HISTORY, SCIENCE AND MEANING

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Abstract: Recent developments in the natural sciences make a renewed dialogue with the humanities possible. Previously, humanists resisted adopting scientific paradigms, fearing materialism and determinism would deprive history of meaning and people of freedom. Scientists, meanwhile, were realizing that deterministic materialism made understanding emergent phenomena like life virtually impossible. Scientists also discovered that their methods interfered with their goals and that descriptions of nature at the subatomic level were essentially random. The latter development, Monod said, weakened the "Modern" paradigm sufficiently to make qualitative changes scientifically possible. To understand life, however, scientists had to grasp how information created through interactions reducing thermodynamic gradients is then stored in self-organized systems. The patterned processes by which a historical nature changes over time may apply in the human realm, where interactions can change people and created information can be stored in societies. The qualitatively new information stored in social systems includes Values, Ethics and Morals (VEMs). VEMs map the effects of actions on societies, demonstrating meaning arises naturally *in* history. Mapping what actions mean, VEMs script the behaviors structuring societies, which solves the problem of how sequences of events—chronicles—become causally linked narratives. Moreover, when societies compete, their relative performance tests system-structuring information in the same way the fate of organisms tests DNA. Thus, the succession of social systems suggests there is a meaning *of* history. The meaning of history need be no more transcendental or intended than Darwinian evolution. But if organs and traits can have biological value without implying design, socially constructed attributes like morality, consciousness, and freedom can be valued without supposing history has an ultimate or eternal purpose. Aspiring to show how the cacophony of historical events becomes a cosmos, a process in which actions become meaningful, this sketch suggests a new understanding of nature may provide a basis for ethics.

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For over a century historians have struggled to avoid the rock of determinism by wedging themselves into the hard place of meaningless contingencies. After decades of wriggling, the historians are still stuck. Fortunately a helping hand is available from an unexpected source, the science on which determinism once depended. Over the past hundred years, science discovered limits that challenge determinism (Sullivan, 1933/49) and now describes nature in probabilistic terms. Based in part on these limits, a way to restore meaning to history without dehumanizing it or privileging the winners may be found. A way to ground ethics in our understanding of nature may follow, as well.

To avoid determinism and save free will, humanists since the late 19th century (Rickman, 1961) have restricted the role of "covering laws" (Hempel, 1942). Their decision has been reinforced by observing the devastating effect that covering laws have when ideologues apply them to human societies (Popper, 1962). But while virtuous from a political perspective, the rejection of covering laws leaves a causal vacuum. Covering laws provide the logic that explains events. If covering laws exist, the law of gravity can explain how stones fall because all material objects attract each other and stones are particular material objects in gravitational fields. If, however, covering laws are denied, all that is left is description—telling the story of how one event succeeded another in time. In the absence of causal explanation, history is intellectually devastated, for there is no meaning in a sequence of isolated events.

Oddly enough, while historians were consciously rejecting nineteenth century "scientism" they were embracing radical empiricism, Modern science's most primitive notion. With nothing more to devote themselves to than conscientiously collecting facts associated and getting them in the right sequence, generations of historians have been trained in the most mindless "Baconian" methods (Depew and Weber, 1995). Taught to wait until the facts spoke for themselves, historians gleefully gathered data and ignored the resulting silence. They contented themselves with shushing buffs proclaiming "lessons" (Adams, 1918) and snickering at political scientists inventing models.

History nearly buried itself beneath a heap of empirical data, all neatly arranged in chronological order. But, as Hume pointed out, sequence is not causation. So, if explanation depends on causation, getting the sequence correct explains nothing. If all historians can say is that one thing followed another, as Harold Morowitz said of biology (Morowitz, 2002), they will never have a satisfactory explanation. If History is merely a list of meaningless events, then the only constraints on human action or judgments of their effects would have to be transcendental in origin. People seem unwilling or unable to live contingently passing from one excruciatingly experienced existential moment to another (Luckmann, 1967), but moral commitments decoupled from fact have only enthusiasm to commend them. When people commit themselves ideologically, they justify themselves by devoting their lives to imposing their commitment on others. Thus, by exercising disciplinary responsibility and rejecting covering laws, historians foreclose understanding and open the door to the very totalitarianisms they abhor. The antiseptic utopias imposed by cold blooded "scientific" rationalists are then replaced by the unctuous heavens dictated by righteous fundamentalists and the Politically Correct. Both groups, one suspects, tend to conceal the groundlessness of their positions by making them non-negotiable acts of faith (Margolis, 2004). But saving freedom at the expense of meaning may not be necessary.

Historians would do better if they more carefully considered the problems of their discipline (Gaddis, 2002). Historians would notice an immediate problem if, rather than simply assuming story-telling is so naive a goal it needs no reflection (Conkin and

Stromberg, 1971), they looked at its implications. To have stories, actors at one moment in time have to get to the next moment in time, as Zeno said of arrows moving in space. Now if all historians can do is collect data about discrete moments in time, they can never account for the movement from one event to the next. They know exactly where and when an agent did something. But they have no covering law that says in such and such a field, actions of this sort result in the following outcomes. So historians cannot "move the story along" simply by telling it (Danto, 1985). They do not want to dictate results, thereby robbing man of free will and encouraging utopians. Nor do they want to impose structure on events, especially self-congratulatory structures like the "Whig interpretation" (Bowler, 1989). Yet they must allow some sort of causation to generate the next step and some sort of context to generate meaning.

To be sure, historians can hide behind the veil of "humanism" and say it is the intentional choices of individuals that move the story along. Individuals can be thought to project the consequences of various actions and rationally select the one which advantages them most. Or they can be seen passionately choosing an action for purely emotional reasons. Now no one would deny human rationality or passion affect history (Collingwood, 1946), but if the story never rises above the level of private interest or personal whim it remains meaningless. Twenty-five million people died because Hitler, take your pick, pursued a geopolitical policy aiming at world conquest or he hated Jews. If historians do not admit that something more general moves the story along, all they do is leave fate to arbitrary accidents like Hitler's "thoughts" or his personality, which amount to nothing more lawful than the statistical probabilities describing subatomic particles. Historians successfully perpetuate the illusion that reconstructing a sequence explains an event because a conspiratorial wink establishes membership in the guild of simple story tellers, whose members are forbidden by self-interest from pointing to the obvious fact that their stories cannot account for the intentions of all whose actions make historical events possible. Depending on unexamined assumptions about causes, historians have left us with no secular vehicle for finding meaning in our lives. This paper will attempt to rescue history from the historians by appealing to a science based on evolutionary systems to provide both contexts that make actions meaningful and processes that "move the story along."

