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A Synthesis Center for the Social, Behavioral, and Economic Sciences

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We are drowning in information, while starving for wisdom. The world henceforth will be run by synthesizers, people able to put together the right information at the right time, think critically about it, and make important choices wisely.

Edward O. Wilson, 1998

Abstract

Synthesis, the integration of data, concepts and theories across disparate disciplines, is a powerful instrument for advancing knowledge and addressing complex societal problems. Synthesis is essential today because the intellectual and practical problems that confront us, including the socio-environmental dynamics of climate change, political instability and terrorism, macro-economic turmoil, and the diverse challenges of global health, transcend disciplines, scales of organization, and conventional distinctions between basic and applied research. Rich resources of data are available for analysis, but our sciences lack the theories, tools, organizations, cultures, and institutional arrangements to explore them. To achieve synthesis, advance the human sciences, and contribute to solving vexing societal problems will require investment in a center and associated computational infrastructure, education and training, and realignments of collaborations and cultures.

Wilson's vision is stirring but incomplete: he is silent about where synthesizers will come from, and where, how, and with whom they will work. This brief paper will sketch answers to those questions and present reasons for creating a synthesis center to advance knowledge in the social, behavioral, and economic (or human) sciences. As practiced today in centers within the U.S. and around the world, synthesis is the integration of concepts, theories, analyses, and data among intellectually disparate disciplines, across varied places and scales of organization, and over time to produce knowledge that is more thorough, deep, or extensive than otherwise attainable (Carpenter

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et al., 2009). Global challenges of poverty (the "bottom billion" and many of the lower 5 billion), social order (terrorism, security, nation-building and -maintaining), socio-environmental dynamics, a stable world economy, multifaceted health problems (costs, aging, emerging diseases, pandemics) and other such challenges demand of the human sciences a form of synthetic analysis and understanding that embraces the sciences and humanities and reaches into the realm of decisions, policies, and practical professions (such as law, business, planning, and architecture). At present the human sciences are too reductionist, fragmented, and retrospective to meet such challenges; they must be complemented by an organization for collaborative investigation that integrates analytic power among disciplines, that addresses complexity rather than simplifying, that considers not only the origins of phenomena but also their emergent qualities, and that learns from the past while also anticipating the future.

Achieving synthesis of such scale and depth will require a novel form of intellectual organization, one that is reflexive and adaptive, forward-looking and receptive, global and engaged; one that is supported by sophisticated information technology and cyber-infrastructure, and embedded within a culture of interdisciplinary collaboration (which will require ongoing construction and maintenance). The center will host in-person and virtual research collaboratories, constituted of scholars from around the world; provide access to visualization, modeling, and analytic tools; enable computational thinking, both onsite (in immersive environments) and from a distance; support a secure, broad-gauge pipeline to data repositories and offer technologies and associated expertise for combining and analyzing sensitive data (Census micro-sample, transactional, or proprietary data); foster a cultural and institutional environment that

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promotes the interdisciplinary study of problems that are important in themselves and for what they contribute to fundamental knowledge. The just-published World Social Science Report (UNESCO, 2010) is subtitled "Knowledge Divides," and whether "divides" is noun or verb, the implications are troubling for those of us who would not only span knowledge divides but would replace a few bridges with a richly joined border region where diverse people, data, and disciplines collaborate to create explanations that are original, deep, and extensive. The human sciences must start down the path toward synthesis by initiating a process of collaborative planning, design, and construction of an international synthesis center.

Why synthesize? Problems of global scale that demand integrative understanding and action, listed above, are one sort of reason. But they are coupled to another sort of reason, one firmly grounded in the opportunity to advance fundamental knowledge. Changes in society, technology, and science have enlarged the ambit of the human sciences, rewriting the cardinal questions of our sciences, while posing new ones about emerging phenomena (such as social lives and identities that extend into virtual worlds), raising the standard of analysis and evidence, and restructuring the web of relationships among researchers, those we study, and those who use research-based knowledge. The research domain of the human sciences is enlarging in the dimensions of place, scale, time, and engagement, which poses new challenges for our sciences. Consider each in turn.

"Place" refers both to actual places on the ground (such as neighborhoods and nations) and to places in cyberspace or networks, which daily become more real in their consequences for human behavior and social organization. Humans live in varied

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settings, which may be nested or intersecting in many ways, and characteristics of the contexts surrounding a person, group, or organization will shape its structure and behavior. This foundational precept, present at the birth of the human sciences, was cast into shadow by the bright scientific possibilities of survey sampling, statistical analysis, and quantitative social science that dominated mid-20th century social research. But new theories, spatially-referenced data, and suitable research technologies (e.g., GIS and spatial statistics) have made place salient once again. The research realm of the human sciences now includes both a richer and more consequential local context and an extended and influential distal (virtual, networked) context. In response, we need synthetic research to integrate deep and detailed understandings of specific places and circumstances into systematic, explanatory theories and models.

