diversity can take many forms, not all of which are (always) good for the collective: division of labor or task specialization, dominance hierarchies, antisocial (e.g., free-riding) or asocial (e.g., loner) behaviors, or the ability to solve different types of collective problems. Whether behavioral diversity does arise depends on a suite of factors—such as ecological context (and associated selective pressures), scale (e.g., size of the social group), physical environment (e.g., nest architecture)—all of which play a role in amplifying or suppressing the preexisting differences among individuals.

Behavioral diversification in the form of task specialization is not always favored by natural selection. For instance, not all ant colonies exhibit division of labor—some species make colonies of millions of individuals, all of which are ultra-specialized, while other species make colonies of millions of individuals that all seem to flexibly be able to

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[1] E.g., genetic variation, demographic variation, morphological variation.

[2] Y. Ulrich, J. Saragosti, C. K. Tokita, C. E. Tarnita, D. J. C. Kronauer (2018) Fitness benefits and emergent division of labour at the onset of group living. *Nature*, 1–19.

[3] "But sometimes, I become gloomy of the increased thinking in terms of background, instead of destination. [...] We have to be careful not to bring personal background too much into the foreground, and to view identity as a predestination. [...] The goal of university diversity policy is to welcome everyone to the home of science, in full acknowledgment that for many the path there is long and full of obstacles. But let us watch out not to try to cram everyone who eventually gets in into the same template. Or, worse, lock them up in the strait-jacket of their identity. Science also needs to be a safe space, a refuge, where you can lay down the burdens of environment and culture. Where you can develop yourself into directions you did not know you had in you. […] Can we also put that diversity of destinations on the agenda?"—https://www.nrc.nl/nieuws/2021/05/14/hokjesgeest-a4043583

switch between tasks. Similarly, cells in most human tissues irreversibly differentiate during development (with the notable exception of the immune system[4]) but cells in other multicellular animals (e.g., sponges) continuously switch between types. Different ecological pressures can account for these different levels of specialization/diversification vs flexibility/uniformity. When flexibility is adaptive, having a fraction of 'lazy' (inactive) individuals in the group can also be adaptive because it can facilitate quick changes of group focus[5].

Creating the conditions to interact according to similarity (homophily) but retaining an ability to also interact across differences (heterophily) seems critical to harnessing the benefits of diversity without succumbing to its costs (e.g., group fracturing). Depending on the ecological context, social groups can also oscillate temporally between selection for behavioral diversification (e.g., when task allocation is beneficial) and selection for uniformity (e.g., when consensus-building is necessary for collective action—honeybees are a great example of navigating both regimes. They achieve this by, as needed, "interacting with like" to amplify specialization or "interacting with different" (aka cross-inhibitory interactions) to suppress differences[6].

Anti-social and asocial strategies might not always be inefficient, maladaptive, or destabilizing strategies; they could have adaptive value, and thus may be worth purposefully fostering, as groups can be strengthened by individuals that are temporarily outside the social dynamics. For instance, free riders can be destabilizing to the status quo but can also contribute to innovating strategies for longer-term resilience in systems that adapt to them. Most, but not all, social systems have evolved mechanisms for preventing or suppressing free riders. Those that have not, harness other types of behavioral diversity to persist. For example, slime molds seem to lack a mechanism for strictly controlling genetic composition and preventing free-riding and the associated demise of the social group; however, they hedge their bets by setting aside a subpopulation of loners that remain outside of the social group (and are thus not vulnerable to free-riders) but whose offspring can eventually recreate the social group.[7]

How can we shape (human) systems and environments to harness diversity and create value from it?

- **Create opportunities for group interactions in small groups**: in groups that are neither too small nor too big, spontaneous self-organization allows individuals to harness even minute and unknown differences among them and lead to individuals finding their own place/strength. The interactions can be oriented towards uncovering problem-solving, resourcefulness or adaptation skills (e.g., in business) or a wide range of traits and skills (e.g., in academic institutions).
- **Reshuffle groups (rather than pre-assigned roles) periodically:** Behavioral outcomes depend on group composition, so reshuffling groups could help individuals unlock different potentials.
  In reshuffling, different kinds of group composition could be considered to maximize the likelihood of different emergent roles: (i) random; (ii) no vs some evident background diversity e.g., in seniority, type/degree of expertise; (iii) some mixing according to previously emerged roles. The overall group-level outcome or success could be less important at an early training/development stage than creating different contexts for the same individuals to find their strengths/positions in a multidimensional behavioral space.

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[4] The immune system exhibits substantial flexibility in response to unpredictable attacks by pathogens, through activation and proliferation of specific immune cells and reallocation of existing immune cells to different defensive functions.

[5] M. Staps, C. E. Tarnita (2022) When being flexible matters: Ecological underpinnings for the evolution of collective flexibility and task allocation. Proceedings of the National Academy of Sciences 119, e2116066119.

[6] C. K. Tokita, C. E. Tarnita (2020) Social influence and interaction bias can drive emergent behavioural specialization and modular social networks across systems. *Journal of The Royal Society Interface* 17, 20190564.

[7] F. W. Rossine, R. Martinez-Garcia, A. E. Sgro, T. Gregor, C. E. Tarnita (2020) Eco-evolutionary significance of loners. *PLoS Biology* 18, e3000642). Other interesting strategies harness the free-riders themselves, e.g., biofilms of *Pseudomonas fluorescens*.

- **Modular environments allow for behavioral amplification:** In large groups, a physical environment that allows similar individuals to primarily interact (and be influenced by) each other will amplify the rudimentary specialization into full-blown specialization[5].

  In a modular organization, allow **modules to be linked via 'generalists'** that 'can talk to everyone' in order to facilitate the spread of information and/or consensus-building.

  In universities, for instance, this would argue for maintaining specialized departments that are connected via interdisciplinary groups/institutes of 'generalists' whose work naturally lives in multiple departments. But, interestingly, successful cross-disciplinary and interdisciplinary endeavors eventually become their own fields and act more like departments (e.g., biophysics institutes that have become departments or environmental institutes that have become schools of environment); this, in some sense, is a testament to the success of the original endeavors. As this natural progression occurs, for a university to continue to innovate in creating diversity of outcomes, it needs to constantly look at new opportunities for disciplinary cross-talk and for seeding new institutes that can remain truly 'generalist'.
- Periodically **create contexts that require uniform collective action** in order to temporarily allow interactions across different types that are specifically targeted at building consensus and community (even and especially across differences).
- **Create opportunities for a fraction of individuals to temporarily be outside the social dynamics** in order to increase the resilience of the collective. In organizations, this could mean a rotating subset of employees/members being tasked with looking at the organization as outsiders.

Intelligence and diversity - Simon Levin

My comments will build upon the excellent provocations from Corina Tarnita and Richard Lenski, with all drawing inspiration from evolutionary biology.

Without question, diversity holds the potential to provide collective benefits to any multiagent system, but also carries costs. A central question is to determine how benefits and costs balance, in relation to different environments. In biological evolution, natural selection helps find that balance; for institutional design, key decisions must be made in order to maximize performance.

The evolutionary tradeoffs are evident in Fisher's Fundamental Theorem of Natural Selection, which quantifies that the rate of evolutionary progress is proportional to the strength of selection multiplied by the genic variance, a measure of diversity in the system. As Lenski points out in his provocation, without variation biological adaptation would not be possible. But establishing variation is also not without cost, since it requires maintaining suboptimal genotypes and phenotypes. For this reason, mechanisms like mutation and recombination, which break up genotypes to create variation, are subject to natural selection themselves, and are expected to be higher in fluctuating environments. Indeed, Hamilton (Hamilton, Axelrod and Tanese, 1990) and colleagues have argued that sexual recombination has been selected for to large extent because of varying selection pressures mediated by parasites; but other sources of variation, including intrapopulation frequency dependence, also play a role.