SCIENCE AND TIME

Properly used, the contemporary scientific paradigm could allow historians to make sense of the past without threatening the future—and it could show the way for rediscovering meaning and purpose. This paradigm grew out of work in biology and thermodynamics. Its origins are in the nineteenth century, when Darwin and Boltzmann discovered the reality of time (Prigogine, 1982). Its goal is to understand that creative world "between crystal and smoke" (Atlan, 1979), where changing relationships are neither rigid nor deterministic but become organized and regular.

Darwin and Boltzmann had their work cut out for them, for they were willy-nilly challenging the frozen images favored by Western science (Gare, 2005) and enshrined by Newton's covering laws. Newton's laws depended on universality, simplicity, and necessity. According to his mathematico-physical analysis, forces always and everywhere acted on qualitatively identical bodies in geometrical directions that economically determined effects. But since outcomes were perfectly determined by the logical necessity of laws acting on precisely located bodies, time played no role in science. This is because a body which had to go precisely to a certain spot could, in theory, have its trajectory reversed and it would return to its exact starting point. Perfect mechanisms run forward or backward indiscriminately—satellites orbit in one direction just as well as in another. So before and after are merely convenient bookkeeping devices for Modern scientists. As Einstein said, to physicists "time is only an illusion."

Darwin and Boltzmann attracted lots of attention by introducing a temporal direction into science, but their work was not, at first, well understood. In fact, to the degree that scientists did realize biology and thermodynamics were introducing time into nature they rejected these ideas. Darwin, for instance, was never officially honored for his work on evolution, which the President of the Royal Society dismissed as "the law of higgeldy-piggeldy" because random variation was critical to it. He eventually won the Copley Prize, the nineteenth century equivalent of the Nobel, but for his work on coral reefs. Moreover, much of the scientific community saw evolution through the established paradigm, which substituted variation and selection for inertia and gravitation in determining speciation. Boltzmann was even more scathingly criticized for his work on thermodynamics, where precise causal determinations were lost. Backing away under pressure from Newtonian ideals, Boltzmann tried to preserve determinism through statistics. Rejected nevertheless, he eventually committed suicide (Lindley, 2001).

But while both men showed the world had a direction in time, their insights seemed contradictory. Boltzmann's nature changed irreversibly in the direction of increased entropy, but Darwin's world evolved from the simple to the complex. In either case, there was an actual before and after, which distinguished both from the timeless nature of the Newtonians. But how Darwin and Boltzmann could both be right remained unclear: If entropy always increased, how could more complex life forms evolve?

The Belgian physical chemist, Ilya Prigogine won the Nobel in 1977 for resolving the paradox between evolution and entropy, which is fundamental to science and at the root of the historians' dilemma. Prigogine showed that it takes work to organize structures, and we all know that work dissipates energy. When energy is dissipated, entropy increases. So, according to Prigogine, when the complexity of local structures increases as Darwin proposed, the price of their evolution is greater universal entropy, as Boltzmann calculated (Nicolis and Prigogine, 1989). In particular, the rate at which external entropy is produced increases when more complex systems evolve.

Prigogine thus showed that "time is fundamental" because nature is historical in the most basic sense. Time is fundamental because there is a creative aspect to entropy—when energy is dissipated structures can emerge (Prigogine, 1980). In fact, there would seem to be what Popper called a "propensity" (Popper, 1990) toward the evolution of more complex structures because the extra work needed to create and sustain them tends to maximize the entropy of the universe, which the Second Law requires. Thus, the universe has a direction in time and its history accounts for its evolved condition. Fortunately for freedom-loving humanists, the actual paths followed in accordance with the Second Law depend on random acts by individual particles.

But scientists can do more than tell the story of the emergence of structures in the aftermath of the Big Bang. They have a sequence, but events in the sequence are causally linked. Some of those causes are Newtonian—they are mechanical and universal. But they apply only to that part of nature described by physics. Even so, those laws are now understood to operate statistically. Being uncertain in their effects, physical laws may, in time, have the surprising effect of producing ever more interesting structures, like complex chemical molecules, biological cells, or ecosystems, which can only be understood using new laws (Prigogine, 1984). At these emergent levels, causality is better thought of as nonlinear interactions which feed upon and amplify themselves. Being results of "circular causality," emergent structures defy explanation by the laws of physics because they are "wholes greater than the sums of their parts."

There is nothing mystical about proclaiming wholes are greater than the sums of their parts. All it means is that the behaviors of more-or-less large numbers of bodies are changed by interactions, with the information created being stored when systems self-organize by correlating the behaviors of their components (Wicken, 1987). Behaviors are correlated because the actions of each component depends on the effects of the actions of others, which are themselves the effects of the actions of the first. Thus, what each member of a self-organized system is depends on what all the others are doing. Describing this situation would be less complicated than the last few sentences are if we could describe the parts by dissecting the system. But then we could only know how the behaviors of separate bodies are mechanically explained. When bodies interact, which is the case in complex systems, effects depend on how components are mutually transformed. Since mutual transformations depend on how all other components in systems interact, the laws covering results are not reducible to the attributes of the parts. Thus, the wholes which emerge through interactions and self-organization are unpredictable. When unexpected wholes emerge, explanations that go beyond physics are needed (Prigogine, 1996).

It is one of the great ironies of science that Newton's fame depended on the physics he supposed would map the solar system so that the elliptical orbits of the interacting planets and their moons formed a mechanism whose future was as predictable as the hands of a clock. Unfortunately, Newton was never actually able to deliver on that promise, and neither were disciples like Lagrange and LaPlace. None of them could handle the mathematics needed to show how three or more bodies interact. Eventually, Poincare showed that the three-body problem is intractable, for it is impossible to have perfect knowledge of each of the interacting bodies all of the time (Poincare, 1952). So what they do together is something that cannot be accounted for by understanding exactly what each of them does apart.

Since the world has more than three bodies in it and those bodies interact, if anything, it is mystical to claim that perfect knowledge of nature is ever possible. Scientists certainly do not have it, which is why they cannot accurately compute the trajectories of planets forever into the future. For having misled the public into thinking science was omniscient since 1686, President of the Royal Society J. Lighthill apologized during a speech commemorating the publication of Newton's *Principia* (Lighthill. 1986). In fact, scientists now know that nature is far more "chaotic" than previously thought.

Chaos, of course, is a kind of ignorance, which suggests that planets are no smarter than scientists. But some chaos turns out to be beneficial—it is, for example, internal irregularities that permit natural systems to survive impacts with randomly moving bodies. The Solar System is a good example. If it were perfectly balanced it would be like a crystal and shatter when any meteor or comet drifted into so rigid a system. But interstellar objects pass near and through the Solar System regularly and it continues anyway, for the irregularities within the system prepare it to adjust to threats from outside. Robust systems are resilient because they are sloppy (Hollings, 1986; Juarrero, 1991).

