Academic Cultures: Toward Perspective from the Future

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To envision the future of academic culture, we consider the epistemic, administrative, and social dimensions of the American research university. Given the existential cultural, economic, political, social, and environmental dilemmas that confront society, constituents and stakeholders alike would be justified in contemplating the academy three or four generations hence with a degree of apprehension. Leaving aside the most dystopian prospects, we summon historical perspective and speculate about the future of academic culture to critique the contemporary research university in an effort to propose new models going forward. We also consider the institutional contexts of knowledge production and examine the imperative to recognize the plurality of academic culture. We argue that if constituents assume that the venerable genealogies that support academic cultures guarantee their perpetuation, they will fail to act with the sense of urgency that is required to meet the entangled challenges ahead.

Imagine the arrival of the twenty-second century on the campuses of our nation's colleges and universities, seventy-five years down the road. Given the existential dilemmas of the present moment – cultural, economic, political, social, and environmental – constituents and stakeholders alike would be justified in contemplating the future of academic culture three or four generations hence with a degree of apprehension. But leaving aside the prospect of dystopian scenarios, we anticipate that the institution famously characterized in 1963 by then University of California president Clark Kerr as the "multiversity," which produced knowledge he deemed "central to the conduct of an entire society," will maintain this crucial role despite the many challenges that will test its resilience throughout the balance of the twenty-first century. "As an institution, it looks far into the past and far into the future," Kerr observed, "and is often at odds with the present."[1] He might have added that with each new discovery, the university transforms the past and shapes a differentiated future. What no one could have foreseen, however, was the extent to which segments of the cultural, political, and social order that produced the City of Intellect, as Kerr termed the multiversity, would come to undermine that very institution during the first quarter of the twenty-first century.[2] "The twentieth century was a grand century for the cities of intellect," Kerr ob-

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served in remarks delivered in February 2000. "The century, that golden century, is now past, never to be replicated."[3]

As the default model of the contemporary American research university, the multiversity envisioned by Kerr more than six decades ago nevertheless remains fundamental to the discovery, creativity, and innovation that have transformed the quality of life and improved the standard of living of our nation and the world. This claim is no mere hyperbole, as evidence-based assessments of the impacts of the leading American research universities and research-based liberal arts colleges amply document. The integrated and complementary research, development, and education functions of these complex institutions, both public and private, advance not only pedagogy but also scientific discovery that has transformed our understanding of the universe and technological innovation that has enhanced human well-being and accelerated economic growth, which is to say nothing of their roles in promoting the arts, humanities, social sciences, and professions such as law and medicine.[4] Educational attainment has direct and indirect effects, both market and nonmarket, that contribute to the prosperity and well-being of individuals and society. For graduates, these benefits include improved economic returns, increased prospects for intergenerational socioeconomic mobility, better health outcomes, longer-lasting marriages, and enhanced civic participation.[5] These complex large-scale knowledge enterprises will continue to lend expertise, guidance, and perspective to business and industry, government agencies and laboratories, and organizations in civil society. Service to the nation and the determination to effect a shift toward desired societal outcomes become integral to their mission.

Kerr described the multiversity as an institution comprising "communities and activities held together by a common name, a common governing board, and related purposes," which, he quipped, included "individual faculty entrepreneurs held together by a common grievance over parking."[6] Business theorist Clayton Christensen lampooned this arrangement as a merger of "consulting firm McKinsey with Whirlpool's manufacturing operations and Northwestern Mutual Life Insurance Company," which is to say, "three fundamentally different and incompatible business models all housed within the same organization."[7] However, despite whatever shortcomings are ascribed to universities, the multiversity model long before 2100 may actually seem restrictive in scope and scale because academic conglomerates will have "bundled together" so many disparate functions as to more accurately deserve the epithet "megaversity," as suggested by sociologist Craig Calhoun.[8] Nevertheless, there is no reason why the multiversity or, if you prefer, megaversity cannot serve as what literary scholar Christopher Newfield termed a "multifaceted instrument of social development."[9]

The advent of the next century portends to be either an occasion to celebrate the cumulative impacts of scientific discovery, technological innovation, artistic creativity, and humanistic and social scientific insight or, conversely, an occasion

to confront the sobering realization that the twenty-five-hundred-year trajectory of the academy has often produced merely incremental progress or, worse, dispiriting outcomes that have left many of our fellow citizens behind. "The organized intellect is a great machine that has gained extraordinary momentum since the Greeks got it going 2500 years ago," Kerr observed. "It turns out its countless new pieces of knowledge but with little thought for their consequences – their impact on the environment – like a new insecticide." As it happens, investigating problems "does not always relate primarily to their importance but often, instead, to the possibility of their solution."[10]

Although the academy in America has long invoked tenets of social responsibility, it was never designed to guide society through the rapid changes triggered by the accelerating pace of modernity. Nor could it have anticipated the fragmentation of our postmodern condition. Researchers must recognize that knowledge production and technological innovation do not automatically align with overarching beneficial social goals.[11] The historically laissez-faire approaches to the applications of research and innovation have more frequently than one would wish precipitated unpropitious outcomes and subverted the equitable distribution of the benefits of science and technology.

