

Better is Better Than More

Complexity, Economic Progress, and
Qualitative Growth

by Michael Benedikt and Michael Oden

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Better is Better than More: Complexity, Economic Progress, and Qualitative Growth

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When it is said that we are too much occupied with the means of living to live, I answer that the chief worth of civilization is just that it makes the means of living more complex; that it calls for great and combined intellectual efforts, instead of simple, uncoordinated ones... Because more complex and intense intellectual efforts mean a fuller and richer life, they mean more life. Life is an end in itself, and the only question as to whether it is worth living is whether you have enough of it.

Oliver Wendell Holmes, Jr. (1915)

1. Introduction, and an overview of the argument

Because mainstream neoclassical economics focuses on the marketplace and its system of pricing, the practical interest of most economists revolves around ways to improve market efficiency, i.e., ways to get more goods to more people at the least overall risk, cost, and outside regulation. While accidents of history and geography, advances in technology, the design of institutions and governments, and the nature of human nature are important, from the perspective of mainstream neoclassical economics they are important chiefly insofar as they enhance or detract from market volume and/or market efficiency expressed in quantifiable terms.

For critics from both inside and outside of economics much remains sidelined by this disciplinary self-circumscription: not just issues of quality and quality-of-life, but of social justice and environmental sustainability, the latter especially in the face of global economic and population growth.

By the 1980s, academic economists had embarked upon several new lines of investigation, among them: economies as complex-adaptive systems, agent-based computational modeling, and the sub-fields of behavioral, ecological, evolutionary, and neuro-economics (cf. Davis, 2006). The law-and-economics movement and institutional and development economics were also relatively new in the 1980s, while the mathematics- and computation-driven field of finance was expanding rapidly. Some of these new lines of investigation were (and are) dedicated to improving economics' effectiveness in conventional terms: how better to set interests rates, reduce unemployment, control inflation, protect currencies, or direct capital to stimulate growth, trade, and profitability while managing risk. Others are dedicated to extending the range of economics' concerns to social and material life generally, this in the effort to answer such questions as: why do some people, some firms, some cities, and some countries prosper while others do not? What *should* money be able to buy, and what not? How do social arrangements affect markets and vice versa? What sorts of education will lead to

future prosperity; and what sorts of technologies? And how are we to cope with the mounting distress of the natural environment?

It is chiefly with this latter set of questions in mind that this paper foregrounds the idea of *quality*.

We argue that quality is more than an outlying variable addressed by adding a term (or two) to the utility function of a mathematical model. Neither is it well captured by studies in product differentiation, point-of-sale information asymmetries, consumer preference, technological innovation, or management protocols (such as Total Quality Management). We think that *quality* represents something deeper and more universal, that it's a "force" in the economy related to, but not the same as, utility, and one that taps into the ancient processes of evolution. And because product-quality, work-quality, and life-quality can be measured—quantified—at least to the extent of making transitive comparisons of degree (so that if $Q_A \geq Q_B$, and $Q_B \geq Q_C$, then $Q_A \geq Q_C$ over the same criteria for the same people), we think it can be built into market models at a basic level.

We will argue, further, that a general increase in the *quality* of the goods and lives produced by an economy—which is what we will mean by "qualitative growth"—is not only more sustainable than, but can substitute for the general increase in the *quantity* of goods and lives produced—which is what people generally mean by "economic growth"—while offering the same if not greater opportunities for profitable investment, full employment, and decent wages. We see, especially in advanced, consumer-driven economies like the U.S.'s moving from a quantitative to a qualitative growth ideal, not just the possibility of easing the stress on the natural environment, but of reversing the Great Jobs Recession that was gripping the United States *circa* 2011 and that may be gripping it still.¹ If recessions are periods of "creative destruction," or times when economies begin transitioning from one set of values and production priorities to another (cf. Schumpeter, 1934; Romer, 1996), we might let *quality* be the new watchword.

Herman Daly stands out among economists sharing this view. He has long argued that a quantitatively

¹ The term "Great Jobs Recession" is due to Robert Reich (Reich, 2010a), who soon called it the Great Jobs Emergency (Reich 2010b). Reich acknowledges that job automation by software and job exportation to low-wage countries are two long-term trends causing unemployment in the U.S., but, following Keynes, points to a deeper cause: extreme income and wealth inequality, rising middle- and working-class debt, and the corruption of American politics (by money), which keeps the first two rising. Critical to recovery, Reich argues, are not jobs in greater number (i.e. "employment"), but increased spending power among the middle- and working classes coming from jobs that pay well.

We want to argue that increasing the spending power of the working and middle classes may well drive up demand, but that that demand should not be for the same old goods and the same old jobs—i.e., for business as usual but better paid. Our advocacy will be to increase the demand for, and supply of, only higher *quality* goods, broadly conceived, this by several means including harnessing some of the power of the financial sector.

steady-state economy, which is probably necessary for ecological sustainability,² does not preclude a qualitatively growing economy—an economy that, rather than sprawling over hills and valleys leaving freeways and junkspace in its wake,³ expands cleanly into another, non-physical dimension. To make this happen, Daly proposes putting whole national economies on a diet: government-imposed caps on industrial throughput (= nonrenewable resource consumption + non-biodegradable waste production, industry by industry), and then relying on the still-very-free market to learn how to become more efficient at producing the same or better goods. On a diet like this, market competition would force producer ingenuity upward and quantitative materio-energetic consumption downward, leaving qualitative improvement the best if not only avenue for growth.

Is Daly's proposal realistic? In the U.S., U.K., Japan, and other capitalist democracies, as Jackson (2009) points out, success depends on how closely government and private capital can work together, and on whether people will vote for throughput limits on their major industries without every other country doing so too.

Success depends also, however, on how well legislators, producers, and consumers understand what "quality" *is*, how it can be measured and accounted for. This requires shifting focus from the how many and how much of things to the how well and how swell of them. Once more people come to value quality over quantity, greater economic-strategic advantages will accrue (as they already do) to the companies and countries that produce the highest quality, not the highest number of goods. The need for greater materio-energetic consumption will wane, the drive to greater natural-resource exploitation will abate, and regulations encouraging these trends will more readily be put in place.

What, then, is "quality."

The quality we call the "quality" of a good or service or experience, we will argue, is due to its

² E.g. Daly (1991). "In my view," Daly writes later (1996), "industrialized countries must attain...a level of resource use that is both sufficient for a good life...and within the carrying capacity of the environment. ...Population growth and production growth must not push us beyond the sustainable environmental capacities of resource regeneration and waste absorption. ...[O]nce that point is reached...Physical growth should cease, while qualitative improvement continues."

Not everyone agrees to this, of course (e.g. Ben-Ami, 2010), or agrees that zero-growth *capitalism* is possible. "But how could there ever be a capitalist economy that does not grow *quantitatively*?" asks Smith (2010): "For more than thirty years Daly has chanted his mantra of 'development without growth' but he has yet to explain, in any concrete way, how an actual capitalist economy comprised of capitalists, investors, employees, and consumers could carry on from day to day in 'stasis'." This paper might provide a part of the answer. For an elegant and accessible review of the ecological economist's argument, see Stoll (2008); for its present shortcomings see Speth (2008), and for a terse overview of the need for sustainable, quality-of-life-driven growth, see Capra and Henderson (2009).

³ The word "junkspace" was coined by architect and urbanist Rem Koolhaas. See Wolf (2000).

complexity. Most fundamentally, *complexity* is the non-material dimension into which a qualitatively growing economy expands without using more space, mass, or energy.⁴

Not incidentally, biological life generates just this kind of complexity. Or rather, *evolution* does. The long-term increase of the neural complexity of animals, for example, both over evolutionary time and over the life of any animal that learns from experience, is a product of life's fundamental evolutionary processes, namely, reproduction with inheritance, variation, and selection, operating in an increasingly crowded and/or changing physical environment.⁵ Ditto the proliferation not just of cells, but also more importantly, of cell *types*. In both trends, contrary to popular opinion, the principle of efficiency does not count for much. At work instead is the principle of whatever-works—and kinder yet, the principle of whatever-trait-doesn't-get-in-the-way-(of-reproduction)-gets-to-stay.⁶ This is how complexity accumulates. Selection winnows out certain traits, to be sure, but only those that are harmful to reproduction. The result is the apparent ingenuity on the one hand, and the improbable splendor on the other, of all living things.

The long-term increase in the diversity and complexity of human affairs that Oliver Wendell Holmes Jr. describes at the start of this paper is a consequence of evolutionary processes too. It's just that with human beings the evolutionary game is played at higher levels of complexity, involving language, tools, institutions, markets, and (ideally) fewer casualties. Also emergent at these higher levels of complexity is the organizing/selective ideal of *efficiency*, this as evolution—in human hands—speeds up, virtualizes, and becomes design.⁷

⁴ Among prominent economists other than Daly, Paul Romer comes closest to identifying economic development fundamentally with the creative "rearrangement" of resources to create new value. Arrangement is an essentially informational, complexity-theoretic idea, but to our knowledge, he does not valorize complexity per se.

⁵ We include individual learning as an instance of the evolutionary process not because we are Lamarckians, but because we are persuaded by Nobelist Gerald Edelman that learning is evolution operating in the medium of neurons, specifically, in the differential reproductive fitness of neuronal groupings (see Edelman, 1987, 1992; Mountcastle, 1978; see also Calvin, 1996; Dennett, 1991).

Some might note at this point that, in evolutionary terms, the "success" of a species *means* its success at proliferating, i.e. at achieving numerical "moreness;" and indeed, we just referred to increasing crowdedness as an evolutionary pressure towards complexity. Does this mean that among humans quantitative growth is necessary for qualitative growth to occur? Up to a point, yes, of course (Kremer, 1993a; Galor and Weil, 1999): complex systems develop emergent properties only after their populations reach critical numbers. But among living things, "crowdedness"—i.e., population density with interactivity—is the significant variable, not absolute number. Among humans, great social and economic complexity can be achieved with relatively small populations by properly amenitized and communication-served urbanization. (Classical Athens at its height numbered 250,000.) Cf. most recently Glaeser (2008, 2011), presaged by Jacobs (1969) and Meier (1962), who first saw the importance of communications.

⁶ Nelson and Winter (1982) were among the first who, in developing an evolutionary theory of economic growth, pointed out that firms, like ordinary people, will keep to the same routines as long as they are successful at doing so, which is to say, until the environment changes and/or competition increases to the point that viability—self-reproduction—is threatened.

⁷ On the homology between the evolutionary process and conscious design (by actual designers), see Benedikt (2010).

Holmes recognized that greater complexity makes life more “worth living.” And surprisingly perhaps, this is so even as—and in part because—people long for simplicity. When we look at that paradox more closely, we will see that there are ways to have both more complexity *and* more simplicity, a double goal, the achievement of which guides evolution and the quest for which drives design.

Certainly, the arrangements that must be made to ensure fairness on the one hand and to reward personal ambition on the other inevitably become more complex as societies develop in directions that lead to a higher quality-of-life for all. Enter *equity*, we will say, as a partner to quality in the quest to increase that part of life’s naturally-evolving complexity that is under our control. This paper tries to make these two linkable dynamics at least plausible as a source not of economic growth, which is largely quantitative—i.e. about “more”—but of *economic progress*, which we might define as the simultaneous and sustainable increase in the *quality* and *equity* of all people’s lives—i.e. about “better.”⁸

2. Economic growth, economic development, and economic progress

We begin with a discussion of the three-part distinction made by economic historian Rondo Cameron: that between economic *growth*, economic *development*, and economic *progress* (Cameron, 1989, p. 9ff.).⁹

Economic *growth* tracks absolute population increase and/or a population’s rising living standard relative to subsistence, and entails, in the main, raising, feeding, housing, and employing more people. While growth sometimes demands new levels of coordination, these evolve only to cope with and promote further quantitative growth, which is to say, the production and consumption of more goods and services by and for more people, usually on more land and using more of earth’s natural resources. Such growth is as potentially exponential as the mandate to “be fruitful and multiply” will allow. It is also the easiest path to follow, creating, as it does, standard jobs and standard, low-risk business opportunities, which are based on doing things we already know how to do and making things we already know how to make at ever greater volumes and with

⁸ This paper will treat financial markets only glancingly. Exceedingly complex in their own right, and generating 20% to 40% of U.S. *GDP*, how financial markets operate will likely remain critical to realizing economic progress no matter how much insight we, or anyone else, can supply about the real economy. Perhaps because of this, and because they are “where the money is,” financial market modeling has attracted the lion’s share of the attention theoretical economists have given to complexity science.

⁹ Daly and Farley (2004) make these distinctions a little differently. For them, economic growth is measured as an increase in the total material and energetic *throughput* of an economy. Economic *development*, on the other hand, is “evolution towards an improved, but not larger structure or system, an increase in the quality of goods and services provided by a given throughput.” Daly and Farley here include, as one of the features of “development,” what we, following Cameron, will reserve to characterize economic *progress*.

lower marginal costs.

And then there's real estate. With quantitative growth based primarily on population growth (by fertility or in-migration), real estate becomes more valuable all by itself, turning the owning of land and buildings into the equivalent of printing money. Huge financial institutions grow up around this mechanism, making loans to growth-fed and growth-feeding enterprises (including flipping real estate) whose inherent profitability, in turn, attracts new rounds of fertility and/or in-migration.

Beyond economic growth, economic *development* begins to be qualitative. Development is a form of growth too, but growth in the diversity and coordination of society's roles and products. Spurred on by the growing size of potential markets, and by the greater levels of interpersonal interaction that characterize urban agglomeration, economic development begins to be growth in complexity through connectedness, not just volume. It means more and new *kinds* of jobs, more and new kinds of goods, markets, social networks, institutions, laws, jobs, arts, and technologies. Development builds capital in the sense of useable science, engineering know-how, and organizational capacity, which makes further development in certain directions easier (i.e. makes it "path dependent"). Development stimulates ideas and inventions of new goods as well as more efficient ways to produce traditional goods. It makes money not just for factory-owners, landlords, merchants, and bankers, which simple growth will do, but also for designers and engineers and entrepreneurs and institution-builders who create new niches in the complexifying economic landscape. In this context, the discovery, distribution, and application of new knowledge are essential (Romer, 1986, 1990, 1996; Warsh, 2006).

If economic growth increases a country's GDP, and economic development increases its GDP/capita, what remains? Why is development still not enough?

The answer is well rehearsed in the literature critical of mainstream neoclassical economics (MNE).¹⁰ Consider a society that promoted industries that polluted the environment *and* industries that cleaned up the pollution. Or one that built more hospitals to cure a disease rather than worked to eradicate its source, or that manufactured things shoddily and then repaired them, or that used up natural resources with abandon and then engineered artificial substitutes. Imagine a society in which the population grows fatter each day on richer food while spending on diet plans, gym dues, running shoes, and diabetes treatments. These are

¹⁰ Indeed, one of the GDP measure's principle architects, Simon Kuznets, warned some 50 years ago: "The welfare of a nation can scarcely be inferred from a measurement of national income... Goals for 'more' growth should specify of what and for what." (Kuznets, 1962; cited in Cobb et. al., 1995).

societies in which no “good idea” has to make sense; it just has to make money. All would register positive economic growth by measures of *GDP*. They might even register positive economic development by measures of the production of new kinds of skills, new sorts of businesses, and new varieties of chemicals, drugs, machines, and regulations. But none would rate well by a measure of economic *progress* such as the Genuine Progress Indicator, or GPI.¹¹ For economic progress is tied up with the complex goal of *increasing the quality of life of all at the involuntary expense of none*, doing it with limited or zero quantitative growth, and only ecologically sustainable development.

To be sure, for economic progress to take hold, goods and services in sufficient quantity and of acceptable safety must circulate to satisfy a population’s basic needs. But after that, an ever higher *quality* of goods and services must circulate: goods and services that are *more functional, beautiful, resource-efficient, reliable, ethically produced, healthy, and interesting* than they were a month, a year, a decade ago. This continual upgrading, which we could equivalently call “qualitative growth,” can proceed without quantitative growth and requires only intellectual, social, and technological development.¹² This is because “quality” depends on the complexity embodied by a good or service—on its evolvedness—and not on the quantity produced or consumed, nor on the amount of raw material or energy put into their production.

Economic *development* creates new institutions. It also makes new job specializations economically viable. The division (and then coordination) of labor, as Adam Smith theorized, lies at the basis of all economic development especially as it is admixed with accumulating knowledge (Romer, 1986). But as an economy matures, it is economic *progress* that lifts the fruits of development into artistry and ethicality, i.e., into another whole level of complexity.