Limited knowledge may also be the source of evolution, for it is when surprising encounters occur that existing structures can merge and grow into something neither interacting agent expected. More interestingly, it appears that natural systems are subject to the same sort of limitations as, say, mathematical ones are. According to Godel, mathematical systems can be built around almost any sort of arbitrary axioms and theorems. But if the operations performed using those theorems and axioms are logically consistent, which defines mathematics, then sooner or later the system will encounter problems whose solutions lead to contradictions. The relations between starting points and conclusions is another way of saying systems are wholes greater than the sums of their parts, for there is no consistent way to reduce all the workings of natural systems to the laws governing the behavior of any of their separate parts. Moreover, since the rules governing the behavior of each system are unique to its contingent mutually transforming interactions, there is typically no privileged perspective from which to explain nonintegrable systems (Prigogine, 1996).

These top-down constraints provide for many of history's famous ironies, for the system-level effects of individual actions can often be as contrary as they are unexpected. No Napoleon ever knows exactly where all other agents are nor exactly how they will respond to initiatives. The self-sustaining effect of system-level actions provide agents the feedback on which their next actions are chosen. So while Napoleon can occupy Moscow, some nameless patriot may always be inspired to burn it, thus saving Russia as the intentions of history' greatest "hero" are turned upside down.

QUANTUM EFFECTS

When Quantum Physics (Rae, 1986) discovered that the scientific method gets in the way of scientific objectives, the goal of knowing nature by observing it seemed lost forever. At the subatomic level natural entities are so small that the act of observing them bounces and jiggles them about unpredictably. Since looking at nature changes it, the map science draws is always "uncertain" (Heisenberg, 1958). Since how nature changes depends on the ways it is observed, the maps science draws are always "complementary," as well (Bohr, 1958).

While the loss of complete knowledge and a God's eye-view completely traumatized many physicists, science's loss may be nature's gain. As Monod, for instance, pointed out, it was quantum indeterminacy that gave life "the right to be" (Monod, 1971). Yet Quantum Physics tells us that the results of subatomic observations cannot be taken as natural for they are artifacts—Bohr called them "phenomena"—created by observation (Popper. 1982). But that does not make phenomena either subjective or unreal. According to Bohr phenomena may not be natural but they are "objective" (Bohr, 1934/56). An observation releases an energy and matter flow at an object, which may have quantum effects. But because the energy and matter flows are carefully controlled, any scientist releasing a similar flow under comparable conditions will observe the same phenomena embedded in comparable macroscopic apparatus (Bohr, 1963). Phenomena are real, in this sense, even if they are not natural. Socially constructed (Berger and Luckmann, 1996) phenomena, like money and morals, are just as real (Searle, 1995), and they can be created by similar acts of "observation" when energy flows excite people to interact. Although the original quantum theorists spent most of their time lamenting the inability to know what nature is, the new science succeeds by aspiring to understand how nature works.

Prigogine turned the obstacles of quantum theory into the opportunities of a new science simply by reminding us that energy and matter flows are everywhere present in nature. Natural thermodynamic gradients bounce and jiggle each anything that gets in their way all the time. Perhaps they create phenomena by embedding an observable structure in the flow in the same way that Quantum Physics experiments do. For instance, molecules of a liquid or gas could be subject to an energy flow from some hot source to a colder one. This happens constantly when the sun's energy impacts on the earth's atmosphere and seas. Sometimes the molecules are just battered about aimlessly, which means their entropy is high. But at other moments the jiggling molecules may spontaneously organize into sets of six coordinated columns with a regular clockwise or counter-clockwise rotation. Such self-organized systems, called "Benard Cells," are examples of how nature creates structures using Darwin's and Boltzmann's ideas. The emergence of the Benard Cell is an example of more complex structures evolving in nature, because the coordinated motions of the molecules of air or water dissipate the solar energy flowing by at a faster rate when convection replaces conduction.

Thermodynamic systems like Benard Cells can easily be understood, for they emerge as a result of energy flows within appropriate boundary conditions. More complex chemical and biological systems, like oscillating "clocks" and replicating molecules, can also be explained. You simply need laws respecting the qualitatively new nature of such systems to explain them, which increasingly probabilistic laws will emerge with the systems themselves. You will, for example, never know in advance which way a Benard will rotate or how big it will be or where exactly it will be located until it self-organizes, for such systems are not the results of deterministic processes whose initial conditions are exactly knowable. On the contrary, in all their specifics they are contingent. But once in existence they tend to persevere, for, of course, the entropy of the universe always tends to a maximum and the extra work done creating and maintaining structures dissipates energy faster.

No covering law necessitates the emergence of particular natural structures, whose emergence is consequently irreversible. But once a system has self-organized it operates top-down according to system-level rules—in effect, it writes the "covering laws" that explain the behavior of its parts (von Neumann, 1963). Historians are actually very familiar with this sort of process, for they know well the difference between Medieval "chronicles" that simply list successive events and real histories that tell stories. The latter reflect the emergence of self-organized social systems, while chronicles reflect near-to-equilibrium states where discrete events randomly occur.

THE EMERGENCE OF SOCIAL INFORMATION

Once societies self-organize there are system-level physical and spiritual processes at work that act as covering laws. Self-organization itself records social information, self-replication preserves societies, and self-correction protects them. These three processes are neither deterministic nor foolproof, but they introduce regularities. Closer to patterns than laws in the traditional, prescriptive sense, they model natural actions by which cosmos spontaneously emerges through interactions creating the laws organizing behaviors within systems. These three process also allow us to respect the changes that constantly occur in history and appreciate the rare occasions when evolution actually takes place (Eldredge and Gould, 1972). These three processes account for long periods of "development," in which systems learn better ways to do things, and symmetry-breaking phase changes when systems learn new things to do. We can also recognize that systems—including societies—have ways to police their members so that stability is maintained. Thus, when societies self-organize they draw members into "attractors;" when they replicate they teach youth to imitate tested ancestral behaviors; and when they are perturbed by external forces or internal fluctuations they tend to "snap-back" into established orders. These system-level processes turn chronicles into narratives as, over time, they move the story along.

Nothing in this statement implies that the story or narrative was planned or has an intended outcome. Nature requires no Creator nor intelligent design, for where a historical world goes is not determined and fitness substitutes for intelligence. But within local systems of organization there are organized patterns of behaviors resulting, as we have seen, from natural processes. So while local systems did not have to exist, once they self-organize they act to preserve themselves. Systems need no ultimate reason to be "homeostatic," but preserving their local order does increase universal entropy.