For the academic sector, the balance of the twenty-first century and the advent of the next will play out against the backdrop of interrelated systems-level challenges that will require moving beyond the limitations of our present epistemic frameworks and organizational platforms. Despite its successes, the design shortcomings of this model are well known. For instance, it will come as no surprise that admissions protocols that correlate with affluence have excluded academically qualified but socioeconomically disadvantaged or middle-class applicants from our leading universities. Furthermore, by prioritizing basic research over praxis and by promoting individual attainment over interdisciplinary collaboration, scientists and scholars have diminished the social impact of knowledge production. It is essential to create new organizational models that leverage the complementarities and synergies between discovery and accessibility.

The arrival of the second century of the third millennium may seem distant, yet speculation about the trajectory of academic culture over the next seventy-five years has already taken off in some fields.[12] Science and technology policy scholars were especially primed to think within this timeframe because 2020 marked the seventy-fifth anniversary of the publication of *Science, the Endless Frontier,* the landmark policy manifesto submitted by Vannevar Bush, founding director of the Office of Scientific Research and Development, to President Harry Truman after Franklin Roosevelt died in 1945. In the report, Bush advocated for the federal government to fund unfettered academic research after World War II to ensure a linear "flow of new scientific knowledge to those who can apply

it to practical problems in government, in industry, or elsewhere." Bush envisioned America's research universities as the "wellsprings of knowledge and understanding," where scientists were "free to pursue the truth wherever it may lead."[13]

With federal support for basic research ensuring the autonomy of what chemist and philosopher Michael Polanyi idealized as the "republic of science," the Bush manifesto hybridized the values of academic researchers by funding an ongoing program for postwar federal investment in a national science enterprise that continues to promote competitive engagement among research universities.[14] Unfortunately, the report also promoted the widely accepted but misleading linear model of innovation that reified the spurious distinction between fundamental and applied research that still inhibits the potential of the academy by marginalizing the pursuit of use-inspired research.[15] Yet integrative research will increasingly transcend the linear model, which begins with fundamental research but requires subsequent application to develop products and services appropriate to markets.[16] The synergistic recombinations of disciplinary perspectives will reduce barriers to the unification of scientific disciplines and convergence of technologies.[17]

In this essay, we use "academic culture" to refer to the interrelated epistemic, administrative, and social frameworks of the set of major research universities and research-based liberal arts colleges in the United States. Any attempt to articulate the extent to which these institutions have collectively shaped the "real world" would be futile because the impact of their knowledge production, innovation, and service so thoroughly pervades contemporary society. Then, as now, these leading institutions will perpetuate the academic gold standard that is at the heart of the academy. Accordingly, after an effort to define academic culture and consider its values, we summon the past and speculate about the future to critique the scope and scale of the contemporary American research university. This is the institutional context of an academic culture that embodies the enduring norms, values, ideals, and practices that govern the production, legitimization, and dissemination of knowledge that will be needed to address an entangled future.

Consistent with the fragmentation of disciplines, differentiation of organizational models, and divergences of purposes and values within academic communities, constituents may find it more appropriate to frame the culture of the academy as a plurality: that is, *academic cultures*. In his foreword to the republication of a 1997 issue of *Dædalus* titled "American Academic Culture in Transformation: Fifty Years, Four Disciplines," historian Stephen Graubard invokes the insights of sociologist Robert Merton, who found that the "cultural soil of seventeenth century England," which was "peculiarly fertile to the growth and spread of science," anticipated the "cultural soil of twentieth-century America" along with the "intellectual flora and fauna it nourished." Merton's comparison

leads Graubard to ask whether an overarching "American academic culture" exists or whether we should "more properly, speak of academic *cultures*, specific to particular disciplines and professions?"[18]

Extending the logic of Graubard, we find that it is imperative to recognize the plurality of academic cultures, beginning with the dynamic interplay of allegiances among a range of constituents and stakeholders within academic disciplines, professional networks, institutional affiliations, and interpersonal relationships, both collegial and competitive. Then, as now, the concept is neither monolithic nor static and will remain both fragmented and subject to multiple meanings and interpretations that accommodate the pluralities embedded within differentiated situated contexts. Although, of course, there can be no such construct without an institution to which it is attached, sociologist Anthony Giddens would emphasize that academic cultures both draw upon and shape the formal institutional structures within which they exist.[19]

The fragmentation of academic cultures in the twentieth century was shaped by historical determinants and intellectual shifts that influenced the structure, priorities, and self-conception of the academy. For instance, the postmodernist critique of grand narratives challenged the notion of universal truths and highlighted multiple perspectives and interpretations as well as emphasizing context and subjectivity. In 1980, sociologist Burton Clark described the splintering "brought about by a proliferation of parts that operate under the centrifugal force of a growing number of different needs and interests" as the dominant trend in the academy. What he terms academic ideologies serve as "emotional bonding and moral capital but are increasingly pluralistic, tied to the primacy of the discipline and the profession."[20]

