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Emergent Management Morality: Explaining Corporate Corruption

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As the twentieth century closed out and a new one dawned, a great wave of corporate scandals swept across the United States. They brought financial ruin and bankruptcy to leading firms, led to widespread employee layoffs, decimated workers' pensions, wiped out untold millions of dollars of shareholders' investments, shook investors' confidence, and greatly elevated public mistrust of business in general.

Top-level executives were charged with fraudulent reporting of company revenues and profits; engaging in insider trading; looting company treasuries for personal gain; lying to employees, board members, and regulators about their company's financial condition; colluding with public auditing firms to inflate revenues and conceal costs; illegally fixing prices by restricting energy supplies; ordering employees to destroy potentially incriminating company documents; establishing internal conflict-of-interest partnerships; creating offshore operations centers as tax-escape havens; receiving outsized salaries, bonuses, stock awards, and stock options as their company's financial fortunes degenerated; misusing company airlines for family benefit; borrowing and not repaying company funds to build private mansions; buying art for personal use through company channels to avoid paying taxes; and numerous other illegal and questionable actions.

As the scandals spread, various explanations were offered. President George W. Bush favored the bad-apple idea, saying that "the vast majority of businesspeople are living by the rules [but] a few bad actors can tarnish our entire free enterprise system" (Bush, 2002). Others cited

character flaws, greed, faulty governance mechanisms, market imperfections, and a profits-before-people attitude. Rejecting these folk explanations as inadequate and misguided, this article offers a theory-based hypothesis that seeks to explain the source, motives, behavioral outcomes, and normative dimensions of decisions taken by corporation executives.

The argument proceeds in seven main parts:

1 The business firm's main operations are a function of three intertwined biological processes: negentropic economizing; niche competition, and social exchange within a dominance hierarchy. The relevant theory bases are thermodynamics, organizational complexity, and evolutionary psychology.
2 Corporate organization/architecture manifests an underlying (primordial) order-creation dynamic emerging from the entangled actions of autonomous organic agents. Theory base: complexity theory.
3 A corporation's behavioral pathways are modulated and constrained by diverse attractors: fixed point, periodic, and strange/chaotic. These reflect and reinforce organizational commitments, which are equivalent to the corporation's core value set. Theory bases: complexity theory and value theory.
4 Agent members of a dominant managerial coalition are carriers of ancestral neural algorithms that motivate organizational efforts to achieve the corporation's attractor-driven commitments/values. Theory bases: cognitive-affective neuroscience and evolutionary psychology.
5 A corporation's moral posture is a function of mutually exclusive and contradictory corporate commitments/values expressed by the algorithmic brains of managerial agents; the risks and dangers of competitive niche taking and niche defense; and the necessities of engaging in collaborative, mutual-benefit social exchanges among internal and external agents.
6 This section identifies theoretical gaps in the general hypothesis and raises a series of questions needing further research and theory development.
7 A final section challenges complexity scholars to engage in moral inquiry through interdisciplinary analysis of organizational phenomena.

THE BIOLOGY OF BUSINESS

The normative basis of business decision making is rooted firmly in natural biological processes that, although themselves not normative, create conditions encouraging and even impelling the making of evaluative judgments and moral rules. Given sufficient time, human values, moral rules, and ethical principles emerge from life conditions laid down by physical and biological forces. The particular way in which such normative phenomena appear on the business scene is explained in this section. At each successive stage, the behavioral and organizational context that eventually produces full-blown moral judgments about business operations emerges in clearer outline.

AGENT ECONOMIZING

Considered as an evolutionary/emergent phenomenon, the business firm is an *economizing* adaptive entity responsive to thermodynamic energy flows in negentropic ways. It pushes back against entropic pressures—that is, it economizes—by drawing resources from its environment and converting them to fungible products and services. All forms of life economize; they must if they are to sustain life by warding off entropy.

> Cells and organisms have achieved astonishingly ramified and subtle detectors that measure sources of energy, plus coupling devices, that extract work and use it to build rough copies of themselves. (Kauffman, 2000: 95)

The corporation's economizing operations are energy transactions among agents inside and outside the firm. The firm itself is an aggregation of energy forms that make economizing possible: the organic energy of agent-employees; physical structures, buildings, and equipment; process materials; mechanistic and symbolic technology; organizational structure; and information/knowledge/data banks (Frederick, 1995, 2002).

"Economizing" as used here carries a more expansive connotation than the normal usage that emphasizes a careful, cautious husbanding of one's possessions. An economizing firm usually attempts to *magnify* the numbers and kinds of energy forms that it commands. However, all firms confront the unavoidable and unyielding entropic pressures of the Second Law of Thermodynamics, which motivates them to strike a positive balance between the capture and cost of energy and its "economical" use in production. For further discussion, see Burley & Foster (1994), Frederick (1995), Ruth (1993).

Kauffman (2000: 4) speaks of "autonomous agents able to manipulate the world on their own behalf," saying that "an autonomous agent is a self-reproducing system able to perform at least one thermodynamic work cycle." That is precisely what a business corporation does when it economizes over successive quarters, trying to manipulate the world on its own behalf. These repeated thermodynamic work cycles keep entropy at bay and thus serve an adaptive function. Economizing companies display

> adaptive tension effects … aimed at moving a firm toward a more adaptively improved state relative to competitors and other forces and constraints in its competitive environment. (McKelvey, 2002: 10–11)

McKelvey (2002: 12) suggests that a corporation can be understood as a Benard cell, with this "adaptive tension" emerging from the interactions of firm and environment. Reducing the thermodynamic energy gradients between organism and environment defines the meaning and origin of life itself, according to biologist Lyn Margulis (Margulis & Sagan, 2002). Agent economizing by and through corporations is clearly one of nature's fundamental and essential life processes.

The principal forms taken by corporate negentropic economizing—and therefore among the principal goals of a corporation—are (McKelvey, 2000) the pursuit of economic rents (higher than average industry profits) and economic growth (made possible by productivity increases). These constitute desirable goals indeed for the firm's agents and the firm itself: an extended life.

Niche competition

Business agents and their companies seek and acquire economizing niches that support their adaptation and survival. This negentropic activity is what Kauffman calls a natural game.

> A natural game is a way of making a living in an environment. That is, autonomous agents are able to act on their own behalf and regularly do so in order to make a living in an environment … The winning games must be those that are readily searched out by the very adaptive search procedures used by the coevolving autonomous agents themselves. (Kauffman, 2000: 73, 74)

Natural (business) games are played both competitively and mutualistically. Fierce battles for greater market share, industry dominance, tech-

nological superiority, financial control, and so on regularly occur. In such environments, the key to niche persistence for an individual firm turns on attaining a rate of internal, intrafirm innovation greater than those of its competitors, plus keeping one step ahead of broad changes in the firm's operating environment.

> To be effective in increasing the probability of creating rent-generating initiatives, microcoevolution rates must exceed technology, market, and institutional change rates as well as the microcoevolutionary rates of a firm's niche competitors. (McKelvey, 2000: 3)

Niches also may be won and defended by forming alliances and partnerships with putative competitors, by merging with or acquiring actual or potential rivals, by controlling standards and key network nodes, by penetrating and capturing the seats of political and governmental influence—essentially, by any search procedure that secures a firm's economizing capacity. Ken Baskin (1998) points out that competitive niche strategies can successfully dominate a market ecology; his example is the struggle between Microsoft and rivals Apple, Motorola, and IBM for dominance of the personal computer market. However, there is another way.

> [Since] living things … exist by virtue of their ability to nurture mutually beneficial relationships in their environment … managers with organic models focus on using their products and services to build relationships with customers, suppliers, and even competitors. (Baskin, 1998: 63, 68–9)

Much the same story is told by James Moore (1996), who, like Baskin, believes that businesses can succeed only by tapping into the symbiotic mutualisms found within ecosystems.