Moreover, the internal rules mapping the ongoing effects of mutual interactions account for stabilizing actions, and sustaining themselves gives system a sort of "purpose." The purpose or "telos" of a self-organized system may be contingent in origin and entirely local, but it is effective nonetheless because it exerts top-down constraints on how members perceive and react to the world and for how the world responds to their actions. In human systems, these top-down constraints operate within more-or-less certain boundary conditions to process energy and matter flows. These energy and matter flows are the physical realities making actions possible. But energy and matter flows must be regulated by correlated human behaviors to replicate societies. By themselves, boundaries and flows no more determine what individuals do than macroscopic apparatus determine the behavior of subatomic particles. Behavior becomes regularized only when moral information measures reduced uncertainty about boundaries and flows. Moral information then loads the dice by exciting people in favor of replicating actions. Still, knowledge of how individual acts affect system wholes does not determine behaviors—individuals are free to choose how they act and some will invariably break the rules. Societies are no more deterministic than the thermodynamics systems Boltzmann studied, and some individuals will inevitably violate laws by posing as social benefactors while serving themselves. Fortunately for societies, the law of large numbers tends to wash out the constant variations between individual motives and actions, leaving systems relatively stable most of the time.

To the extent that systems act to preserve themselves they are purposeful, and purpose, said Aristotle, is the source of meaning. Meaning emerges when a context translates (Ogden and Richards 1923/89) the behavior of its parts into globally stabilizing or destabilizing consequences. When a system reacts to the actions of its components by preserving itself or by changing, it—the system—becomes the context making the actions of the part meaningful. Homeostatic purpose will lead systems to attempt to regain stability. If the action cannot be corrected and systems are thrown into turmoil, they will either fail or evolve to new, possibly more complex forms. The new state of the system, therefore, is what the actions of the part mean. Moreover, systemic adjustments in pursuit of stability will modify all the interactions relating and defining component parts. Responding to global realignments, individual components will take further actions that, again, trigger global adjustments. In either case, system-level adjustments respond dynamically to the part's action. In its reaction, the system observes the parts, whose changes are indeterminate but can be globally consequential. This is as true of atoms organized into molecules as it is of molecules organized into cells or humans organized into societies.

Interaction leads to unexpected consequences, partly because it is a two way street. In interactions observers are both observers and observed. The best example is Darwin's environment, which is an observer when it selects between biological possibilities. But environments are partly shaped by the presence in them of dynamic organisms (Lovelock, 1988). Being changed by the effects of the organisms they select means environments are, in turn, observed by species. Environments are as selected as they are selecting (Henderson, 1913). Of course, the observing organisms are themselves shaped by the environment they are shaping. The effects of observation change observers, whose altered forms affect the observed. The play back and forth of transforming observations produces systems, for what the interacting agents are depends on what they do which depends on the effects each has on the other. Once that interaction stabilizes, if it does, the system itself is selected by the environment its effects helped create, and the actions of each of its components are meaningful in the effects they have on the system and its selecting environment.

FREEDOM AND MORALITY

For historians, the really nice point here is that once social systems self-organize, stories can move along without robbing humankind of its meaning or its freedom. In fact, morality and freedom now appear as evolved consequences of membership in social systems. The roots of morality no longer need to be sought in biology (Artigiani, 2002).

Freedom becomes a moral category only when people become conscious, which, as we shall shortly see, follows from membership in social systems. Independent of societies, people could act whimsically in response to appetites and urges. They would simply respond to external stimuli, recognizing the natural world by the attributes located in, say, honeycombs and bee stingers. Experiencing nature biologically, actions affecting only individuals can be processed within separate organisms in the language of pleasure and pain. But actions valued on the basis of their effects on others are good and bad, as well. Thus a new language is needed to record moral information, which nevertheless builds on biological senses. Societies inform people of their goodness or badness by varying their access to energy and matter flows, which people experience as doses of pleasure and pain. That is, morality emerges when, through "bricolage" (Jacob, 1982), pleasure and pain are put to new uses in the altered context of self-organized social systems. Moral symbols map the shared pleasure and pain experienced as social systems adjust to individual behaviors as meaning (Bruner, 1990).

Individuals tend to accept moral guidance because, once social systems exist, all their members depend on those social systems for survival and have a vested interest in preserving them. In such contexts actions become meaningful, and people may become free and conscious choosing between meaningful alternatives. Consciousness and morality emerge in societies because what people do is not just pleasurable or painful to them personally but significant for the survival of others. When what people freely and consciously do becomes meaningful in the deepest moral sense, individuals exercise agency (Artigiani, 1995 and 1996).

CONSCIOUSNESS

Human systems, organized societies, no doubt grew out of a genetic propensity to share some resources and care for immature off-spring. But such genetic factors only make people members of flocks or herds—bands, to use anthropological terminology. Bands are typical of near-to-equilibrium organizations—they reveal some structure but tend, when perturbed, to fragment rather than sustain themselves. Social systems only emerged through human interactions under particular boundary conditions and in certain thermodynamic flows. Societies came into existence when the stress of population growth overtaxed the naturally occurring resources in an area (Steiner *et al.*, 2001). To extract more food than nature provides, and to secure its regular availability, people correlated their behavior—they cooperated, whether willingly or not (Steiner *et al.*, 1999). But once human survival depended on self-organized systems, societies were solving problems individuals could not solve for themselves. To survive under these altered circumstances, individuals had to "fit in" to societies (Humphrey, 1993), which depends on sharing the information created by interactions rather than displaying the attributes inherited genetically.

Of course, it took more work to create more resources more regularly, which work dissipated more energy and generated more entropy. But increasing resource flows through cooperative action allowed population to grow even more, which, of course, made people more dependent on one another. Mutual dependence meant people behaved differently as members of social systems than they did individually, which means a phase change occurred when bands moved far from equilibrium and societies emerged. Changed behavior reflected the fact that individual actions had acquired moral meaning, which is the symbolic program by which far-from-equilibrium human systems preserve and protect themselves. Myths recorded this phase change, as when Adam and Eve were propelled from Edenic equilibrium into society for eating from the tree of knowledge of good and evil. With society came consciousness as well as morality, and the leaves with which Adam and Eve covered their bodies were as much badges of membership as signs of sin. Interpreting membership as sin, however, reflected the socially constructed nature of self-consciousness.

People became self-conscious in social systems (Mead, 1924-5; Elias, 1991), for then the world they observed contained evidence of their own existence. When people observe nature they see the world as it is given to them and which does not need them. But when people observe societies they see a world they helped make, change, or sustain, a world whose state reflects their own actions. To observe societies, therefore, is to observe the observer. The self is thus an example of how nature creates information. The new science maps this historical world dynamically; nothing in it is defined in an essential or internal way (Juarrero, 2002). Instead, elements of nature gain identities by interacting with their contexts. Thus an organism is the result of interactions between DNA and an environment (Lewontin, 2000). Similarly, "persons" are not simply what their internal essence makes them. Identities result from interactions between individuals and between individuals and social systems. Who we are depends on interactions with our surrounding worlds, and in dynamic social systems we create multiple identities threading our way through altering environments.