In any case, the evolutionarily determined levels of mutation and recombination will in general reflect levels of environmental variation, whatever the source, and in turn will affect evolved discount rates (Livnat, Pacala and Levin, 2005). There are lessons here for institutions, including of course corporations, in that at the macroscopic (institutional) level, a longer-term perspective argues for low discount rates, while selection pressures operating at the individual level may lead to a higher aggregated discount rate; what that will mean for diversity is not clear. What is clear is that the challenge for companies recapitulates a familiar exploration-exploitation tradeoff in evolutionary biology: How is sufficient (costly) diversity maintained in relatively stable environments, given that its main benefits are in preserving long-term adaptability?

The discussion to this point identifies a number of central questions concerning diversity:

(1) ***What are the costs and benefits of diversity?*** Diversity, as already mentioned, is essential for adaptation in any system, reflecting the exploitation dimension of the explore-exploit duality. As Tarnita discusses in her provocation, it also creates the opportunity for task allocation and the construction of multi-agent complexes, which can be the building blocks for the next level of advance (Simon, 1996). Diversity is the engine of evolvability, and also enhances robustness (Draghi and Wagner, 2009)(Levin, 1999). On the other hand, diversity comes at the cost lower short-term success in stable environments, and also necessarily reduces redundancy, which itself is also important to robustness in variable environments.

(2) ***What then is the optimal level of diversity for any set of environmental or market conditions?*** As already discussed, this will depend on the environmental context, but more should be expected to be favored in variable environments. From an institutional perspective, adjudicating this balance is central to informed management.

(3) ***How is diversity established and maintained in natural systems?*** What is the interplay between top-down (design and macroevolution) vs. bottom-up (self-organization and microevolution). This is a fundamental issue in elucidating the emergent structures of natural systems (Levin, 2005), and raises challenges for management.

(4) ***What are the most relevant dimensions of diversity?*** Tarnita's invocation of Robbert Dijkgraaf's "diversity of destinations" is especially relevant here. Diversity comes in multiple forms, as Tarnita discusses. For maximal collective benefit, for any institution or corporation, one needs to understand how to encourage

a complementarity of traits that best serve the collective good. And. again as she and Dikgraaf point out, this may have little to do with initial labels; task allocation can create the essential functional diversity.

(5) ***How best can diversity be harnessed for the collective good?*** There is need here for informed collective intelligence , going beyond simply the statistical "wisdom of crowds," and taking advantage of the emergent diversity of destinations discussed in the previous bullet (Leonard and Levin, 2022). As Tarnita discusses, the strategy is not just in the creation of relevant functional roles, but through their optimal organization into modules and hierarchies that can exploit the fact that "more is different" (Anderson, 1972).

(6) How is the public goods tradeoff resolved, when the short-term interests of individuals are not necessarily in accord with what would be good for the group or institution? This is a broad open question, but much work exists on public goods across levels, and the importance of modularity in creating building blocks. (Tilman, Dixit and Levin, 2019)(Simon, 1962; Ostrom, 1990)(Hartwell et al., 1999). Addressing the public goods challenge is perhaps the greatest challenge facing societies, and similar issues need to be confronted for institutions, notably corporations (Leonard and Levin, 2022). Getting individuals to act in the collective good is a game-changer.

These I think will be the main questions that will involve our discussions on November 15.

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Section II: Economics and society

In Search of Institutional Diversity – Susan M. Fitzpatrick

I am grateful for the early submissions by Richard Lenski, Corina Tarnita, and Simon Levin and the comprehensive framing they provide for thinking about diversity as strategic attribute of successful biological and social systems. In this piece, I use elements of their beautifully formulated essays to discuss the importance of the concepts of diversity they provide in the context of institutions – particularly two highly derived cultural institutions: philanthropic organizations and universities. Funding organizations and academic research universities are considered major partners in the generation of knowledge and the testing of solutions needed for continued progress against societal issues. Not surprisingly, these funders and universities also share an overlapping professional workforce and organizational structures. If you look across these institutions it is worth asking to what extent do they differ from one another and along what dimensions?

Sitting in a 150-year-old cottage on the coast of Maine thinking about this provocation piece and staring at a blank screen I called on the well-known trick for overcoming writer's block: turning to the dictionary. Googling the "definition of diversity" instantly yielded responses along the lines of the two examples below:

1. the state of being diverse; variety.

"there was considerable diversity in the style of the reports"

2. the practice or quality of including or involving people from a range of different social and ethnic backgrounds and of different genders, sexual orientations, etc.

"equality and diversity should be supported for their own sake"

The circularity of number 1 makes it completely unhelpful for our purposes. Number 2 is interesting for its use of the word "practice" which suggests deliberate action over time and the repetitious use of "different". If variety/difference the key attribute of diversity and diversity is a sought-after attribute how much variety is needed and what differences matter?

Looking up from the screen my eyes fell on Webster's New Century Dictionary (1910) and the New Universities Dictionary (1917) sitting quietly on the cottage's library shelf. Curious, I wondered how diversity was defined 100 years ago. Interestingly, definitions were provided for divergence, divers (no e), diverse (with e), diversification, diversify, diversion, and divert – there was no entry for diversity. The common element defining the words with a shared root was, not surprisingly, variation. Diversity also shares a root with divergence – whose definition emphasizes separating and separateness. I wondered to what extent we, as a group, can think about separation in the context of diversity?

How are ideas about variation, difference, and separation manifest in the 21st century university or the large private foundations that partner with them? The significant ongoing commitment, long overdue and much needed by both philanthropy and academia, to embrace "the practice or quality of including or involving people from a range of different social and ethnic backgrounds and of different genders, sexual orientations, etc." is without doubt introducing dimensions of diversity that are strengthening both kinds of institutions. But is this commitment enough to ensure the "state of being diverse" when it comes to the knowledge generation and the responsible application of knowledge to solve the many challenges we face? A diverse academic and philanthropic sector with a workforce varied along the dimensions of social background, race, ethnicity, gender, and sexual orientation is highly valued but are there additional dimensions that need consideration as we seek to sustain the emergence of creativity, novelty, and innovation? Are the dimensions of diversity targeted at the level of the individuals comprising the workforce of academia and philanthropy enough to achieve what Lenski describes as strengths of diversity: avoiding bad outcomes and promoting good outcomes? Is focusing the lens for viewing diversity at the level of the individuals that comprise foundations and universities sufficient? What do we find if we focus our sight on higher levels of organization?

Tarnita's provocation piece beautifully summarizes the factors that influence the way diverse sets of individuals become successful when functioning as a group. At JSMF we have seen these factors at work in our support for

multi-institutional collaborative research teams and study panels. Over the past three decades our observations have been codified a set of best practices – many of which enjoy the support of organizational behavior scholarship. Depending on how our group discussion develops I will be glad to share some of our real-world lessons. I was particularly struck with Tarnita's "reshuffling" and the ways individuals' roles evolve or emerge within a group. I offer one supporting anecdote. In that same library of that same Maine cottage, my husband took on the task of completing a vexing jigsaw puzzle left unfinished by a prior occupant of the cottage. While he focused on this goal of task-completion, I was in the room, but engaged in other activities, so I would sporadically "help". His strategy for the puzzle was assembling motifs and then stitching these motifs together. My strategy was to seek individual pieces to fill in holes that he swore has been lost or not provided. Our chosen strategies might reveal something about us as individuals – but the roles and goals we selected probably reveal more about who we are as a team. With different tasks and different motivations, the roles and strategies we pursued could look quite different.

Individuals, teams, groups. As we go up the scales of organization – each level will manifest an identity and a culture that departs from what might be predicted from the sum of the individuals comprising them. Regardless of how much effort is expended on "the practice or quality of including or involving people from a range of different social and ethnic backgrounds and of different genders, sexual orientations, etc." because evidence shows that a diversity of lived experiences contribute to diversity of thought, do these efforts at the individual level ensure diversity at higher levels of organization?