Whether market niches are sought, won, and defended either competitively or cooperatively, their acquisition is one of business's prime functions and a manifestation of its natural biological origins. McKelvey (2000: 2–4) draws a seamless picture of the coevolution of biological agents and the niche-seeking, rent-generating activities of autonomous business agents. For Kauffman the evolutionary outcome of niche taking and niche defense—the playing of natural games by autonomous agents in business firms—is the construction of an economy, which for him is "a merely human extension of biospheres" (Kauffman, 2000: 73–5). Frederick (1995: 153–62) also contends that the mutualistic economizing of diverse, interlinked life entities within ecosystems greatly multiplies

(probably exponentially) the ability of such organic entities or agents, including business firms, to make a living. Business, it seems, is little more than biological process expressed as agent economizing.

SOCIAL EXCHANGE WITHIN DOMINANCE HIERARCHIES

Business and the market rest solidly on a long history of exchange.

> Social exchange is not a recent cultural invention … [it] is universal and highly elaborated across human cultures, presenting itself in many forms. (Cosmides & Tooby, 1995: 1202)

Before money-modulated exchange, there were barter, trade, and reciprocal exchange rooted in family, clan, tribal, and social relations (Angell, 1929; Bohannan & Dalton, 1965; Braudel, 1982; Einzig, 1948; Mauss, 1967; Polanyi *et al*., 1957). Farflung trading empires based on reciprocal exchange predate by several centuries the appearance of monetary economies (Dalton, 1967). Early hominids, precursors of *Homo sapiens*, may have traded stone materials used for tool making, and there is certainly archaeological evidence of ancient exchanges among members of our own species. One can go even further back in evolutionary time and discover reciprocal exchange behaviors genetically embedded in various hominid primates, especially chimpanzees and bonobos (de Waal, 1996, 2001).

This ancient practice is a form of self-organizing among agents playing natural games, and the cooperation and collaboration it brings to relationships are selectively adaptive for the exchange partners. Many, probably most, problems encountered by humans living in groups require cooperation: finding a mate, birthing and nurturing offspring, getting food, defending against competitors and predators, sheltering from climate and environmental threats, and so on. When repeated over long stretches of evolutionary time, such pressures generate common approaches, methods, and attitudes.

Social exchanges emerged among primates, including humans, living within dominance hierarchies, which necessarily shaped the reasoning logic of social exchange partners. As evolutionary psychologist Denise Delarosa Cummins puts it, "our reasoning architecture evolved in response to pressures to reason about *dominance hierarchies*, the social organization that characterizes most mammals." This meant having a brain that could "recognize and respond appropriately to permissions, obligations, and prohibitions … [and could] circumvent the constraints of the hierarchy by dint of guile" (Cummins, 1998: 30).

> Deontic reasoning is reasoning about what one is permitted, obligated, or forbidden to do. When reasoning about deontic rules (social norms), humans spontaneously adopt a violation-detection strategy: They look for cheaters or rule-breakers … [This leads to] a robust deontic effect in human reasoning and [to] … cheater detection and rank discrimination … [as] core strategies for surviving in a primate dominance hierarchy. (Cummins, 1998: 39–40, 42)

Within a corporate setting, these reasoning rules translate into a reward and punishment culture that defines which and in what amounts managers, employees, and owners gain or lose.

These common pathways and reasoning methods encourage and make possible the emergence of cognitive modules responsive to adaptive challenges. The outcome is the presence in today's human brain of sets of neural algorithms—that is, hard-wired modules—matched to the types of special problems encountered in the course of human evolution. Our brains in this age of the World Wide Web are ancestrally derived from the Pleistocene, shaped by selective pressures to attack Ice Age problems (Cosmides & Tooby, 1989, 1999).

Among those evolved, adaptive neural modules, *social contract algorithms* are central to business (Frederick & Wasieleski, 2002). Evolutionary social contracts undergird the modern marketplace. They set the terms of trade. They determine fair and unfair prices. They enable the playing of natural games among agents who pursue diverse interests and needs (Binmore, 1994). Collectively, they constitute the core—the central substance—of a market exchange economy. Corporations as social contractors are the natural game-playing agents of such an economy, seeking economizing goals while occupying and defending market niches.

Social exchanges are never "equal," though, except in the eye of the engaged beholders who settle for an equivalence considered to be fair enough to justify the exchange. Social custom generates proxies such as ritualistic symbols or monetary media of exchange that are then accepted as "equalizing" agents, as revealed by the history of money (Angell, 1929; Einzig, 1948; Malinowski, 1953).

Even more important is the presence of power differentials among social exchange contractors. Deontic reasoning acts as a regulator of power differentials among social contractors that might be placed at risk by unequal social exchanges. While both dominators and the dominated stay alert for cheaters, they also closely attend to their respective

"permissions, obligations, and prohibitions." Needless to say, the reach of a corporate chief executive's deontic duties exceeds those who hold lower rank. The same can be said of their power to break rules and modify social contracts; that is, to be cheaters who dishonor social contracts with shareholders, employees, creditors, and so on.

A spectacular example is Enron CEO Kenneth Lay, who urged loyal employees to hold company stock while he sold huge blocks in anticipation of its declining value. Or the general counsel of Tyco International, accused of illegally taking a $12 million bonus and concealing $14 million in unauthorized personal loans. Or WorldCom's CEO Bernard Ebbers, charged with misleading the board of directors and defrauding shareholders by using $27 million of company loans for purely personal, nonbusiness purposes. Or Rigas family members, indicted for stealing Adelphia company funds to finance purchases of private homes, golf courses, and sports teams.

Deontic reasoning can thus either be used to stabilize a rank-order system of unequal power where the way to survive is to know your place and play by the reward-and-punishment rules, or contrariwise it permits dominants to modify the terms of trade in destabilizing ways. Natural games, it seems, are played for more than economizing prizes alone. Clearly, corporate dominants frequently, or perhaps even characteristically, choose personal power over company economizing, thereby breaching social contracts.

Here, then, are three evolutionary building blocks of today's corporation. They define (1) an agent-driven economizing entity—the firm—playing natural games, (2) by fighting for and defending ecosystem—market—niches, (3) where agent reasoning conforms to reciprocal social exchanges that induce deontic effects while preserving and favoring a power-dominance—executive—hierarchy. Though subsequently elaborated by cultural custom, all three share naturological origins.

More importantly, these biological fundaments constitute the primordial moral seedbed of corporate operations. It is at this basic biological level that moral judgments about business behavior are foreshadowed. Slowly, imperceptibly, a moral consciousness emerges. Economizing is perceived as adaptive and survival oriented, not just for the firm but for all who shelter within its economizing orbit. Niche competition drives firms up to the edge of maximum performance and productivity. An ethic driven by deontic reasoning suffuses market exchanges, tempering and softening the potentially abusive practices of executive dominants.

The corporation achieves coherence and structure—becomes a recognizable, organized entity—as it economizes. Absent organized order, it cannot play natural games or perform thermodynamic work cycles. Organization and economizing are reciprocal, self-reinforcing forces, bound together in a cocreating, coevolutionary embrace. Kauffman (2000: 72) defines organization as

> sets of constraints on the release of energy which constitutes the work by which agents build further constraints on the release of energy that in due course literally build a second copy of the agent itself.

So, we have a coevolving feedforward process: Sets of constraints (organization) —> release work energy (economizing) —> creates new organization —> enables more economizing, and so on.

> Precisely because an autonomous agent links exergonic [energy-releasing] and endergonic [energy-absorbing] reactions in work cycles, the breakdown of high-energy sources here can be used to build up structure here and organization there. (Kauffman, 2000: 75)

This amounts to saying that negentropic economizing and organization are interwoven and mutually reinforcing features of interacting autonomous agents.