Fitting into a society posed problems to individuals comparable to those a species faces trying to fit into an environment. The species probes the space of biological possibilities by randomly shuffling genes. It must locate the particular blend of size, color, and other physical potentials that existing organisms are not successfully exploiting. Similarly, individuals fitting into societies must locate the limited set of behaviors from the vast range of biological possibilities that allow a person to access resources and pass on processed flows in forms and at rates that others can use to sustain the societal whole. Just as many of the biological organisms a species launches into its physical world do not fit the available niche, many of the choices and actions taken by individuals fitting in to societies only imperfectly correlate with those of others.

Individuals learn their roles no more smoothly than species learn suitable genetic sequences. Each behavioral adjustment requires a choice between acting "naturally" and acting with regard for system-level considerations, and self-consciousness emerges as people experience the difference between personal desires and global duties, between individual acts and societal responses. When the shifts are nearly continuous, which is what happened as societies became civilized (Armstrong, 2006), consciousness becomes permanent. Beginning as the perceptions others have of us rather than the perception we have of ourselves, much of the feedback individuals receive about their existence testifies to their missteps. Perhaps that is why Empedocles spoke of daimons surviving wrongdoers in various unhappy forms and early records of self-encounters—like Augustine's—are so full of anxiety and grief. Hence, as interactions generated the sense of inwardness and reflection associated with the "Axial Age" (Jaspers, 1949), the initial painful response often inspired behaviors and transcendental beliefs designed to escape self-awareness. In any case, the collective origins of identity are still visible in Aristotle's "great-and-glorious-man" preening before the *polis* in the fourth century B.C.E. Medieval Catholicism gave the early Christian version of self—conscience—a virtually physical embodiment by creating the confessor as the communal voice evaluating individual behaviors (Nelson, 1981).

STORING SOCIAL INFORMATION

Because what species need to know about nature has to do with physical attributes, the chemical molecules in genes can map biological environments. Fitting into societies requires mapping the relationships processing energy and matter flows. Relationships mapping interdependencies cannot be mapped in components. So the emergence and evolution of social systems offers a good example of how nature changes through interactions and self-organization.

Interactions created the systems needed to solve problems like over-population. The top-down information stored in social systems probably began as rituals teaching people how to fight and farm together. As societies became more complex and the repertoire of behaviors longer, abstract symbols—Values, Ethics and Morals (VEMs)—were introduced to map behavior. Reprogramming behavior, VEM symbols changed the biological organisms whose interactions created the systems. People acquired new identities and, in effect, became humanized as members of social systems—like Adam and Eve, Gilgamish, or Achilles. They became conscious agents able to choose and they gained the freedom necessary to act morally. Membership implies acting in morally trustworthy ways, and we become aware of ourselves when our initiatives fail to correlate with the behaviors of others. The self is the reified record of past social experiences. Watching and correcting us, the self provides a model for fitting in.

To fulfill moral obligations—and to avoid pain and increase pleasure—individuals need to be able to predict what their social worlds will do (Rosen, 1985). Like periscopes that allow individuals to glimpse the next higher level, VEMs are the symbols that map desired and undesired social states. Following these maps of meaning, individuals can adjust their actions in accordance with societal needs. Sadly, they can also learn the hypocritical art of deception. But once individuals are able to choose between actions that will reinforce or undermine the cooperative arrangements on which all depend, appetites and urges are disciplined and redirected by concerns for preserving stable societies. The moral symbols that constrain social behavior produce, for instance, the "dutiful" behavior of firemen rushing into doomed structures in opposition to their natural "instinct" to save themselves. Such actions are not guided by genetically communicated information. People know right from wrong because of what they learn from their cultures, not from what they are told by their genes. Fortunately, our tendency to do what we know how to do encourages us to choose in favor of fitting in, and moral languages quickly enough developed emotive symbols to further excite this tendency by adorning desired states in attractive colors.

Moral symbols stored in individual minds constrain—not determine—how individuals perceive the world and react to it (Langer, 1967, 1982), probably in ways very similar to those described in Edelman's "neural Darwinism" (Edelman, 1992). Whitehead, perhaps surprisingly, anticipated this point. He realized the distinction between social order—where events are predictable because the covering laws are known—and natural chaos was the origin of rationality. As Durkheim had earlier (Durkheim, 1915), Whitehead rightly supposed that the regularities mapped by social experience were read into our shared representations of nature (Whitehead, 1926/54). Through play, he thought, people developed rituals that organized minds as they structured behaviors. If so, neural networks map the social relationships symbolized by morals. Members of civilized societies are thus encouraged to dissipate energy at increased rates by correlating behaviors—serving the common cause—rather than indulging their biological directives. Farmers growing more food than they can eat, artisans making more tools than they can use, sentries watching through the night rather than sleeping—all are elementary examples of how VEMs trump genes. Duty and entropy then reconcile in human history the way Darwin and Boltzmann do in science, for morality is the created information that dissipates energy at higher rates when societies self-organize.

HISTORICAL MEANING

Moral rules constraining individuals top-down demonstrate that something is present in social systems that has not been accounted for by reduction to biological instincts, chemical genes, or physical forces. Members of societies still learn through their senses, but they control their urges, regularize their behavior, and demonstrate the responsibility on which trusting relationships rest. Morality, the phenomenon that emerges when biological humans are embedded in social systems, has the function of legitimating the system that it maps (Durkheim, 1915; Geertz, 1973; Lincoln, 1986).

Of course, no symbol system is so perfect that every social state is exactly mapped and every individual decision is correctly computed. Societies are many-body problems, made all the more difficult to understand because the bodies in them are living, feeling, thinking creatures. So contrary to the dreams of both rational and righteous utopians, the rules governing societies are not deterministic and cannot be imposed mechanically. But they are rules nevertheless, and individual actions are influenced by them because individuals know the rules of their societies. How brains operate, in other words, relates to the cultural contexts in which they are embedded (Donald, 1991).

Historians need to collect the facts about events occurring when societies self-organized and wrote their rules, for contingencies and accidents influence initial conditions. The moral codes affecting human behavior, like DNA sequences, are what Walter Fontana calls "random grammars" (Fontana, 1991)—their self-referential rules are contingent in origin. But once historians know those rules and how individuals perceived their social states at any given time, historians can intuit why choices were made and how replication and snap-back moved stories along. Biological accidents and contingent circumstances may distinguish Lycurgus from Solon, but moral logic distinguishes between the behaviors of Spartans and Athenians.