Ross Douthat, writing in the Oct 30 New York Times about campus diversity, observed while achieving a kind of diversity along gender, racial, and ethnic dimensions, academia is also conspicuously lacking in diversity of class, ideology and thought. For example, much attention has been paid to the lack of political diversity in academia (see for example https://heterodoxacademy.org/blog/bbs-paper-on-lack-of-political-diversity/). Not surprisingly, foundation staff, particularly at large foundations, are drawn heavily from academia and also lean heavily Democrat (https://www.philanthropydaily.com/97-of-political-contributions-by-employees-of-top-foundations-went-to-democrats-in-2019-20-2/). How diverse can organizations be on a deep level when the individuals comprising philanthropic and academic research universities come in lacking diversity along a number of important dimensions and then, as a result of shared experiences and education develop a common sense of what a problem looks like and what its potential solution space might be?

One of the great traditions of American private philanthropy, and surely one of the reasons our tax code is favorable toward nonprofit organizations, is the diversity of decision-making grounded in the notion of American federalism, a resistance to yielding too much authority to a central government (see https://www.jsmf.org/about/s/2003-keep-philanthropic-funding-distinct.pdf and references therein). The widely distributed decision-making has allowed support for ideas that are considered heterodox to the mainstream or that challenge common wisdom assumptions. Similarly, the institutional diversity of American higher ed is credited with as one of the strengths contributing to its success (see https://www.academia.edu/4682590/UnderstandingInstitutionalDiversityinAmericanHigherEducation).

There is increasing pressure from vocal critics of foundations and their tax-exempt status for philanthropic organizations to use common application forms, and under the guise of sharing best practices, to standardize decision making. There is also an increasing call for foundations to "partner" with other funders, a de facto way to decrease the diversity of decision-making. Foundation staff, who are already drawn from a somewhat narrow slice of the general population, increasingly turn to professional societies for networking and career advancement risking group-think homogenization.

American institutions of higher education increasing strive to be more alike than different. Counterintuitively, the competition for students has actually driven campuses to become more standardized in their offerings.

The concern is that a focus on diversity at an individual level of analysis and along a set of dimensions as described above, "people from a range of different social and ethnic backgrounds and of different genders, sexual orientations, etc" may result in institutions staffed by individuals similar along other dimensions – the questions they ask, the approaches and solutions that seem desirable, the issues deserving of attention, how problems are defined, their sources of information, and from whom they seek advice.

In summary, in the spirit of Simon Levin, I offer a few questions I hope we might consider during discussions:

1. In what ways does personal diversity co-exist with professional diversity?
2. What values are needed to support both individual and institutional diversity?
3. Is diversity only difference or is it also separateness? How do institutions create atmosphere supportive of the heterodox?
4. How do we avoid the 20/80 problem in academia and philanthropy – where only a small number of issues/people/approaches garner the bulk of the resources?
5. What factors support respectful separation – without perturbation how does novelty emerge?

How can we shape systems and environments to create value from diversity? – Cathy Kling

In recent years, the concepts of ecosystem services (or nature's contributions to people), and natural capital have become well embedded in environmental economics and related disciplines. These terms, and the literature that has evolved around them, emphasize the role that nature plays in enhancing human well-being, both in terms of producing goods and services that are traded in markets (food and fuel), and the many non-market goods and services that can be equally important to people's quality of life (wild bird populations, hiking trails, clean water for swimming, etc). Biodiversity provides ecosystem services and the stock of many forms of natural capital (clean water, wildlife populations, recreational land, forests, etc) are essential to the maintenance and provision of biodiversity. To tee up our discussion, I focus on environmental diversity and make three points.

1. **Our understanding of the value of biodiversity is increasing and extending to areas not previously appreciated.**

A substantial literature on the economic value of biodiversity and nature has developed (PNAS 100th Anniversary Special Feature, 2015).This research has identified and quantified ecosystem services associated with supply chains for marketed goods (e.g., timber, pollination services), innovations based on natural designs (e.g., medical advances), the direct enjoyment of nature and its products (recreation, spirituality, cultural values), and its role in protecting infrastructure from storms and natural disasters.

Recently however, nature's contributions to the financial and corporate world is coming into focus. Evidence suggests that biodiversity and natural capital losses can negatively impact sovereign credit ratings (Agrawala et al, 2022), can alter long term interest rates (Muller), and threaten economic stability (NGFS-Inspire).

Creating value from biodiversity in all of these forms requires government action and policy. An important step in this regard is to measure and monitor the stock of natural capital and associated ecosystems, a step which has been taken by the Biden administration with the announcement of plans to develop and continuously update natural capital accounts (National Strategy to Develop Statistics for Environmental-Economic Decisions, 2022). These accounts, for the first time, will allow the American people to assess the value of biodiversity and tracks its changes over time.

2. **Providing biodiversity can be costly and tradeoffs in the provision of alternative services**

There can be complementarities and/or competition between producing ecosystem services and the provision of both marketed and nonmarketed goods and services. Acknowledging these tradeoffs is necessary for creating the most value possible from natural capital and biodiversity-based ecosystem services. In a study quantifying ecosystem services from agricultural land use in the Midwest, tradeoffs in the quantity and value of services from food production (grain crops), energy production (ethanol from both corn and switchgrass crops), and water quality (reductions in nutrients to surface waters) was evaluated (Valcu-Lisman, Kling and Gassman). Tradeoffs between these services is stark. For example, to achieve a 45% improvement in both nitrogen and sediment loads into rivers and streams in the region, the available land area could be used to produce 150 million gallons of fuel (ethanol) and 0.28 million tons of food. Alternatively, the same water quality improvement could be achieved while producing about 55 million gallons of fuel and 1 million tons of food. Thus, in exchange for producing about 4 times as much food, fuel must fall by about 2/3's. Which set of products is most valuable depends upon the value of these marketed and nonmarketed services services.

3. Resilient provision of biodiversity ecosystem services can be even more costly

The system property "resilience" can have significant value in the provision of ecosystem and other services. However, more resilient provision of these services will come at an even steeper trade-offs and costs. Resilience has been defined and evaluated in a variety of ways across disciplines (see Longstaff, Kowlowski, and Geoghegan (2013). In another study of the cost of resilience related to improving water quality in agricultural watersheds (Rabotyagov, Valcu-Lisman, and Kling), we adopted their definition of Type 1 resilience: the capacity of a system to rebound and recover. To implement this approach, we developed a set of models to assess the costs of achieving a given water quality improvement with varying amounts of uncertainty. Water quality is heavily impacted by precipitation and thus is best understood as stochastic. For any given level of conservation actions on agricultural lands, the amount of runoff will vary depending on the amount of rainfall among other environmental factors. More expensive conservation actions (such as buying entire parcels of land and setting is aside) can act as a better buffer against run run-off of pollution and risk of flooding. Thus, more resilience (higher probabilities of achieving a given level of water quality improvement) can only be achieved at higher cost. The associated figure shows the costs of additional levels of resilience. In this example conservation practices that achieve 6 tons of nitrogen reduction into the waterways 50% of the time will cost $10 million annually. To achieve that same level 60% of the time, it will cost $40 million and to achieve it 80% of the time, the cost will be $100 million. Again, whether these trade-offs for additional resilience are worth the costs depends on the value more resilient system provide.


Iso-Cost Curves: Normal Approach
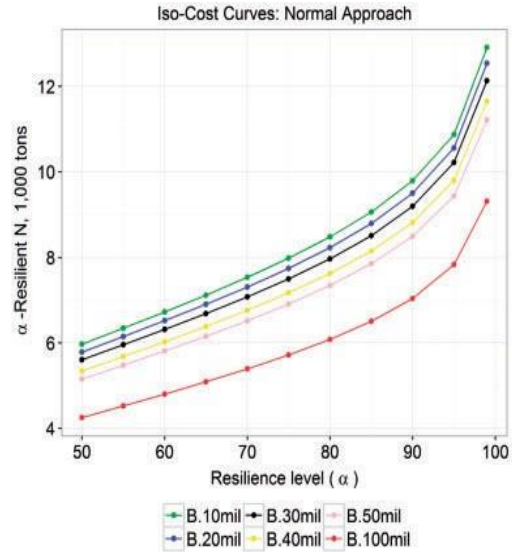
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An alternative approach to measuring diversity – and why it matters – Mathieu Lefevre

This provocation will focus on two sub-questions from our list: **What is the nature of diversity and how should it be measured?** and **What are the costs and benefits of diversity? What follows** is submitted from the point of view of a practitioner in the social change space. I will expand on how these ideas are applied into the world during our discussion in a few weeks.