For McKelvey, too, order creation follows essentially the same route. As entangled agents encounter Benard cell-like energy differentials in their environment, an "adaptive tension motivates the importation of negentropy and the emergence of adaptation fostering dissipative structures" (McKelvey, 2002: 8). In other words, the firm acts as a Benard cell by developing structure and techniques that remove the energy differentials through effective economizing operations; hence, it becomes another feedforward sequence. The resulting "efficacious emergent structure [fosters] adaptation that enhances [the firm's] survival [and] economic rents [that is, profits above industry average]" (McKelvey, 2002: 8–9). These "adaptive tension effects are … aimed at moving a firm toward a more adaptively improved state relative to competitors and other forces and constraints in its competitive environment" (McKelvey, 2002: 10–11). That is what corporate economizing (Frederick, 1995) and, more generally, life (Margulis & Sagan, 2002) are all about.

The particular *kind* of order and organization that emerges in any given corporation depends largely on the nature of the firm's operating (market) environment, especially the existing level and quality of technological development and the prevalence (intensity and extent) of social dominance, class order, and status rankings within the surrounding sociocultural system. The firm's *economizing order*—its ability to reduce adaptive tension, import negentropy, and play a successful natural game—rests on the congeries of tools, machines, skills, talents, cooperative teams, linguistic nets, information and knowledge data banks, inventive and innovative expertise that it can draw from its surroundings and effectively apply to economizing challenges. Ideally, a company's technologizing capabilities will match or exceed those of its competitors if it is to generate economic rents (McKelvey, 2000).

But there is another kind of order and organization typical of corporations: *dominance-and-power order*, more commonly called command and control. A hierarchy of power, privilege, status-rank, and central control is interwoven with the firm's economizing order, conditioning and channeling policy, strategy, and decisions. As noted in the first section, such a dominance hierarchy induces deontic moral reasoning, as agents pay close attention to organizationally defined duties, obligations, permissions, and prohibitions. On occasion, dominance-and-power order overwhelms economizing order, tipping the balance away from negentropy toward entropic disorder and economizing decline. Overly ambitious mergers and acquisitions pursued by dominance-minded executives can produce this effect.

> Entropy occurs simply from the merging of structures. Thus, despite the wishful aspirations of Wall Street gurus and CEOs, mergers and acquisitions are mostly entropic. (McKelvey, 1997: 369)

The resultant power arrangements create enormous, and enormously rewarding, value-extraction opportunities for well-placed executives who, while touting "synergies" of the merged structures, pocket gains only they personally both control and create (stock options, executive loans, bonuses, golden parachutes, cars, travel, housing, lavish healthcare payments, personal services, and so on). Frederick presents "power aggrandizing" as a core value that

> stands at the very center of business mentality. Few business practitioners vary from the belief that business must be organized and conducted by

> and through the instruments of power and dominance. (Derry *et al*., 1999: 640, quoting Frederick; cf. Frederick, 1995: Chapter 3)

Both kinds of order—technological and command and control—establish a close bond between company and society. Both reflect not only the "law of requisite variety" calling for a rough match between firm and society, but also the organizational and societal "histories of entanglement;" that is, embedded legacies and commitments that condition and sometimes thwart managers' efforts to guide their companies in adaptive ways. "Entanglement" refers to the linkages between autonomous agents in a self-organizing adaptive system. Thus, a company's "entanglement pool" may be "corrupted" by actions taken and commitments made in the past. These historical legacies then either help or hinder a company's pursuit of economic rents (McKelvey, 2002: 8–12).

TRIPARTITE ATTRACTORS AND CORPORATE VALUES

The normative seedbed that germinates moral judgments about business behavior not merely consists of the underlying biological fundaments and an internal order-creation process, but especially and centrally depends on the kinds and qualities of the firm's attractors.

Corporate behavior is constrained and modulated by several kinds of attractors. These attractors are the corporation's values or, more correctly, the total value set that drives the firm's actions, decisions, strategies, and policies. Although an attractor is a mathematical expression describing a system's trajectories in phase space, attractors assume a tangible, substantive form and function within the business corporation. The corporation's *systemic* value sets are adaptive responses to entropic pressures and to self-organizing impulses felt within the firm. Specifically, they include *economizing* that reduces adaptive tensions, *power dominance* that seats control in a managerial elite, and *competitive and mutualistic social exchange* that secures the firm's market niches.

This is not the whole story, however. *Nonsystemic*, nonlinear linkages and interactions among internal agents (employees and managers mainly) inject novelty and unpredictable behavioral rhythms into daily work life. Diverse behaviors and personal values intermingle and, in McKelvey's phrase, form "entanglement pools." Collectively, they comprise a vast clustering of values with potential (but largely indeterminate) influence on a company's operations. They might usefully be called *autonomous agent values*.

In *Values, Nature, and Culture in the American Corporation* (Frederick, 1995), they are called "X-factor" values, with the X denoting the difficulty of knowing their numbers or qualities in any given corporation at any given time. Richard Seel (1998), an organizational consultant, has said that

> there may be thousands of attractors "within" an organisation. Most of these will be at the personal level … but others will be at team level, business unit level, and so on … The wonder, as ever, is that there is any stability at all.

Getting a handle on a company's value complex is a big assignment, given the vastly different ways in which economizing can be accomplished and given the sociocultural wrinkles embedded within any culture's phase space that can spawn value galaxies of great variety, not to speak of the virtually infinite subtleties that distinguish the personal value commitments of the company's workforce. But it is this mosaic of values that drives the corporation's actions, like it or not. To be a manager faced with such bewildering complexity calls for courage of the highest order. Some falter; others "get it" and move the organization along the channels carved out by the three biological fundaments: economizing, niche competition, and social contracting. The firm's normative outcome depends on the particular mix of the three behavioral impulses that the managerial coalition chooses to emphasize, as well as the kinds and relative weight of the attractors embedded within the company's organizational structure. A tripartite set of attractors is typical of corporate organization.

POINT ATTRACTORS

Point attractors are common in the modern corporation: control and concentration of information toward defined roles or divisions, usually specialists of one kind or another; monopolization of key information by the managerial elite and refusal to share knowledge widely within the company; focusing decision making and policy at board or top executive levels; petty turf building and protection of vested management power by alpha males (and an occasional female); and in general "traditional control style management decision structures" (McKelvey, 1997: 370). These "equilibrium points"—that is, fixed-point attractors—exert a conservative force on corporate operations, curbing their oscillations and pulling them in the direction of a desired managerial control. Such values are deeply and permanently embedded within the minds of organizational man-

agers. They comprise a latent, dark force of concentrated organizational power.

Limit-cycle, periodic atttractors

So too do *limit-cycle, periodic attractors* affect performance. They can be seen in the requisite financial performance reports issued periodically, usually quarterly, as well as year-end summaries and forecasts that appear as regularly as the rising and setting sun. Also qualifying as limit-cycle attractors are such transient pendulum swings as "recurrent shifts in the centralization and decentralization of decision making, or functional specialization vs. cross-functional integration" (McKelvey, 1997: 370), along with year-end performance evaluations of employees; plus year-end distribution of bonuses, sometimes skewed into a *saddle attractor* if profit or individual performance has faltered. Periodic attractors and point attractors create a sense of orderliness and expected rhythm within organizational life, conveying a feeling of regularity and control that is psychologically reassuring.

Strange/chaotic attractors

It is *strange/chaotic attractors*, though, that account for most of the firm's criss-crossing, overlapping, never-repeating trajectories as it seeks adaptive niches. Pity the poor managers who believe that they can "manage" this process. They confront the *systemically* embedded values and commitments devoted to economizing purposes and goals, plus what they perceive as the necessities imposed by the deontic duties and obligations incurred in a dominance-power pyramid, as well as the reciprocal expectations of a host of market-exchange partners.