Historians can recognize the reality of meaning in human affairs simply by appreciating the existence of social systems (Huizinga, 1936/63). Societies are like the games Merleau-Ponty discussed—they are the bounded arenas in which rules structure actions and make them meaningful (Merleau-Ponty, 1964). Structure translates (Eco *et al.*,1988) individual acts that may be as separate and random as radioactive emissions into global arrangements that affect other people. Once we see that structures emerge naturally through processes of *self*-organization, it becomes clear that "meaning" emerges *in* history (Lowith, 1949)—it is not something historians impose on events. Objectivity no more precludes historians reporting on meaning than quantum physicists from describing phenomena. Recognizing there is meaning in history is a step in the right direction. But we would also like to see whether there is a meaning *of* history, and, in respect to the historians' craft, that meaning has to be found within the narrative itself (Voegelin, 1956). The problem is that historians and philosophers have convinced themselves that any narrative making history meaningful is inevitably introduced by historians and philosophers (White, 1987).

But scientific models may discover historical meanings without introducing any transcendent telos or purpose. Mimicking the Second Law that introduced time into nature, historians can find a direction in social evolution if not a destiny. Applying the Second Law to history allows us at least to speculate that, while the sequence of social systems self-organizing in time has no purpose beyond increasing entropy cosmically, the differences between social systems will reveal something meaningful about the ways in which they are constituted. At first glance, what is revealed does not seem meaningful, for thermodynamics makes the obvious point that more recent societies, expelling entropy at greater rates, make bigger messes than earlier ones. Still, how people make messes and what messes people make partly depend on the societies to which they belong. So differences in their messes imply differences in societies, some of which may be important.

Because nature selects between systems on the basis of the Second Law, those that expel entropy at greater rates tend to be favored. But in societies, the rate of entropy production depends on the work done by individuals, and how hard people work depends partly on their moral values. Of course, societies can always force people to work, but coerced people tend to resist, thus increasing internal entropy and reducing collective competitiveness. If, on the other hand, people are rewarded they are excited to work harder. Moral systems valuing work are a key element in motivating people. But to dissipate energy at increased rates, people must also be confident that earned rewards will be forthcoming. Thus, when societies compete institutional arrangements inspiring or inhibiting individuals, which moral values map, are tested. This is the same process that exists in biology, when the fate of organisms measures the selective quality of their genes.

SELECTION

The tautological nature of Darwin's concept of fitness makes it somewhat ambiguous. If the fit survive because they are fit and the survivors are fit because they survive, we seem to be saying more than we know. Perhaps we can see in the thermodynamics of social systems (Adams, 1988) that there are reasons for fitness. Max Weber implied a link between VEMs and thermodynamics in his discovery of the "Protestant Ethic" (Weber, 1904/58). Weber suggested that people are energized when they are emotionally committed to work. Weber argued the spiritual shift that occurred with the sixteenth century Reformation, not any genetic or climatic condition, linked hard work to religiously induced anxiety: sixteenth-century Protestants, he thought, worked hard to avoid thinking about God and Damnation. Protestants were anxious about God and damnation, Weber said, because their reform stripped away the intercessionary Church that previously enveloped Medieval Christians. Alone before a judgmental God, Protestants acting without communal guidance became intensely conscious of their own existence and frantic to find communities into which they could fit. They collected allies by honoring contracts, making profits, and displaying their reformed piety. The best of them reinforced the effects of their "work ethic" by rationalizing their enterprises. Together, more energetic people and more efficient institutions increased the rates at which modernizing societies produced entropy.

But while the fate of social systems measures the effectiveness of their VEMs, VEMs alone do not account for symmetry-breaking changes. The transformation of human behavior Weber described worked because, just at that moment, European social systems were coincidentally being redesigned. Natural selection thus had a golden opportunity to discover whether new system forms socially selecting for Protestant VEMs dissipate energy faster. In effect, a population of societies confronted nature with a new variant around the sixteenth century, and the resulting emergence of "Modern" systems gave history new meaning.

Following the Second Law, selection favors systems able to locate and use resources. Since systems locate resources by "reading" their environments, those societies that can read the world around them in different ways and at finer grains are likely to locate new and different kinds of resources. Self-consciously distinct individuals provide systems with this ability. Thus, societies that cultivate individuality tend to dissipate energy at higher rates, and more complex societies made their members more self-conscious by observing them obtrusively (Foucault, 1977). Weber's Protestantism mapped that experience. Isolated before a God of absolute power and total freedom, Protestants became intensely aware of their existence. Trying to locate signs of their ultimate fate, Protestants devoted to self study located and preserved individual variations. Loyola's "spiritual exercises" would soon have similar effects in Catholic societies.

Societies able to read environments in different ways have to individuate their human members, locating and developing the features unique to each and every one. But individuating people does little good if they are not allowed to be themselves, so for societies to benefit individuals must be liberated. Despite efforts by philosophers since Plato to perfectly map the actions of individuals, human societies need even more tolerance for error (Weizsacker and Weizsacker, 1987; Allen and Lesser, 1993) than, say, planetary systems. Even liberation is not enough, for free individuals must also be able to globalize the information they gathered in pursuit of their own pleasures. Societies rarely limit their controls willingly, so it typically took revolutions to establish the constitutional constraints on governmental powers that protect individual freedoms. But when societies do individuate and liberate their members, they have agents willing and able to locate environmental threats and opportunities and initiate effective actions.

Exploding the Darwinian tautology, we see that societies empowering individuals have selective advantage because societies adapt through individual initiatives that locate opportunities and process new flows. The more environmental circumstances to which societies can adapt, of course, the more selectively advantaged they are. But to enjoy selective advantage, societies need moral values that script behaviors allowing people to alter their behavior in response to environmental perturbations or internal fluctuations, which is how societies "think" (Douglas, 1986). Information must be globalized to have selective advantage, which means successful revolutions democratize systems to some degree.

SELVES AS MEANING

The value of individuals, along with their liberation and empowerment, are not prescribed by laws of physics, chemistry, or biology. Rather, individuation, liberation, and empowerment are consequences of choices and actions taken by people in the process of rewriting societal VEMs. But we can see the emergence of consciousness, morality, freedom, and individuality as historically evolved attributes (Taylor, 1989) emerging within a natural process (Buss, 1987) that gives them meaning. We can also see that it is not, therefore, where history ends up, which no one knows, but what history accomplishes that makes it meaningful. The meaning of life may turn out, as the Christians think, to be the saving of souls; the meaning of history—life so far—is the making of selves. And we need to appreciate the historian's sense that everything takes time to develop, that everything changes over time (Ortega y Gasset, 1941/61). Thus, the self-conscious individual is a Modern phenomenon (Mauss, 1938/85; Dumont, 1985), constructed to meet the needs of successfully competing societies.