1: What is the nature of diversity and how should it be measured?

In addition to standard measurements of diversity in human organizations (using race and religion as types of diversity, for example –both important metrics to track), organizations might consider integrating an element of diversity of *worldview* into their thinking, for example using the core-values model. Inspired by the work of academics like Jonathan Haidt and Karen Stenner (and others) and by the stories told, for example, by George Packer in *The Unwinding*, we teamed up with social psychologists to understand why people hold certain positions, hoping to shed light on the *hidden architecture* that animates the lives and views of people. We have done this very regularly since 2016 in the United States and in Europe on sample size of more than 80,000 people in total. We map and group people's core values by asking people questions such as '*which one you think is more important for a child to have: well-behaved or creative?*' *How much control do you feel most people have over the way their life turns out'? People should not do things that are disgusting, even if no one is harmed (agree/disagree)?* The result is segmentation "maps" which groups people into different segments or 'tribes'. One of the attributes of this method is that it is quite evocative and predictive – often more so than standard measures like voting behavior. Below is what this looks like in the US[8].
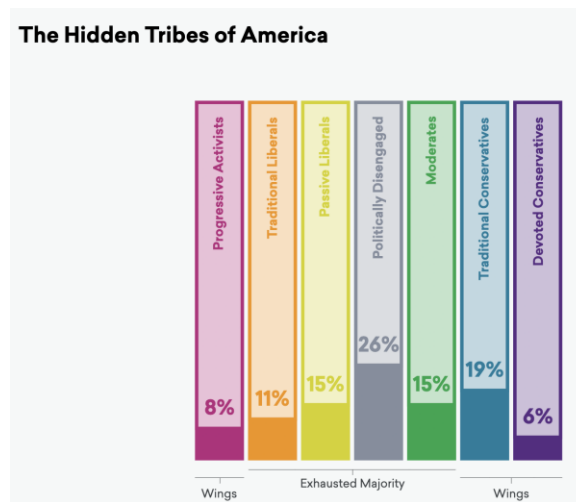
The originality of this methodology – and why it might help us think about and measure diversity in a different and complementary ways - is that it is derived using **only** questions drawn from social psychology (see above). None of the traditional socio-demographic indicators (race, income, education) are taken into account to make the segments. Once the segments are created, we layer on things like race or education or income or voting behavior. The results can be quite surprising, particular to partner organizations we work with. For example, in the US, our Progressive

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8 Please see www.hiddentribes.us for more

Activist segment is the wealthiest of all 7 segments and has the fewest Black Americans (3%) of any segment, followed by the segment at the other extreme of the chart, Devoted Conservative (4%).[9]

Why does this matter? As I will share in more detail when we meet, we use a quick version of this tool to map worldview diversity within the 150+ organizations with which we work in civil society, social change, philanthropy, media, business, government and in politics. What we often find is even when organizations have good metrics of diversity on race and religion, most of their leadership and teams are drawn from one or two of our segments, making them highly un-diverse on worldviews. Should we be widening our definition of diversity to arrive at a more precise definition of "optimal diversity?

2: What are the costs and benefits of diversity specifically when it comes to thinking about political systems? A look at Perception Gaps.

Many of the thoughtful provocations shared argue persuasively for the benefits of diversity in natural ecosystems and in business. I'd like to suggest that lack of diversity of worldview also has a cost in that it contributes to **polarization**. Specifically, our work shows that a lack of exposure to worldview diversity increases people's **perceptions gaps**, a contributor to polarization which we define as the gap between what we imagine an opposing group believes and what that group actually believes.

This matters: when opponents, for example Democrats and Republicans in the US, believe their opponents hold extreme views, they become more threatened, start seeing each other as enemies, and start believing they need to win at all costs. They make excuses for their own side cheating and breaking the rules to beat the other side. This is how countries fall into a cycle of deepening polarization.

Take the case of perceptions of how US history should be taught in US schools – a sensitive topic which risks becoming a new front in America's culture wars (see graph below). These conflicts are far-reaching: local school board meetings have devolved into violence, death threats and arrests. In a forthcoming study (still under embargo), we find that while some Republicans and Democrats hold strongly opposed ideological views, they are in a small minority. Republicans may believe most Democrats want the teaching of American history to be a history of shame, guilt and a repudiation of the country's founding documents, but we find that is not the case. Democrats believe Republicans want the teaching of American history to gloss over the injustices of slavery and racism, but that is also inaccurate.

What causes Perception Gaps and how can we fix them? The primary factor we have found to explain why some people have wider Perception Gaps while others don't is **diversity**. Specifically, exposure to social media (which tends to promote extreme content within a narrow set of views), college experience (which exposes students to people with similar beliefs) and exposure to most media (because media is more ideological) increases Perception Gaps. What helps reduce perception gaps – and thus polarization – is exposure to greater diversity: a wider range of news sources, connections with people who think differently and directly engaging with and cooperating with people whose experiences and views differ from our own makes it harder for us to see them as the enemy.
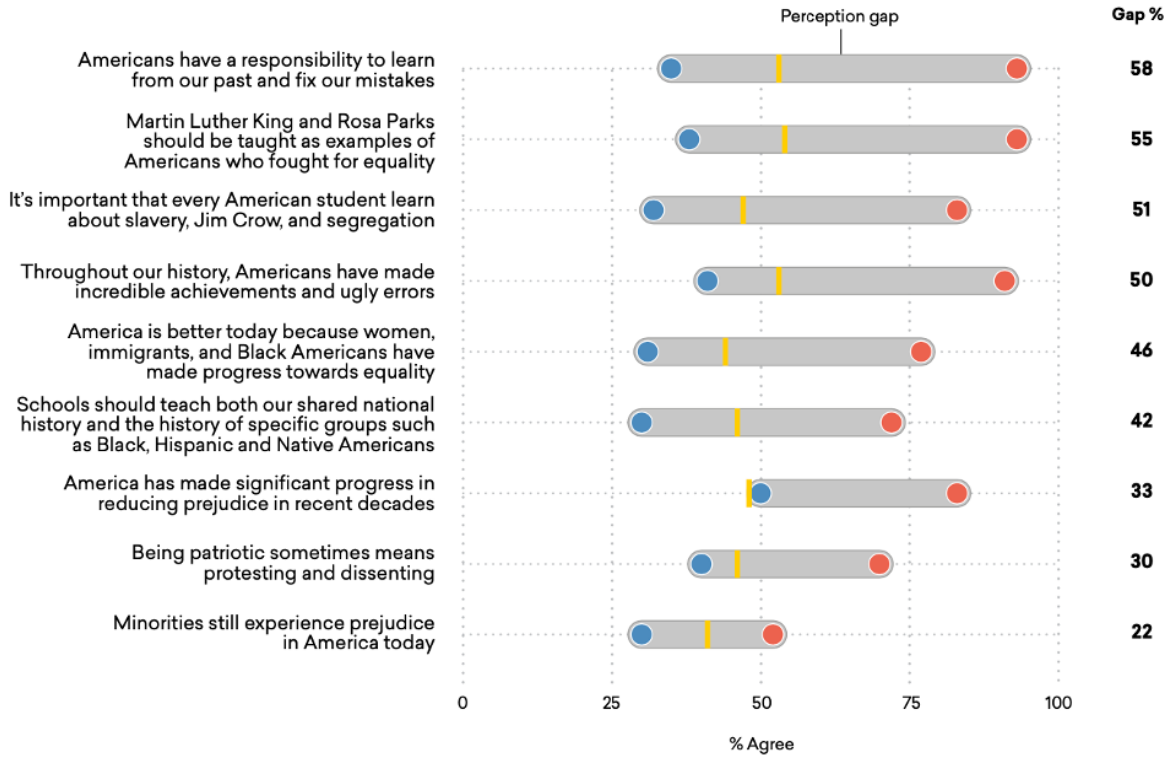
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9 See OpEd in the New York Times about this https://www.nytimes.com/2018/10/15/opinion/politics-race-white-tribalism.html