Disciplinary allegiances typically transcend commitments to institutions, although these loyalties often coexist in tension. Disciplinary acculturation guides research agendas, theoretical orientations, and methodological approaches that encourage scholars to form epistemic communities. Despite growing consensus regarding the significance of transdisciplinary approaches, disciplines nevertheless structure the frameworks, methodologies, and languages through which knowledge is produced, validated, and disseminated. As sociologist Andrew Abbott put it, "Careers remain within discipline much more than within university."[21]

The social dynamics that underpin academic communities have notoriously been the stuff of both sociological investigation and novelistic satire. For sociologist Pierre Bourdieu, academic culture reveals a complex social field marked by power dynamics, symbolic capital, and the reproduction of social hierarchies. Academic "habitus" – the ingrained dispositions, beliefs, and behaviors acquired through socialization – favors those who are already familiar with the "rules of the game."[22] Differentiated operational logics that may be characterized as aca-

demic, bureaucratic, market, and entrepreneurial influence organizational strategies and may institutionalize normative values such as sustainability or responsible innovation.[23] Scholars align within cultural, political, socioeconomic, or identity-based orientations, the latter of which correspond with what historian David Hollinger termed dimensions "ignored by the universalist, rationalist, and individualist biases of the previous generation, including the human body, language, class, gender, and, above all, the solidarities and confinements associated with ethnicity and race."[24]

American academic cultures are uniquely marked by their competitive configuration, a consequence of the failure of the founders to enact legislation to establish a national university. In retrospect, its absence fortuitously led to a decentralized "academic marketplace" of heterogeneous and autonomous research universities.[25] The formation of national disciplinary associations and publication of disciplinary journals also contributed both to the differentiation of academic cultures and consolidation of the academic profession. The founding of the American Association of University Professors in 1915 and the publication of its "Declaration of Principles on Academic Freedom and Academic Tenure" systematized claims for academic freedom and shared governance. These types of organizations promoted an ethos that historian John Thelin describes as a "new conception of academic professionalism essential to the creation of a university professoriate," which codified academic rank and formalized processes associated with promotion and tenure.[26]

Scholars and administrators will increasingly recognize that organizational design is never arbitrary nor merely adventitious. As organizational theorists John Seely Brown and Paul Duguid observed: "In a society that attaches particular value to 'abstract knowledge,' the details of practice have come to be seen as nonessential, unimportant, and easily developed once the relevant abstractions have been grasped."[27] In this context, philosopher Philip Kitcher posed a self-evident question: "How should inquiry be organized so as to fulfill its proper function?" The answer depends on the differentiated designs of our knowledge enterprises. Organized science, after all, is a "group activity carried on by limited and fallible men," as historian Hunter Dupree put it – formulated in the gender-specific locution of a bygone sensibility – adding that "much of their effectiveness stems from their organization and the continuity and flexibility of their institutional arrangements."[28]

To the extent that the academy conducts business as usual in the face of the formidable challenges confronting contemporary societies, it underestimates their complexity and succumbs to the misperception that the venerable genealogies that support academic cultures – academic freedom, shared governance, or the disinterested pursuit of truth among them – guarantee their perpetuation. To prepare for unexpected contingencies or irreducible uncertainties with the requisite sense of urgency, futurists suggest that strategists investigate a range of sce-

narios.[29] To modulate the surprise provoked by unexpected events, scenarios explore alternative risk landscapes that illustrate potential opportunities or threats. For instance, in their speculative essay "The Collapse of Western Civilization: A View from the Future," historians of science Naomi Oreskes and Erik Conway tried to spur scientists and scholars into responding to incontrovertible evidence of climate change by exploring a dystopian scenario that could emerge in 2373, or three hundred years after the hypothetical collapse of Western civilization. From the perspective of future historians, Oreskes and Conway conjecture that the catastrophic downfall occurred because "we – the children of the Enlightenment – failed to act on robust information about climate change and knowledge of the damaging events that were about to unfold."[30]

The following twelve core values codified by Jonathan Cole, provost emeritus of Columbia University, constitute a working definition of academic culture. Rather than pieties to be routinely invoked without commitment, these values represent norms, ideals, and practices that will continue to guide academic cultures: universalism; organized skepticism; creation of new knowledge; free and open communication of ideas; disinterestedness; free inquiry and academic freedom; international communities; peer review; working for the common good; governance by authority; intellectual progeny; and the intellectual vitality of the academic community. The "value system" articulated by Cole extends the so-called Mertonian norms, referring to the four institutional imperatives proposed by Robert Merton in an influential 1942 essay. He argued that communalism, universalism, disinterestedness, and organized skepticism – the CUDOS norms – underlie the scientific ethos.[31]