With economic progress, work becomes more meaningful and more rewarding. MNE’s assumption of the disutility of labor is at least partially neutralized when *work* is what most people choose to do with their freedom. This is because high quality goods and services invariably induce pride in those who design them,

¹¹ For a sample of alternative progress indicators, see the HPI, “Happy Planet Index,” at <http://www.happyplanetindex.com>, the GPI “Genuine Progress Indicator” at <http://www.gpiatlantic.org>, used in Bhutan, the Legatum Prosperity Index at <http://www.prosperity.com/default.aspx> and the “genuine wealth” measure offered at <http://www.genuinewealth.net>. See also the Prosperity Without Growth report by the Sustainable Development Commission of the U.K.: <http://www.sd-commission.org.uk/pages/prosperity-without-growth-background.html>, and the Calvert-Henderson Quality of Life Indicators: <http://www.calvert-henderson.com>. For a recent review of critiques of GDP/capita as a measure of social welfare, as well as a study of why fifty years of criticism of GDP/capita as a measure of human welfare has had little impact on policy in the U.S. so far, see van den Bergh (2009). For the ongoing development of the Index of Sustainable Economic Welfare (ISEW) proposed by Daly and Cobb (1989) see Beça and Santos (2010).

¹² Continual upgrading can be done badly, of course. It could generate massive waste if everything old is summarily discarded rather than repaired or reused, and if new products do not have ease-of-recycling designed into them. More about this later.

make them, handle them, and purvey them. It is also because progress is an ideal to which all can feel dedicated even as we argue its finer points (and maybe *because we can*).

With economic progress, incomes do not become equal, but they do become more *equitable*, by which we mean: proportionate to the skill-level, effort, personal risk, and consequence of the work itself, but (a) with the minimum slope upward necessary to motivate ascension to the next rung (rather than the exponential slope we have now), and (b) with a minimum, solid, living wage for the employed at the bottom of the wage scale, indexed to the local cost of living.

With economic progress, we begin to count not only people's achieved degree of material provision, but also the number and quality of the opportunities they are offered to become more able to pursue whatever it is they (responsibly) value (Sen, 1999, 2000). Satisfying intrinsic motivations, such as for self-actualization, affiliation (having close relationships with family and friends) cultural production, and community engagement, become legitimate and viable choices for all (Kasser, 2007; 2002).

And it's the goal of further *progress*, not of further development, that tells what kinds of development are still needed.

Now, to realize the *equity* component of economic progress is, by itself, not that difficult: people can be coerced into living more-or-less equally short and basic lives, surrounded by poorly-made appliances and housing and consuming only basic foodstuffs—think Russia circa 1960, or Cuba to this day—for an indefinite period of time. To realize greater *quality* by itself is not that difficult either: with their wealth and status, the permanently rich can simply command it for themselves from a population of poor craftsmen, artists, and laborers eager to please—think France until 1789. But realizing greater equity *and* greater quality is the challenge, and also our hypothesis: *economic progress is made only in the recognition, embrace, and mastery of the social, intellectual, and technical complexities involved in realizing greater equity and greater quality at the same time.*

One can see the role, then, of moral teachings that insist (or do they simply observe?) that we cannot enjoy our lives unless those around us are enjoying theirs.¹³ The extent to which people know, or believe, that

¹³ Is it a matter of inculcated belief (i.e. culture) only that my happiness is conditional on yours (and vice versa), or is it objectively, involuntarily, the case (i.e., a feature of natural evolution)? Research into the origins of empathy reveal that all human beings and higher animals have "mirror neurons" in the brain. From infancy, these neurons (or more accurately, these neuronal groups) fire involuntarily in resonance with the emotional states of others (Preston and de Waal, 2002). Then there is the hormone oxytocin, produced involuntarily after sex and childbirth, which promotes social bonding throughout the genus of mammals. It would seem that religious and moral teachings encouraging empathy are designed to reinforce genetic basics on the one hand, and to compensate for their occasional absence on the other.

their quality-of-life depends on their neighbor's quality-of-life—indeed, the extent to which they realize that their happiness in major part *consists of experiencing* their neighbor's happiness—is the extent to which the quest for equity and the quest for quality might be seen the two sides a single coin—as a single quest.

One can see the role, too, of *connoisseurship* and of *expertise*. For without connoisseurship, qualities go unnoticed. Without connoisseurship, consumers compete in the amounts they can acquire rather than in the discrimination they can show and producers are not challenged to improve their goods. And without *expertise*, which is connoisseurship's complement on the production side, that challenge, when it comes, cannot be met.¹⁴

The complexity encountered when striving to improve our own and others' quality-of-life, to increase our/their connoisseurship, or to develop our/their expertise, is not a problem to be eliminated. Complexity is key—the key—to economic progress. If we imagine complexity located on a sloping ridge, ascending the ridge against the gravitational pulls of rigidity on the left and chaos on the right is what produces both livelihoods and liveliness—the latter, in the biological sense, for millions of years. That is why when things are going even tolerably well by standard welfare measures (life expectancy, education levels, GDP/capita), complexity-increase is very likely characterizing every aspect of social and cultural life.

To help complexity along we need to understand both how to *let* it happen and how to *make* it happen. The New Frontier does not lie across any body of land or water; nor does it consist in broadening industrialization, global trade, market efficiency, or even sustainability. It lies in managing the expansion of life's *complexity*, which derives from the fineness and connectedness of things rather than their massiveness or “energetic-ness” and thus knows no resource bounds.

3. Complexity

The pursuit of equity and quality generate complexity, the more so as they are aimed at and achieved together. To make this claim more plausible, and to shepherd our arguments a little closer to application, we need to focus briefly on what we mean by complexity.

What is *complexity*?

Complexity is a property of systems comprised of many interacting parts—in particular, systems whose overall behavior is not easy to predict from knowing (even perfectly well) the behaviors of the individual parts.

¹⁴ Occasionally, low-quality producers will sidestep the challenge by implying, if not cheekily asserting, that sophistication is sissy or decadent.

Readers hesitant to delve into the mechanics of this definition might wish to inspect Figures 1 and 2, and then skip ahead to the paragraph starting “We recognize...” Readers interested in a more thoroughgoing account are invited to examine the footnotes over the next few pages, where pointers can be found to more complex approaches. Ours, we believe, is the simplest “technical” account of complexity possible that supports true statements about how complexity is experienced and can be managed. The roots of this account lie in information theory, originated by Claude Shannon and Warren Weaver in 1948 and amplified by many since.

In our account, the physics term “entropy,” meaning degree-of-disorganization and used by Daly (following Georgescu-Roegen [1971]) to explain what value-productive systems *do* (namely, capitalize on found, low-entropy resources, and/or keep natural entropy-increase at bay), names the entire spectrum along which *rigidity* (zero or very low entropy), *complexity* (mid-level or optimum entropy) and *chaos* (maximum entropy) lie for a given, relatively-closed system. Living systems in particular (including people but also corporations and institutions)¹⁵ try to reduce entropy if their condition is too chaotic and to increase entropy if their condition is too rigid, their goal being to maintain and maximize their *complexity*, which lies at the peak of an upside-down-U curve between chaos and rigidity. Why? Because living systems need to operate in this zone in order to continue to live and adapt (Brooks and Wiley, 1988). To consume a “good,” then, or to seek a “better situation,” is to try to increase, or to maintain-against-the-threat-of-decrease, the complexity of the consumer-seeker.

By complexity we mean more accurately “good entropy,” since low entropy rigidity and high entropy chaos, both lacking in complexity, lie on either side of it and mean dysfunction or death.

¹⁵ For an exploration of the properties of “living systems” this broadly conceived see Miller (1978), and Meier (1962), whose analysis of complexity stress on a growing branch library is a classic exposition of how to treat a human organizations as quasi-living systems using information-theoretic terms.

In the main, in treating complexity philosophically, we follow complexity-theorist Stuart Kaufman and physicist Murray Gell-Mann, although Gell-Man reserves the term “effective complexity” for our “complexity.” See Kaufman (1993), Gell-Man (1994). Also Simon (1962). Economic theorist Georgescu-Roegen (1971) deploys a much more physical/thermodynamic interpretation of entropy; he was entirely skeptical of identifying the entropy of material and chemical processes (which are about the “economics” of heat transfer) with the entropy of statistical mechanics and communications theory in the manner of Claude Shannon—which, as we say, is the tradition in which we follow.

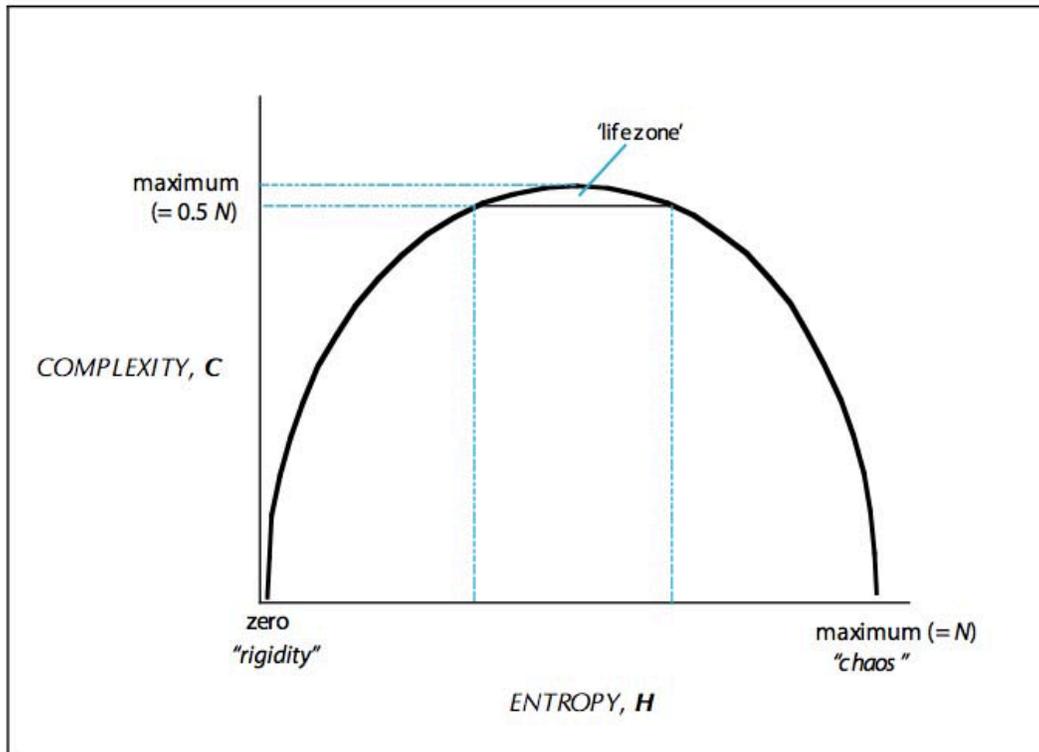


Figure 1: How complexity is maximized between rigidity and chaos

Figure 1 illustrates the logic just outlined. The mathematics underlying Figure 1, and more of the reasoning behind it, can be found in Appendix One.¹⁶ The unit of measure of both complexity, C , and of entropy, H , is “bits.”

Potentially, the greater the number (N) of the working parts in a system,¹⁷ the more complex is the whole. Why only potentially? Because complexity, C , changes with the *way* those parts interact over time, and

¹⁶ See <http://soa.utexas.edu/files/csd/wps201101-app1.pdf>. Because of the simplifying assumption in this paper that every one of the system’s N parts can be in only one of *two* states at a given moment (e.g. on/off, active/inactive, true/false...), Figure 1 shows $H_{\max} = N$ bits and $C_{\max} = N/2$ bits, the latter occurring when H_{actual} , the system’s actual entropy is equal to $H_{\max}/2$. Many real systems’ N parts can be in one of more-than-two alternative states. Mathematically, this represents no special problem: the curve in Figure 1 still holds and $C = C_{\max}$ when $H_{\text{actual}} = H_{\max}/2$ always. Here “chaos” does not have the specific connotation it does in complexity science (e.g. spontaneous non-periodic phase changes in large deterministic systems caused by small changes in initial conditions). Here it simply means “without order.”

For a recent treatment of complexity that is mathematically all-but-identical to the one presented here (and formulated in 1992 by the first author) but different in application, see Piasecki and Plastino (2010).

For a survey of, and commentary upon, contemporary “complexity approaches” to economics, see Fontana (2010). See also Holt, Rosser and Colander (2010), where our account is closest to they call “connective complexity.” For a more thoroughgoing application of information theory (and by implication complexity) to econometrics, see Theil (1967, 1980).

¹⁷ And also the greater the number of states each part can be in...but here, recall, we are limiting that number to 2: on/off, yes/no, black/white...

this in two possible directions from the peak: (1) C can decrease to the left by descending towards rigidity if the system's N parts interact so that one pattern or ensemble of part-states dominates all possible others; and (2) C can decrease to the right by descending to chaos if all its N parts interact so that every possible pattern or ensemble of part-states has an equal chance of occurring. For a system of a given *size* measured by N (not weight or volume), complexity is maximized in the middle, top-of-the-hill condition.¹⁸

Not incidentally, long-lived complex systems like walled cities and living cells are more complex internally than they are externally, that is, more complex in their internal connections than in their connections to the outside. Partly for this reason, measuring a system's internal complexity with any accuracy from the outside is difficult. Although the mathematics are available, you must decide how finely to parse the system into "parts" (assuming one can get inside to examine them in action), and then how sensitively to register those parts' state changes. When making these decisions it's hard to know at what scale to stop in the fineness of one's attention. At the scale of subatomic particles, for example, the complexity of a toothpick is effectively infinite. It is more credible, therefore, to make comparative rather than absolute judgments of complexity, and to measure visible behavioral complexity rather than internal complexity.¹⁹

¹⁸ Parts have parts too, of course, all the way down, making it essential to parse a system into its hierarchical levels or scales. Complexity is always complexity *at a certain level* or scale in the hierarchy. Thus, looking at written language, one would expect measured complexities at the scale of letters, phonemes, words, phrases, sentences, paragraphs, and so forth, to differ by level (Simon, 1962). What conditions and dynamics, exactly, lie *behind* a system's freezing up or going out of control (adapting or dying, self-elaborating or self-simplifying...) are the subject of complexity science, which has long surpassed, in terms of its own mathematical complexity, the information-theoretic approach taken here.

¹⁹ There's a mathematical-physical reason for this. Suppose we have a system embedded among and interacting with many others of the same type as itself. Let $X > 0$ be the total number of behaviors that can be *exhibited* by any one system. Let M be the number of neighboring systems that each one can perceive and respond to. The number of neighbor-behavior *permutations*, each one representing a single "whole-neighborhood state," that any system could respond to uniquely (i.e. with a single, unique behavior of its own), is thus X^M which is much greater than X if $M > 1$...and so is impossible. That is to say: *It is not possible for any system to respond uniquely to every state of a neighborhood consisting of systems like itself.* Each must contain some internal computational/decisional machinery that, at the very least, reduces its informational input, X^M , to its informational output, X . This ensures that every system must be more complex internally than its external behaviors let on.

There is a work-around of sorts, but it takes time and loses information. Let's say that system A wishes its internal processing rules (i.e. its inner complexity) to be known by an outside observer. It could do the following: encode its unique response to every particular neighborhood state by *ignoring* consequent neighborhood states ($X^M - 1$) times, and using those times to encode and signal its unique response to *the first* neighborhood state as one, unique, X^M -long *sequence* of its own states; then do it again for the second neighborhood state, then the third...until all X^M possibilities have been encoded. The least number of time-steps this would take is $X^M(X^M - 1)$, and the reader of these states (you or I, say) would have to have the decoding key already internalized and ready to go.

It is unclear to us whether *all* the systems could avail themselves of this reading strategy at once. They certainly could do it sequentially if the system-of-all-systems were closed, but at two prices: the loss/destruction of a lot of information about how neighborhood states are indexed to *when* they happen(ed), and having to have a yet more elaborate decoding method already internalized. The latter makes them internally more complex...and we are back to square one: *like systems that respond to each other must be more complex than they are able to "say" to each other, and so filter out, or destroy information internally all the time.*

These are very elementary physicalistic considerations. Koppl (2010) provides an overview of more technical ones—which support the same (and we think far-reaching) conclusion: that in nature as in daily life, more patience and more sensitivity to the external behaviors of a system can tell us more about its internal complexity, but not everything, even if (a) it wanted to, and (b) we were

To believe with justification, then, that A is more complex than B, it's important that A and B be similar enough in kind to count their parts and part-states, and/or their external behaviors, the same way. Mechanical wristwatch A can safely be said to more complex than mechanical wristwatch B if A has more moving parts than B, period. Random external shocks aside, probabilities are hardly a factor with a watch, whose individual part-states and part-ensemble-states are designed to repeat themselves at certain intervals with perfect predictability. The more complex of the two watches might tick faster (say 8 beats per second rather than the standard 5) and it might display more information: the day, the date, and phases of the moon. It might have a stopwatch function too, and keep time more accurately. Watch A not only divides time more finely, it has more parts inside—more “movements” and “complications”—a larger number of behaviors on its face to see, and more mechanisms to resist or compensate for shock, wear, and temperature change (all forms of high entropy).