…And Democrats have equally distorted views of Republicans

- 🔴 Republicans' actual views
- ▎ Independents' estimates
- 🔵 Democrats' estimates

Perception gap

Gap %

Statement		Gap %
Americans have a responsibility to learn from our past and fix our mistakes		58
Martin Luther King and Rosa Parks should be taught as examples of Americans who fought for equality		55
It's important that every American student learn about slavery, Jim Crow, and segregation		51
Throughout our history, Americans have made incredible achievements and ugly errors		50
America is better today because women, immigrants, and Black Americans have made progress towards equality		46
Schools should teach both our shared national history and the history of specific groups such as Black, Hispanic and Native Americans		42
America has made significant progress in reducing prejudice in recent decades		33
Being patriotic sometimes means protesting and dissenting		30
Minorities still experience prejudice in America today		22

0   25   50   75   100

% Agree

Question: [Republicans] Do you agree or disagree with the following statements? [Democrats/Independents]
What percentage of Republicans do you think agree with the following statements?
Source: More in Common

17

Section III: Politics and business

Diversify Holistically to Reverse Polarization and Achieve Academic Excellence - John Chisholm

Achieving a diverse student body, faculty, and staff are worthwhile aspirations for any university. Diverse lived experiences and viewpoints improve our thinking, sharpen debate, and foster innovation. Properly implemented, academic diversity and inclusion initiatives can help mitigate and potentially reverse long-held prejudices and harmful, growing polarization. We advance a new, holistic approach that achieves both maximum, inclusive diversity and the highest academic standards. As a case study, we use MIT, which has been part of my life since before I was born: my mother was an MIT librarian when she was pregnant with me and until I was five. Recently, I served as president and chair of the Alumni Association.

Let a Thousand Attributes Bloom

As it applies to higher education, I define *diversity* as the degree to which students, faculty, and staff represent/demonstrate a range of different skills, knowledge, cultures, identities, geographies, experiences, ideologies, philosophies, values, and personalities, thereby providing the greatest opportunity to learn and grow from each other. There are a myriad of diversity attributes and even more ways to group them. I find three groups particularly useful:

1. **Physical/identity** characteristics, mostly immediately visible, include race, gender, age, ethnicity, language, disability, and sexual orientation.

2. **Cognitive/intellectual** attributes, less visible, include abstract vs. concrete thinking; risk aversion vs. risk taking; long- vs. short-term time horizons; collaborative vs. independent work styles; relationship vs. transactional orientations in dealing with others; and introversion vs. extroversion.

3. **Related attributes**—one's "extended phenotype," to use the words of biologist Richard Dawkins—include geographical location; industry; household income; veteran status; years of education; first-generation college attendance; civic associations, hobbies, and sports; and musical, sartorial, and tonsorial preferences.

Attributes can cross more than one group. For example, religion/faith, political orientation, and sexual orientations may reflect both identity and cognition. In *The Righteous Mind*, psychologist Jonathan Haidt identifies six foundations of morality—care, fairness, liberty, loyalty, authority, and purity—that individuals and cultures differ in valuing[2]. In *The Difference: How the Power of Diversity Creates Better Groups, Firms, Schools, and Societies[3]*, University of Michigan and Santa Fe Institute scholar Scott Page shows that it is cognitive/intellectual diversity that makes boards, committees, and work groups better at decision-making.

While cognitive/intellectual attributes are less immediately visible than physical/identity attributes today, they are becoming more visible thanks to Augmented Reality, 5G, and other social, mobile, and cloud technologies. In the future, these technologies will provide us real-time details of the people we are interacting with (think LinkedIn with a hundred times the detail), and enable us to see, for example, that everyone in a Zoom conference is an INTJ. Even one ESFP might make that meeting more effective4. While some may view this as an invasion of privacy, the outcome may well be that we will less likely "judge books by their covers" and more readily prioritize less-visible attributes in ensuring diversity and inclusion.

What I call *holistic* diversity—encompassing the entire individual—comprises all three groups. This brings me to my first point:

Let's embrace a broad set of all the attributes for which greater diversity and inclusion could make universities stronger, better, and more equitable. By expanding our candidate pools to include all three attribute groups, for admissions, hiring, promotion, and team building, universities can achieve the most inclusive diversity, the highest academic standards, and are less likely to reduce diversity in less-visible attributes, a widespread outcome of Diversity, Equity, and Inclusion (DEI) initiatives today of which we will see examples below.

Thinking Fast and Slow

Prioritizing visible attributes such as race and gender is readily demonstrable and may also signal a desire to right past wrongs. Addressing less-visible attributes, even if just as important and more underrepresented, is harder to demonstrate.

To use Nobel laureate economist Daniel Kahneman's language[5], our focus on visible attributes is an example of "thinking fast:" immediate, rapid-fire reactions akin to attacking or running away from a threat. Fast thinking is the very behavior, whether learned or innate, that drives unwanted racial and gender discrimination. To fight racism and sexism, we must refuse to think fast and superficially about people, and instead think slowly and deliberately about them. As Martin Luther King Jr. said, his dream was for his children to be judged not by the color of their skin, but by the content of their character. That is hard work. Character is not immediately visible. Recognizing character, like most attributes in groups 2 and 3, requires slow, deliberate thinking. We should not disregard them just because they are not immediately visible.

Case Study: MIT

Having completed its most successful, $6 billion campaign under the leadership of President Rafael Reif, MIT is able to fund DEI programs as well as any university. In mid-2021, MIT announced the hiring of no fewer than six new deans for DEI. But as its Five-year DEI Strategic Action Plan makes clear, its focus is on physical/identity characteristics:

> "The Institute currently identifies members of a "racial/ethnic underrepresented" group as: 'a U.S. Citizen who self-identifies as Black/African-American, Hispanic/Latinx, Native American or Alaskan Native, Native Hawaiian, or other Pacific Islander.' In this plan, we use a broader set of attributes— including socioeconomic status, religious beliefs, gender identity, veteran status, sexual orientation, disability, and other identity characteristics—to understand the composition of our community."

Such identity characteristics enjoy strong on-campus constituencies. "Slow-thinking" attributes are not only less visible but have few or no on-campus constituencies. They are neglected. As an example of just one such neglected attribute, consider geographical location.

Admissions Pipelines Feed the Urban-Rural Divide

Adjusting for state populations, 2018 MIT undergrad enrollment for the least-enrolling 25 US states was 33% of the enrollment for the most-enrolling 25 states (see chart). The top seven states (including Massachusetts, MIT's home state) enjoy northeastern proximity to MIT. Most of the under-represented states are rural. The admissions pipeline helps explain why MIT's geographical distribution of US students is this way.

University student body pipelines have four stages: outreach, applications, admissions, and enrollments.

1. **Outreach** is university marketing to and recruitment of high school seniors. Like most leading universities, the vast majority of MIT's outreach is to urban areas. This is both more efficient than spreading limited resources across sparsely populated rural areas and is where most top-rated high schools are located. Failure to reach rural seniors is not specific to MIT; see, for example, this NPR article, "One Reason Rural Students Don't Go to College: Colleges Don't Go to Them."6
   Universities thankfully now recognize the importance of reaching out to underserved communities. With a holistic approach, we will recognize rural and other underserved communities in need of such outreach as well.
2. **Application rates** to MIT and top universities are significantly lower from rural states than for the US overall, due to less outreach to them; less awareness and word-of-mouth among students; lower SAT/ACT scores overall, giving students less confidence to apply; and to socio-economic and cultural factors. Two such factors are urban scalability and "somewhere" vs. "anywhere" mindsets:
   Urban scalability. The Santa Fe Institute has shown that, as the populations of cities double, average income, average numbers of graduate degrees and patents, and many other *per-capita* metrics increase by approximately 15%[7]. Thanks to higher population and density, larger cities enable more frequent

interactions, faster flows of knowledge, greater specialization and division of labor, and greater value placed on specialized skills. These benefits are created in part by self-selection – people who move to cities – but accrue to everyone in the city, whether self-selected or not. Urban college applicants and their families benefit from these dynamics.