We contend that these values will be as tenable in 2100 as they were when philologist and Prussian minister of education Wilhelm von Humboldt envisioned the contours of the modern research university in his plans for the University of Berlin during the first decade of the nineteenth century.[32] But the imperative to question these values is implicit in their formulation. Therefore, we anticipate that future generations will modify existing values or define new ones based on emerging ethical frameworks such as sustainable development, intergenerational equity, or responsible innovation, which simply means "taking care of the future through collective stewardship of science and innovation in the present."[33] We assume, for example, that scholars will demand that academic cultures empower marginalized participants who have faced "dispossession of epistemological agency."[34] Accordingly, philosopher Seyla Benhabib envisions communities of inquiry predicated on discursive rationality rather than on an "Archimedean standpoint situated beyond historical and cultural contingency." She suggests that constituents negotiate consensuses that are "sufficient to ensure intersubjective agreement among like-thinking rational minds."[35]

Furthermore, these values are undergirded by the tenets of American pragmatism, which emerged contemporaneously with the consolidation of the American research university in the late nineteenth century. This approach views truth not as an absolute but as a process, tests ideas through application, treats thinking as a form of action, and relies on observable outcomes. Accordingly, philosopher Richard Rorty calls for a "literary culture" in which "intellectuals will have given up the idea that there is a standard against which the products of the human imagination can be measured other than by their social utility."[36] Although we do not anticipate that the academy will abandon its search for a correspondence theory of truth in favor of the propositions that truth is contingent, pragmatic, and embedded in human practices, we do expect that the neopragmatist tenet that truth is neither more nor less than social consensus will increasingly guide academic discourse.[37]

As society confronts challenges such as the disruptive effects of climate change exacerbated by dysfunctional governance, constituents and stakeholders will need to examine plausible scenarios of the future to understand, assess, and redesign the scope and scale of the academic research enterprise. According to our conception, scope refers to the limits, tasks, and functions that determine the outcomes produced by academic cultures, which influence expectations, options, and plans. Scale, on the other hand, refers to the size, extent, or capacity of academic cultures to operate and execute their educational, research, and service functions by focusing on the magnitudes or levels of resources, time, and complexity. As described below, it is critical for participants to understand the interrelated nature of the scope and scale associated with differentiated academic cultures to effectively and efficiently plan, manage, assess, and redesign their strategies and operations.

Alongside recognition of the scope of its world-leading knowledge production and societal impacts, critiques of the academy find that it falls short of the mark in its potential to secure equitable or optimal outcomes. Observant participants can cite, for example, its equivocal efforts to ameliorate the unraveling of the national culture in the United States, which is currently riven by economic inequality, political dysfunction, social fragmentation, and eroding trust in institutions. Furthermore, despite global leadership in research that investigates the biogeochemical cycles that constitute the Earth's systems, research universities have largely failed to inform government policies that apply the knowledge they have produced to mitigate or adapt to environmental stresses by promoting sustainability.

Nevertheless, extrapolating from near- to midterm projections for leading research universities, one may confidently assume their continued preeminence, both in terms of concentration of research performance and institutional wealth.[38] Buoyed by endowments that rival the gross domestic products of developing countries, research universities in the United States will continue to dominate world-

wide rankings. Despite chronic swings in federal R&D funding determined by the ideological convictions of successive administrations – from surges to draconian cuts – which will inject volatility into university-based research ecosystems, disrupt multiyear projects, drive talent loss and short-termism, and skew agendas toward commercially appealing domains, America's sustained global leadership in fundamental discovery and innovation will remain undiminished. For public universities, the intensification of knowledge production and innovation will be accompanied by demographic and enrollment fluctuations.[39] Knowledge spillovers from university-based research and development will continue to accelerate the diffusion of innovation. But the formation of virtual innovation clusters, augmenting the regional clusters epitomized by the entrepreneurial nexus between Stanford University and Silicon Valley or among Harvard University and MIT and the Route 128 tech corridor near Boston, will increasingly extend the impacts of the triple helix of university-industry-government collaboration.[40]

Although he concedes that even now "only a small fraction will attend college in anything like the traditional sense of the word," for privileged students, elite colleges will perpetuate the comforting myth of what American studies scholar Andrew Delbanco calls the "American pastoral" familiar to generations of predecessors.[41] Except in a metonymic sense, to speak of brick-and-mortar campuses in the digitally augmented contexts of the future seems anachronistic. Nevertheless, research universities and research-based liberal arts colleges will continue to cultivate their verdant quads even as digital infrastructures leverage far-flung global operations that accommodate online, virtual, and asynchronous collaborations. Ad hoc transdisciplinary epistemic communities will circulate ideas and research findings instantaneously across the globe in ways that render historical prototypes such as the invisible colleges or transatlantic Republic of Letters of the early modern era quaint.[42] By 2100, advanced communications technologies empowered by artificial intelligence will work around the strictures of time and space that have bedeviled countless generations of scholars.