They also face a terror of unknown (and largely unknowable) dimensions that lurks hidden within the minds of the organization's workforce: the *nonsystemic, nonlinear* personal and role-conditioned value commitments that may or may not be compatible with the intentions and goals of the company's managers. For example, a union's strategy may be enough to deflect and defeat the most determined plans of top managers. Courage indeed is needed to grapple with such an uncontrollable behavioral monster. The best managers have learned that they can only shape and cajole and channel, not "manage" or "direct," their company's operations.

Is it any wonder that a corporation has no idea this year where it will be next year? Once set in motion, either by genetic predisposition or sociocultural conditioning, agents' values and commitments are not

willingly relinquished. When thrown together within an organizational context, the hope of the firm's managers is that they will work toward systemic economizing ends. Alas, the trajectories are deflected and warped by the totality of value commitments emerging from other sources: competitors, suppliers, customers, government regulators, warmongers, terrorists, *et al*. The behavioral result is literally "strange" or bizarre or seemingly chaotic, as the company swings through successive but variable cycles bounded only precariously by an attractor basin full of diverse and often contradictory value impulses.

Such values hold the corporation to a recognizable order—organizational roles, standard operating procedures, permitted information flows, short-range goals, allocation of work responsibilities—while opening the company to innovations, new explorations, and discoveries that carry it along in diverse, varying, and unpredictable directions. That is precisely the function of any strange attractor of any complex adaptive system. "The long-term dynamics of a system is governed by its attractors, and the shape of the attractor determines what type of dynamics occur" (Stewart, 1995: 117). That says it as clearly as can be said: Values and attractors are identical.

The point is controversial, some believing that attractors are behavior, not values *per se* (McElroy, 1998). Another online commentator (Arrow, 2002) puts the case this way:

> If, by attractor, we mean a region of state space toward which a system is drawn by the dynamics of system operation, then specific norms for behavior can usefully be thought of as attractors … Such attractors would not necessarily be strange however—they could be fixed action sequences which could be thought of more as a point or a behavior loop.

Moeller (1998) comments in the same vein: "[I]mplicit … organizational values may act as 'strange attractors' at times, providing competitive advantage." Richard Knowles (1998) concurs: "All organizations have strange attractors made up of our values, principles, standards, expectations, vision, and mission."

Nor is this view a mere metaphorical or analogical flourish. Quite the contrary: The claim here is that value sets indeed duplicate and carry forth the exact same function within human organizations as is found within the calculations of nonlinear differential equations that have produced the mathematical notion of strange attractor. In fact, the claim goes even further. A corporation's phase space should be seen as the total

range of value variables and behavioral reinforcements available to any given corporate dynamical system; its phase portrait is a set of swirling values that represents all possible behaviors starting from all possible initial conditions (Frederick, 1998). That it can maintain itself at all as an ordered system requires further explanation.

MANAGERIAL AGENTS AND THE ALGORITHMIC BRAIN

The human agents who reside in a corporation are responsible for its operations. They make decisions, set policy, carry it out as best they can, plan for the company's future, and find and live a life within corporate walls (Dilbert's cubicles?). Together, they comprise *a coalition—an alliance, a collective, a consortium—of interacting agents* whose collective goal is to economize in the name of, and for the benefit of, the larger whole that is the corporate body. This organic human core includes owners, directors, officers, managers, employees, consultants, and all others who enable the firm to do its work. In most large companies multiple coalitions exist, often with overlapping membership. Ideally, they cooperate in pursuing the firm's goals but frequently compete with each other for resources, pay, prestige, perquisites, favorable links to upper management, and so on.

The presence and prominence of organizational coalitions constitute a further commentary on the evolutionary ancestry of today's corporations. It is widely believed and theoretically plausible that hominid primate coalitions, typically headed by a dominant alpha male, have existed for some seven million years, perhaps even since the common ancestor of apes and humans (Boehm, 1999). With variations among different species, particularly bonobos where females play a more prominent role (de Waal, 1996, 2001), the prevalent pattern among most living primates perpetuates the ancestral dominance of males, which should hardly come as a surprise to observers of today's corporations.

The key corporate coalition is, of course, the one at the top: the executive officer group with designated authority over policy and strategy, consisting mainly of top-level executives, directors, division or function heads, legal counsel, and a varying number of support personnel who execute directives and guidelines issued from the upper levels of corporate authority. Most large companies harbor numerous formal (departmental, divisional) and informal (ethnic, gender, water cooler) coalitions that are expected to be submissive to the will of the dominant managerial coalition. Union coalitions, generally less malleable, sometimes can

bring a powerful counterweight to bear on management decisions and policies.

Now, consider the logic chain that connects these coalitions to the company's biological fundaments, its order-creation process, and the behavioral patterns produced by its main tripartite attractors; all of these discussed above. *Members of the company's coalitions are the equivalent of McKelvey's entanglement pools of interacting agents and Kauffman's autonomous agents playing natural games.* Their interactions are responsible for whatever order is present, for success or failure in niche taking and niche defending, and for the value-based behavioral patterns that trace the outlines of the firm's multiple attractors. The agents' actions in a very real sense *are* the corporation. They constitute its order, their actions are in response to the biological fundaments, and collectively their values comprise the operational equivalent of its multiple attractors.

These human, biological agents are products of a selection process extending far back in evolutionary time, and their present behavior reflects much of that ancestral past. The same is true of the human brain and its cognitive-affective architecture. Evolutionary psychologists (Cosmides & Tooby, 1992; Gaulin & McBurney, 2001) posit that current human behavior owes much to the experiences of our hunter-gatherer ancestors of the Pleistocene (Ice Age) era two million to 50,000 years ago. It was then that the human brain took shape and became the computational tool we now possess.

In confronting and resolving the many different kinds of survival and adaptational problems that arose, the hunter-gatherer brain became specialized, developing domain-specific neural algorithms that matched the challenges presented by Pleistocene environments (an early form of requisite variety?). Our modern brains bear the deep imprint of our ancient forebears. As evolutionary biologist Mayr (2001: 252) says, "the human brain seems not to have changed one single bit since the first appearance of *Homo sapiens*, some 150,000 years ago." Wired for Pleistocene times, the brains of coalition members of today's corporations confront an entirely different set of challenges. Therein lies the puzzle, and the tragedy, of management morality. (Contrariwise, developmental psychologists argue for a greater flexibility of brain function stemming from an interplay of genes, neural cells, organisms, and environment; Scher & Rauscher, 2002.)

Among all of the coalitions making up the modern corporation, some agents are "more equal than others" in shaping the corporation and its practices, so the focus here is on the more powerful managerial coalition.

The agent members of the dominant managerial coalition are carriers of ancestral neural algorithms that are brought to bear on the challenges and opportunities encountered by their companies. The domain-specific neural modules of greatest interest are those that mediate *economizing, niche competition, power dominance*, and *symbiotic social exchange*. In the following examples, note their compatibility with the kinds of problems typical of ancestral environments that are now repeated within the arena of contemporary corporate operations.