On this analysis, we can offer that chess is a more complex game than checkers (draughts) without looking much further than the number of different game-pieces and move-types involved, this although *some* actual checkers games played by masters might be more complex than *some* actual chess games played by beginners. For more accuracy, one would need to go on to compare the variety of possible moves in each game, then their probabilities of occurring, then of occurring in certain strings, and take into account the average number of moves per game, and do all this over a very large number of games and players. Notwithstanding chess's greater upper-limit complexity, one would find actual games played by adepts of either game neither perfectly predictable (i.e. “rigid”), nor perfectly unpredictable (i.e. “chaotic”), but somewhere near the game's complexity optimum (or is it ours? No matter). Were it otherwise, we probably wouldn't play these games.

One can compute and compare the complexity of musical melodies of the same length at the scale of equal-length notes (or rests) and played at the same speed. Indications are that complex melodies are preferred over both repetitive ones and random ones. Using the math behind Figure 1, John H. Conway's celebrated cellular automaton *The Game of Life* can be shown to be most productive of “creatures” when its rule system is set around its maximum complexity. The complexity of DNA at the scale of codons is also

watching closely and patiently, unless (c) *we* were *ab initio* much smarter—much more complex—than the thing we are studying. (Hayek, 1952, p. 185: “[T]he capacity of any explaining agent must be limited to objects with a structure possessing a degree of complexity lower than its own’.) The problem with psychologist B. F. Skinner's behaviorism, perhaps, was not its premise (which is that all we *can* observe is behaviors), but its impatience with and insensitivity to *all* our behaviors. Our attraction to behaviorism is probably a function of the better uses we have for our time than to try to understand any one thing—much less another human being or animal—through and through. Computational simulation of the Other is not only costly, but Quixotic.

The fundamental asymmetry we have been discussing here, and its time-efficiency consequences, will return when we discuss the virtue of the quality we call “simplicity,” which applies too to theories of complexity.

maximal given the combinatorial possibilities of nucleotide base-pairs three at a time (which is what a “codon” is). One might also use the compressibility of digital files as a measure of their complexity. And although none of these examples constitute the theory, they provide data points for a possible future proof.²⁰

In general, a defining feature of biological life as we know it on earth has been an overall increase—albeit with setbacks—in the number of different species and families of species (Bonner, 1988; Ayres, 1994). Moreover, the evolutionary development of each new species has been characterized by increased complexity, both in each typical new-species-member’s body (as measured by the number and variety of cell-types they contain), and, closely related to that, in the level of interactivity of each typical new-species-member with members of its own kind as well as with other organisms (Heylighen, 1999; Brooks & Wiley, 1988). The driver for this rising complexity is simple in principle: it is the *quest by the living for more life* among other forms of life questing for the same. We see this quest too in the growing number of subcultures, ethnic groups, religions, styles of architecture, and classes that coexist in cities, in the growing number of communication media and channels, in the increasing breadth and depth of organizations (markets, corporations, institutions, professions, charities, government offices, etc.), in the proliferation of categories and brands of goods, in the lengthening of supply chains and multiplication of intermediate (or component) goods, in the increasing specialization of jobs and “positions,” in the growth of libraries and the lengthening of the average time it takes to become educated. Despite surges, setbacks, and plateaus quite analogous to the surges, setbacks, and plateaus experienced by species throughout biological history, these trends have been the hallmark of human cultural and economic development for tens of thousands of years (cf. Boulding, 1981; Beinhocker, 2007; Blume & Durlauf, 2001-5; Peter Albin in Foley, 1998; Jencks, 1997, 2010; Meier, 1962). The imperfectly self-reproducing process called *life* animates whatever materio-energetic systems stumble upon its formula, setting them on the unsteady, multi-generational, and open-ended course of mutual complexification. Everything living around us, and every process and artifact that “works” in life’s cause, represents success at following the course thus far.

Figure 2 depicts this general idea in relation to Figure 1. Note that the Second Law of Thermodynamics, which says that the entropy of an isolated (therefore constant N , constant temperature) system can never decrease, is preserved in this conception, just as it in Brooks and Wiley (1984), upon which Figure 2 is based. It’s important to note also, however, that isolated systems do not exist except in laboratories, and even there

²⁰ All these examples, and others, are presented in Appendix Two to this paper, available at <http://soa.utexas.edu/files/csd/wps201101-app2.pdf>.

they are not really isolated. Outside of the lab, increasing H_{\max} is more often the result of two or more systems clumping together or newly communicating with each other, or of assimilating outside materials (so increasing M), than it is the result of Second Law losing of internal organization through isolation.²¹ Living systems are always embedded in an environment, trading energy and information with it. They also work far from the thermal equilibrium implied by the flask-of-gas idealization of the Second Law (Prigogine, 1984).

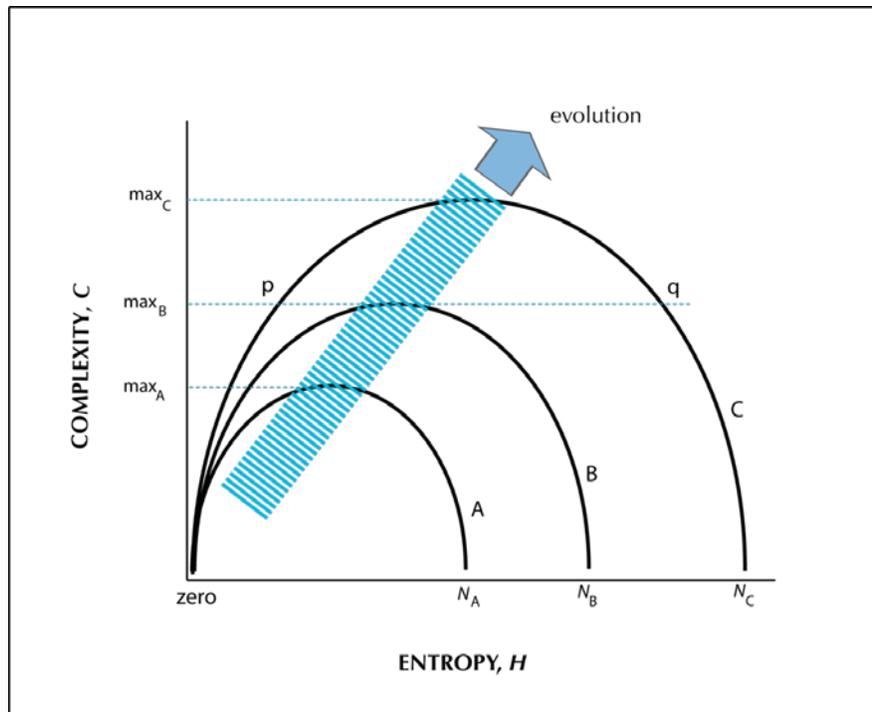


Figure 2: How complexity increases with evolution

Finally, H_{\max} can also increase through internal differentiation, that is, through a system's parts either dividing and duplicating, amoeba-like, or allowing new entropy from *their* formerly sealed constituent parts to infiltrate. But note that in all cases—clumping, new communication, material assimilation, internal differentiation, or entropy infiltration from the micro-scale²²—increasing H_{\max} does not *automatically* increase

²¹ Think of the size of organic molecules relative to inorganic ones, or the lengthening of DNA with speciation [DNA is sticky], or the integration of communication networks into super-networks. Piasecki and Plastino (2010, op. cit.) measure system size by $\log N$, where N is the number of cells in two-dimensional finite pattern, using diagrams of growing complexity, formulated much as ours is, closely resembling Figure 2.

²² Physicist Roger Penrose suggests that some ancient (left over from the Big Bang?) natural entropy still wells up from 'below'—i.e. from quantum scales up into the 'classical' atomic scales, and thence, more rarely, into the molecular scale in tiny, sometimes-consequential amounts (tiny, because if the porosity between quantum mechanics and classical physics were large, there would be no

a system's overall complexity, C . Only if the system were operating on the rigid side of optimal could complexity increase automatically occur. Otherwise it would take new constraints, either applied from outside or emergent from internal collective self-organization (Prigogine, 1984; Kaufmann, 1993; Laughlin, 2009).

To sum up: increasing the number of a system's parts (and thus its maximum potential entropy) makes the hill to be climbed to optimal, life-zone complexity that much larger.

Do thriving organisms seek their own optimal complexity? In theory, yes, and smoothly. In reality, probably, and erratically. In theory, when N is fixed, organisms move themselves back or forth along a curve like the one shown in Figure 1 until they reach the peak of the "life zone," which is where they ply their trade responsive to random perturbations but not too, resistive to them but not too. The idea is to stay there. But when N is not fixed, they might seek (or luck into) absolute complexity increase too (which in Figure 2 means them moving from the life zone of curve-A, to the life zone of curve-B, to the life zone of curve-C, and so on) both in the short term, with learning and maturation, and biologically, as a genus over the long term, with speciation in an increasingly crowded environment.²³ Again: increasing N and thus H_{\max} —i.e. just growing in population or part-number—might be helpful, but it is not enough for learning or evolution to occur.

No living system is guaranteed to stay in a life-zone when increasing in C . It's entirely possible to go sideways when moving from a point on curve-A to a point on curve-B, say, and land on a slope outside of the life-zone of curve-B. The evolution of optimal complexity requires maintaining a *balance* between rigidity and chaos while *ascending* in absolute complexity: it requires staying "on the ridge," as we put it earlier. In relatively simple living systems, this balanced ascent requires only luck. In human affairs, it requires luck seized upon by intelligence.²⁴

classical physics, i.e. no stability at larger scales). See Penrose (1989); also Laughlin (2009). It reminds us of how individuals can inject unpredictability into otherwise stable social arrangements "from within themselves."

²³ Some readers may see a resemblance here to the concept of "fitness landscapes" in evolutionary genetics (Kaufmann, 1995; Dawkins 1996). "Fitness" there is defined as replication rate, and applies to whole populations. Successful genotypes are said to occupy different peaks in the landscape, and, with speciation, travel riskily between them.

²⁴ Angier (2010) conveys the flavor of the argument, to wit, that optimality-of-function in nature always entails the embrace of noise, or entropy. Evolution, like a good artist, depends on a certain shakiness and vulnerability in its hand. Composer and music producer Brian Eno writes this in his diary (from a letter to Stewart Brand on 'generative systems'): "I've noticed that all these complex systems generators [such as 'Life' and 'Boids' [the flocking one] and 'The Great Learning'] have something in common—just three rules each. And these three rules seem to share a certain similarity of relationship: one rule generates, another reduces, another maintains. I suppose it's obvious, really, but perhaps it's not trivial to wonder if those three conditions are all that you need to specify in order to create a complex system generator, and then to wonder how those are actually being expressed in complex systems we see around." (Eno, 1996, p. 144)

This model is limited by its abstraction, of course; it cannot be applied to every system like a tape measure to a trouser leg. But it applies to many (as we have indicated), and we think it has broad explanatory power at the level of principle.

For example, earlier we remarked that the search for *simplicity* could promote complexity. We will return to this assertion yet again, when we discuss simplicity's contribution to *quality*; but here we would like to use Figure 2 to advance the point in principle.

Imagine a system with N_C parts operating at or near "max_C", i.e. in the life-zone of curve-C in Figure 2. Now suppose that you or I, or our computer or our firm, finds this level of complexity too much to deal with: too much to understand or control. Suppose, that is, that *our* capacity to process information from that system is limited to "max_B" bits. What might transpire? Assuming we don't want to ignore a whole set of behaviors arbitrarily (for how would we choose which without first having to attend to all?), we will very likely try to *simplify* the too-complex system itself so that it *will* work with us (or *for* us) at "max_B".

Now, we have three initial options as to how to limit the system to "max_B." (Option 1): proactively constrain or rigidify the system's behavior so that it operates at point "p" on curve-C; (Option 2) proactively unconstrain or "chaoticize" the system's behavior so that it operates at point "q" on curve-C; or (Option 3) proactively reduce the number of parts comprising the system to N_B and re-distribute its part-state (or behavior) probabilities so that, reduced in size, it operates in the "life-zone" of curve-B rather than curve-C. The desire for more simplicity is the same as the desire for less complexity. But that desire—our theory suggests—is best satisfied by Option 3, which *optimizes the complexity of a smaller system rather than visits rigidity or chaos upon a larger one*.²⁵

Actually, there is a fourth option, and a fifth.

Option 4 is to introduce a second system (or third, if we count ourselves as "a system" too), which is optimally complex for its size but well *within* our capacities to understand and control. This second system's role is to act as a go-between, as an "interface," to the system whose complexity, though good and necessary

²⁵ We are assuming here, either (a) that we *care*, ethically, for the success of the system we are trying to work with, or (b) it is pleasing to see a system operating *in what would be its life zone* if it were alive (think of a piece of instrumental music, or a chair, happy in its form and place). Why does it please us? Because in seeming, itself, to be "full of life," it fills our minds with life. We resonate with it, as it were, and that brings us neurologically closer to *our* peak functional complexity. (We should not think of this claim as far-fetched. See Dutton [2008] or the theory of mirror neurons. To some extent, we *are* what we see and hear; or as psychologist William Mace put it much earlier, in explaining the work of J. J. Gibson: "Ask not what's inside your head, but what your head's inside of" [Mace, 1977]).

Now remove assumptions (a) and (b) above: If the system in question is inanimate, or contains no living components, then we may well be justified, ethically if not also aesthetically, in forcing it to behave ultra-predictably at p or allowing it to "run wild" at q. Some inanimate things *need* to act like doorstops and others like dice.

for *it*, is beyond us. This strategy abounds in biology as much as in technology. Do you *really* know what's going on in your body, in your computer, under the hood of your car, or in your employer or employee's mind? Does any creature understand any other creature *fully*? No; nor does it need to. The price we pay for our lack of complete understanding of the Other is the loss of full control of, and/or responsiveness to, the complex system that *is* the Other. What we gain, however, is time—and release from the need to be greatly intelligent. For Option 5 is a strategy we overlooked in its obviousness. It is to increase *our* capacity to deal with “max_c” directly, this through training, knowledge, and intelligent observation based on (good) theory.

We recognize that the last few pages do not prove that burgeoning complexity is essential to evolution, to life, to life's fullness, and thus to what appears to us, embedded in life, as having positive value in an economic context. Nor have we provided the mathematical models that a development economist would like to see. For these one must look to a larger literature, and even there one will not find *definitive* empirical confirmations or formulae. But if we are right, if increasing complexity characterizes both economic development and economic progress, the question arises: by what rigidity-avoiding, chaos-avoiding, *extra* principle does the complexity of economic *progress* distinguish itself from the complexity of economic development?²⁶

One piece of empirical evidence for the link between economic complexity and economic development (but not yet economic progress) is a study by Hidalgo and Hausman (2009) who show (1) that the number of different capabilities possessed by a country is reflected in the diversity of that country's products and exports, and (2) that this product-capability diversity, which is a “part-count” H_{\max} measure of a country's potential economic complexity, is in turn strongly correlated to its *per capita* Gross National Income (GNI). Hidalgo and Hausman conclude thus:

Up until now, economics has disregarded the search for these detailed capabilities, hoping that aggregate measures of physical capital (e.g., measured in dollars) or human capital (e.g., measured in years of schooling) would provide enough guidance. Here, we show on the contrary, that the level of development of a country is strongly connected to the complexity of its economy, showing that wealth is

²⁶ For even if the trend towards greater complexity were in some sense guaranteed over the very long run, i.e., even if it were the implacable working out of a Law of Nature, the fact is that we live in the much shorter term, and cannot take recoveries from downswings for granted. We cannot sit back while Nature—as wise as she might be—takes her time re-establishing the trend. A million years is nothing to her. No, such are our powers now and numbers now that human flourishing is up to us, day by day, year to year. For better or worse, so is the flourishing of most other species. And maybe, just maybe, human commitment to reducing suffering and promoting life everywhere was Nature's bright idea for promoting herself in the first place.

an emergent property of the interactions between the capabilities available in a country's economy. This suggests focusing development work on generating the conditions that would allow complexity to emerge, as wealth is the result of the interactions between individual economic activities, and is therefore not a property of any economic activity in itself.