"Scale" for the human sciences extends from genes and neurons to the global and into the limitless virtual world. In consequence, from the piecemeal and almost proprietary explanations of disciplines we may now build more extensive and integrated explanations that connect, for example, the genetic foundations and neural processes of valuation and judgment, through decisions and behaviors, to the structures of markets, networks, or cities. Neuro-economics is the most developed of the interdisciplinary fields engaged in this quest, but there are rapidly growing streams of research concerned with the neural dimensions of legal, moral, and political judgments. Similarly, genetic and other biological data form the empirical foundation for explanations that connect biological characteristics, including genetic background and gestational circumstances, to behavioral and social phenomena. At the same time that research in the human sciences is extending from societies "inward" toward their constituent elements, it is also

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extending "outward" to compare conditions and explain patterns of change on a global scale, using comparable data across nations. To fashion durable, integrative explanations of such disparate forms of data will require the collaborative, technical, and analytic capabilities of a synthesis center.

"Time," the third dimension, extends from ephemeral phenomena that nearly defy measurement to the long sweep of history and prehistory that underlies contemporary structures and processes. Understanding patterns and processes of change is at the heart of the human sciences, but much human behavior and social change occur beyond the temporal limits that humans ordinarily sense and measure, so we must extend our capabilities in two directions. At one extreme, consequential perceptions, preferences, judgments, and decisions that occur in a "blink" cascade and cumulate to form stable attitudes, traits, and preferences. And at the far end of the time scale, changes that accrete over decades or centuries leave legacies on the landscape and in the culture that shape socio-environmental patterns and processes in the long term. Only by integrating the study of history and prehistory, paleoecology, geology, and culture, with contemporary analyses of human settlement patterns, land-use transitions, and ecosystem dynamics, will we learn the "late lessons" of early history.

"Engagement" is blurring distinctions between the roles of researcher, participant (or subject), and user (or client). Sharply delineated roles and responsibilities are being supplanted by hybrid identities that have researchers reflecting on their own activities, participants taking a hand in the conduct and interpretation of research, and clients active in design, analysis, and inference. The human sciences are negotiating new terms of engagement with those who participate in and use our research, creating a more

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collaborative mode of inquiry, accompanied by expanded professional responsibilities and impacts.

Similarly, those who use the results of social and behavioral research are less inclined to do so principally through our published findings and potted policy recommendations, insisting instead upon substantive, flexible, and ongoing collaborative examination and exploration of the design, assumptions, results, reasoning, and implications of research. Such intersectoral collaborations have themselves become sites of academic inquiry into the creation, diffusion, and utilization of knowledge. Work of this sort will require a decision theater, immersive computational environment, or similar facility designed to support real-time data analysis and visualization, model construction and evaluation, and critical evaluation of implications, decisions, and policies.

In sum, ongoing changes in the importance and nature of **place** (from local to virtual), the **scale** of phenomena (from genetic or neural to global), the scope of **time** (from briefer than a blink to evolutionary), and the terms of **engagement** with research subjects and users are combining to expand (in cultural, spatial, and virtual dimensions) and fractionate (into segments that are smaller yet salient) the research domain of the human sciences. To meet the challenges and seize the opportunities presented by such changes, behavioral and social scientists must organize to design and construct an innovative collaborative institution for a new form of scientific synthesis.

Building synthetic theory that explains the aggregate forces shaping human social structure and interaction, yet that accommodates individual genetics, biology, perceptions, decisions, and values, stands as a grand intellectual challenge to accompany the technological transformation ahead. We are not alone in the quest for synthesis: in

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recent decades biology has been working toward a synthesis of evolutionary theory, ecology, and development that has properties of deep time, extensive and multi-scalar contemporary space, and individual dynamics that resemble the intellective challenges confronting the social and behavioral sciences. Similar efforts are underway in other fields of science and engineering, with support from NSF, NIH, and DoE. We should learn from their efforts.

In policy circles, it is common to talk about the need to invest in "research infrastructure" for the sciences. While such conversations are well intentioned, infrastructure is a misleading term for what is needed. Understood literally, infrastructure is the stuff below the structure: it is the foundation or groundwork upon which a structure is built, something solid, serviceable, enduring, and inert. Unlike infrastructure, however, the ensembles of technologies and organizations used for scientific research have agency, reactivity, and potential energy: they are transformative forces that challenge orthodoxy, generate empirical insights, and catalyze new formation of new sciences. Change in one part of a technological system will cause change elsewhere. New research technologies will generate data that demand explanation with synthetic theories; require new analytic models and tools (e.g., complex adaptive systems models and approaches broadly labeled "computational thinking"), and people versed in their use; initiate new patterns of research organization, collaboration, and publication (including collaboration with those we study and those who use our results); catalyze innovative policies and actions; and require values and ethics attuned to such emergent challenges. In other words, new research technologies and organizations will be disruptive, placing demands upon what is

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built upon them and, in turn, the using those technologies will cause them to be reshaped and repurposed.

This vital quality—technologies that shape and are shaped by their use—will demand a process of design and construction that is iterative and reflexive to create a new form of organization that is managed adaptively to accommodate changing circumstances and needs. A synthesis center for the human sciences must also offer innovative arrangements for collaboration—a physical place for face-to-face meetings, combined with cyberinfrastructure for distal and asynchronous work--and a network of partnerships to provide data access and storage, with associated expertise and collaborators. New forms of synthesis will require new and renewed generations of scholars prepared to use the organization and its capabilities in innovative ways. This will require ongoing education at every level, from the most experienced investigators to the newest undergraduate and graduate students. Openness, inclusiveness, and broad participation across disciplines, ethnicities, nationalities, and sectors are essential to elicit innovative ideas and build a foundation of legitimacy and support for the innovations to come.

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