Societies that succeed tend to be, relatively, worldly, liberal, and democratic. They were not intended to take this form, and societies like Tudor and Stuart England were well on the way to becoming liberal democracies before any of their members realized it. Moreover, there are many ways in which societies can be worldly, liberal, and democratic, so no existing form can claim the right to impose its structure on others. But once the value of individuation, liberation, and empowerment is demonstrated in the competition between societies, liberal democracies tend to be selected. And it is clear that individuating, liberating, and empowering societies are fit because of the free, conscious, and moral people in them. Were it not for creative individuals— e.g., Voltaire and Jefferson—there would be no liberal democracies. But were there no individuals transformed by Protestantism, reinforced by private property, and protected by law, there would be no liberal democracies, either. Moreover, to survive liberal democracies must adapt to a wide range environmental conditions, which is probably why Modern "science" succeeded: its "value-free" emphasis on quantities applied equally to all circumstances.

DIVERSITY

Social complexity increases as individuals become conscious of themselves and the differences between them. Nature selects for societies populated by conscious, energetic individuals, and societies reward self-awareness and individualism materialistically. Fed by greed and competition, material rewards fast become alienation and vulnerability. The scramble for individual rewards, for instance, leads to regular environmental alterations and frequent changes in defining relationships. Members of complex social systems thus find themselves falling out of defining relationships and searching for new allies. The resulting psychological stresses reveal that while increasing complexity brings valued consequences, its benefits have a price.

Increased social complexity puts advanced societies at "the edge of chaos" (Langton, 1990), where systems are embedded in environments so dynamic that survival no longer favors stability but "evolvability" (Kauffman, 1993). As the sociologist Gianfranco

Poggi pointed out, societies are most likely to evolve when they are not tied inescapably to sets of transcendent, timeless VEMs. Historistic VEMs—VEMs which emerged in response to contingencies and whose acceptance depends on their functionality—are likely to prove most adaptive (Poggi, 1978). Basing societies on historistic VEMs does not mean there will be no conflicts and discords within societies, for individuals seeking to defend privileges will fight to control history in their defense as those seeking change will revise it to advance themselves (Gallie, 1968). But it is hard to put forward a static societal vision based on history, and few will foolishly proclaim that history has ended because they believe some particular set of VEMs will endure unchanged in our dynamic world (Fukuyama, 1992).

Poggi called societies based on history "fragile" (Poggi, 1983), which fragility actually makes societies more likely to survive because more capable of changing (Vattimo, 1988). Surviving in unknowable futures, societies must keep the widest range of options open to recognize and adapt to unexpected environmental shifts. Since variation, not perfection, saves systems at the edge of chaos, societies must move beyond the "tolerance" typical of Modern systems and make the criteria for membership looser and more flexible. Societies with internal diversities are better equipped to meet external challenges (Allen, 2006). Societies can make space for variations the same way organisms protect themselves by regularly producing the deviations that can respond to external perturbations. Thus, says Nobel Laureate Christian de Duve, organisms do not protect themselves by conscious autoimmune systems but by random errors in cell replication unintentionally equipped to feast on alien invaders (de Duve, 2002). This is very much like the experience of "Modernizing" societies which, since the fifteenth century, have flourished because some of their members diverged from the morally accepted norms of Medieval Christendom and chivalry to become energetic, calculating entrepreneurs. But it was not Western superiority that gave birth to Modern societies; new bourgeois nation-states emerged because Medieval Europe put together such a rather ramshackle version of traditional civilization that it could not sustain itself effectively and seemingly inferior variants took off by locating rich new opportunities.

Liberal democracies competed successfully against Fascism and Communism in the twentieth century because of their Modern innovations. But modernized VEMs now tend to crystallize around the attributes characteristic of dominant elites, and it would be misguided, at the edge of chaos, to equate liberal democracies with competition between individuals for material rewards. That faulty conclusion was embraced by Social Darwinists in the nineteenth century—and anarchoreactionaries embrace it still. It confuses the fact that nature has created information through often bloody interactions with the judgment that civilized people must behave that way, too (Huxley, 1894). Pursuing the law of the jungle in the streets of the city, however, is not consistent with the new science. If nature is, as Prigogine said, too rich to be described in a single language (Prigogine, 1980), we no more ought to use biological evolution to prescribe social behaviors than physics to explain life. If there are truths about biology that cannot be reduced to physics, there are truths about behavior that cannot be reduced to biology. Those irreducible behavioral truths preserve the societies on which individual survival depends. It has taken us millennia to discover some of the rules maintaining social systems, and it is only now that we can understand why communities are so important and begin to construct values favoring social systems as well as atomic individuals.

Of course, it may be impossible to hold a world governed by historistic VEMs together. Traditionally, it has been enthusiasm for some shared ultimate goal, whose value is thought to be absolute, that binds societies together. But tightly bonded societies frozen in allegiance to a final objective are too rigid to survive in the dynamic environment constructed by liberal democracy, scientific technology, and capitalism. So, too, are societies held together by hating others (Moore, 1987). But liberal democratic societies need not survive—they may prove just another dead-end in nature's quest to reduce gradients. If they are to survive, we need moral as dynamic as our world. To start with, we need to admit that, given the limits of knowledge, there is no absolute Truth to guide us. This humbling realization should make us open to more modest proposals. Since we cannot know that where we want to go is where we ought to go or even where we will end up, we need a new mental model to prepare for change. We need a way to generate trust that does not, at the same time, freeze society into rapidly outmoded patterns. Perhaps a nature-based scheme may provide the "new rationality" (Prigogine and Stengers, 1977) societies need to decouple existing social roles and relationships from transcendental validators.

REVISITING THE NATURALISTIC FALLACY

Finding VEMs that will hold social systems together when they have no way of knowing where they are going and no way to know where they end up is, in any case, intellectually challenging. Prigogine made opportunities of similar obstacles, reconceptualizing the limits of science as the processes of nature. Perhaps we can follow his example in morals. In that case, the fact that we do not *know* what is right becomes the key to figuring out how to act. Intellectually it is a simple maneuver: since we do not know where we are going, advanced knowledge of final outcomes cannot determine what we do. If the end does not justify the means, it follows that the means must justify themselves. Since how well societies locate and adapt to opportunities—or, of course, threats—depends on both individuals and the societies that construct, liberate, and empower them. That is, the way to survive at the edge of chaos is to focus on how we treat each other. A morality based on how we treat each other, regardless of where we are going, promises to provide a community able to solve problems no matter where we find ourselves at any given moment. In a world where each is potentially the source of an innovation beneficial to all, the best way to survive is by valuing and nurturing all. This sort of morality mimics evolution and keeps the future open.