Nor is wealth the simple sum of them, we might add.

Hidalgo and Hausman are looking at development rather than progress as we and Cameron (op. cit.) have defined it, and so are justified in using GDP (actually GNI) as the relevant dependent variable. Macro indicators of economic *progress*, however—like GNH (gross national happiness), education levels, or environmental health—linked to measures of socio-technical complexity like Hidalgo and Hausman's, are still lacking in the field.

Warsh (1984, p. 38) reports the marked increase in the total number of different jobs listed by the Bureau of Labor Statistics' Standard Occupations Classification (SOC) since the 1870, and the similar increase in the number of different industries listed by the NAICS industrial classification code. This too suggests a feature of all economic development is not just growth in mass and population, but increased labor-differentiation as well whole-industry differentiation or "speciation." Economic *progress* is at least implied by these trends, inasmuch as finer-grained needs are being met by more specialized skills and goods, probably for more people.

So, again we ask: by what extra rule or consideration might the complexity of progress distinguish itself from the complexity of development? If we knew, we could consciously and more justifiably reduce the number of pollute-and-clean, afflict-and-cure, dig-a-hole-and-fill-it-again industry circles that might not, at first, seem to be circles, as well as cut back on all the war-making, bureaucracy-creating, paper-wealth printing, highway-to-nowhere projects that generate economic growth, and even economic development, but little or no economic progress.

Daly's objections to growth—like McKibben's (2008, 2010), Speth's (2008), and others'—are about its sustainability, or rather, *unsustainability*. Most of the above industry "circles" and projects are things we simply can't keep doing given the fragility of our planet's ecosystems, this even if they are also developmental to some degree by virtue of job- or industry specialization. He is right.²⁷ But we want more justification for changing our ways than certain ecological doom. We want joy; we want nature and ethics to agree as it were, knowing full well that they don't always "naturally" do so (as when, for example, we take care of the chronically infirm, or at least try to love our enemies). We want to feel connected, shall we say, to our world's

²⁷ Recall that for Daly "development" and "progress" are synonymous, and his "development" can be had without growth.

larger project, which is for life to flourish in all its life-quality-enhancing forms—from *paramecium* to Puccini—indefinitely.

Let's return to the two engines of economic progress we have identified, *equity* and *quality*, and look next at *equity*. How and why does the pursuit of greater equity generate complexity? Afterwards we will ask: how does the pursuit of *quality* generate complexity? And finally: how does pursuing both catalyze the process?

4. The pursuit of equity as a generator of complexity.

Consider the *no-harm principle*, a principle crucial to our understanding of justice and, in turn, of equity. In the West, the no-harm principle goes back to the Hippocratic Oath, in the original of which there is this statement: "I will prescribe regimens for the good of my patients according to my ability and my judgment, and never do harm to anyone." Echoing the more ancient Hindu principle of *ahimsa* (non-violence), and often summarized as "first, do no harm," the Hippocratic Oath is the model of all professional codes of ethics to this day.

In *On Liberty*, John Stuart Mill famously extended the no-harm principle to the political principle of "non-interference:" the idea that as long as someone's actions do not physically harm anyone else, they cannot legitimately be stopped. "The only purpose for which power can be rightfully exercised over any member of a civilized community, against his will," Mill wrote, "is to prevent harm to others. His own good, either physical or moral, is not sufficient warrant" (Mill 1956 [1859] p. 13).²⁸ Adam Smith said much the same some fifty years earlier.

Based on a similar logic, the philosopher-economist Vilfredo Pareto articulated what came to be known as Pareto-optimality: an allocation of resources is 'Pareto-optimal' if every possible *re*-allocation of resources that might make someone better-off would surely make someone else worse-off.²⁹ Pareto-optimality is clearly an ideal, but it provides a strong criterion for judging resource allocations. It suggests, for example, that a public investment is clearly warranted only (1) if the aggregate social benefit of the investment exceeds its

²⁸ And yet: why do we intervene to prevent or reverse drug addiction, cult membership, self-mutilation, and suicide attempts? Is it to prevent people from hurting themselves or hurting others, like ourselves?

²⁹ Exchange the phrases "would surely" and "might" and we are given this problematic variant: "An allocation of resources is 'Pareto-optimal' if every possible re-allocation of wealth or resources that would surely make someone better-off might make someone else worse-off." With this play on words we are alerted to the problematic role of *probability* in realizing Pareto optimality. Other well-recognized difficulties arise from treating "better-offness" as multidimensional, or short- vs. long-run.

aggregate costs *and*(2) if the benefits enjoyed by each and every affected individual exceed the costs to each and every affected individual, in the view of these individuals.

This is not the place to survey theories of justice, whose subtleties are beyond the scope of this paper. It suffices to note that all development-without-progress pursuits involve someone, somewhere, involuntarily being worse-off than they were before. For example, without the no-harm principle, a mayor could justifiably ignore the desperation of the poor in his town (or even exacerbate it) and then hire more police, judges, and jail wardens. Without the no-harm principle, colonialism can be justified because it gives useful employ to soldiers, sailors, explorers, entrepreneurs, and clerks, as well as enhances life “back home” with cheap raw materials, labor, and curios.

Extend the no-harm principle beyond human life, and whole ecosystems and whole species can be destroyed in the search for raw materials or land for human use. Neglected from the mayor’s accounting is the increased misery of the poor (although policemen, lawyers, judges, and wardens surely prosper). Neglected from the colonizer’s accounting is the destructive effect of his actions on the land, resources, culture, and dignity of indigenous peoples. Neglected from the Amazon logger’s calculations is the suffering of the animals scattered or killed by forest clearing as well as the loss of the oxygen produced and carbon dioxide absorbed by foliage—losses than can have (and is having) global effects.

Extend the no-harm principle to future generations, and we have the moral basis for much of today’s environmentalism.

Now, a common, widely-noted violation of Pareto-optimality involves the spillover effects, or “externalities,” of many ordinary production and consumption processes. Pollution from factories is the poster-child case. Since the market does not price the effects of a good’s production or consumption on agents external to the buy-sell transaction, the price paid does not reflect its full marginal costs or benefits to society. In the case of positive externalities, goods are brought to market too expensively because those who buy them (and the firms that produce them) allow many to benefit from them without paying their full value (or not paying at all). Think of a privately-owned building whose beauty enhances a whole street or neighborhood. In the case of negative externalities, goods are brought to market too cheaply because those who buy them (and the firms that produce them) shift a part of their true cost to unnamed, unconsulted, and often unwitting others. In result, goods that produce negative externalities are apt to be over-produced while goods that produce positive externalities are apt to be under-produced. Neither result is utility-maximizing or resource-efficient in economic terms. Moreover, in the case of negative externalities, large populations can suffer involuntarily, and this causes market inefficiency *and* moral failure.

Correcting externality-caused market inefficiencies and failures, however, generates complexity if it is done without creating further negative externalities. Consider the extension of the no-harm principle that says that if there *must* be a harm to achieve a benefit, the free and informed consent of the to-be-harmed must first be obtained. On this lately-evolved moral rule, welfare-improving actions cannot go forward with a simple calculation that tells us that more people are likely to be better off than worse-off. Rather, all possible future “losers” must agree in advance to risk the loss. It is *individuals* who must calculate expected utility first—selfishly or altruistically, as they please—and not groups, or other people for them unless those “other people” have been freely ceded the authority to do so by the people risking loss in *this* case.

Now, obtaining consent under these conditions is a problem.³⁰ But solving the problem works in life’s favor. For such consent can rarely be obtained without creating whole exchange economies³¹ designed to persuade people that the challenges they will face and the sacrifices they will have to make will be worth it.³² The persuasion-machinery of democracy alone—an economy in its own right, trading in votes, licenses, rights, promises, obligations, favors, approvals, compliments, and yes, money—is weighty on the one hand, but tonic on the other. The same might be said of the law and its courts, the free press, and the entire artistic-literary-publishing enterprise (which encourages the free investigation of the value of our values), of religion (which tends to conserve the values that persuade us of self-sacrifice), of savings and investment institutions (which, by spreading risk and offering interest on deposits, encourage the voluntary postponement of our present

³⁰ It is especially a problem in the case of the destruction of natural habitat, since animals and plants are not capable of consenting to their sacrifice. Their interests are no less real than ours despite their incapacity to sign documents, however, and so must be represented by compassionate human beings. Ditto with children, the very aged, and the very ill.

³¹ Parallel to the production, trade, and consumption of material goods or labor services, we are saying, is the production, exchange, and “consumption” of *tokens*, which are social-psychological goods like promises, votes, contracts, licenses, obligations of all sorts, compliments, insults, permissions, guarantees, titles and positions, and even the fleeting gestures by which social life is lived under rules of reciprocity and mutual benefit: handshakes, nods, scowls, and smiles...all of which are packages of information that serve directly or indirectly to satisfy basic human needs like survival, security, legitimacy, approval, confidence, and freedom (Benedikt 1996, 1997). These tokens are not free, and the laws of supply and demand, and of quality, apply. We discuss the idea of a *token economy* later.

³² We say “persuade” advisedly because, if people had to be *coerced*, their consent would not be free by definition. For example, when people are convinced to accept harm A (or the heightened risk of harm A) by being assured that greater harm B would thus be avoided, their consent is hardly free. It is partly coerced; and it is fully coerced if the assurer has the option of being the *cause* of harm B. We are thinking not just of blackmail and extortion, but of how quickly people can “voluntarily” be mobilized against a perceived threat from the outside—say from a neighboring tribe or country making “unacceptable demands.” Unresolved is the question as to whether coercion is justified if it saves people from very-probable and severe harm, as in the case of forced evacuations ahead of hurricanes, floods, advancing armies.

pleasures)³³, and of side-markets (as in pollution rights) and other mechanisms that try to price externalities correctly at the point-of-sale, or, failing that, to invoice them to their proper sources.³⁴

In all, one cannot help but be impressed by the cultural, institutional, and psychological complexity that has already flowered from our persistent (if inconsistent) efforts over the centuries to maximize value, minimize harm, and distribute necessary sacrifices and resources more fairly. When economic advisors urge struggling countries to stop warring with each other, to eliminate corruption, establish the rule of law, guarantee property rights, allow political expression, and extend basic education to all, they can do it without seeking to impose this or that ideology. A range of different stories, images, and maxims can promote the social complexity necessary for the engines of economic progress to start turning—first at all, and then by themselves.

Ecologically, the no-harm principle says that we may not harm or destroy other forms or instances of life for *our* life. *Ahimsa*: non-violence. We may not even cause pain to other animals. If this seems too stringent a rule, we might turn to the consent proviso: let us obtain voluntary consent from non-human life to suffer for human life. Alas, we cannot ask trees for their fruit, or hens for their eggs. We cannot ask rivers for their fish, or if they mind conveying our sewage to the ocean, even if we ritualistically said “please” and “thank you.”

³³ Of course, in making consumer loans, banks also encourage current consumption at the expense of future debt.

³⁴ Within the canon of mainstream neoclassical economics there are several well-known remedies for the market failures and distortions caused by externalities: from government regulation or direct provision to selective Pigouvian taxation, from side-markets in rights (e.g. pollution rights) or access privileges (in the case of positive externalities), to private negotiations between affected parties. Implemented, each increases the resource efficiency and equity of market outcomes at the cost—but actually benefit, we would argue—of adding a layer of complexity to the economy.

Take the imposition of “carbon taxes,” or of more extensive cap-and-trade schemes for limiting CO₂ production (a by-product of most energy-intensive industries and goods) in order to curb global warming (which will negatively affect everyone on the planet). Whence the resistance? It comes from several quarters offering several arguments. First is the argument for no-more-rules-please simplicity, more about which later. Second is the argument that carbon-emission controls, by “distorting the market” (as though it were not already multiply distorted by government subsidies and taxes), would move us away from our choice-rich, energy-intensive, consumption-happy way of life. This too is a weak argument, since there are ways to live as richly *and* produce less carbon. Third is that most if not all countries will have to agree to enforce—and actually enforce—equally stringent emission controls or carbon sequestration technologies lest some countries, defecting, gain economic advantage at everyone else’s expense. Fourth, and quite reasonable, is citizen skepticism that valuing externalities can be carried out in a precise and fair way by technocratic economists and policy makers. After all, the value of clean air and a stable climate can be valued accurately only up to a point (e.g., the social cost of disease, of reduced agricultural production by desertification, of the loss of coastal real estate by rising sea levels); but in the end, valuations involve social preferences and human nature. It is human nature, for example, to object to disruptions of habits caused by, say, large increases in gasoline, electric power, or food prices. These are felt immediately, as versus the more diffuse and long-term benefits to all of controlling global warming. Moreover, they are felt more acutely by the poor, and this raises ethical concerns that require their own complexity-causing mechanisms of redress, persuasion, and habit change. Needed, it would seem, are revisions not only to our legal, institutional, and market-based methods for pricing negative externalities (as well as better, cleaner, and more remedial technologies), but revisions to how and what we *value* as producers, traders, and consumers in the first place. We think that beginning, in principle, to value *equity* over advantage and *quality* over quantity would be steps in the right direction. Speth (2008) arrives at the same conclusion.

We can be sure, however, that sentient and social animals would never consent to the harms caused them by current animal-handling and slaughtering practices. We must anticipate, then, accept, and even welcome the complications of instituting harm-minimizing practices and technologies to the greatest extent possible in industrial farming, not only out of compassion, but also because they are a part of what converts economic growth and development into progress. More widely implementing the humane farm-animal-handling practices recommended by Temple Grandin (Grandin and Johnson, 2009; Grandin, 2006), for example, would represent a significant step towards a cleaner environment, cleaner consciences, and a healthier and higher-quality food supply for us all.

In general, and in sum: the lengths we must go to in order to win consent from, and minimize harm to, other living beings are equity- and complexity-producing lengths. They are time and money well spent. The lengths we must go to prevent the pollution of the biosphere are equity- and complexity-producing lengths.³⁵ They too are time and money well spent.

We might begin to suspect that the no-harm (or minimize-harm) principle—whose religious roots flowered in post-Enlightenment moral philosophy—is an expression of a deeper value-principle, a principle that, if it were universally applied, would increase the quality of life on earth in part *because* it is difficult to apply: difficult because worthwhile, worthwhile because difficult, and both because life depends on its own burgeoning complexity. Not *everything* difficult is worthwhile, of course; nor is everything worthwhile difficult. When the two occur together, though, the feeling is unmistakable, and there is no surer sign of life's approval. Psychologist Mihaly Csikszentmihalyi's *flow* is an indicator: people are most happily active when "flowing" *up* the ridge of complexity, balanced between the *anxiety* caused by too-great task entropy (and the valley of chaos to the right) and the *boredom* caused by too-little task-entropy (and the valley of rigidity to the left), while feeling the absolute complexity they are dealing with rise to higher levels as their skills improve. This is hill climbing of the most pleasurable sort (Csikszentmihalyi, 1991, 1998, 2008).³⁶

In *Non-Zero*, Robert Wright makes a similar point: social complexity is driven by the increasingly intricate arrangements that must be made between humans and humans, and humans and other creatures, to achieve fairer "win-win" outcomes for all (Wright, 2000; see also Beinhocker, 2007, p. 238; Nelson, 2003). The take away lesson? Moral development leads to economic development.

³⁵ The annual beef diet of the average American emits as much greenhouse gas as a car driven more than 1,800 miles (Fiala, 2009).

³⁶ Animals value the flow experience too, it seems. See Hearn and McCaig (2007).

In *The Spirit Level*, Richard Wilkinson and Kate Pickett amass data to show that societies around the world with marked income inequality suffer greater incidence of crime, obesity, drug abuse, mental illness, teenage pregnancy, and education-abandonment than societies with moderate income inequality (Wilkinson and Pickett, 2009). Income *equity* (which manifests itself in moderate inequality) serves the rich, and rich countries as much as it serves the poor and poor countries, because it makes societies richer as a whole, not just in monetary, security, and health terms, but in the density and variety of political and economic arrangements that must be maintained to keep equity going and *all* citizens applying themselves voluntarily.