"Somewhere" vs. "anywhere" mindsets. According to author David Goodheart in *The Road to Somewhere*[8], "somewheres" are people who identify more with places and groups, such as hometowns and like-minded communities. They more value familiarity, security, and local civic groups. In contrast, "anywheres'" identities and self-worth are more tied to achievement, position, and life experiences. According to Goodheart, people raised in rural areas tend to be "somewheres"; those raised in suburbs and cities, "anywheres," who can more readily acclimate to living anywhere. "Somewheres" are less comfortable or willing to move long distances to unfamiliar places, such as from midwestern hometowns to elite, coastal universities. But many "somewheres" who do so eventually adopt "anywhere" mindsets. See also this InsideHigherEd.com article, "Rural Students Gain but Lag in College Attendance." [9]

Since most outreach is urban, and word-of-mouth about MIT among rural students is sparser, the fewer rural applicants are more likely to be serious candidates who really want to go to MIT. I am an example of this. My high school guidance counselor, Mr. Bussell, discouraged me from applying to MIT: no one from Jupiter, then a remote Palm Beach County outpost, had ever gone there. Few in our high school had even heard of MIT. Even Dad expected me to go to Palm Beach Junior College. But before we moved to Florida when I was five, my mother been an MIT assistant librarian, so I had heard all about (and idolized) MIT from an early age. Mom – only Mom – believed I might get in and made sure I applied. (Moms: realize your influence.) I became the first male in my family to get a bachelor's degree.

3. **Admissions.** According to former Chancellor Cynthia Barnhart, MIT admission rates (relative to the number of applicants) are slightly higher for rural than urban regions. Since outreach invites a wide range of applicants, pulling down average applicant quality, the quality of rural applicants, who enjoy little or no outreach, tends to be slightly higher on average.

   Achievement measures where applicants stand when they apply; distance advanced, much harder to discern, measures how far they have progressed on their own initiative from where they began. Either set of metrics could better predict an individual's future performance and success. SAT/ACT scores are important to both measures. AI can help discern distance advanced. We give credit for distance advanced to selected underserved communities; we need to do the same for a broader set of such communities, including rural ones, who have also faced obstacles but advanced similarly far from where they started on their own initiative.

4. **Enrollments.** Chancellor Barnhart did not have data on rural enrollment rates, but anecdotal evidence suggests that rural candidates feel less welcome and included during campus visits and other interactions and are thus less likely to apply or, if admitted, enroll (more on this below).

The "Other Half" of the US

Apart from MIT's mission of serving the entire nation, omission of the single attribute of geographical location from its DEI initiatives – inconsequential to some – has unexpectedly significant consequences. The disparity is not merely geographical: it is also cultural, economic, intellectual, and political[10]. More than the US population overall, individuals from these states, mostly red, tend to value individual rewards and responsibility, local civic ties, frugality, a work ethic, and nuclear families. They have center-right sensibilities, tending to be more fiscally and socially conservative. They are lower income overall. They are more likely to be "somewheres" than "anywheres." I call them the "Other Half," because they make up about half of the US population, yet, as discussed below, they are likely the most underrepresented segment on elite university campuses.

"Other Half" Invisibility on Campus

Rural, center-right-sensibility, and lower-income individuals have no on-campus constituency or advocacy at MIT at all. They are invisible. In 2021, I served on a committee to select recent alumni for very senior leadership roles at MIT. In my interviews with candidates, all exceptional, I asked, when the subject of diversity came up, "Allowing for any segmentation of the US population you can think of, which segment do you think is most under-represented at MIT?" Separately, I asked the same question of our Dean for Humanities and Social Sciences. The most common

response, including that of the Dean, was Native Americans. According to the US Department of Health and Human Services, Native Americans, including Alaskan Natives, comprise 1.7% of the US population. No one mentioned rural, center-right-sensibility, or lower-income individuals by those or any other designation. Again, this is "fast" vs. "slow" thinking. This is even though "Other Half" under-representation had been called out by the Corporation Joint Advisory Committee (CJAC) in its FY19 report:

"Explore and publicly track a wider range of diversity metrics for income/wealth and geography (including rural/urban split). Only 30% of MIT undergraduates are from rural states compared to ~50% of the US population. Only 13.5% of undergraduates come from the lower 40% of the income distribution (which is still better than our peers). Roughly 2/3 of undergraduates come from "blue" states vs. 43% of the US population."

According to that report, 57% of the US population was in red states. As noted, most of the Other-Half states are red. Adjusting for state populations, MIT's 2018 undergrad enrollment for red states overall (see chart) was 38% the enrollment for blue states overall[11]. But given that cities, including red-state ones, are more blue than rural areas, and that students enrolling are more urban than rural, the actual blue/red disparity is even higher than the state-level aggregates suggest. Relative to their total population, they are almost certainly more under-represented on our college campuses than racial minorities and women[12]. Yet we never talk or hear about them.

We value diversity both for exposing students to different lived experiences, thus helping to foster tolerance and understanding, and for better decision-making and creativity that comes from different cognitive styles. In both ways, the Other Half's sensibilities are complementary to and counterbalancing universities' primarily blue-state perspectives. They deserve to be included in on-campus conversations and our DEI initiatives urgently need to include them. Arguably, MIT has a greater responsibility to attract, expose its undergrads to, and serve Other Half students because Massachusetts is both one of the bluest states and the most heavily represented among undergraduates' home states. (The MA datapoint [x=65%, y=49] is literally off the chart above.)

Under-representation and Stereotyping: A Negative Feedback Loop

It gets worse. Above I mentioned that rural students may feel less welcome/included from campus visits and other interactions and may thus be less likely to apply or enroll. In part due to their under-representation on campus, Other-Half individuals—whether students, faculty, or staff—are widely, if unconsciously, stereotyped. The greater the under-representation, the easier it is to stereotype.

At a recent visiting committee meeting, a senior administrator stated that those in the Other Half "don't share our values." Yet another characterized them as "poor, white, and uneducated." Imagine making such gross generalizations about women, Blacks, or gays: utterly unacceptable. Both comments reflect bias, whether conscious or unconscious. But such sentiments are widespread on campus about Other-Half individuals. Many such students, faculty, and staff have become as deeply closeted as I was growing up gay in the 1970s. The bias and stereotyping are not unique to MIT: at many law schools, students routinely equate conservatives with white supremacists, without repercussion. Relatedly, MIT Provost Martin Schmidt acknowledges that, "Being Republican may be the hardest thing to be on campus." Indeed, according to FIRE's 2021 College Free Speech Survey, 5.5 times as many MIT students self-declare as very or somewhat liberal (44%) than very or somewhat conservative (8%), and 4.8 times as many self-declare as Democrat (34%) than Republican (7%).

Imagine how uncomfortable many would feel on a campus where everyone was a Trump supporter. Very uncomfortable indeed, I daresay. That is how many Other-Half seniors feel when they visit MIT.

"Other-Half" Most Under-Represented among Staff

A survey reported in a 2018 New York Times article, "Think Professors Are Liberal? Try School Administrators," found that "Only 6 percent of campus administrators identified as conservative to some degree, while 71 percent classified themselves as liberal or very liberal. … The 12-to-one ratio of liberal to conservative college administrators makes them the most left-leaning group on campus."[13]

At a recent department visiting committee meeting, I observed that MIT could usefully engage an independent firm to confidentially survey staff to see 1) how many staff we have of center-right sensibility (expect there to be few),

and 2) how welcoming and inclusive they find the MIT work environment. To elicit honest survey responses, I believe the provision of confidentiality would have to be airtight.