As in centuries past, the incremental improvement of historical models will remain the default modus operandi of the academy. The confluence of filiopietism, referring to the excessive veneration of tradition, and isomorphism, referring to the paradoxical tendency for organizations and institutions to become increasingly homogeneous but not necessarily more efficient, will continue to favor stasis rather than organizational dynamism.[43] Nowhere more than in the academy does resistance to change remain so firmly entrenched. As sociologist Neil Smelser observed, "Faculties appear to have cultivated the art of resistance commensurate with their levels of intelligence and ingenuity."[44]

Consensus regarding the significance of transdisciplinary collaboration will increasingly supersede assumptions that research and scholarship are solitary endeavors that produce optimal outcomes by amalgamating individual contribu-

tions. In a globalized world beset by intractable challenges that flout geographical or intellectual boundaries, discovery that creates tangible, use-inspired progress will be prioritized over discovery for its own sake. To advance research and innovation through assimilation, synthesis, implementation, and application, scholars will benefit from a renewed appreciation for know-how, which explores tacit or articulated understandings or techniques that seek to achieve a particular outcome.[45]

By facilitating the transdisciplinary or transsectoral application of socially robust knowledge production and innovation, academic cultures will have advanced the emerging cognitive, epistemological, and social reorientation ascribed by policy scholar Michael Gibbons and colleagues to Mode 2 knowledge production. Whereas the long-standing patterns of Mode 1 knowledge production may be characterized as primarily disciplinary and analytical – indeed, Mode 1 is said to have been "identical with what is meant by science" – beginning in the mid-twentieth century, Mode 2 is presumed to have been conducted in contexts of application, reflexivity, and social accountability. Accordingly, dynamic problem-focused collaboration undertaken in contexts of real-world application and accountability to constituencies outside the academy will increasingly guide research.[46]

In contrast to the operations of "normal science" described by historian and philosopher of science Thomas Kuhn, scientists and scholars will increasingly recognize that efforts to understand "post-normal" anomalies, which are "never absolute but instead variable, imprecise, and uncertain," will be fraught with ambiguity and contested values. Since post-normal problems transcend science, physicist Alvin Weinberg characterized them as "trans-scientific." Inconclusive results will increasingly require governance and "extended peer review" from outside the academy because questions regarding, for example, the "deleterious side effects of technology, or the attempts to deal with social problems through the procedures of science – hang on the answers to questions which can be asked of science and yet *which cannot be answered by science*."[47]

Some patterns are predictable based on current trends. Major research universities will achieve unprecedented scope and scale and deliver economic growth but fail to address the inequitable distributional implications of their research and innovation. Federal investment in research and development, which tends to support fundamental long-term research with public benefits, will continue to decline relative to industry funding, which focuses more on applied research with immediate commercial potential. Allegations regarding the corporatization of university-based research and development will abound. Initiatives to develop revenue streams in response to disinvestment by state legislatures and declining federal support for research will gain momentum. Exploiting perceptions of liberal bias in academia, successive political factions will intensify present efforts to erode the autonomy and self-determination of public universities by making them more subservient to the state. The rivalry between the United States and ad-

versaries for technological and economic supremacy will hinge on expenditures in research and development in fields like artificial intelligence, quantum computing, biotechnology, and nanotechnology. Against the backdrop of geopolitical tensions, research associated with strategic national interests and especially national security will rekindle aspects of the military-industrial-academic complex that once defined the Cold War university.[48]

Academic bureaucracies will be charged with allegations of administrative bloat even as protocols of shared governance remain contested. The proportion of tenured and tenure-track faculty relative to adjuncts will continue to diminish by significant margins. The overproduction of doctorates will contribute to the perpetuation of an academic precariat that suffers from insecure incomes that diminish material and psychological well-being. Small colleges destabilized and undermined by declining enrollments will have no options other than acquisition, merger, or closure. Rapid technological innovation will increasingly require workers to periodically reskill or upskill at colleges or universities since the private sector cannot deliver required outcomes at requisite scale.

Knowledge will increasingly correlate with prosperity and well-being, and if the nation is to remain competitive in the globalized knowledge economy, millions more Americans will require advanced levels of education. Absent significant structural reforms, untold millions more will have spiraled downward in unfulfilling socioeconomic trajectories by 2100. Even now, forty million Americans have attended college without completing their degrees and, to make matters worse, are often burdened with crippling student loan debt.[49] If we are not to become a nation hopelessly divided between an affluent and highly educated upper class, a stagnant middle class, and a working class mischaracterized as having abandoned aspiration, we must build world-class academic infrastructure at a socially meaningful scale. Academic cultures may otherwise be implicated in the stratification of a society "nearly medieval in scope," as futurist Bryan Alexander observes, with the "disempowered poor or working-class people kept in line through a mixture of rich entertainment and ubiquitous surveillance," a "social base of impoverished techno-peasantry and a vanishingly small middle class" dominated by a technocratic elite.[50]

The unprecedented decline in life expectancy among middle-aged Americans without a four-year college degree that emerged during the first quarter of the twenty-first century, as documented by economists Anne Case and Angus Deaton, will worsen as prospects for meaningful employment and social cohesion continue to diminish.[51] Although then, as now, college will not be for everyone, the "relentless credentialism" and "single-minded focus on education as the answer to inequality" that philosopher Michael Sandel has described as a hallmark of our meritocratic ethos will persist and leave a college degree a "condition of dignified work and social esteem."[52] Similarly, universities will remain "sieves for

sorting and stratifying populations; incubators for the development of competent social actors; temples for the legitimation of official knowledge; and hubs connecting multiple institutional domains."[53]