The drive to greater equity, in sum, is rarely simplifying. On the largest view, equity is a new wrinkle in how the game of life is played on earth. It's as though the very ideal of "equity" and its cognates "compassion" and "justice" came into being in order to create new realms for complexity's expansion in this, our neck of the universe's woods.

5. The pursuit of quality as a generator of complexity

It is difficult to measure the *complexity* of truly complex things directly and objectively on a cardinal scale. Usually, we must measure complexity ordinally or comparatively, taking care to count the same internal parsings and/or external behaviors of a finite set of similar phenomena.

The degree of *quality* of a good, service, or experience is difficult to measure on an absolute scale too, and for basically the same reasons. To judge the degree of quality of good A requires comparison to a similar good, B, "similar" in this case meaning: serving in the same functional domain as A with the same quality-categories and ambitions (if not achievements), and thus offering itself as a possible substitute for A. For example, food: Let A be a meal at Taco Bell, B be a meal at Chez Panisse. Both will stanch hunger. Bicycles: Let A be a Schwinn, B be an Orbea. Both will get you to work. Education: Let A be four years at Oakland College, B be four years at Yale. Both can earn you a bachelor's degree. And so on. The market prices of the partners in each these pairs are radically different, to be sure, and most of us take those differences in price to signal differences in quality.³⁷ Fair enough. Among similarly-priced goods, however, even more acute quality comparisons are sometimes made, for quality is what distinguishes among them, and sometimes us. (Recall Freud's cutting phrase: "The narcissism of small differences"?) What's harder to show is that quality comparisons are also *complexity comparisons*, with greater complexity—not greater volume, length, or

³⁷ For expensive durables, unit price, P , and overall quality, Q , correlate positively. Not so for cheap non-durables and local services. We go into this a bit further later in the text.

weight—usually yielding the judgment “better.” We will look into this claim more carefully soon and, presaged by Adam Smith’s concept of capitalist development based on an ever-evolving refinement in the division of labor, try to make some generalizations. But here we offer some obvious instances of its truth:

Consider the telephone circa 1911: a marvelous device. Now consider the *iPhone*, circa 2011: perhaps ten times the functionality, a hundredth the weight, a thousand times the number of discreet manufactured components, and a hundred thousand times the number of person-years of education and training to design it, produce it, and put the infrastructure in place that would give it usefulness. The difference is complexity.

Consider a doctor’s office circa 1870: his tools, his prescriptions, his education, and his accounting system. Compare it, as David Warsh (1984) does, to a typical doctor’s office a hundred years earlier, and a hundred years before that, back to the time of Galen. Today, the medical profession has blossomed into a hundred specialties backed by a vast body of research findings and technological aids. Even today’s primary-care physician—the figure closest to the general practice doctor of past centuries—has eight or nine years of training and works daily at the nexus of a dense network of information flows from diagnostic information suppliers, drug companies, blood-testing laboratories, insurance companies, Medicare officials, hospitals, her own nursing and accounting staff...and, oh yes, the patients themselves, many of whom have learned about their condition on the Internet.

No nation spends more *per capita* on medical care than the U.S. Some say there’s no better medical treatment anywhere in the world. Others contest that. No matter. We certainly do not contest that the socialized health care systems of Canada and Western Europe are better at providing basic medical care economically and equitably than is the U.S.’s. Our point is that the complexity of medical *treatment* is far, far greater than it was just decades ago in *all* developed countries.³⁸

The story of the development of high-quality medical treatment—a service—can be repeated for many if not most goods and services available today. It is the story of complexity grown large, with more education required both to produce and appreciate them. Computers, movies, cars, even bread have not stopped evolving and diversifying. Each new model/generation builds upon the earlier model/generation, taking the complexity already embodied there for granted and building upon it. Most (but not all) are of higher quality.

³⁸ Certainly the high price of health care in the U.S. is not *all* related to quality. Overpaid specialists, bureaucratic inefficiencies, and many unfortunate incentives (e.g. doctors owning testing facilities and then ordering tests at them) are built in to the American health care system, with private insurers and pharmaceutical companies still profiting enormously at the expense of the public good, despite “health care reform” in 2010. See Carey, Herring, and Lenain (2009).

In some cases, though, complexification in one aspect of an industry has resulted in invisible and deleterious simplification in other areas. The technological complexity of modern industrial farming, for example, has caused a considerable simplification of agricultural products and ecological systems. An ear of corn was once the self-reproducing fruit of organically rich topsoil, grown adjacent to and in rotation with other plant species under the watchful eyes of experienced farmers. Corn is now the hybridized (i.e. non-self-reproducing) trucked-from-afar fruit of monoculture, uniform in color and shape, straight-jacketed by strict prescriptions of herbicide and pesticides, grown in depleted soil laced with chemical fertilizers (which are simpler and more repetitive chemical chains than organic topsoil) and watched over by satellite cameras. Compared to the organic complexity of natural topsoil, compared to the microbial, plant, and animal ecology of polyculture, and the accumulated tacit knowledge of farmers, “scientific” industrial agriculture is complexity-reducing. Industrial agriculture has effected an enormous simplification of natural food growing processes in order to achieve greater *quantity*, and we are paying the price not just in quality. In 1900 it took one dollar’s worth of material and energy input to produce four dollars worth of crops in output. Today it takes close to three (mostly oil-based) dollars to produce the same.³⁹

Some generalizations: Every industry, service, and institution has a list of the positive qualities it tries to realize in its products and processes, and on no one’s list except perhaps a wine-maker’s would we likely find “complexity.” Moreover, outside of advertising hyperbole and poetry (“Shall I compare thee to a summer’s day?”), it seems far-fetched to compare the (quality of the) *handling* of a car, say, with the *taste* of a wine, the *ease of use* of a piece of software or the *warmth* of a blanket. These qualities and a thousand others would seem to be incommensurable in every way, much less devolvable to a single quantity called complexity (or anything else). Does our complexity-based idea of quality run into the same critique that has been leveled at “utility” by philosophers like Elizabeth Anderson (1993, 1997),⁴⁰ who argues that no single, valid, universal

³⁹ With good topsoil long swept into the ocean and the oil companies still in charge of agribusiness, we can expect matters to get worse before they get better. For the beginnings of product re-complexification by learning from nature, however, see Benyus (1997), from which the above account is drawn. We can also draw hope from the burgeoning market in organic produce.

Of course, it might be argued that all we are seeing here is the well-known substitution of capital for raw materials and labor, which has happened across the entire economy, and which has made food dramatically cheaper per calorie to buy than, say, a century ago. What we and Benyus are pointing to, however, are some of the hidden negative externalities of the particular *way* this has happened in agriculture. Economic progress would not abandon capital conversion; just do it more wisely, and probably complexly, with a larger ambit of accounting.

⁴⁰ On the way to his entropy theory of economic processes, Georgescu-Roegen had mounted much the same critique of MNE’s utility theory in the 1950s (see Beard & Lozada, 1999).

scale exists along which one could find goods that are *different in kind* to be better or worse than one another?⁴¹

No. For quality has neither utility's commensurability ambitions nor utility's commensurability problems. Given a modicum of common sense in the application, we can indeed equate and compare qualities. As with complexity itself, we compare qualities only within product groups and categories, i.e., among goods that have, or aspire to have, the same quality or qualities: *handling* among cars, *flavors* among wines, *speed* among software packages, and so on. Each of these qualities derives from complexity, but from the complexity of different mechanisms at different scales: mechanical linkages, springs, shock-absorbers, and rubber compounds in the case of cars' handling, polyphenols, pectins, alcohol, and acids in the case of wines' taste, number of coding modules, loops, and memory calls in the case of software's speed. Among true *commodities*—goods whose qualities are highly standardized by law—we do not compare quality. But among the dozens/scores/hundreds of competing goods that would be substitutes for each other, we do (Lancaster, 1990).

In sum, unlike utility, which was posited precisely to validate valuation across goods (and bundles of goods) of quite different kinds, *quality* claims only to work with goods of the same kind, i.e., within product

⁴¹ To hypothesize, or to act as though there were such a measure, argues Anderson, is to risk smudging life's variety, and to make life's point the achievement of a non-specific, drug-like "happiness." This risk is only increased, in Anderson's view, by economists' admission that (relative marginal) utility is best understood as that which is *revealed* to us by the relative *prices* people actually pay for different goods (and different bundles of goods). But if willingness-to-spend so and so many dollars on them is all that two arbitrarily chosen goods (or bundles of goods) have in common, then to posit that good A (or bundle of goods A) on average offers the same (or twice, or half) the *marginal utility* of good B (or bundle of goods B), is to learn nothing more than what A and B's relative going prices ($\$_A = \$_B$, or $\$_A = 2\$_B$, or $\$_A = \frac{1}{2} \$_B$) have already told us about them; in which case utility is an unnecessary construct and money is the only and best metric of value. To maintain that utility is a deep and universal value measure, essential to decision making and somehow prior to money, we would have to show (1) that individuals *have* a central usefulness- and/or satisfaction- (i.e. utility) scale in the brain—i.e., a neurologically-constituted process or place to which *all* goods, physical and psychical, *including money*, are "brought" to be weighed against each other in terms of their happiness-production likelihoods (i.e. expected utilities)—and (2) that maximizing personal total utility/happiness, arrived at this way, was our chief ambition.

Is (1) plausible? Actually, yes. The work of neuroeconomists Glimcher et. al. (2005) and Padoa-Schioppa and Assad (2006) would lend this argument support.

Is (2) plausible? Yes, but not simply. One might look to the chemical complexity of food for an analogy as to why: for complete nutrition, the human body needs many things at once and non-substitutably: water, minerals, carbohydrates, vitamins, oils, proteins, and other nutrients in sufficient amounts and in the right combination. On this analogy, happiness—like "good health"—may be the state we broadly desire, but it cannot be had by the consumption of anything other than many, specific, different, and non-substitutable foods in sufficient amounts and in the right combination, plus physical exercise, sex, clean air and water, etc. These are things we want and seek specifically: to go out for a run, to take a shower, to kiss a friend, to eat something sweet (or salty, or crisp).

The argument goes back. One of the differences between the utilitarianism of Jeremy Bentham and that of J. S. Mill was the Mill's view that utility was no single, scalar, bottom line, but rather a compound "vector" of qualitative ethical, esthetic, and practical assessments made by everyone. Also, in Mill's view, what does not increase the *general* (i.e. social, i.e. pretty much everyone's) multi-aspected happiness does not have utility at all (Mill, 1863, Chapter Two). For Mill, "utility" was meaningless measured in respect of one person, even theoretically. Not so "happiness."

categories and even smaller groupings.⁴² Whereas “amount of utility” depends on the good and our neediness of it, “amount of quality” presumes enough utility to care about the good in the first place, but thereafter depends on its complexity and our discernment of it. Goods of high marginal utility can be of low quality and vice versa. This makes quality a more circumscribed, further-down-the-road measure of value than utility, and one that leads to a more focused study of the labor, technology, and psychology that brings competing goods into existence.⁴³

Now, accompanying the variety of goods and services produced by modern market economies is the variety of qualities (or “characteristics” [Lancaster, 1966, 1971]) that attach to them. Certain of these qualities appear again and again, however, as components of a wide variety of goods’ overall quality. For their breadth and recurrence we might call them *component qualities*.

Consider these seven commonly-sought-after “component qualities:”

- (richness of) *Functionality*,
- *Reliability/durability*,
- *Attention to detail*,
- *Beauty* (or style),
- *Generosity*,

⁴² For formal treatments of “degree of similarity,” see Tversky (1977), Georgescu-Roegen (1971, pp. 73-75) and Appendix Four to this paper at <http://soa.utexas.edu/files/csd/wps201101-app4.pdf> .

⁴³ Some might argue that quality is utility by another name, i.e., that a good’s (degree of) quality is simply either a contributor to its *utility*—in this tradition see Leffler (1982)—or utility in its higher reaches. If utility is allowed to trump quality like this, then we can have no argument: utility *is* the most inclusive measure by design, because it can have any number of components. But this is so only because “utility” has come to mean so much more than the usefulness, *U*, of a certain good, X, to a certain purpose, Y: it has come to mean any good’s capacity to provide happiness or life-satisfaction in any modality or manner whatsoever, and in some usages, that very happiness/life-satisfaction itself, in us. When *beauty*, for example, is subsumed by utility, as it is in MNE theory—when craftsmanship, refinement, subtlety, ethicality, and exemplariness are all said to have (or be) nothing more than a little *extra*, “upper-end” utility, or one component of it—“utility” risks becoming both too general and too reductive a concept, and loses its ability to help engineer economic progress.

In recent evolutionary economics, *fitness*, and especially *reproductive fitness*, has come to serve the same unifying theoretical function as utility. But it’s worth noting that the valorization of fitness is as likely, ultimately, to justify population-growth-based quantitative economic growth as to justify discrimination-based qualitative economic growth. Proliferation, after all, is what biological evolution takes to be *success*, as we noted earlier. While Miller (2001), for example, shows convincingly that a large part of culture’s gratifying complexity is a manifestation of almost everyone’s urge to maximize their own reproductive fitness (i.e., to appear—and even to *be*—healthy, wealthy, clever, secure, young, and sexily-shaped for as long as possible), it should not be forgotten that nature’s “reason” for optimizing (the appearance of) reproductive fitness *is the having of more children* (or, from the gene’s point of view, the spreading of more copies of itself as quickly as possible), and not the enjoyment of art, or music, or the Good Life, which may or may not involve being outnumbered by actual children. One must, we think, be liberal in one’s interpretation of what it is that evolution wants “reproduced.”

- *Simplicity*, and
- *Ethicality*.

Such is their degree of abstraction that they appear in some wording or another in countless quality-control manuals, manager's checklists, company mission statements, product advertisements, and review magazines.⁴⁴ We will look briefly at each, mainly in the context of material goods, and show how they depend on complexity. With a shift in interpretation, the same component qualities might apply equally well to non-material goods like educations, firms, services, theories, and financial instruments. Sometimes they make sense in application to people.⁴⁵

1. Richness of functionality. The link between this component quality and internal complexity and/or behavioral complexity is clear. Goods that have more than one function (and perform them well) tend to have many components and/or many inflections of shape; they tend to be the fruit of long, multigenerational development in design. The materials they are made of have more than one property, and these are made use of: rubber that resists grease and that grips well, or glass that is visually transparent, reflects heat, insulates, is fireproof, and won't shatter.

Even basic single-purpose goods, like sledge-hammers, upon closer scrutiny offer several areas for functional optimization and connoisseurship: the use-determined choice and distribution of their weight, the material, length, and curvature of their shafts, the fixity of their heads to their shafts, their stability at rest, and so forth.⁴⁶

⁴⁴ We are omitting near synonyms. For example, "ethicality" can show up as "professionalism," "simplicity" as "ease of comprehension," "beauty" as "appeal" or "attractiveness," and so on. The seven component qualities can overlap in some cases, depending on the category of goods, as when, for example, "attention to detail" helps "reliability" or is an avenue for "generosity."

⁴⁵ It strikes us as significant that many human virtues are so easily, if not projected upon, then derivable from the attributes we share with the things we call "goods." But we shall leave that observation there. Too much wrong can flow from treating people as goods, as means rather than ends, which is precisely what capitalists are wont to do when they consider people only as providers of labor. The reverse, anthropomorphism, treating goods as having human characteristics, is far less dangerous.

⁴⁶ One could develop a typology of material goods (and another for services) that arrays on a spectrum goods whose value comes mainly from their internal complexity as expressed in relatively simple outer behaviors, and goods whose value comes mainly from their outer complexity of *shape*, supported by simple interiors. The former tend to be "hi-tech" or organic goods, like cell phones or foodstuffs. The latter tend to be "low-tech" and mechanical goods, like hand tools, sculptures, and machine parts. Most products obtain their functionality from combinations of their inner and outer complexity. Across the spectrum, however, the complexity of *production processes* can be considerable, requiring much labor, intelligence, and time. When that is the case, we tend to say that the complexity of the production process is "embodied" in the final product. When biological evolution provides the bulk of the "production process," and we take note of its embodied complexity, we will often try to "bring it out," as when we polish a fine piece of furniture or train and groom a dog for show.