Unwittingly Polarizing America

Growing polarization may be America's greatest existential threat. One, if not the main, driver of polarization is lack of dialogue among polarizing groups. Driven by user engagement ("Likes"), social media today encourage us to interact just with those who already share our views. We urgently need to find common ground with those outside of our in-groups to keep our civil society from breaking apart.

Stereotyping invites those stereotyped to do likewise, driving sides ever further apart, and—amplified and accelerated by social media and partisan press—drawing our country down into an authoritarian spiral. More than any other institutions, universities can model open discussion and tolerance to avert these outcomes. Too, if a high school senior from rural America has, or perceives she has, less chance to be admitted to a major university than an equally qualified, traditionally under-represented racial minority but less under-represented in fact, that will arouse resentment. Deservedly so. Resentment also drives polarization. Some feel that being left behind in education is one of its key drivers.

Effective DEI Requires a Light Touch

I came out late, in my late 30s. Prior to that, if I were chosen, promoted, or elected, I knew it was due to what I had contributed or accomplished, not to the fact I was gay. Now that I am out, I can't always be sure. No one should have to deal with that insecurity and indignity.

To avoid undermining the very individuals we intend to serve, and, as noted above, to avoid arousing resentment that fuels polarization, DEI needs to use many dimensions with a light touch rather than a few dimensions with a hammer. Let's make certain that no one has to wonder whether they were accepted, hired, or promoted just because of gender, race, sexual orientation, or other physical/identity characteristic. To quote MIT Chancellor Melissa Nobles, we need to attract a diverse pool of students and faculty "defined in the broadest terms."

Across Top Universities, Alumni Giving Participation Steadily Declining

Inclusion and belonging apply to alumni, too. Alumni represent approximately 140,000 of 165,000 (alumni + students + faculty + staff) total members of the greater MIT community. As has been widely documented (see Council for Aid to Education chart below for one example), the percentage of university alumni who donate to their alma maters has steadily declined over the last two decades. Here is a hypothesis we owe it to ourselves to test: At least part of the decline is attributable to universities straying from their focus on education and research, becoming more ideological, and consequently estranging alumni. Even among my close friends with advanced degrees and successful careers, some have stated clearly that they will not support their alma mater "because my money would go to ideology instead of education." For similar reasons, some alumni have stopped reading MIT's magazine, Technology Review.

I had the great privilege and joy of serving as 2015-16 MIT Alumni Association (MITAA) president/chair, a position I fondly refer to as MIT's head cheerleader and matchmaker. During that time, I met with over a thousand alumni in 25 MIT Clubs in a dozen countries. As a result of that experience, I recently advised my friend and colleague MITAA CEO Whitney Espich as follows:

"Closely review all large-scale alumni communications for content which is unduly political. Consider content not just from our own blue-state viewpoints, but from the viewpoints of those of red-leaning sensibilities, of whom there are relatively few on campus but who are well represented among our alumni (especially older cohorts); and of international alumni, whose countries invariably have their own political, economic, and social issues to deal with. Whenever possible, lead instead with MIT's universal, inspiring, unifying achievements in the sciences, engineering, and technology."

What Universities Must Do

Embrace a broad set of diversity attributes, including physical/identity, cognitive/intellectual, and related attributes for which greater diversity could make stronger, better, and more equitable universities, for outreach, admissions,

hiring, promotion, and team building. By expanding candidate pools to include all three attribute groups, universities can achieve the most inclusive diversity, the highest academic standards, and are less likely to overlook and reduce diversity in important attributes.

Assess admissions pipelines – outreach, applications, acceptances, and enrollments – to understand where and why shortfalls are occurring and address them, especially where on-campus constituencies and advocacy are lacking. The "Other Half" may well be the most under-represented such constituency on your campus as it is at MIT.

Refuse to stereotype the "Other Half" and other under-represented segments with no on-campus constituency and advocacy. Recognize our vast common ground with such segments and expand on it. Whether it's eliminating poverty, preserving the environment, making higher education and health care more accessible and affordable, or achieving world peace, different constituencies share similar goals but differ in their approaches. Recognizing this invites a discussion of the benefits, costs, and unintended consequences of various approaches and shifts the discussion from ideological to practical. The greater the polarization, the more heavily common ground should weigh in our policies and advocacy. This approach is harder work and less satisfying short-term than stereotyping and doubling down, but it is a win-win long-term for universities, our nation, and the world.

Leverage outreach, applications, and enrollments (Stages 1, 2, and 4 of the admissions pipeline) to achieve diversity along a broad range of dimensions. Resist the temptation to compromise academic standards to admit any candidates (Stage 3). Lowering standards is a recipe for mediocrity, compromising the university's standing and effectiveness long-term, and mismatch (under-qualified students who are admitted to elite universities), leading to students experiencing worse life outcomes than those who were not admitted in the first place.

Consider both achievement and distance advanced in evaluating all candidates. Either set of metrics could better predict an individual's future performance and success. SAT/ACT scores are important to both measures.

Launch institution-wide task forces on US and global polarization to study forces driving this polarization and recommend solutions to mitigate and reverse these destructive forces. The task forces should address, in part, what universities themselves need to do.

Achieving holistic diversity and inclusion in universities and addressing marginalization and exclusion of Other-Half students, faculty, and staff, may well be as unpopular today as addressing on-campus discrimination against Jews in the 1930s, Blacks in the 1950s, and gays in the 1970s. But confronting those instances of exclusion in the past has paid huge dividends, helping our universities and our nation survive and flourish. Our DEI efforts, if holistic – encompassing the entire individual – will do the same today.

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13. To better ascertain this point, I have asked the MIT Chancellor's Office for a more granular analysis at the zip code- rather than aggregate state-level.

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Role of Diversity: An Idiosyncratic Management Perspective – Daniel Levinthal

I want to first [very] briefly lay out some of the central ways in which diversity animates the management literature and then to discuss a less traditional perspective on diversity that I have been developing in my recent work.

Diversity of Skills and Perspectives:

A fundamental role of management is to use the "visible hand" of the organization to realize the dual goals of specialization and coordination. Adam Smith pointed to the role of the division of labor and the associated accrual of distinct skills --- interestingly for Smith the diversity of skills was an endogenous property resulting from the division of labor (different workers developed skill as different facets of pin making as a result of learning by doing, as opposed to these skills being a pre-existing characteristic). Smith's argument for the power of the "invisible hand" of self-interested actors in a market, obscured the fact that the pin factory was run by a management process and was not solely an emergent market outcome. This role of organizations as mechanisms to achieve coordination and cooperation among a diverse set of actors is central to theorizing about organizations (March and Simon, 1958; Thompson, 1967) and Williamson's (1975 and 1986) transaction cost argument for corporate governance of relation-specific assets. The role of diversity is a central theme as well in the study of more micro group processes, in particular with respect to the creativity of groups and their operational effectiveness.

Strategic Management: Diversity of Options:

The strategy literature has given considerable attention to the value of options and in particular a line of work that considers "real" options as an analogue of a financial options. A financial option gives one the right, not the obligation, to purchase shares in a company's stock at a specified price within some specified time frame. Scholars have considered toe-hold investments, for instance r&d initiatives in a given domain, as being akin to an option in that such efforts create the opportunity to build on such "toe-hold" investments in the future if circumstances (consumer demand, broader technological developments) make such follow-on investments attractive. The critical conceptual issue is that this initial stage 1 investment gives one some privileged access to a subsequent stage 2 opportunity. While I have offered a critique of this line of work (Adner and Levinthal, 2004) as tending to trivialize the subsequent evaluation of whether to "exercise" a given option and that this work generally fails to consider the endogeneity of the development of the option (e.g., how hard working and clever is the product development team in engaging in their "stage 1" activity --- versus the movement of stock prices which is exogenous to the investor), the basic insight offered regarding portfolios of options in an uncertain world has clear merit.

