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Living in a Material World

The doctrine of materialism, dating back to the ancient Greeks and Chinese and providing background for Descartes and Marx, argues that all phenomena found in nature can be explained by causal material factors. Because materialism is assumed to apply to all observed phenomena, it is also assumed that materialism can be applied to explain the behavior of life and systems of living things. This assumption forms a basis for the study of animal and human biology, as well as the study of ecological and social systems.

Is this so? Are life and living systems amenable to materialist explanations? Are such explanations poorly understood or are they fundamentally elusive? Does life exhibit the regularity that allows for the application of mathematics? Does the reduction of living systems to enable more precise mathematical treatment oversimplify them to the point of rendering them untrue to what they are? At some granular level, might life and living systems rely on the events occurring within an irreducible decision box that remains unpredictable?

Unlike in the physical sciences, description, more than explanation, continues to occupy most life scientists. Better description of ailments constituted much of medical practice until the beginning of the 20th century. A history of disciplined observation of the regularities found in living systems has yielded great insights (such as the germ theory of disease and immunization through vaccination) and delivered enormous health benefits in terms of increased longevity and prevented suffering. The advent of better diagnostics that enable more precise (and even dynamic) description of biological parameters continues to improve the delivery of health services to patients. Long-term statistical studies benefit large populations. Nonetheless, for the individual patient, the ability to associate symptoms with physiological mechanisms and predict health outcomes suffers because of the small sample size.

Because protecting and promoting human life remains fundamental to human society, medicine is always necessary whether or not it derives from a complete understanding of how the human body works. The patient is sick and must be treated. Honest practitioners will say, though, that despite the advanced diagnostics, a partial understanding of very basic mechanisms of how the human body works continues to be the case. Drugs that have the effect of aggravating cardiovascular problems for the same reason they are effective in reducing joint inflammation offer a case in point.

Although some proponents argue that DNA analysis will offer personal "customizeability" in future health care, the knowledge of sequence has yet to lead directly to knowledge of outcomes. The structure of the DNA molecule is known, but the syntax (and thus the meaning) of the genetic code remains mysterious. The structure itself is not deterministic. The weakness in the current knowledge of the mechanisms leading to disease is also evident at the level of organisms and their habitat, as science remains far from achieving a definitive characterization of the pathways and toxicology of the brew of synthetic chemicals that cloak the environment. In practice, the material chain of events leading to the diagnosis, treatment, and outcome of a human patient will remain uncertain. Statistical data and physiology and patient behavior, as well as physician patience and judgment, all contribute to treatment decisions. The ability to generate predictions based on statistical analyses worsens in moving from simple organisms to more complicated systems. Science can describe microbes better than it can describe adolescent girls, and describe girls better than the functioning of a modern city. Applying materialism to human social activity requires identifying parameters to measure and using those measurements to predict. Measuring the data and trusting that it can be used to predict the future responds to very practical needs. The fact that rational frameworks can be applied to describe human societies appeals to bureaucrats, businesspeople, and scientists alike. Mathematical models remove bias. The abstraction provided allows for nonideological decisionmaking.

Models as justifiers

Government bureaucrats, seeking objective explanations to justify expenditures, encourage the use of statistical models to describe the processes at work in societies. Based on model results, scientific rigor is invoked, as is the claim to objectivity, when determining how to direct public resources. Commerce itself of course benefits handsomely from the predictability of a reliable, mechanistic world. When Cornelius Vanderbilt offered regularly scheduled ship and rail service, commerce followed. Both bureaucrats and businesspeople rely on an orderly world where society operates according to rules. Mechanistic models offer an ideal, despite their lack of any consistent ability to predict.

Arguably, the scientific enterprise betrays an innate preference for systems that exhibit regularity most of all. That regularity gives meaning to a scientific description of reality that relies on the existence of fixed relationships between variables. The need for regularity may even undermine objectivity. For example, breeding strains of laboratory mice with rapid reproductive cycles may expedite orderly data generation, but it may also introduce bias into the subject population that becomes embedded in the analysis. Only by assuming regularity can sociologists and ecologists isolate single variables and attempt to describe their effect on a society or ecosystem.

What harm could come from the expectation that all features of life and living systems can be counted and understood? How would society benefit from revisiting the suitability of so strictly applying materialism to predict outcomes for life and living systems? Despite the flaws of the materialist approach, does it not ensure the greatest amount of objectivity? Does it not provide the most benefit to the largest number of people? Why should society question a strictly materialist model of life for social decisionmaking?

Blind adherence to the materialist idea that today's best mathematical models should always provide the basis for social policy poses several problems. New biases are introduced, or perpetuated, by relying too heavily on materialist approaches. As computers become more powerful, society may be limited to considering variables that can be captured or counted (i.e., digitized or "datafied") so that they can be modeled mathematically. The drive to digitize all information can force crude approximations of the factors that influence life and living systems. Modern society winds up restricting its interests to data suited to the binary format of current digital computers.