2. Reliability/Durability. Goods are expected to function for a time, usually the longer the better. To this end, they must protect their complexity against entropy's endless raids on their weaker, smaller-scaled parts (wear and tear), and also against larger shocks from the outside (accidents and shortages). Other things being equal, the more complex a system is, the more prone it is to breakdown. This is why some people prefer a can opener with no moving parts to one with cranks, gears, hinges, clamps, or a motor.⁴⁷ Ditto with business processes: who likes endless and delicate protocols to get a simple thing done? Who wants long chains of decision-points that need only one mistake—somewhere, anywhere—to stop everything? It's for similar reasons that naturally-evolved complex systems contain so many redundancies—from duplicate organs to elaborate immunity and repair systems (themselves redundantly "staffed" and provisioned), to skins and carapaces to protect them from external shocks, and stores of energy to tide them through shortages. Likewise, engineers use safety factors of 2 or 3 in specifying material strengths and make allowances for inaccuracies and "contingencies," designers of institutions and businesses deploy backup systems for power and data, create stocks of essential supplies, make sure there are alternative routes between destinations, more than one way to do everything, and more than one person who knows (just about) everything. Building the whole out of sub- and sub-subsystems and arranging them hierarchically into departments, modules, units and such, is also a reliability strategy borrowed from nature: should any one subsystem malfunction, damage is limited and replacement can happen faster (cf. Simon, 1962).⁴⁸ The point being that core complexity requires more complexity to protect it.

Reliability-cum-durability is probably the component quality most commonly sought. How is it measured? Before being put on the market, one can measure the average number of hours (or uses) before products fail.⁴⁹ Once they are on the market, agencies like J.D. Powers and Associates and Consumers Union

⁴⁷ The expressed preference for simplicity does not always constitute the callow "bells and whistles" characterization of complexity in general that one hears from salesmen and contractors bent on expediency. Ironically, "bells and whistles" refers to the ornamentation of carnival calliopes and carousels, which are absolutely necessary to their attractiveness, and thus functionality.

⁴⁸ These strategies run very deep. Nobel physicist Robert Laughlin (2009) argues that every physical law and every numerical constant discovered in nature represents a shell-like or ladder-rung-like stable state emerging from an immense collectivity of smaller parts whose behaviors individually, or in small numbers, would be unstable. One way to put it: complexity, which is partially-organized entropy by definition, is not a smooth but a step-wise emergent feature of evolution. Containing/preserving complexity in large-system behavior is something nature does "all the way down," not just at the very large scale of biological life.

⁴⁹ Production industry discussion of quality usually revolves around "quality control," i.e. reliability-in-production, i.e. how to reduce errors, variation, discards, and returns. Kremer (1993b) nicely shows that, in the production of goods that must be discarded or deeply discounted if they have any flaws, the value of a worker's skill (i.e. workers "who make few mistakes," = our functionality + reliability)

(in the U.S.) regularly assess reliability using measures such as rates of repair and number of consumer complaints. And so on. In the marketplace, interestingly, the offering of long warranties, which is intended by the seller-producers to signal their confidence in the reliability of their wares, can signal low confidence and quality instead. And a desperation to sell.⁵⁰

3. Attention to detail. Again, this is easy to see first as a cause (and then result) of complexity.

Whether the good is a material one, like a jacket, or a service, like a haircut, attention to detail decreases the scale of consideration from meters, say, to millimeters, from minutes, say, to milliseconds, and thus vastly multiplies N , the total number of parts in play. One judges the jacket's stitching, its "drape" (which is a function of the fabric's micro-scaled weave), its button holes, the number of panels used, the subtleties of its slopes, padding, lining, and cut; and, of course, the jacket's fit to one's particular body. One notices the demeanor of the hairdresser, the freshness of his or her clothes, skin, and hair, the smell of their shampoos, the speed and precision of their scissors, the thoroughness of their inspections, the quietness of their dryers, their sensitivity to your mood... All of these are now variables in a much expanded complexity equation.

Quality in musical performance offers perhaps the paradigmatic case. The overall genre may be utterly predictable; the piece being played may be well known; but worlds of difference are to be found in the nuances that each musician brings to the performance, which is a matter of microseconds in timing and microdynes of force. With recorded music, much attention is given to the acoustics of the room, the quality of the instruments, the recording process and equipment...all of which culminates in the close attention you and I give to listening.

With attention to detail, the ideal is perfection. But whether or not perfection is achieved, voluntary attention to detail also shows *care*—that precious and entirely human commodity closer to love than labor input. Architects are fond of quoting Mies van der Rohe, who in turn was quoting Michelangelo: "God is in the details."

4. Beauty or "style." This component quality greatly affects both production costs and market prices. However, beauty is not as straightforwardly quantifiable as reliability is. Indeed, many would say that treating

increases, as do his or her wages, as his or her contribution happens nearer the final stages of production. Moreover, workers of equal skill tend to work together, and congregate in certain firms, stratified by the quality of their products.

⁵⁰ Enhanced warranties offered direct to consumers by manufacturers that have poor reputations for quality are ineffective. Required (for that warranty to work) is the product's availability through a retailer of good reputation. The same dependence on the retailer does not apply to manufacturers that have good reputations (Purohit and Srivastava, 2001).

esthetic qualities analytically threatens to reduce us to hopeless, eye-of-the-beholder subjectivity on one hand, or blindly-accepted, Lagerfeld-says authority on the other. Perhaps this is why *Consumer Reports* has no category for “aesthetics,” this even as Postrel (2003) shows how very important beauty and style is in our economy, and Miller (2001) and Dutton (2008) explain why this has long been so in evolutionary terms.

Confounding matters is the *authority of price*, as when very expensive goods of their kind, and believed to be selling to elites, twist our arms over time into seeing them *as* beautiful.⁵¹

The earliest attempt to “quantify” aesthetics in terms of complexity was mathematician George David Birkhoff’s *Aesthetic Measure* (1933). Ever since Pythagoras’s discovery of the correspondence between the pitch of a plucked lyre-string and its length (for example, that halving the string’s length raises the pitch a perfect octave), people have believed that perfect mathematical *proportionality* is what gives inherent, harmonious beauty to all things—buildings, paintings, tools, music, the human body, the cosmos. Also in the air was the age-old intuition that beauty was achieved in finding or creating *unity in diversity*, a formula—vague to be sure, but a first step towards quantification—that seemed to apply to religious, scientific, and political ideals as well. Birkhoff proposed this formula: $M = O/C$ where M was an aesthetic value measure, O was a

⁵¹ As Scitovsky (1945, p. 100) noted: “Economists are wont to minimize the importance of this factor” (i.e. the authority of price), “fearing the havoc it may wreak with the whole theory of choice.” When people genuinely enjoy wine more when they believe it’s expensive wine (Brochet, 2001; Plassmann et al., 2008), and when the same is probably true of jewelry, perfume, haute cuisine, luxury cars, every kind of gift, and of more ordinary goods than we care to admit, mainstream economics’ demand-supply-price argument stands in need of revision. This revision needs to occur not only along the Veblenian lines (telling us how expensiveness helps create exclusivity, a “good” in itself), but acknowledging the quasi-religious emotional effects upon everyone of evident *sacrifice* on our behalf: of labor on the production side and of hard-earned money on the consumption side.

Also capitalizing on the authority of price is the age-old marketing technique of anchor- or *reference pricing*. Here, one price, the reference price, often put forward first, signals the “true quality” of the product; while the second, lower price is the one that *you*, O lucky consumer, need only pay today. It has been shown that consumers are strongly and irrationally influenced by reference prices (Ordonez, 1998, Introduction; Shell, 2009; Poundstone, 2010). Sellers who wish to maintain the perception (as well as, possibly, the reality) of the high quality of their brands rarely offer discounts therefore, and the fixed price of their goods often becomes the reference price used by imitators.

As is also well-known, some goods become “prestige goods” almost entirely. These are goods whose extraordinarily high prices must be widely known in order to function as intended, i.e., to evoke recognition from peers, or envy from *hoi polloi*, or both (Frank, 1987). But this analysis is not totally accurate: more accurate is that people who buy prestige goods must *believe* they function in this way (i.e., to evoke recognition from peers or envy from *hoi polloi*). The goods may in fact do neither. Hence the amount advertising in magazines like *The New Yorker* devoted to reassuring us that that they do function as intended by depicting celebrities and models using/wearing their products, ads sometimes depicting admiring/envying onlookers too, just in case we don’t get it.

But let us not rest with *this* analysis either. For many of us are wont to ridicule the rich as emperors buying invisible clothes while congratulating ourselves on being gimlet-eyed, illusion-resistant appreciators of what’s *really* high-quality. Researchers as celebrated as Gary Becker and Edward Glaeser for example (Becker and Glaeser [2000], also Becker and Landes [2000]), following Veblen, seem satisfied to explain the extreme expensiveness of certain luxury goods as having purely social and political utility (rich “leaders” wishing to distinguish themselves from less-rich and middle-class “followers”), rather than as a reflection of the truly extraordinary quality of the goods available at high prices, accompanied by an extraordinary appreciation of them. The “social distinction” theory may derive from outdated attitudes towards the *nouveau riche*, who are unfairly assumed to be uncultivated. Drive a Bentley Corsage yourself, however, or don a \$1000 custom shirt, or actually own a significant work of art while knowing something about cars, clothing, or art, and you might find your scorn for (the tastes of) the rich wavering. You might realize that the *very* rich, anyway, have access to realms of quality of which you knew nothing, and worse, that they care rather little about what we think of their choices.

measure of "order," and C of complexity. The greater the degree of order in an object (or piece of music, or painting...) relative to its complexity, the greater is its aesthetic value. Here was one rendition of what "unity (order) in diversity (complexity)" might really mean.

Can a translation be made from Birkhoff's complexity-model of beauty and ours? Yes. Birkhoff's " C " is our H_{\max} : it increases directly with the number of sides of a polygon, it increases directly with the number of different notes in a melody (these are Birkhoff's examples), and it contains no notion of probabilities or expectations. His definition of O , on the other hand, while it would seem linguistically to correspond to "organization" (or $H_{\max} - H$), is actually closer to our idea of C , *complexity*. This is because "order," as Birkhoff explains it, is the lesser when things are "ambiguous, unduly repetitive, and unnecessarily imperfect." In our terms, "ambiguous" means too much H , "undue repetition" means too little H , and "unnecessary imperfection" means too much H again...all three of them being conditions that reduce the magnitude of C (our C , not Birkhoff's). Birkhoff is saying that things are beautiful to the extent that they maximize their complexity (but really ours, or ours also, in the act of contemplating them), relative to their maximum potential entropy, H_{\max} (really ours, or ours also, in the act of contemplating them).⁵² Look again at Figure 1: C is close to maximum when $H \approx H_{\max}/2$. This state corresponds to its maximum lifefulness. Too much "organization" ($H \approx 0$) is a bad thing. Too little organization ($H \approx H_{\max}$) is a bad thing too.

Perhaps the most influential attempt to link the quality of beauty to complexity was Rudolph Arnheim's 1971 *Entropy and Art*, which makes an argument similar to Georgescu-Roegen's in *The Entropy Law and Economic Process*, also published in 1971. The function of art, like all productive human activity, is to seek or create harmony and order against the "law of increasing entropy," i.e. the Second Law of Thermodynamics. That symmetry, regularity, clarity, crystalline form, and material purity are rare in nature, makes their consistent production by human beings something of a triumph.

But of course, any argument that simply pits order (= good) against disorder (= entropy = bad) cannot go very far: it would turn the world into a block of salt. And so we are not surprised to find Arnheim, by the end of his book, arguing along with Peckham (1967) that we have a "*need for complexity*" and then having to distinguish between "orderliness" (trivial, bad) and "Order" (important, good). The degree of "Order" can be greater or lesser as the work is more complex or less complex, Arnheim says, and begins to follow Birkhoff's usage, which, as we have shown, maps onto our Figure 1.

⁵² We are making no claims here about the H_{\max} (or C) of the entire brain, even if one could measure it, because the vast majority of the brain's circuits are busy doing things other than absorbing the work of art in front of us—doing "things," moreover, of which we are utterly unaware.

There is no room here to explore the considerable literature of complexity theory and esthetics, which is quite well developed in music (e.g. Beauvois, 2007); just to show that for all the things beauty depends on culturally, it depends also, and not entirely subjectively, on how a good maximizes its life-zone complexity, and/or ours when in contact with it.⁵³

5. Generosity. Goods of high quality have about them a margin or aura of unbidden generosity. As fine as they appear to us when we first see them or acquire them, *finer-yet* is what we discover them to be, revealing in use, and always casually, qualities or features not mentioned in any advertisement or demanded by any consumer. This part of them is pure gift, undeserved, an element of art (Hyde, 2007): a coffee table the underside of which is perfectly finished; software having a feature found only with certain key-combinations; the panes of a new window exceeding insulation standards; stainless steel screws, Allen-headed, and four in number where three, flat-headed, in plain steel would have done; dishes warmed before being brought out with food, martini glasses chilled; a doctor's office eschewing automated call-filtering and using a nursing-trained receptionist instead; a teacher bringing in her own books and staying late with a promising student. Opportunities for quietly exceeding expectations are myriad in most goods and services. Availed of non-cynically, they yield complementary pleasures to the provider and to the recipient.⁵⁴

Alas, the deepest principles of neoclassical economics mitigate against such generosity: product characteristics that cost time or money to produce and that are neither necessary to the good's function nor certain to be appreciated at the point of sale are "value engineered" away (cf. Park, 1999). Over time, this disaffects—"alienates"—both makers and purveyors. Gresham's Law ("bad money drives out good money") exceeds its bounds: while currency, which need have no material value, more or less naturally transformed over time from gold, to silver, to brass, to copper coin, to promissory notes, to paper bills, to bits in computers, the "same" efficiency allows forests to be clear-cut to within a few hundred feet of public roads, genuine leather to be used only where car seats are most seen and touched, quality brands to exploit their reputations by authorizing cheaper suppliers to produce their goods, and prestigious universities to allow more and more

⁵³ A part of the complexity of a high-quality good is often contained in the narratives that are attached to it, for example, in the provenance of a work of art: how it was made, its significance in the development of the artist's *oeuvre* and/or the times in which he/she worked, how it came to be here now, and so forth. This complexity becomes embodied in the work, or better said when there is no physical evidence, embodied *by* the work. The same "embodied-by" strategy happens in boutiques of all kinds, with the same opportunities for fraud and deception. For more on what beauty owes narrative complexity, see Dutton (2008, p. xxx).

⁵⁴ They also improve the provider's health (Dunn, 2010).

courses to be taught by adjuncts and graduate students. In markets driven by unrelenting price competition, extraneity becomes anathema. When face-value will do, goods and services are emptied down to their minimal legal descriptions. In all, efficiency bordering on miserliness prevails the way it never does in nature, which is patient and ever-surprising, layered with gratuitous extravagance, and deep with rarely-called-forth capacities. The generation of presently-unnecessary complexity is the very hallmark of biological evolution. Within reason, we should learn from it and keep the value engineers at bay.

6. *Simplicity.* In the midst of a theory that associates (high) quality with high complexity, it might seem odd at first to list simplicity as a “component quality.” But recall our discussion on pp. 20 and 21. There are limits as to how much complexity we can handle; and when we are unable to cope, simplicity offers relief.⁵⁵

And yet complexity is what we need.

This conflict plays out in everyday life: When greater complexity in design and manufacture is required for goods to improve, and when greater complexity in institutional and business arrangements is demanded by every step forward in quality and equity, people become caught up in an urgent optimization problem: *how best to allocate their finite attention and mental energies* (Lanham, 2006; Hirshliefer [on Lanham], 2009). It’s as though each of us had a finite daily *budget* of “IQ-hours,” such that the expenditure of x IQ-hours on any one activity meant that we had x fewer IQ-hours to devote to some, or all, of the other activities.⁵⁶ If the law of diminishing marginal utility applied, one would arrive at the well-known optimization principle that says we

⁵⁵ For a window into the discussion of complexity-handling maxima and optima in psychology, see Walker (1973), Miller (1960, 1964), Rogers (1979) and the pioneering work Daniel Berlyne (1960) in the 1940’s and ‘50s. The psychologist who has pursued the optimal complexity model of “rewarding experience” farthest into the present day is Mihalyi Csikszentmihalyi (1975, 1988, 1991, 1998).

It’s worth remembering, however, that we are surrounded by vastly more complexity than we can attend to, much less understand or consciously control. Nature’s complexity is close to infinite everywhere. Only a tiny portion of that complexity is detected by our senses; only a tiny portion of *that* are we aware of; and only a portion of *that* do we have the need, or capacity, to master. The modern problem is that human media—from billboards and radio to TV and the Internet—are packed with messages targeted at our urgent concerns, and so *seize* our attention the way live-and-let-live clouds, sparrows, trees, and (most) buildings do not.