By the early twentieth century, universities had attained both scope and scale unimaginable to the Puritans who established Harvard College, which welcomed its first class of nine students in 1636. By the end of the present decade, an increasing number of public research universities will serve hundreds of thousands of students through both residential and personalized digital modalities. Annual levels of research and development expenditures exceeding USD 1 billion (in 2025 dollars) will become the norm. Scale is a multidimensional assessment of how much value an institution can contribute to society, and the application of scaling theory to research universities demonstrates that increasing scale produces beneficial superlinear returns. Especially for research universities, the fact that "both research and educational outcomes scale superlinearly suggest that these activities are synergistic."[54] A related study of structural variables concludes that differences in research performance stem mainly from size and not from secondary factors such as age, country, or disciplinary orientation: "larger universities outperform smaller universities, even after correcting for size."[55] A global network of "super research universities" will thus dominate research and innovation, "not only in science and technology but also in their scientization of disciplines traditionally outside the sciences," predicts sociologist David Baker. The dominance of individual scholarship will be superseded by a Big Science approach favoring large-scale team collaboration.[56]

The imperative to increase the scale of public research universities will remain in tension with the boutique production strategies that have historically dominated both research and learning within the elite strata of the academy. In our usage, "boutique" refers to the small-scale craft production strategies characteristic of the manufacturing operations of the preindustrial era. We anticipate that analogous artisanal approaches will continue to define the upper tiers of academic practice, which some economists have likened to handicraft industries.[57] Faculties will essentially remain guilds, betraying the medieval origins of the research university.[58] Disciplinary acculturation correspondingly will remain an apprenticeship, which is "not merely the preferred method of manual trades but also of the higher reaches of academic disciplines."[59] Then, as now, there will be no efficient way to discover the origins of the universe.

The inexorable transitions from the elite to mass to universal phases of higher education presciently delineated by sociologist Martin Trow in the 1970s will relegate the vast majority of students to colleges and universities at the peripheries of knowledge production. Whereas in the elite phase, no more than 4 or 5 percent of respective cohorts enroll in college, mass higher education encompasses 15 per-

cent. In the mass phase, priorities shift toward the transmission of skills for technical roles. However, in the universal phase, the rate of participation exceeds 50 percent and becomes obligatory. The universal phase potentially implicates the entire population, and the "primary concern is to maximize the adaptability of that population to a society whose chief characteristic is rapid social and technological change."[60] As policy scholar Simon Marginson summarizes: "Access to higher education shifted from being a privilege in the elite phase to a right in the mass phase and then to an obligation in the universal phase, when higher qualifications become mandatory for full and effective social engagement."[61]

Well before 2100, the United States will have joined the vast majority of nations that have transitioned to the universal phase anticipated by Trow. To have a sense of the implications of this transition, constituents and stakeholders need only consider the prospects for middle-class or socioeconomically disadvantaged students. Since 1970, an increasing proportion of undergraduates have been consigned to less selective second-tier universities or nonselective community colleges or vocational schools, the outcome of vertical institutional stratification.[62] Enrollment in second-tier schools that offer standardized instruction is less likely to lead to graduation than enrollment in research-based colleges and universities that offer curricula broadly grounded in the liberal arts.[63]

Despite egalitarian presumptions, not all colleges and universities are equivalent, and not all degrees are of equal merit.[64] Mere access to standardized forms of instruction decoupled from knowledge production will not deliver desired private or collective outcomes. Furthermore, narrowly focused vocational or technical education will not sufficiently prepare graduates for the cognitive or moral challenges and workplace complexities of the decades ahead.[65]

As they do today, successive cohorts of eighteen- to twenty-four-year-old undergraduates will enjoy the prerogative of full-time immersion on residential campuses offering comprehensive arrays of majors taught by distinguished scholars who actively produce knowledge in their respective fields. But admissions protocols favored by selective colleges and universities will increasingly skew in favor of the privileged by excluding academically qualified middle-class or socioeconomically disadvantaged applicants. Although selective schools will continue to recruit cadres of the disadvantaged and underrepresented, the scale of these efforts will remain negligible in proportion to the numbers needed to achieve equity. Offers of admission and graduation rates alike will continue to correlate most strongly with the socioeconomic status of students as captured by the zip codes or tax returns of parents. Unfortunately, restricted accessibility to advanced educational attainment will continue to exacerbate social inequality and stifle intergenerational socioeconomic mobility.[66]

If the United States is to retain its leadership and competitiveness in the globalized knowledge economy, millions more Americans will need access to advanced

training and education, especially by way of research-intensive learning environments that integrate comprehensive liberal arts curricula with the cutting-edge knowledge essential to the postindustrial workforce. The demands of both equity and prosperity argue that society needs to expand the capacities of colleges and universities to produce millions of additional graduates over the balance of the twenty-first century. As economist and former Princeton president William G. Bowen and colleagues recognized: "Society at large can build the educational scale that it requires only if its institutions of higher education tap every pool of talent."[67] Nevertheless, absent new models for large-scale public research universities, structural limitations – especially those related to scalability, enrollment of socioeconomically disadvantaged and historically underrepresented students, and the production of beneficial outcomes such as enhanced employability or accelerated social mobility – will impede their capacity to contribute to increasing the scope of positive social outcomes. But conversations about equity and opportunity in American higher education must not focus simply on increasing the scale of production of more college graduates.