- The Paleolithic hunter-gatherer's pursuit of quarry is now the corporate manager's quest for economic rents: both activities are types of negentropic adaptive natural games. The brains of both players, ancient and modern, send the same message. *Economize, they must!*
- Securing a Stone Age hominid's survival niche on the savanna or in the rainforest finds a counterpart in the corporation's fierce competitive struggles for market niches across the globe. Again, an algorithmic kinship works toward the same end. *Compete, they must!*
- The alpha males of Pleistocene times would easily recognize today's ego-bloated CEOs who hold sway over their corporate tribal kingdoms. The message goes out to ancient clan and modern tribe alike. *Dominate, they must!* So too does a reciprocal message echo up from the lower ranks: *Submit, they must!*

  According to the *Wall Street Journal*, WorldCom's director of general accounting, a third-level position in the management hierarchy, admitted that he helped carry out the company's massive accounting fraud that had been "approved at the highest level of WorldCom management," although it was reported that he had "'strenuously objected' to making the accounting adjustments" that came from on high. His lawyer told the *Journal*'s reporter, "[He] did not originate this idea. He did not agree to it." Yet, submit, he did: "[H]e followed orders from supervisors to manipulate the company's books to reduce expenses, create illusory profits and satisfy Wall Street expectations" (Markon, 2002). *Submit, they must!*
- The hunter-gatherer mind grasped the necessities and advantages of social exchanges if group life was to be preserved, just as the corporate executive mind is quick to see the benefits derived from today's market exchanges. The algorithmic brain telegraphed what was called for. *Contract, they must!*

The contemporary executive brain is ruled largely by such algorithmic imperatives. It seeks adaptive advantage for the company (economic rents), for the dominant managerial coalition (power, privileges, social standing, political influence), and for the individual executive self (lavish pay, bonus, golden parachute, etc.). A striking but not unusual example of the latter practice is the 2002 compensation of the chairman and CEO of Bear Stearns, a Wall Street investment firm. He received $200,000 in salary, a $10 million bonus, $8 million of the company's stock, and 68,000 stock options—an annual increase of $11 million plus doubled stock options (*Wall Street Journal*, 2003). Beyond these self-promoting inclinations, managerial mentality additionally seeks to outmaneuver agent groups both within and outside the company, including employees, unions, government officials and agencies, and various community associations (universities, foundations, civic groups, public and private schools).

Ancestral neural algorithms are not completely imperious, and they need not dictate specific behaviors. Rather, they are dispositional in their effects on behavior; they dispose an agent to act in ways consistent with Pleistocene habits and culture. It could be said that they constitute a "basin of attraction" that predisposes their human carriers toward deeply embedded impulsive behaviors, while leaving space for alternative, interpretive behaviors around a central tendency. This behavioral escape valve plays a key role in forming a company's moral posture, as will be subsequently told.

But first, note the interplay between managerial algorithms and the company's attractors. The algorithmically driven will of the dominant managerial coalition is to act out the company's commitments to economize, secure niches, and best its rivals in market exchanges—the three biological fundaments underlying business operations. Those organizational commitments in turn become top management's core values, which comprise the set of tripartite attractors pulling the enterprise along varying paths on the economic (fitness) landscape. The executive algorithmic brain, shaped ancestrally, is the active agent striving to match attractors to commitments, behavioral predispositions to actual behavior, entangled agents to corporate goals.

Warring Attractors, Algorithmic Imperatives, and Moral Contradictions

Each agent that inhabits a corporation is a product of natural selection and genetic variation; hence, no two are expected to be or to act the same.

However, agents comprising the dominant managerial coalition appear to exhibit overlapping evolved predispositions rooted in ancestral neural algorithms and can therefore act in concert with their kind. They seem driven, both as individuals and as representatives of the firm, to promote and pursue negentropic economizing goals and to do so from a power-dominance organizational posture. These two attractors give direction to corporate strategy, policy, and decision making and are consistently selected for over evolutionary time, thus giving a characteristic tone and design to the business corporation (Frederick, 2002). It is possible but not empirically established that a self-selection process recruits agents who are especially attracted to these two kinds of challenges and opportunities. One leads to personal wealth, the other to power grandiosity.

Each impulse and predisposition—one to economize, the other to dominate—emerges from a distinctive domain-specific neural module and carries no guarantee of harmony or consistency with the other. At times, power-hungry executives drive their companies into mergers and acquisitions of ruinous proportions, while simultaneously trumpeting the (imagined) economizing virtues of the combination and pridefully displaying a captive "trophy" company (Frank & Sidel, 2002; Orwall & Peers, 2002). Frank (2002) reports that

> well over half of all mergers and acquisitions fail to enhance shareholder value or live up to their promises … [One study] analyzing 700 of the most expensive deals from 1996 to 1998 found that 53% actually reduced shareholder value.

Another study revealed even more drastic outcomes: 81 percent of highly touted 1998 mergers lost money for shareholders (Henry, 2002). As previously noted by McKelvey (1997: 369), "Entropy occurs simply from the merging of structures."

Contradictions like these are inherent in corporate operations. They stem from a kind of warfare between adaptively inconsistent signals sent by different neural algorithms within the executive mind. The most common and ruinous firefights arise from overweening attempts to economize at all costs, regardless of the impacts on company, competitors, and host community. Economizing neural circuits drive the firm and its members to fend off life-threatening entropy, although these very actions generate an increasing wave of ever-greater entropy and disorder that disrupts and sometimes tears asunder a community's symbiotic ecosystem linkages.

With a corporation's increasing, almost ravenous economic expansion in search of new market niches, its host communities become sinks where entropic wastes are dumped: obsolete technology, resource tailings, downsized employees, broken and bankrupt competitors, unpaid debts, diminished stock values, urban decay, impoverished local governments, devastated landscapes, grievously wounded ecosystems. Examples abound: Pittsburgh's devastated steel valley towns, Youngstown's rusting abandoned mills, West Virginia's heaps of coal tailings, the 1,200 Superfund hazardous waste sites scattered across the United States.

Already mentioned is the addictive appeal of power wielding by key members of the dominant managerial coalition who magnify their power, prestige, status, and privileges at the expense of shareholders from whom they may steal surreptitiously or brazenly, extracting wealth for themselves while showing little regard for employees who may lose their jobs, healthcare benefits, and retirement pensions as a result of power-hungry executives answering the call of genetically embedded command-and-control algorithms.

Today's media channels are rife with story after story of these executive depredations: Tyco, Global Crossing, Imclone, Adelphia, *et al*. Sometimes, the perpetrators themselves appear to be bewildered by what they have done, believing that they signed on for their economizing skills but discovering a latent penchant for power maneuvers and the rewards they bring. Little do they realize that they are pawns of behavioral impulses laid down in the neural substrate of their Paleolithic ancestors resurfacing now in the modern corporation's executive suites.

Moral uncertainty also arises from the exercise of social contract algorithms, which elicit the needed cooperation and collaboration of employees, suppliers, creditors, and others if the firm's economizing operations are to succeed. Natural game-playing contractors seek personal and group advantage from which is woven an organizational skein of duties, obligations, and permissions embedded in negotiated social contracts (Rousseau, 1995). Deontic reasoning (Cummins, 1998) drives these negotiations toward what are generally expected to be moral outcomes. Most would agree that social contracting, cheater detection, and a reputation for honesty and integrity constitute the moral seedbed of fairness and justice in social and market exchanges. Thus, the morally corrupted social contracts with employees, retirees, shareholders, and creditors that were negotiated by top executives at Enron, WorldCom, Tyco, and so on betrayed this central moral principle underlying social contracts forged by algorithmic deontic reasoning (Young, 2002).

Popular views to the contrary, such algorithmically activated moral transgressions are not to be explained simply as instances of personal greed, or character failure, or criminal intent, or rule breaking. *They are natural, expected behaviors.* Here one encounters the moral tragedy of the modern corporation. *Its principal actors possess, and give operational expression to, the conflicted behavioral potentials of their algorithmic brains.* For these reasons, the corporate firm is not only its own worst enemy but cannot avoid moral condemnation by others both inside and outside the company. The corporation is morally conflicted for reasons largely beyond the control of its participants, while simultaneously preserving and promoting what is arguably the firm's central moral principle—economizing—on which all life and a society's ecosystem depend.

Enron-like moral reasoning displayed by top-level corporate executives produces an array of algorithmic contradictory behaviors that, while not new to the business scene, are impressive for their audacious magnitude.