⁵⁶ Thus a person with an IQ of 100 who is alert for 16 hours/day would have a daily budget of 1600 IQ-hours to allocate to various activities. Alas, non-linearities plague this semi-serious proposition: a person with an IQ of 133 might be able to attend to and process the same information in 12 hours as a person with an IQ of 100 can in 16, but a person with an IQ of 80 might have no success at all, no matter how much time they spent. Can IQ be assigned by degrees, i.e. can I decide to be smart and attentive about this but not that, this morning but not this afternoon? Only to a degree, both within myself and as a manager assigning differently-complex tasks to differently intelligent employees.

Hovering over all such ruminations, however, is the fact that the Stanford-Binet IQ test of general intelligence has fallen so deeply out of favor in recent years that one can use it today only parenthesized, semi-seriously. Better to talk of *skill*, like this: “(When production consists of many tasks, all of which must be successfully completed for the product to have full value, (I will) assume that it is not possible to substitute several low-skill workers for one high-skill worker, where skill refers to the probability a worker will successfully complete a task” (Kremer 1993, p. 551).

should *equalize* the utility of each activity per extra IQ-hour spent on it. It follows that the greater is the number of different goods and activities that confront us, the less time and the less intelligence we can dedicate—indeed, *should* dedicate—to enjoying, doing, or figuring out the advisability of any one of them. Put another way: when the complexity of daily life creates stress, and that complexity derives chiefly from very *variety* of goods and activities put before us, then the simplicity of any one good or activity plays to its advantage: it promises us relief, and also the assurance that we may move on to enjoying the *other* goods all the sooner.⁵⁷ Think kid in candy store.

But this speaks to simplicity's utility as an attractor of attention, not a deliverer of skill, health, or happiness. It does not tell us how a good, once paid attention to, can give us access to the complexity we actually need to absorb or master. The trick is *leverage*: learning how to control and/or consume the complexity we cannot consciously understand by means that we can.

We touched upon this “trick” earlier. The simplicity we like often masks enormous complexity, indeed *requires* enormous complexity to be packed into and become embodied by the final product, this not just to give the product its capabilities over time, but to make our interaction with it—our use of it—simple and intuitive at any given time. How is this done? In two ways: (1) by capitalizing upon our native abilities to process massive amounts of environmental complexity subconsciously (as we do when we see, hear, balance on our feet, sort socks, catch a ball, open a door...) and/or (2) by designing a product that provides some information-processing power itself. Case in point: Apple's *iPhone*, which we have already lauded. Containing a built-in gyroscope in addition to an accelerometer/tilt detector, proximity sensor, touch screen, microphone, speaker, ambient light sensor and a camera—all analogs to the human senses—it also presents a graphic interface cunningly adapted to the hand's natural proclivities (holding, touching, swiping, pinching) as well as myriad other visual screen effects we see as normal because they behave like physical, sometimes living, objects. At the time of writing, HTC's *Evo 4G* or Motorola's *Droid* were almost as accomplished. The Palm *Pre*'s ad copy a

⁵⁷ Of course, *choosing one* from among many alternatives can be a stressful exercise in itself, as many have observed: for consumers with respect to goods (e.g. Schwartz, 2004), patients with respect to treatments (e.g. Morra and Potts, 2003), executives with respect to courses of action (e.g. Nutt, 1998).

Then too, the law of diminishing marginal utility might not apply to complex, high-quality goods. The marginal utility of “consuming” a good like music or literature or mountain-climbing grows with the time and attention you “pay” to it. The danger here is that the IQ-hours devoted to such goods can increase over time, starving all other goods of the attention it would benefit them (and us) to give to them. Becker (1996, compendium) treats this and similar phenomena as cases of addiction, adding a “consumption capital” term, S , to the consumer's utility function. In general, the greater S , gained from earlier consumption of the same or similar goods, the more or less is the pleasure of consuming another instance of the good.

year or so earlier was telling: “Filled with technology you’ll never have to think about.” Apple’s *iPad* and its imitators are only extending the idea.

The principle of simplicity leveraging complexity—of simplicity *in use* and complexity embodied—is a familiar one, ancient, and ubiquitous.

Driving a car is a simple matter compared to manufacturing it or fixing it. On the road, the car’s frame and suspension absorb and tame myriad close-to-random inputs. Its tens of thousands of parts course with electrical signals, mechanical stresses, and chemical processes beyond our ken...all so that we, humming a tune, can move our limbs in simple ways to keep it on course. Precursors: riding a horse, harnessing an ox.⁵⁸

Hiring someone to do a cognitively demanding job reduces the load on *us* to a handful of instructions. It’s a wise employee who says “no problem” to every request. The division of mental labor, which is the very engine of most economic development, is founded on the leverage we are speaking about: simplicity controlling complexity, returning simplicity in answer. Precursors: intra-family assignment of skills and responsibilities among men, women, and children; the domestication of dogs to herd sheep or help hunt and of cats to control rodents and demonstrate sleep.

Good scientific theories are simple in just this complexity-leveraging way, the formulae within those theories being prized for their conciseness. Good computer graphic interfaces and web-pages are simple in use too, as are good graphics and software generally. As was writing itself, long ago. All of these are *intelligence assistive technologies*. By taking some information-processing tasks on themselves—be it of memory or actual computation—they let us be dumber, or at least let us direct our mental efforts elsewhere. Do they take concentrated intelligence to produce in the first place? Very much so; and time. But not from everyone.⁵⁹

⁵⁸ A horse is several orders of magnitude more complex than a car, of course, and can go where no car can go with much less fuel. Does this mean we have “de-evolved” to using cars and tractors? On the face of it, it would seem so, and a return to an older lifestyle suddenly seems tempting! But further reflection recalls the technological and social complexity that mechanical power and transportation allowed to mushroom through urbanization.

⁵⁹ The reduction of the news coverage of American politics to 9-second sound bites is but one symptom of what many have observed: in a media-soaked environment, sustained attention is in short supply. The way “tweeting” replaces email, which replaces letter writing and conversation, the way online skimming and clicking replaces book-reading, etc., etc., are regrettable only if they also, under economic pressure, reduce the quality of the information reaching the public—for example, if they eliminate professional editors and journalists whose job, precisely, is to mediate and organize the complexity of the news with knowledge, skill, and neutrality. Theoretically, the increase in the complexity of products—including the news—should lead to an *increase* in high-skill employment, to an increase, not decrease, in complexity-leveraging intermediation services. For that to happen, however, the demand for quality must change from preference to insistence.

Consider, finally, the simplicity of minimalist modern architecture: clean, empty, creating islands of peace away from crowds and noise. There too simplicity is a front—part carapace, part interface to invisible, embodied complexity. Architects produce it knowing that “Minimalist Modern” is a devilishly difficult style to pull off. It demands extended decision-making, a trained eye for light and proportion, the highest-grade materials, zero tolerance for error in construction, high levels of technical ingenuity (to waterproof, conceal services, and handle expansion and contraction), many moving parts, extremely strong and light structural members, and much clever joinery; it demands furniture that has the same character, careful living, fastidious housekeeping, and highly-considered, high-maintenance landscaping all around. Truly, as architect Mies van der Rohe famously quipped, “Less is more.”⁶⁰ By contrast, the columns and rooflets and bays and bump-outs of the average suburban developer home are complex only superficially, masking simplicity within: rooms that are haphazardly-furnished, one-windowed boxes made of gypboard and carpet, carelessly and additively adjoined to each other to make the bumps outside picturesque.

This is not a pitch for minimalist modern architecture, or even for “smart buildings” that control their own security devices and heating and ventilation systems. Good classical buildings with operating windows and substantial walls are just as complex, and at more scales. Likewise, parks that require skilled gardeners are more complex than lawns that can be motor-mown in an hour, and more complex too than nature-let-go, neglected. In selecting plants and pruning them, in creating beds and making ponds, skilled gardeners present a concentrated order, secure in the knowledge that nature’s seasoned entropy will shine through everywhere: in cloud patterns, leaf-shimmer, and the paths of dragonflies.

When simplicity gives on to simplicity within, we call the thing *crude* but honest.

When complexity gives on to complexity within, we call the thing *complicated* through and through.

When complexity gives on to simplicity, we call the thing a toy, or *sham*.

But when simplicity gives on to complexity, we call the thing *sophisticated*, elegant, confident in its power.

7. Ethicality. Given our earlier discussion of equity, we can be brief. For when ethicality is added to the list of component qualities, a window is opened to all the complexities involved in making goods healthy, safe, ecological sustainable, and socially just. Every item presently in the marketplace, after all, has a history and a destiny. These two stories create an arc, as it were. Assessing a good’s ethicality properly requires that its

⁶⁰ He might just as well have said “less is more expensive.” We discuss the cost of quality below. See also Blayley [2010].

entire arc be known and critiqued, and that the harms and benefits to *all* living systems along the way be tallied.⁶¹ This complexifies record keeping and cost accounting, with the potential for asymmetries of knowledge at every market juncture: sellers who *know* and buyers who don't, and perhaps don't want to (Akerlof, 1970).

One of the reasons negative externalities abound is that they are *simpler* to accommodate to than to correct.⁶² Although trouble and injustice *can* add complexity to people's lives, removing negative externalities involves new complexities: technologies, regulations, mechanisms of oversight, side markets (as in pollution rights), negotiations between injuring and injured parties, etc., with the difference that *these* are greater complexities, and better for all.

Goods made ethically in the first place, of course, are best. Fair-wage labor, honest business practices, foods grown organically, cars made out of recyclable materials, buildings that use solar energy, natural light, and non-outgassing, low-embodied-energy materials, factories that scrub their own wastes, banks that lend only to ethical enterprises and so forth—all add complexity to their kind. All cost more to research, produce, and operate than their cruder, less ethical counterparts. We will address the cost of quality shortly. For now we offer that, absent the effort to research all product arcs and communicate those results effectively, absent the resolve to innovate and to legislate so as to correctly price externalities and thus raise the bar, broad improvements in product ethicality will be to hard come by.

But we have hope. At the end of the 1990s, as Crane (2001) notes, marketing experts saw "ethicality" as an optional augmentation of a product's appeal rather than as a quality at its core, and be expected along with its functionality and reliability. As Crane also noted, however, this was changing. More and more consumers in 2000 were expecting ethicality from goods and their producers as a requirement of purchase and were willing to pay a premium and/or make choices in that direction. In Britain at least, the evidence as of 2008 proves that he was right.⁶³ Today it is common for producers to tout their own ethicality, and that of their products, in social and environmental terms. The truth of those claims is a legitimate concern.

⁶¹ This includes the moral goodness of the happiness produced by most goods for their makers, sellers, buyers and users. As for listing all the harms and benefits of a good's arc through the economy, McDonough and Braungart's "cradle-to-cradle" accounting is a start (McDonough and Braungart, 2002). To ask for ethicality on top of goodness is to ask that that goodness not have been achieved at the involuntary expense of other sentient creatures. Recall our earlier discussion of the no-harm/minimize-harm principle.

⁶² The other reason they persist, of course, is their original reason: when certain costs of production are being borne by the public, the final product can appear in the marketplace that much more cheaply.

⁶³ "Expenditure on ethical goods and services has grown almost threefold in the past 10 years, the Co-operative Bank declared today (30 December 2009) as it publishes its tenth annual report into green spending. Overall the ethical market in the UK was worth £36 billion in 2008 compared to £13.5 billion in 1999." For more detail, visit <http://www.goodwithmoney.co.uk/ethicalconsumerismreport/>.

This brings to a close our introductory discussion of the seven “component qualities.” Our aim has been to suggest how goods of higher-than-average quality derive much of their value, beyond their basic utility, from the way they create, maintain, and manage higher-than-average levels of complexity. *Products of high overall quality, Q , are apt to be richly functional, super reliable, unusually attentive to detail, notably beautiful, surprisingly generous, gratifyingly simple to use, and more ethical than they need to be by law.*⁶⁴ The pursuit of these seven component qualities is a way of growing life’s complexity against the forces of chaos and rigidity, a way of embracing and controlling complexity in the cause of both pleasure and progress.

If we denoted these seven component qualities respectively q_F , q_R , q_A , q_B , q_G , q_S , and q_E , we could take successive pairs of competing products and judge them, one superior to the other, on each component quality, and derive a overall ranking of the products from “winning-est” to “losing-est.” This would be the most conservative procedure, and likely produce many ties. Alternatively—as in rating cars or ice skaters—we could have a panel of judges score each component quality’s degree-of-presence in a given product from 0 to 10, and compute the overall quality of product i belonging to product-group j , $Q_{i,j}$, as equal to $7/(1/a_j q_{i,F} + 1/c_j q_{i,R} + 1/b_j q_{i,A} + 1/d_j q_{i,B} + 1/e_j q_{i,G} + 1/f_j q_{i,S} + 1/g_j q_{i,E})$, where a_j through g_j are coefficients greater than 0 and less than or equal to 1 that reflect the *a priori* weight of each component quality as it reasonably applies to goods belonging to group j .⁶⁵ Which is to say, mathematically, Q could be defined as the weighted harmonic mean of the

⁶⁴ *Newness* is not a component of quality, Q , in our view. This may seem strange: most growth economists cite original ideas, new knowledge, and/or technological innovation as the drivers of growth in the modern era. Although new products are usually qualitatively better than their older counterparts, for us it’s the improvement-in-quality that counts, not novelty per se even in the arts. Quality may or may not require new knowledge; it may require the application of old knowledge, or simply paying more attention to detail. The invention of whole *new categories* of goods, of course, is fully in line with the comparison of innovation to speciation. Speciation events, however, are rare in nature, and we would be wise not to wait for them to happen, or *depend* on them happening, in analog, in the economy. [Some would see a parallel to Thomas Kuhn’s well-known division of the practice of science into “normal” and “revolutionary” periods. As Kuhn notes, normal science is concerned with “quality improvement,” and occupies the bulk of history.]

Note also that *convenience* and *safety* are not on our component quality list, but this is for different reasons. Both seem to us to belong to a good’s basic utility: “convenience” being adequately taken care of by current market dynamics and related to *simplicity* anyway; “safety” being a legal requirement for entry into the market at all and related to *reliability* (e.g. the thing purchased will not collapse, crumble, or explode in use).

⁶⁵ Note, first, that one cannot change the coefficient weights “inside” a category or group (e.g. from brand to brand) without risking Q intransitivity. Note, second, that using the harmonic mean formula, a very low score on any one of the component qualities drags Q down a great deal. This is in keeping with the extra salience people give to negative quality cues when more than one cue is available (Purohit and Srivastava, op. cit., p. 133). Ditto the assignation of a very low *a priori* weight to any one component quality. This property of our formula is not accidental: we *want* to see all the component qualities considered as necessary, and believe it most conducive to economic progress that they become so. But this criterion may itself be adopted only with the maturation of the market in question. One might start with judging overall quality, Q , using simple component-quality-score averaging (*a la Consumer Reports*), but end with using the harmonic mean. Think of it happening in stages. We might write (omitting some subscripts and the setting all coefficients to unity for the sake of exposition) that at Stage One, $Q = (q_F + q_R + q_A + q_B + q_G + q_S + q_E)/7$; that at Stage Two, $Q = 2/(1/q_F + 1/q_R) + (q_A + q_B + q_G + q_S + q_E)/5$; that at Stage Three, $Q = 3/(1/q_F + 1/q_R + 1/q_E) + (q_A + q_B + q_G + q_S)/4$, and so on, until we reach the formula offered in the main text.

component quality scores, and would itself vary between zero and “a perfect ten.”

Ironically, it’s often easier to assess and compare the quality of goods than to assess and compare the complexities upon which their quality is ultimately based. In many instances complexity becomes...well, *too* complex to measure in a reasonable amount of time.⁶⁶ This leaves quality, Q , which we are more practiced at assessing, as complexity’s best evidence and estimator. Recall our treatment of the component quality “simplicity.” Among Q ’s *own* component qualities, it seems, is simplicity in use: Q gives us leverage over complexities we cannot understand in the time available.

Why, then, rest our model of quality on the foundations of complexity theory in the first place? Because the path to higher quality goods often requires deeper analysis than can be yielded by ruminating on how to enhance this or that component quality, finished product in hand, not knowing how it works, how it was made, or where it will end up. As brief as our treatments have been of the seven components of Q , we think they offer several pointers already as to how efforts to improve a good’s overall quality might proceed in the kitchen, so to speak, rather than in the dining room.