Many human factors may lie outside that format. For example, the quest for greater efficiency will move health care even more toward an exercise in matching diagnostic codes and treatment codes. These codes already drive the system more than responding to its needs. Code-matching naturally follows as the best response in a world where it is possible to handle essentially unlimited amounts of data. Once the framework is established, data definitions become entrenched. Subsequent policy evolution locks in early decisions about what codes to use, what data fields to populate, and what budget factors to consider in conducting cost/benefit analyses. Legacy data definitions drive the governmental and industrial responses, limiting the future range of possible actions.

Unspoken assumptions

When formulating broader social policy, unspoken assumptions abound regarding what constitutes the "greater good." Here, too, the desired objectives, and the means to reach them, will favor measureable data. The data can be used to advance any number of policy agendas that may objectively reflect the interest of their proponents but remain partial. The drive to quantification favors economic analysis and the necessary valuation of public goods. Conveniently, dollars offer an eminently measurable variable, a common convertible currency that captures the value of livelihoods and lives, playgrounds and prisons, and all things of value to society. Using economic models, the policies of the 1950s and 1960s that presaged civic decline and suburban sprawl offered the most promising solutions to the social engineers and business interests that promoted them at the time.

The materialist approach influences not only how the United States sees itself, but how it sees other societies as well. The notion that aggregate wealth offers the best proxy for measuring social progress is not universal. Other cultures may aspire to a more equitable wealth distribution, greater national prominence, recognized technological prowess, or the exalted glory of God. These social goals remain important to societies around the globe and influence national-level decisionmaking in much of the world. The successes of neoliberalism notwithstanding, seeing the world through a strictly materialist lens may systematically underestimate the importance of the religious and cultural forces that motivate societies.

Perhaps the most troubling consequence of considering the best current modeling efforts as constituting the definitive materialist approach (that is, the rational understanding) is that the tail wags the dog more and more. In a digital age, model results are used to set priorities, and social goals that may hide what is in plain sight. The overwhelming attention to the modeling of climate change serves to diminish the attention paid to other, equal and even greater, environmental concerns such as municipal water systems, childhood disease, and urban air pollution, as well as social concerns such as public safety.

Things easily modeled receive the most attention in the social sphere whether they convey or obscure the relevant scientific parameters. Climate offers a clear case of modeling exercises used to advance political agendas by choosing which data to focus on and how to tweak the (literally) hundreds of parameters in any given model. Whether by design or default, the model tends to vindicate the modeler; for instance, the modeler that selects which natural mechanisms to include and which to neglect when modeling the annual global flux of carbon. Models, and policies to be based on them, ignore the consequences of climate change mitigation strategies, such as costly regressive electricity rates that force even middle-class people to scavenge the forest for fuel, or the benefits of global carbon fertilization. What becomes obscured is the fact that a self-consistent description useful for numerical modeling may not faithfully represent reality, whether physical or social.

Models offer an abstraction, a common basis for dialogue. For example, global initiatives such as the ongoing international activity beginning with the Earth Summit in Rio de Janeiro in 1992 were inspired by and continue to derive their relevance from model results. In trying to describe social and environmental problems, much effort is expended in modeling global inequity or evidence of environmental crisis. The effects of changing consumer attitudes that drive rising living standards and regional political realities such as war and lawlessness typically do not find their way into the analysis. Still, a vast enterprise continues to operate under the assumption that model refinement will always lead to greater accuracy in describing socially dependent natural phenomenon and that such accuracy will lead to better remedies for problems. Such expectations derive from the fact that materialist assumptions go unchallenged.

Adding needed perspective

What can be done? Given the pervasiveness and attractiveness of materialism and its centrality to Western thought, no simple list of policy recommendations can correct for its undue influence. Several steps in how the nation and society treat the results of strictly mathematical descriptions of social phenomena may help put things in better proportion from the public perspective.

One step would be to demand greater transparency in models used as evidence to formulate social policy. Transparency in the assumptions and limits of validity for studies involving large complicated systems would offer government and society a better understanding of the instances where quantitative analysis is and is not appropriate. Such stipulations might be alien not only to those who use models to justify their political agenda, but to scientists trying their best to create self-consistent digital versions of observed phenomena. Such transparency would expose the latent bias and the poor understanding of mechanism manifest in many mathematical descriptions of living (and nonliving) systems. Nature can never be proved wrong, but the errors of those who claim to understand it are legendary.

A further step involves actively incorporating groundtruthing from practitioners, not only from experts, when investigating the effects of proposed changes in public policy. Those with the common sense that is born of experience (such as patient caregivers, field scientists, engineers, and local officials) should be allowed to reclaim a stronger voice in public decisionmaking. Using protocols that treat expert analysis or computer simulations as sacrosanct in all cases should be reexamined.

As in the case for life and living systems, at the thermodynamic ensemble level, the description of physical systems also relies on statistics. The main difference between living and nonliving systems is that in nonliving systems, the units lack volition (i.e., will), a property found in the units that make up living systems. The debate is old, and the contention here is that despite their regularities, humans and human societies make choices. They are choices because they can, and do, defy prediction, even if the choices may seem inevitable, or at least explainable, in hindsight. Should life be modeled to the point of deliberately ridding it of the very drama that makes it dear? Stripping life of its serendipity to fit a model may not only be an assault on the soul; it may simply substitute one type of bias for another.

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