A different conversation, under the label of dynamic capabilities (Teece, et al. 1996; Helfat et al, 2007), points to an intertemporal diversity --- a dynamic capability is characterized as an attribute that facilitates the firm transforming its capability set as circumstances suggest. I argue (Levinthal, 2022) that an important weakness in this literature is that the focus tends to be on identifying specific attributes of firms (and more recently individuals) rather than understanding firms as complex adaptive systems for which changing the rate of learning of one component may or may not prove adaptive for the system as a whole (Levinthal and March, 1993).

The field of entrepreneurial management has also highlighted the role of inter-temporal diversity in its focus on the role of [lean] start-ups' search for product-market fit as they "pivot" from one technology and/or market niche to another. This discussion has been largely practitioner based (Reis, 2011) though I have tried to point to some important links to the literature on organizational learning (Contigiani and Levinthal, 2019).

Diversity of Selection Criteria:

In my recent book (Levinthal, 2022), I make an argument for firms as constituting artificial selection environments --- as opposed to selection pressures directly stemming current competitive processes (see especially chapter 4). A basic overarching fact about organizations is that firms receive profits and losses, while individuals and units within the firm generally only receive rewards as mediated by an organization's accounting system and incentive structure. In that sense, a firm can be considered to be a credit assignment mechanism (Holland, 1975).

In developing this theoretical framework, one of the key challenges that I point to is the diversity of the selection criteria that guides this artificial selection environment. In that regard, it is important to contrast the diversity of underlying elements --- people, ideas, routines --- and the diversity of selection criteria. Underlying this difficulty of

organizations in sustaining a diversity of selection criteria is the tendency of resources to be allocated by a hierarchical authority structure within an organization.

Our discussions of innovation and change tend to highlight the role of variety. However, variety alone is clearly not sufficient for innovation. To take Kanter's (1988) imagery of "letting a thousand flowers bloom", such diversity in blooming will not be of consequence if the organization only has one type of "lawnmower", or less metaphorically, one type of screening criteria.While obviously a caricature, the point is that experiments must be complemented by sufficient variety in the feedback mechanisms and selection criteria that inform the internal selection process within an organization. Innovation within organizations requires resources; therefore, sustaining diversity requires on-going resource commitments to a diverse set of emergent efforts.

In this spirit, I have argued for supplementing our current conception of what is means to "explore" (Adner and Levinthal, 2008; Levinthal 2022 [chapter 5]). The literature has emphasized the point that exploration is to take actions that are not maximally enhancing of near-term performance. But researchers have treated as unambiguous the question of what constitutes performance. Similarly, in a fitness landscape exploration is generally treated in a behavioral fashion as movement in the space of action --- a long-jump. I suggest that one might also conceptualize exploration as a departure from the established metrics of performance. Indeed, much of the contestation around strategy in an organization concerns what constitutes more or less important dimensions of performance by which to evaluate initiatives ex-ante and ex-post. As Adner and I note, to an observer a given action may appear exploratory [consider basic research as viewed by a funder] but to the actor may feel more like a clear exploitive activity [a research program with a clear agenda and goal]. A corporate entrepreneur is often faced with convincing higher levels of management that their initiatives may "cast a shadow" on the performance gradients preferred by management, even if these are not the animating metrics and goals for the entrepreneur.

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Realizing the Value of Diversity in Business – Martin Reeves

The value of diversity

Almost all large businesses vocally support the ethical imperative of promoting diversity, equity, and inclusion (DEI) in human resources.

There is also growing evidence that diversity, equity, and inclusion (DEI) can create economic value by fueling innovation and growth. Companies with above-average total diversity, measured as the average of six dimensions of diversity (migration, industry, career path, gender, education, age), have 19% points higher innovation revenues and 9% points higher EBIT margins, on average. This positive impact of diversity is observed across geographies, but with some regional differences in the pattern of diversity. Additionally, the most innovative companies are already diverse before they became innovative, bolstering the case for a causal connection.

Diversity also plays a role in enabling future growth. In partnership with Fortune magazine, we developed an index of "corporate vitality" using machine learning methods, to identify and quantify the factors predictive of long-run growth. Among the 19 factors predicting future company growth were diversity of gender, age, and geographic origin of company directors and executives. The 50 companies with the highest vitality were twice as likely to have at least 25% of their top executives be female.

Despite growing evidence for the economic benefits of diversity in human resources, surprisingly little progress has been made in creating diversity of human resources. For example, in 2021 in all large global companies still only 28% of senior managers and 15% of senior executives are female.

What we know about how diversity creates business value

These macro-correlations between DEI and performance tell us little about *how* diversity creates value however.

Diversity enables an adaptive approach to strategy. We know that the range of business environments is expanding with respect to their degree of predictability, malleability and harshness. We have proposed that because of this, companies need to develop and deploy multiple approaches (planning, adapting, visioning, collaborating, renewing) to business strategy, depending on the nature of the competitive environments they face. Further, large firms need to be strategically ambidextrous: to be able to deploy multiple approaches to strategy at the same time in different parts of their business. These multi-tasking imperatives in turn require an expanded sense of diversity beyond DEI, to include diversity in all elements of the "strategy stack" - from strategizing processes and performance metrics to intellectual and cognitive capabilities.

To investigate this need for intellectual and cognitive diversity further, we teamed up with Pymetrics, a company that uses AI and neuro-traits to match applicants with jobs. We measure individual competence in the 5 canonical strategy environments using a strategy game based on a population of multi-armed bandits and compared it with 90 neuro-cognitive traits using a digital assessment tool. The results indicated that different profiles are required for success in each strategic environment. Very few individuals have the traits to be successful in all business environments. This implies that a diversity of neuro-cognitive types is essential to securing strategic success in the varied competitive environments that large companies operate in.

Further, diversity supports resilience in changing and unpredictable environments. We define resilience as a company's ability to anticipate change, absorb stress, recover critical functionality, and thrive in altered circumstances. Our quantitative study of nearly 1800 companies for over 25 years shows that resilience is critical to the long-term performance of companies: the ability to outperform in unfavorable periods accounts for nearly 30% of long-term outperformance.

Our work with Simon Levin reveals that 7 principles underpin the resilience of both man-made and natural systems: one of them is diversity, which plays key role in absorbing and adapting. Operational diversity can create "cushioning advantage" for a company through lowering the immediate impact of a shock (e.g. through revenue source diversity of offerings, customers, geographies or sales channels or operational diversity in terms of supply chains, processes, and means of production). Diversity of ideas and capabilities is also the grist for the adaptive process by which companies adjust to changing or new circumstances.

What we don't yet know about diversity in business

One area requiring further exploration is how cognitive and intellectual diversity can be harnessed in collective problem solving. This is a critical capability for any company. We know that groups of diverse problem solvers can outperform groups of high-ability problem solvers. We also know that the inclusion of women in teams can make teams smarter. However we are far from understanding how to operationalize and optimize collective intelligence in business. To address an aspect of this, we are currently collaborating with CrowdSmart, a tech startup, to develop tools to better extract and process diverse insights from group discussions and to apply these to the process of collective imagination.

Second, while we know something of the benefits of diversity in business, we know less about its costs and how to balance costs with benefits. Operational diversity may for example create inefficiency through reduced scale benefits and greater complexity and we are only beginning to understand how resilience trades off with efficiency. We have not yet explored if similar observations can be made about cognitive and skill diversity.

Finally, we need better understanding of how businesses should react to diversity of beliefs. This facet of diversity is not on the radars of the business leaders as much as it should be, given that it's part of the context of business activity. When the heterogeneity of beliefs across groups increases and interactions are reduced, social polarization or even fracture can result. Polarized environments are hard for businesses to navigate: they can lose clients and employees if they are perceived as biased for example. We need to understand better how polarization works and how it can be reversed, avoided or navigated by business.