The foundational prototype of a new model for the American research university was operationalized by the academic community of Arizona State University during the first two decades of this century. The New American University model was conceived to augment both the scope and scale of the standard model of the research university. The model demonstrates that large-scale public research universities can negotiate the tensions between broad accessibility, which entails the enrollment of both students and learners from the widest possible demographic spectrum representative of the socioeconomic and intellectual diversity of our nation, and academic excellence, which refers to world-class knowledge production and innovation with societal impact. The intent behind the model is to address critical national priorities while fostering transformative academic cultures committed to human flourishing and value creation for all potential learners. The evolving model embraces social progress, economic growth, and sustainability as among the foremost objectives, outputs, and outcomes of the learning, research, and service produced by research universities in a pluralistic multicultural society.[68]

Informed by the egalitarian aspirations and social embeddedness of the land-grant colleges and universities, the model couples within single institutional frameworks the research excellence of the University of California system with the educational accessibility offered by the California State University system.[69] Indeed, the California Master Plan for Higher Education, initiated under the direction of Clark Kerr in 1960, established a prototype for the salient contours of the New American University model.[70] The subsequently conceived and interrelated Fifth Wave model – so termed in our book *The Fifth Wave*, in which we describe our heuristic schematization of five waves of American higher education – extends

these objectives by envisioning the emergence of a league of large-scale public research universities committed to differentially accelerating research and innovation while simultaneously scaling enrollments. Fifth Wave universities collaborate as nodes in networks that may be metaphorically conceived as a disaggregated de facto national university, referring to the federally chartered seat of higher learning envisioned by the nation's founders.[71] Evidence of the viability of the model can be found in the trajectories of several large-scale world-class public research universities that similarly integrate research excellence with accessibility through educational technologies at previously unobtainable scales, including Purdue University, Pennsylvania State University, and the University System of Maryland.[72]

Inasmuch as access to knowledge underpins the social objectives of pluralistic democracies, both models are thus further predicated on enabling large-scale public research universities to serve as platforms for universal learning. This corollary aspiration postulates that a subset of these institutions differentially lead efforts to accommodate two groups of learners: 1) traditional on-campus students consisting primarily of the successive cohorts of eighteen- to twenty-four-year-olds who increasingly come from diverse socioeconomic and demographic backgrounds to enroll in undergraduate academic programs based on funded research embedded in the liberal arts; and 2) everyone else, referring to all possible demographics of learners who would benefit from advanced education and training at any stage in their lives, especially the forty million Americans who have attended college without completing their degrees. Educating students who graduate from the top 5 or 10 percent of their high school classes represents baseline contributions by our leading colleges and universities. For a subset of large-scale public research universities, the more consequential challenge is to educate the top quarter or third of traditional cohorts of undergraduates to internationally competitive standards, as well as to provide opportunities for lifelong learning to more than half the population of the United States.[73]

By 2100, the conventional distinction between traditional and nontraditional students will be rendered irrelevant. To cope with rapidly changing conditions, we anticipate that individuals of all descriptions will increasingly need to become *learners* throughout their lives. The advent of scalable educational technologies that support personalized learning will empower learners of all descriptions. In a knowledge economy that catalyzes innovative opportunities, only those who possess relevant knowledge and skills will be competitive in rapidly developing fields. Moreover, we anticipate that consistently executed, universally accessible, and scalable digital platforms will not only supplement but for many replace the traditional undergraduate experience of learning on residential campuses.

A system of higher education that rewards only the privileged few fails to animate hope for meaningful societal progress in those who have been left behind. The New American University, Fifth Wave, and Universal Learning models repre-

sent abundant systems that are explicitly designed to increase the scope of beneficial outcomes of higher education at the required scales. Like languages or open information systems that become more valuable for individuals and society when they are widely adopted, an abundant-systems perspective extends the potential of a high-quality undergraduate education to all qualified learners. Designing and implementing such systems on a scale proportionate to the need would transform and empower our society.