- *Dominants versus submissives*, where employee job losses and pension wipeouts were the price paid for executives who gained through cashouts of stock holdings and stock options. Prime example: Enron.
- *Executive pay/perquisites versus company assets*, where executive loans, salaries, stock options, and personal expenses looted company treasuries, often with board approval. Prime example: Adelphia.
- *Executive coalition versus shareholders/investors*, where top executives took advantage of privileged information and engaged in insider trading at the expense of external shareholders. Prime example: Imclone.
- *Company versus community*, where energy traders illegally boosted the price of energy sold to Californian customers. Prime example: Enron.
- *Coalitional collusion versus stock markets*, where auditors signed off on questionable financial condition reports, thereby misleading investors and undermining trust in stocks and financial markets. Prime example: Arthur Andersen.

Shocking and ugly as they are, such behaviors are entirely consistent with what is otherwise a normal agent–environment, self-reinforcing, feedback interaction. All agents confront environments filled with adaptive opportunities, which then stimulate and activate embedded algorithmic impulses. The combination of investors' "irrational exuberance" during

the stock markets' runup, the easy availability of self-financing stock options, boards' oversight laxness, and corporate cultures primed for and committed to expansive growth and gain created an environment of unparalleled opportunity for executive exploitation. Executive behavior at rogue corporations was precisely what one can expect of adaptive agents responding to environmental opportunities on their "fitness landscapes." No one should be surprised, least of all complexity theorists.

In seeking a way out of this algorithmic trap set by nature, one can be comforted by knowing that these mental modules represent statistical averages and probabilities generalized over many evolved generations. As noted earlier, they induce predispositions to behavior, not precise behavioral regimes. They outline possibilities, not certainties or rigid routines. For any given executive, their operational effect is unpredictable except in a very general sense. When multiplied by the numbers and types of people found within any given business firm at any given point of time, the lack of predictability of their moral state is magnified by several orders of magnitude. They are indeed an entanglement pool of morally diverse agents: a rich source of self-promotion, independence, moral imagination, resistance to organizational rules, and in rare cases rebellion against authority.

At times, even members of the inner core—the dominant managerial coalition—may display a diversity of algorithmic inheritance that deflects a company from morally questionable actions. WorldCom's vice-president of internal audit, assisted by a staff auditor and a senior manager, uncovered $3.8 billion in phony accounting entries authorized by the company's chief financial officer, refused to back down when told not to continue, and reported the fraudulent entries to the board of directors, who then fired the CFO. The *Wall Street Journal* reported that this internal audit team "took their commitment to honest financial reporting to extraordinary lengths." They were

> time and again … obstructed by fellow employees, some of whom disapproved of WorldCom's accounting methods, but were too frightened to contradict their bosses or thwart the company's goals. (Pulliam & Solomon, 2002: A1)

Clearly, the internal auditors' algorithms attuned to honesty differed from those of their submissive colleagues.

Enron's top-level executives were similarly warned by a high-ranking officer about unwarranted accounting and financial procedures that hid

costs and inflated revenues. In earlier years, Johnson & Johnson's CEO bucked strong opposition from key officers and ordered a costly recall of all Tylenol stocks after contaminated packages had fatally poisoned a number of people. The varying algorithmic patterns of a company's biological agentry permit diverse moral themes to be injected into policy, thereby acting as a kind of moral safety valve in face of unbridled economizing and maniacal power aggrandizement.

Unanswered questions, continuing puzzles

The hypothesis presented here has made the following argument. Executive managers of business corporations, acting in concert as autonomous agents, are impelled by ancestral neural algorithms to seek economizing outcomes for their firms and to do so within a social dominance hierarchy that aggrandizes their own organizational power. Their decisions, policies, and strategies are intended as adaptational responses to opportunities and challenges detected within the company's operating environment (its "fitness landscape"). Such environmental encounters represent attempts by the firm's executive managers to reduce ambient energy differentials in order to achieve negentropic outcomes, measured as economic rents and productivity increases greater than their marketplace rivals.

A company's moral posture is established where its diverse attractors, as proxies for core values, intersect with the algorithmic impulses of the firm's dominant managerial coalition. Contradictions arise from simultaneous efforts to achieve adaptive economizing outcomes for the firm, power aggrandizement for coalition members, and deontic obligations stemming from symbiotic social contracts with internal and external stakeholders. Management morality is therefore the emergent consequence of autonomous agents acting out the morally contradictory behavioral predispositions of genetically embedded neural algorithms.

Using this hypothesis, an explanation is sought for the spectacular spate of turn-of-the-century corporate corruption, criminal law breaking, fraudulent financial reporting, theft of company assets, decimation of employee retirement funds, collusion between auditors and audited firms, faked stock research, insider trading, massive employee job losses, abuse of organizational authority for personal gain, and other related illegal actions. Hypothetically, all such activities are the normal, expected consequence of managerial agents responding adaptively to ancestral neural algorithms activated by environmental opportunities and

challenges. In this sense, morally contradictory behaviors are an inescapable feature of corporate and managerial life.

The general hypothesis is derived from core concepts found in organizational complexity, thermodynamics, evolutionary psychology, and cognitive neuroscience. It therefore reflects a reasonably robust theoretical explanation of errant corporate behavior.

Nevertheless, legitimate questions remain, requiring response and further study.

Can corporations be morally judged—put on trial, so to speak—when all the evidence and witnesses come solely from nature?

Put another way, are values inherent in nature? In seeking an answer, most would surely agree that the natural processes of adaptation, survival, development/growth, generational replication, and cultural flourishing have normative weight for the human species. We value, indeed cherish and promote, these evolutionary outcomes for ourselves and increasingly for other species as well.

These human values and normative judgments can be seen as extrusions—a human molding—of naturally evolving processes. Values are not "in" nature. Value judgments emerge from and reflect human experience in coping with nature. (It is arguably true that only humans consciously have values and moral judgments, although some of our close primate cousins act out what would in a human group be called moral behavior (de Waal, 2001), though perhaps it is more appropriately labeled a kind of protomorality.) Neither are values rationally or deliberately "invented," although they do reflect human intelligence in varying degrees. Values and the judgments they inspire exist in pragmatic form and function long before they are recognized and called "values." Though end-products of a long evolution, values and nature are not often conceived as linked together because by the time emergent values take cultural form their initiating provenance in nature tends to be forgotten (Frederick in Derry *et al*., 1999: 636–42). Nevertheless, values are sewn seamlessly into nature's grand fabric.

Such a view raises the philosopher's "naturalistic fallacy" objection that no "ought"—that is, value—is implied by any "is,"—that is, any state of nature. Space being too limited for a full discussion, suffice it to say that the "naturalistic fallacy" is itself a fallacy and an ethnocentric misinterpretation of nature implying its contradictory opposite; namely, that abstract, noncontextual "oughts" can be made into "is-es." Human history is replete with the folly and tragedy of trying to impose human will—that

is, values—on nature. In the end, human values and moral judgments *emerge from*, rather than being imposed on, the natural world. The very emergence of a moral consciousness is itself another manifestation of biological function as neural algorithms process responses to environmental cues.

What specific kinds of situations allow social-dominance/power-aggrandizing impulses to override a company's need to economize and to establish symbiotic social contractual ties with stakeholders? After all, not all corporations act corruptly on the scale recently observed among leading US companies. What determines the balance among competing algorithmic drives within any given managerial coalition?