In other words, there would seem to be philosophical grounds for basing morality on nature, where, again, enthusiasm and commitment can be disciplined by facts and logic. But, as Hume pointed out 250 years ago, there is a difference between what is and what ought to be, and he showed persuasively that it is improper to "derive an ought from an is" (Hume, 1998). G.E. Moore, perhaps the most respected ethicist of the twentieth century, reaffirmed Hume's finding, calling the attempt to derive an ought from an is "the naturalistic fallacy" (Moore, 1903). But Hume and Moore operated within the Modern paradigm, seeing nature as atoms of dead matter acted upon by force laws. Ironically, this view of nature could not even account for the scientists who held it—Modern science left life a statistical miracle. Hume and Moore were right to think force laws could not account for the transition from dead matter to morality.

We now see that Newton's science did not perfectly map nature. A new paradigm is forming that characterizes nature by symmetry-breaking discontinuities, makes relationships as real as things, and tracks the emergence of ever more interesting levels of reality through interactions over time. In this view "life is as natural as a falling stone" (Prigogine and Stengers, 1984), because qualitative changes, like the symmetry break separating genes and morals, are inherent in nature's processes. From this perspective, we do not have to commit the naturalistic fallacy by deriving an ought from an is. Nature, effectively, did it for us when VEMs emerged to map the self-organized human interactions accelerating cosmic entropy production. This does not imply that whatever is is right, for nature seems as willing to experiment with moral aberrations as with genetic mutations. Nature has no vested interest in the morally right.

But creating social systems populated by moral, conscious, free, and energetic individuals turns out to be one of the best ways nature has to increase cosmic entropy. Still, we cannot say that it is moral to imitate nature, for Hume rightly pointed out that nature "cares no more for good over evil than heat over cold" (Becker, 1932). In other words, even though natural processes generated VEMs, morality did not have to exist. Moral symbols do not even have to exactly track what exists, and it is as possible for our symbolic logic to "run away" to absurdities as for sexual selection to produce extravagances like peacock feathers! While this condition appears to preclude grounding ethics in nature, the discontinuity between nature and VEMs is what makes moral actions possible, as the discontinuity between environments and DNA is what makes biological evolution possible. Were our actions determined by natural mechanisms, they would not be moral even if they were right. To be moral an action must be chosen, and to choose individuals must be free. So it will be up to us to decide what to do with what we learn from scientifically studying nature. We will decide whether to use the moral values and intellectual skills developed so painfully throughout history or violate them.

Since societies that individuate their members and treat them relatively well, like the Greeks and Modern liberal democracies, prevail over more authoritarian alternatives, it would seem that actions expected to support and advance liberal, democratic societies are both morally valid and selectively advantaged. Acts supporting liberal democracies are not morally valid because they preserve a currently selected societal form, however. Liberal democracies will, hopefully, someday lose their advantages to societies that treat their members even better. Supporting liberal democracies is morally valid because they are presently the best ways to preserve the human attributes developed historically that make social complexity possible— conscious, moral, free, and energetic individuals. With those building blocks, nature has the potential to surpass itself.

One obvious occasion for exercising moral judgment would be deciding to clean up our mess by exploiting energy resources so much more effectively that the Second Law would favor us. Indeed, altered boundary conditions suggest a new attitude toward housekeeping is in order, for with globalization there is no external environment in which societies can dump entropy. Failing to recognize how much the benefits of technologically advanced societies depend on disrupting less developed ones (Ponting, 1991) is one cause for contemporary violence. Finding ways to turn the noise of globalization into information would smooth transitions as it makes our global system more complex.

But finding ways to integrate a more complex global system would threaten those whose success has committed them absolutely and unwaveringly to established VEMs. These are the individuals whom self-awareness and materialism has isolated. Feeling their identities threatened as their fragile communities alter internal relationships, they grasp for ideologies or movements that will legitimate their resistance to change and provide them membership. It is for this reason that Fundamentalism and Fascism regularly recur in advanced societies—by marginalizing Others they provide identities and by persecuting they define communities. We can say this reluctance to embrace the fluidity and diversity of a complex global society is doomed because it violates the Second Law. But the fulfillment of that dire prophecy would be global devastation. Perhaps a "new rationality" based on natural processes would *persuade* us to use the valued products of historical evolutions to make the transition less destructive.

AN ETHIC FOR THE CHRONICALLY SELF-AWARE

To guide behavior we do not need to know where history ultimately ends up. Nor do we need an unqualified, Fundamentalist commitment to an idealized present that confounds market societies with the end of history or private wealth with the will of God. To guide action, we need only know that other people are conscious agents and choose to preserve their evolved humanity as the instrument for surviving at the edge of chaos. Given the focus on means rather than ends, it only requires common decency to selectively advantage societies by protecting the gains won over millennia of struggle. Thus, rather than acting to make others good we should act to preserve the conditions in which people can solve problems together because they are conscious, moral, free, and knowledgeable. Those conditions involve individuating and empowering others by extending opportunities and protections to all.

Similarly, we should protect many whom current criteria count as failures about as well as we reward those who succeed by practicing established skills. Those variations who keep the future open are potentially more valuable than those wealthy and powerful who tend to defend their positions by inhibiting the symmetry-breaking discontinuities or "punctuations" on which evolution depends. It is not, after all, only the winners who count. And winning in strictly material terms that can only be expressed in private is a hollow, alienating victory. To accumulate in isolation is as meaningless as a history devoid of organizing logic. More crucially, to the alienated every development portends change, every change becomes a threat, and the vulnerability resulting from naked selfishness turns out to be unbearable. So, intent on keeping what they have got, the satiated commit themselves to stopping history, while those frustrated in their attempt to become "modern" use fundamentalist commitments to legitimate smashing obstacles to viable identities.

An ethic based on decency and sharing, however, would provide both previous winners and current pioneers the security of membership and identity, even as the world changes. Thus, even when social relations change as societies adapt, individuals living in nurturing societies can expect to find their identities enduring. This is not as naive as it may seem, since not all previous winners have created all or nothing situations in which change leads to social death for the formerly privileged (Rawls, 1972). After all, no skill is ever either permanently privileged or utterly abandoned—think of how well clerics are doing despite the rise of psychotherapists! Successful societies always keep alternative possibilities in reserve. But the currently privileged set the tone for future societal recalibrations. If they establish and play by fair rules, they create a vested interest in those rules even as new elements rise to the top (Artigiani, 1994).

In sum, the new science finds the meaning of history to be the emergence of moral, conscious, free, and energetic individuals who have the ability to solve unexpected problems by working together. The best way to confront the future, therefore, is to protect our humanity by respecting both the individuals and the communities upon which humanity depends. We do that by abandoning absolute visions and following what amounts to a Golden Rule for evolution: choose to act so the act of choosing remains possible. Viewed through the new science, history has a narrative demonstrating how much we have changed through social evolution and how valuable those changes are. Deriving an ethic from that narrative may supply the courage needed to bear the pain of past events and work toward a more worthy future.

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