Although many sociotechnical aspects of American society will have changed dramatically by the cusp of the next century, we anticipate that the fundamental values and norms of academic cultures will remain viable albeit challenged by the need to accommodate emerging technologies that affect their scope and scale. Then, as now, scholars with "charismatic authority" from the various precincts of these "organized anarchies" will continue to disrupt "normal science" and unleash perpetual innovation through Schumpeterian "creative destruction."[74] Despite standing on the shoulders of giants, scholars will continue to demonstrate troubling lapses into Stone Age logic. In this relentless environment, according to organizational theorists Ann Pendleton-Jullian and John Seely Brown, we will have to learn to navigate "unbound design" in a "white water world" that is "rapidly changing, increasingly interconnected, and where, because of this increasing interconnectivity, everything is more contingent on everything else happening around it."[75]

In contemplating this rapidly approaching horizon, conviction regarding the effort to improve the human condition, however variously interpreted, will remain the North Star of the academy. "Questioning the idea of progress is a bit like casting doubt on the existence of the Deity in Victorian times," political theorist John Gray points out. "It is not so much that belief in progress is unshakable as that we are terrified of losing it."[76] Nevertheless, the ideals and values of academic cultures will continue to guide progress and serve as guardrails against the perils associated with the "paleolithic emotions, medieval institutions, and god-like technology" that define humanity, as naturalist E. O. Wilson quipped.[77]

Among medieval institutions, none has proven to be more enduring than the university, which, despite its limitations, has over the past millennium shown itself able to eventually respond to the needs and demands of societies.[78] Although we cannot know what novel institutional models will emerge in the next seventy-five years, our bounded rationality offers "many theories about how to choose alternatives, once these swim into our field of vision," according to sociologists John Padgett and Walter Powell. "But our theories have little to say about the invention of new alternatives in the first place. New ideas, new practices, new organizational forms, new people must enter from off the stage of our imaginary before our analyses can begin."[79]

By facilitating discovery and innovation, academic cultures have enabled the most sweeping economic, social, and technological transformation in human history. However, the transformation has become "so technologically and socially complex that the Enlightenment thinking that spawned it may be more harmful than helpful when it comes to guiding our actions," in the estimation of science and technology policy scholars Braden Allenby and Daniel Sarewitz. Our "techno-human condition," as they term it, may be perceived as a "complex, constantly changing and adapting system in which human, built, and natural elements interact in ways that produce emergent behaviors which may be difficult to perceive, much less understand and manage." Inquiries or interventions at this level are contingent, unpredictable, incomplete, ambiguous, contradictory, and uncertain. Current approaches, moreover, have become hidebound and irrelevant because they respond to historical errors rather than anticipate future possibilities. "Either we accept that we are impotent brutes living way beyond our means because of the technological house of cards we occupy," Allenby and Sarewitz point out, "or we search for a different set of links to connect our highest ideals to the reality we keep reconstructing." In other words, the mismatch between our accustomed reductionist thinking and what is required to address the challenges that confront us demands "nothing less than a new frame of reference for understanding and action : a reinvention of the Enlightenment."[80]

By 2100, the academy will begin to recognize that our ways of knowing are neither linear, as described in *Science, the Endless Frontier*, nor nonlinear, as demonstrated by the emergent characteristics of complex adaptive systems, but are instead *entangled*. We invoke the concept of the Age of Entanglement metaphorically to capture the interconnectivity and interdependence of science, technology, culture, and the natural world. Although academic cultures will continue to be "empowered by the tools of the Enlightenment," as inventor and computer scientist Danny Hillis put it, in the decades ahead, the academy will have to come to terms with the Age of Entanglement, a new epoch in which we "no longer see ourselves as separate from the natural world – or our technology – but as a part of them, integrated, codependent, and entangled." Whereas in the wake of the Enlightenment, "progress was analytic and came from taking things apart," Hillis explains, "progress in the Age of Entanglement is synthetic and comes from putting things together. Instead of classifying organisms, we construct them. Instead of discovering new worlds, we create them." If we are indeed "governed neither by the mysteries of nature or the logic of science, but by the magic of their entanglement," then we must seek new ways of understanding this new reality.[81]

Sustained efforts will be required to integrate discovery, creativity, and innovation into our academic cultures, which must assume an explicit mandate to bear responsibility for the scope of the beneficial outcomes at the scales required. Absent the realization of new models for our research universities, however, our na-

tion will eventually have to confront the consequences of the decline of one of our most essential institutional assets and, along with it, our economic competitiveness, well-being, and position of leadership on the world stage. Political scientist Suzanne Mettler expressed the dire implications: "We are squandering one of our finest accomplishments and historic legacies, a system of higher education that was long characterized by excellence and wide accessibility to what seemed to be an ever wider and more diverse group of citizens."[82] The continued emergence of the New American University, or other forward-looking models that similarly embrace its tenets, will be necessary to reinvigorate our academic cultures and extend their legacies into our entangled futures.

AUTHORS' NOTE

Throughout this essay, we recapitulate and adapt arguments from our previous coauthored work, especially *Designing the New American University* (Johns Hopkins University Press, 2015) and *The Fifth Wave: The Evolution of American Higher Education* (Johns Hopkins University Press, 2020). Revised formulations of these and other coauthored work appear in this essay with minimal citation and the permission of respective editors and publishers. An expanded version of this essay will appear in our forthcoming edited volume, *Academic Cultures: Perspectives from the Twenty-Second Century* (Johns Hopkins University Press, 2026). We wish to express our appreciation to Ayanna Thompson, Jonathan Cole, and Sheldon Rothblatt for their review of earlier drafts, and to Kevin T. Dwyer for his astute editorial interventions.

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ENDNOTES

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