Although the answer remains elusive, clues exist. As argued earlier, cognitive algorithms predispose but do not dictate behavior, allowing variable judgments within any given population of executive managers. Individual cultural conditioning will have inculcated varying attitudes and inclinations. Idiosyncratic life histories, parental influence, ethnic identification, gender, age, professional affiliations, stage of career development, dominant versus passive personalities, and other such biographical factors inject a lively amount of behavioral diversity into coalitional behavior patterns. Chance—the probability distribution of predispositional algorithms that interface with personal life histories—therefore can be expected to play a role of indeterminate magnitude as executive managers and their coalition partners make decisions, set policies, and plan strategy.

Why was there such an explosion of corporate corruption and criminal behavior at the beginning of the twenty-first century? Was it mere chance that rolled the dice of behavioral diversity, turning up more crooks than good guys? Or was it simply greater transparency of boardroom and executive suite, revealing customary levels of previously well-hidden behavior?

Neither explanation should be rejected out of hand, but theory suggests a more plausible possibility. Adaptive algorithms are by their very nature activated when organic agents encounter ecosystem messages signaling opportunity or threat. A veritable flood of opportunistic signals washed through corporate headquarters as the new century dawned: an unequaled runup of stock-market values, an explosion of high-tech entrepreneurial firms and their associated new stock offerings (IPOs), the exaggerated profit opportunities opened up for investment banks and

creditor institutions by these developments, the headiness of unprecedented rates of return promised by stockbrokers hawking their wares, the ease of financing stratospheric executive pay demands, a relentless pressure to achieve higher economic rents, a collusive climate of accommodation between auditors and their principal consulting clients, and a winner-take-all psychology that permeated executive minds intent on using corporate assets for personal enrichment. Scale, not chance, was at work. The corporate savanna (read market ecosystem) was suddenly alive with game. The predators licked their chops, and struck. The rest, as they say, is history.

If the dominance algorithm is universal, why does it manifest itself so differently in these types of companies?

This was a question posed by a reviewer of the article, citing research on two types of organizational hierarchy, one where power flows from organizational position as seen in AT&T, the other from expertise as in 3M. He wonders, could it be traceable to the original values of the founders and their continuing imprint on company culture, or does the particular kind of market served shape organizational design and architecture?

No definitive answer is to be found in this article's hypothesis, beyond noting the distinction drawn earlier between economizing, which depends almost completely on technological expertise, and command-and-control systems largely reliant on imputed ritual authority to justify decisions. Power drawn strictly from status differentials, absent a supportive economizing technostructure, cannot long survive. Sooner or later a CEO, however much devoted to power acquisition, has to produce or show economizing results. Hence, as the hypothesis suggests, economizing is the most persistently favored selective factor in corporate evolution, although the line between power-as-expertise (3M) and power-as-position (AT&T) is blurred and indistinct.

That blurring may contain an important clue. This article argues that selection pressures operate at two levels: individual (executive) and group (coalition) levels. Which, then, is the stronger; that is, will an executive prioritize his or her self-interest or that of the dominant coalition and *inter alia* the firm? The theoretical likelihood is that genetically determined self-interest will trump enculturated group interest, particularly when the line between executive power and personal (economizing) gain is not clear. Against this background, the reviewer's suggestion that founders' values and company history—complexity theory's initial conditions—set the stage for subsequent organizational priorities helps explain the variations present in an AT&T and a 3M corporation.

Is there, then, a self-reinforcing feedback loop formed by the two kinds of algorithms?

This would allow empowered executive decision makers to maintain the appearance of economizing behavior by the company while at the same time realizing enormous personal benefits for themselves.

Here, the answer is clearer, though speculative. In the most prominent cases of corporate misbehavior—Enron, WorldCom, Tyco, Global Crossing, Qwest, *et al*.—the accused executives have insisted that they acted in good faith to promote board-approved goals and strategies. While easily dismissed as a first line of legal defense, such claims have a ring of truth. For such executives, no clear demarcation line separates the exercise of economizing algorithm from power-wielding algorithm; the one is instrumental to achievement of the other.

Enron CEO Kenneth Lay probably meant what he said when he counseled employee stockholders to hold their shares as good investments, even as he secretly sold his. The same might be said for CFO Andrew Fastow of Enron as he created several off-the-books entities to hide costs and boost revenues, thereby making the company look good and enriching himself, albeit allegedly corruptly and illegally. This blurring of domain-specific algorithms—one to economize, the other to gain and use power—may well signal the presence of an executive mind unable to know the difference between right and wrong, or between the firm's economizing needs and the managerial coalition's thirst for power, privilege, and domination.

This moral myopia clearly is not found in all executives charged with corrupt actions. A coalition consisting of CEO, CFO, financial vice-president, auditor, and purchasing manager of American Tissue "recorded bogus sales, diverted money to subsidiaries, and otherwise doctored the books" with the help of an auditor employed by Arthur Andersen who "deleted e-mail messages, shredded documents, and otherwise helped the paper company … destroy records that might have supported accusations of accounting fraud" (Deutsch, 2003). As the prosecuting attorney remarked, "This is a classic case of corporate greed, fraud and obstruction" that cost creditors $300 million and 2,700 employees their jobs (Deutsch, 2003). The same kind of intentional behavior was revealed in recorded messages between WorldCom executives fully aware of the company's fraudulent accounting practices (Cohen *et al*., 2003).

Finding secure answers to these several questions requires a continuing refinement of theory and a program of research, both beyond the scope

and intention of this article. Research currently underway by the author explores two dimensions: empirical research to identify the presence and intensity of ancestral social-contract/cheater-detection algorithms in diverse groups of business practitioners; and an empirical study to identify the numbers, extent, and organizational depth of membership in managerial coalitions accused of corrupt actions. Both studies should help confirm or disconfirm the central theoretical premise of this article that executive behavior is attributable largely to the activation of morally contradictory neural algorithms.

AN INVITATION TO MORAL INQUIRY

Complexity theorists rarely venture into normative terrain, an ironic mirroring of the positivism that one finds in the oft-criticized mechanistic sciences. It is an odd omission, all the stranger because of complexity theory's potential for normative analysis of organizational life. In an online discussion, complexity theorist Stanley Salthe (2003, emphasis added) remarked that "complexity is an attitude toward subject matter … [that embraces] a desire to include meaning (*for some this includes values*) in our models of natural systems." Continuing, he said,

> [O]ne could conclude that complexity is a philosophical approach, not science at all … As an important example: some think that a more complex approach to technology/economics … would obviate the devastating pollutions that are accumulating apace as a result of applying the classical simplifying scientific attitudes to this basic sphere of social activity. But—how to do it?

One answer to Salthe's challenging question is displayed in this article. Economizing, executive power aggrandizement, and symbiotic social contracting are products of nature constituting the corporation's core functions and also acting as sources of value judgments about corporate performance. Additionally, corporations both negate and sustain the moral/normative dimensions of ecosystem dynamics: nature's wondrously diverse symbiotic mutualisms that enable interspecies flourishings. Complexity theorists quite possibly can bring greater clarity to explanations of corporate behavior by exploring the chaotic moral order hidden among the entangled agents whose collective self-organizing actions define the whole. Investigators will find that moral outcomes vary with the kinds and relative strength of attractors present and active, the

particular mix of neural algorithms driving the decisions and policies of the dominant managerial coalition, and the countervailing influence of attractors and algorithms operative among competitors and stakeholders.

Let complexity concepts—natural games, adaptive tension, entangled agents, attractors, *et al*.—be joined with insights, perspectives, and research initiated in other disciplines: evolutionary psychology, cognitive-affective neuroscience, thermodynamics, ecology, anthropology, and others. It is time for complexity scholars to confront and clarify the normative questions that mean so much to human wellbeing. The potential is there. As Shakespeare's Hamlet, at a moment of hesitation, mused to himself, "'This thing's to do'; sith I have cause, and will, and strength, and means to do't."

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REFERENCES

Angell, N. (1929) *The Story of Money*, Garden City, NY: Garden City Publishing.

Arrow, H. (2002) Commentary posted on complex-science@necsi.org, September 29.

Baskin, K. (1998) *Corporate DNA: Learning from Life*, Boston: Butterworth-Heinemann.

Binmore, K. (1994) *Game Theory and the Social Contract: Playing Fair, Vol. 1*, London: Faber & Faber.

Boehm, C. (1999) *Hierarchy in the Forest: The Evolution of Egalitarian Behavior*, Cambridge, MA: Harvard University Press.

Bohannan, P. & Dalton, G. (eds) (1965) *Markets in Africa: Eight Subsistence Economies in Transition*, Garden City, NY: Anchor Books.

Braudel, F. (1982) *The Wheels of Commerce: Civilization and Capitalism, 15th–18th Century, Vol. 2*, New York: Harper & Row.

Burley, P. & Foster, J. (eds) (1994) *Economics and Thermodynamics: New Perspectives on Economic Analysis*, Boston: Kluwer Academic Publishers.

Bush, G. W. (2002) "Radio address by the President to the nation," Office of the Press Secretary, June 29.

Cohen, L., Pulliam, S., & Solomon, D. (2003) "WorldCom report offers evidence Ebbers knew about accounting," *Wall Street Journal*, March 12: A1.

Cosmides, L. & Tooby, J. (1989) "The logic of social exchange: Has natural selection shaped how humans reason: Studies with the Wason selection task," *Cognition*, 31: 187–276.

Cosmides, L. & Tooby, J. (1992) "Cognitive adaptations for social exchange," in J. H. Barkow, L. Cosmides, & J. Tooby, J. (eds) *The Adapted Mind: Evolutionary Psychology and the Generation of Culture*, New York: Oxford University Press.

Cosmides, L. & Tooby, J. (1995) "From function to structure: The role of evolutionary biology and computational theories in cognitive neuroscience," in M. S. Gazzaniga (ed.) *The Cognitive Neurosciences*, Cambridge, MA: MIT Press.

Cosmides, L. & Tooby, J. (1999) "The cognitive neuroscience of social reasoning," in M. Gazzaniga (ed.) *The Cognitive Neurosciences*, Cambridge, MA: MIT Press.

Cummins, D. D. (1998) "Social norms and other minds: The evolutionary roots of higher cognition," in D. D. Cummins & C. Allen, (eds) *The Evolution of Mind*, New York: Oxford University Press.

Dalton, G. (ed.) (1967) *Tribal and Peasant Economies*, Garden City, NY: Natural History Press.

Derry, R. *et al*. (1999) "Nature's place in legal and ethical reasoning: An interactive commentary on William Frederick's *Values, Nature, and Culture in the American Corporation*," *American Business Law Journal*, 36(4):633–70.

Deutsch, C. H. (2003) "Accountant and paper company chief face fraud charges," *New York Times*, March 11: C4.

de Waal, F. (1996) *Good Natured: The Origins of Right and Wrong in Humans and Other Animals*, Cambridge, MA: Harvard University Press.

de Waal, F. (2001) *The Ape and the Sushi Master: Cultural Reflections of a Primatologist*, New York: Basic Books.

Einzig, P. (1948) *Primitive Money: In Its Ethnological, Historical and Economic Aspects*, London: Eyre & Spottiswoode.

Frank, R. (2002) "More and more, mergers of '90s are becoming today's spinoffs," *Wall Street Journal*, February 6: C1, C17.

Frank, R. & Sidel, R. (2002) "Firms that lived by the deal in '90s, now sink by the dozens," *Wall Street Journal*, June 6: A1, A8.

Frederick, W. C. (1995) *Values, Nature, and Culture in the American Corporation*, New York: Oxford University Press.

Frederick, W. C. (1998) "Creatures, corporations, communities, chaos, complexity: A naturological view of the corporate social role," *Business and Society*, 37(4): 358–89.

Frederick, W. C. (2002) "The evolutionary firm and its moral (dis)contents," The Ruffin Lectures, Darden Graduate School of Business, University of Virginia, Charlottesville, VA, April, forthcoming in *Business Ethics Quarterly*.

Frederick, W. C. & Wasieleski, D. (2002) "Evolutionary social contracts," *Business and Society Review*, 107: 3, 283–308.

Gaulin, S. J. & McBurney, D. H. (2001) *Psychology: An Evolutionary Approach*, Upper Saddle River, NJ: Prentice-Hall.

Henry, D. (2002) "Mergers: Why most big deals don't pay off," *BusinessWeek*, October 14.

Kauffman, S. A. (2000) *Investigations*, New York: Oxford University Press.

Knowles. R. N. (1998) Personal communication to author, February 3.

Malinowski, B. (1953) *Argonauts of the Western Pacific: An Account of Native Enterprise and Adventure in the Archipelagoes of Melanesian New Guinea*, New York: E. P. Dutton.

Margulis, L. & Sagan, D. (2002) *Acquiring Genomes: A Theory of the Origins of Species*, New York: Basic Books.

Markon, J. (2002) "WorldCom's Yates pleads guilty," *Wall Street Journal*, October 8: A3.

Mauss, M. (1967) *The Gift: Forms and Functions of Exchange in Archaic Societies*, New York: Norton.

Mayr. E. (2001) *What Evolution Is*, New York: Basic Books.

McElroy, M. (1998) Commentary posted on COMPLEX-M@HOME EASE.LSOFT.COM, September 25.

McKelvey, B. (1997) "Quasi-natural organization science," *Organization Science*, 8(4): 352–80.

McKelvey, B. (2000) "MicroStrategy from MacroLeadership: Distributed intelligence via new science," in A. Y. Lewin & H. Volberda (eds) *Mobilizing the Self-Renewing Organization*, Thousand Oaks, CA: Sage.

McKelvey, B. (2002) "Emergent order in firms: Complexity science vs. the entanglement trap," in E. Mitleton-Kelly (ed.) *Complex Systems and Evolutionary Perspectives of Organizations: Applications of Complexity Theory to Organizations*, New York: Elsevier.

Moeller, D. (1998) Commentary posted on COMPLEX-M@HOME.EASE.LSOFT.COM, August 28.

Moore, J. F. (1996) *The Death of Competition: Leadership and Strategy in the Age of Business Ecosystems*, New York: HarperBusiness.

Orwall, B. & Peers, M. (2002) "The message of media mergers: So far, they haven't been hits," *Wall Street Journal*, May 10: A1–A5.

Polanyi, K., Arensberg, C. M., & Pearson, H. W. (1957) *Trade and Market in the Early Empires: Economies in History and Theory*, Glencoe, IL: Free Press.

Pulliam, S. & Solomon, D. (2002) "How three unlikely sleuths discovered fraud at WorldCom," *Wall Street Journal*, October 30: A1, A6.

Rousseau, D. (1995) *Psychological Contracts in Organizations: Understanding Written and Unwritten Agreements*, Thousand Oaks, CA: Sage.

Ruth, Matthias (1993) *Integrating Economics, Ecology and Thermodynamics*, Dordrecht: Kluwer Academic Publishers.

Salthe, S. (2003) Commentary posted on COMPLEX-M@HOME.EASE.LSOFT.COM, January 6.

Scher, S. J. & Rauscher, F. (2002) *Evolutionary Psychology: Alternative Approaches*, Dordrecht: Kluwer.

Seel, R. (1998) Commentary posted on COMPLEX-M@HOME.EAST.LSOFT.COM, September 28.

Stewart, I. (1995) *Nature's Numbers: The Unreal Reality of Mathematics*, New York: Basic Books.

Wall Street Journal (2003) "CEO Cayne saw sharp rise in his pay package for 2002," March 3: C13.

Young, S. (2002) "In bankruptcy, getting laid off hurts even worse," *Wall Street Journal*, September 30: A1, A12.