The cost of quality. Higher overall quality costs more to produce/provide, and commands higher prices in the marketplace. Research confirms this conventional wisdom (e.g. Rao and Monroe, 1989; Tellis and Wernerfelt, 1987) up to a point: higher-quality goods typically require more capital input, more skilled labor, more parts and part suppliers, longer supply chains, better advertising, and smarter retailers than do lower-quality goods of the same category (Warsh, 1984; Novak and Eppinger, 2001). Once in the marketplace, they tend to fetch higher prices, other things being equal. But research also shows that this expectation is not met by all categories of goods. They are met by goods that are durable, expensive relative to people’s incomes or to firms’ revenues in the case of capital goods, technologically sophisticated, and testable before sale—like cars,

Note, third, that each component quality can itself be examined in greater detail, revealing its own component qualities, to arrive at *its* overall quality score, q .

Note, fourth, that it’s likely that qualities other than our seven component qualities—and not obviously distributable among them or devolvable to one of them—will continue to appear in any real-world application of Q to specific goods. Studies implementing Q precisely as we have defined it—i.e. using the seven component qualities that we identify and recommend—will take a conscious effort and an experimental attitude towards, if not a complete commitment to, our quality-as-complexity theory.

⁶⁶ Of course, one could simply *ask* dozens of people to tell you which of two goods is the more complex, just as you could ask which of two goods is the superior in overall quality, and hope for consistency. But it would be harder to go deeper, to break it down, to design the next generation of the good in question.

On the effect on markets of the cost of quality-measurement itself, see Barzel (1982). There’s a reason people want to trust price: it’s simpler for them to do so.

For some evidence that quality is beginning to matter more than price in the coming economy, see Sirota (2011).

computers, and x-ray machines. Goods that are ephemeral, cheap, untestable before sale, and technologically passé, like packaged toys and foods (especially frozen foods), yield price-quality correlations that are insignificantly small and even slightly negative (Judd, 2000; Riesz, 1979).^{67,68} The same poor correlations are found for quotidian local services like dry cleaning, locksmithing, and furniture moving. Here, quality correlates very weakly, and often negatively, with those services' prices (Murphy, 2002).⁶⁹

Even when P and Q show significant positive correlation, not all the individual component qualities enjoy the same degree of correlation. With cars, for example, *reliability* is not well correlated with price. Though they excel in one or more of the other component qualities (beauty, functionality, attention to detail...), most expensive car brands have only average reliability and depreciate more rapidly than the average (Terry et. al., 2005).⁷⁰

People shop with expectations as to which categories of goods have high price-quality correlations and which have low, and this affects their buying choices. When expectations are that P - Q (price-quality)

⁶⁷ Why? In the case of packaged food, the lack of correlation might also be due to consumers' low expectations: consumers expect low quality and they get it despite the packaging's loud promises.

The inability of most wine-drinkers to distinguish cheap from expensive wines (most studies eliminate the top and bottom 10%) *when they don't know the price of the wine*—and the only slightly better performance of wine experts—is more disturbing (Goldstein et. al., 2008). These experiments do not prove that quality cannot be discriminated in wines; just that *price* is not a reliable indicator of quality. The lack of P - Q correlation in this case may have to do (1) with the huge variety of wines available (stores specializing in wine may offer 4000 brands, the vast majority of which are never rated) and (2) with the fact that most people think that paying a lot for a bottle of wine is not 'the end of the world,' especially when knowingly doing *just that* genuinely—by report and brain-scan—increases their enjoyment of the wine (Plassman et al., 2008). This is the authority of price at work.

⁶⁸ In 2009, the first author and graduate student Anthony Lavadera conducted an unpublished pilot study comparing retail prices to *Consumer Reports* overall quality scores for five types of home appliances. Correlation coefficients ranged between $R = 0.22$ for toasters to $R = 0.77$ for top loading washing machines. Correlations were sometimes slightly higher when using best online prices rather than suggested retail prices, and sometimes not. They tended to be higher for high-dollar (lawn tractors) or technologically newer (compact fluorescent light bulbs) products, as research predicts (Tellis and Wernerfeld, 1984, Tables 1 though 4). One bias lowering correlation coefficients generally, we believe, comes from using *Consumer Reports* as a data source, since that publication is tacitly dedicated to showing that price and quality are *not* well correlated—for otherwise why subscribe to *Consumer Reports*? Ditto all other expertise-based consumer guides, e.g. for wines (*Wine Spectator*), running shoes (*Runner's World*), hi-fi equipment (*The Absolute Sound*), personal computers (*PC Magazine*), and so on. We do not believe that any of these publications do their testing blind to price, advertising, or labeling. Indeed, evidence is that *Consumer Reports* gives higher ratings to more heavily advertised (not higher priced) products; or at least did (Marquardt et. al., 1975). One can think of several reasons for this bias in the case of advertising-supported magazines, of course—but *Consumer Reports* carries no advertising.

For a formal study of why the marketing pattern "high-introductory-(then-declining)-price" often signals quality, see Bagwell and Riordan (1991).

⁶⁹ It is not known whether service rating sites and apps like *Angie's List* and *Yelp* have made a significant difference in this sector, or will. There is also dispute around the validity, and effect, of the college program ratings and rankings offered annually by *U.S. News & World Report*, *Business Week*, the *National Research Council*, *Design Intelligence*, and others. To our knowledge, no study of the correlation between college quality and true college tuition costs (i.e., as moderated by scholarship aid) has been done.

⁷⁰ Interestingly, in what may be a classic case of "cognitive dissonance reduction" (Festinger, 1957), not to say self-fulfilling prophecy, people who buy cars that have high quality ratings tend to maintain them more assiduously (Conlon et. al. 2001).

correlations are low, people tend to choose lower-price, lower-quality options. When expectations are that P - Q correlations are high—when people believe “you get what you pay for”—they tend to choose higher-price, higher-quality options (Ordonez, 1998). This makes intuitive sense: when you know that price and quality are not correlated, why risk spending good money on what is as likely to be trash as treasure? Tellis and Wernerfeld (op. cit.) anticipate this finding and show, further, that not all consumers have to do primary quality research in order for higher P - Q correlations to take hold and all people to benefit from being able to trust that price is signaling true quality. It suffices that *someone* credible has done the research and let it be widely known.⁷¹ The implications of these two findings taken together are important, because increasing P - Q correlations might encourage more people to choose higher-priced, higher-quality goods generally. *This is just what it takes to promote qualitative growth.* And it can be done without involving *every* consumer in primary research about every product or service they might want to buy.

People and businesses think twice before making more serious durable- and capital-goods purchases. And even if they do not do the research themselves, they expect that greater vigilance has been exercised by other buyers and/or rating agencies. Under these circumstances, severe price-quality disconnects would not survive, and advertisers would not dare to lie (Archibald et. al., 1983), making it possible for most buyers to trust price to be a reliable indicator of quality.⁷²

Perhaps this is why studies of the effect of high-quality production on a country or region’s GDP/capita can and do use the *prices* of relatively expensive exports, like cars and capital equipment, as a proxy measure of national quality-production generally (e.g. Aiginger 1995, Andersson, 2003).

On the production side, higher quality earns more for those who produce it—who then can demand higher quality from others. This is the upward spiral of economic progress through system-wide product-quality-improvement, which at present countries like Germany seem to exemplify,⁷³ and which Japan still does

⁷¹ Interestingly, the relevant information need not actually be known by the would-be buyer. He or she need only know that it is known by enough *other* would-be-buyers that it pays the producer-seller to price their product to match its position in the spectrum of competing products.

⁷² The application of these arguments to financial products would be interesting, especially in the light of the 2008 financial meltdown and the role of credit- and investment-risk rating agencies in it. See Carter (2009).

⁷³ See Aiginger (op. cit.). Aiginger uses euros/kilogram as a proxy measure of quality, a technique we will discuss later. Geoghegan (2010), and Geoghegan in Jung (2010), wonders how Germany manages to provide higher QOL to its citizens with fewer hours of work than America does, and ascribes it (generally) to Germany’s labor movement’s success as restricting work hours. We think there’s more to it than that. Germany’s GDP is based more on *qualitative growth* than is the U.S.’s; and a good part of that, as Geoghegan also notes, has to do with Germany’s socialist commitment to *equity*, its highly trained workforce, and its educated population’s greater ability to appreciate good design and quality.

although its quantitative growth has slowed. Does system-wide quality improvement lead to rising prices and wages? Yes, but not to inflation, which is a different phenomenon entirely (Bils and Klenow, 2000).

This is worth noting because today, in the U.S., we have the opposite trend in large sectors of the economy: a vicious cycle of ever-cheaper goods and more automated services chasing the stagnant or falling real incomes of a population drawn to quantity shopping, bargain-hunting, and instant “wealth” through credit finance, steadily being de-skilled by poor educations, custom software, job exportation, and job rationalization. Call it the Wal-Mart Cycle. Its output is mostly junk; and it’s a cycle that will spread beyond mass retail and housing unless we learn to value quality over quantity (cf. Shell, 2009).

The most common riposte to critiques like the one above is that they are elitist. “Quality costs money and always has,” the objection goes. “What are the poor to do *but* settle for what you haughtily call junk, crude, fake, and so on?” But this critique has forgotten our commitment to equity and to the progressive circle of *economy-wide* quality improvement. When more people produce goods and services of greater quality, more people will be able to afford them. We’ll consume less in overall quantity, but enjoy ourselves more.

Actually, even once quality production is encouraged and fairly rewarded,⁷⁴ one more component is needed: education—the better to produce quality, of course, but in equal measure, the better to appreciate it and seek it out in the varied productions of others. We mean, again, *expertise* and *connoisseurship*.⁷⁵ Happily, both expertise and connoisseurship have passed out of the hands of elites in some areas. Community colleges and university extension programs have tapped into the desire most people have to become expert in some area; enthusiast magazines, Internet ‘zines and blogs, and online rating aggregators like *Yelp*, *Amazon*, and *Angie’s List* are encouraging people to make discriminating choices and let those be known to others. With

⁷⁴ On “...fairly rewarded:” It goes almost without saying that prowess at exporting expensive finished goods is a sure sign of the superior human capital owned by the exporting country. Does this prowess lead, of itself, to greater social *equity* in the exporting country? The answer has to be no; it can lead (for one) to greater wage *inequality* if skilled workers (and managers) in successful export industries are allowed to thrive untaxed, or those taxes are misspent to leave less skilled workers and managers, who tend to work in low-quality-producing industries, without the means to invest in themselves and improve. This inequality increase can happen even within and between firms of the same industry (Verhoogen, 2007). Certainly, the fact that the U.S. exports movies, weapons, airplanes, and videogames of the most technologically sophisticated kind all over the world is no guarantee that other U.S. industries, and jobs in those industries, will not disappear rather than be encouraged to join in the game. Equity improvement takes its own attention, which is why we think of quality as a *partner* to equity, not a substitute for it.

⁷⁵ There’s a small literature on the difference between expertise and connoisseurship, mostly on the subject of the proper role of experts in the populist-democratic process (see Evans and Plows, 2007). Here we mean by *expertise* knowledge of how produce high quality, and by *connoisseurship* knowledge of how to discriminate finely between high and low quality. Both require education and both require training. Both represent what economists call human capital, making the argument we present consistent with macroeconomic models of growth that include human capital improvement through extended schooling and on-the-job training (e.g. Stokey, 1991), but expands it to include informal self-training.

social digital media, quality information is wide circulation, having as much to do with status as with entertainment, and on the production side, with surviving as a business. With better schooling, these informal trends can grow in scope, objectivity, and depth.

Let us give the last proposition more teeth: Consider the benefits of Quality Studies being taught at high schools, as a class. Students would examine an approved selection of commonly available goods and services, by brand and/or model or provider, and then systematically analyze (1) the materials and other factors that went into their production, (2) the externalities (positive and negative) of their manufacture, use, and disposal, (3) the characteristics, dimensions, utility, and component qualities that make them desirable at all, and then rate overall quality, Q . In addition to such “case studies,” they might do laboratory tests and apply statistics; they might carry out modest consumer surveys and apply more statistics, or they might collect and compile tests already done (say by the BLS Consumer Price Index group, or other ratings agencies). In a more literary vein, they might critique current advertising by writing essays or making their own videos, or they might formally debate good A’s superiority over good B. We could inform future generations about the quality of every object, service, and aspect of their economic lives, both as consumers and *producers* (for many would be inspired by such classes to *make* better products themselves someday, with a beginning idea of how). The class would by default also be teaching ethics, psychology, esthetics, science, mathematics, economics, social studies, writing, and rhetoric. And be *fun*, in good part because it builds on that age-group’s natural desire to individuate *and* identify with others based on product preferences.

Just as no one can have expertise in everything, so no one can be connoisseur of everything; but a *culture of quality* is possible, and this is what classes like the one described above could realistically help achieve.⁷⁶ Ultimately, the market need have a very small number of trained connoisseurs making informed quality judgments in any one area in order for benefit to accrue to all (Tellis and Wernerfelt, *op. cit.*). Under the watchful eye of trusted quality-raters with access to a public predisposed to making quality judgments, advertisers would become more honest and prices would become a more reliable signal of quality (Archibald *et. al*, *op. cit.*). Consumers more confident about making higher-price higher-quality choices (Ordonez, *op. cit.*), would start to drive producers to meet that demand and pay more for the skilled labor and smart

⁷⁶ One might interpret the proliferation of *Iron Chef*-like television shows—protagonists competing in front of judges to produce high quality cooking, dancing, singing, interior design in a limited time—as a healthy sign of renewed interest in quality. But one can’t help but wonder whether these advertiser-sponsored, sporting-event-like, short-attention-span versions of Quality Studies aren’t a distraction from the kind of this-means-*you* attunement to quality we need, both in reception and production, across the entire economy. Commitment to quality is steady and slow-burning, rather than a flash satisfaction.

technology required.⁷⁷ Add to this virtuous circle the steady (probably government-overseen) adjustment of market prices to better reflect the true costs and benefits of externalities, and we would have a marketplace whose intrinsic dynamics delivered half of the economic progress we want.⁷⁸

The other half would be delivered by improvements in equity.

6. Quality and equity together.

It's easy to see the relevance of overall quality, Q , to foodstuffs, durable goods, and ordinary services like home repair or paid-for experiences like concerts. Not so with *quality-of-life* (QOL), which seems, somehow, to be more (and sometimes less) than the sum of the products, services, and experiences one can buy (or even get for free in the case of public goods). One reason for this is that QOL derives from our jobs and work environments as much as it does from our home lives and domestic environments. Another is the fact that people can be equally happy with their QOL across wide ranges of material and cultural circumstances, living in quite different ways and in quite different settings.

Yet evidence shows that people's happiness is more affected by the comparative rather than absolute level of their health, social status, or wealth (Frank, 1987). It is here, through *relative* quality-of-life considerations, that *equity* enters the economic progress picture alongside quality.

Let us examine this picture a little more closely.

People compare themselves to others, and are satisfied or not (a) by how they presently rank among their peers, and (b) by whether their rank is ascending or descending (i) relative to those peers, and (ii) relative to their expectations of themselves or feelings of deservingness.⁷⁹ When we learn, then, that almost every

⁷⁷ The success of the U.S. Green Building Council's LEED (Leadership in Energy and Environmental Design) certification program offers a case in point. Making a building "green" and receiving bronze/silver/gold/platinum LEED certification increases a building's construction cost from 4% to 8%. At the time of writing, several municipalities were considering making LEED certification a requirement for new buildings (Crater, 2010), <http://www.npr.org/templates/story/story.php?storyId=129699450&sc=17&f=1001>.

⁷⁸ We resist the temptation to tinker with Robert Solow's famed economic output-growth formula for several reasons, not the least of which is our modest comprehension of the literature that has grown up around it. It seems clear to us, however, that quality enters as a variable within both the capital (K) and labor (L) components of the Cobb-Douglas production function. And with GDP or GNI/capita as the significant dependent variable for growth theorists rather than any measure of economic *progress*, we would be looking for the wrong outcome to start with.

⁷⁹ The limits people place on themselves when making everyday product-quality discriminations (i.e. that the goods compared at least be candidate functional substitutes for each other and cost roughly the same), carry over when comparing qualities of life, $QOLs$: paupers do not normally compare themselves to kings but to other paupers. Ditto with kings. People compare themselves to their neighbors, their co-workers, their brother's-in-law...their "peer group." In short, social comparison is local, and this helps explain why (knowledge of) extreme income inequality in the U.S. has had so little *political* effect.

modern social malady, from alienation, anxiety, depression, and teenage pregnancy to crime, violence, obesity, imprisonment, insanity, and drug addiction, is strongly correlated with the acuteness of a country's income and wealth inequality,⁸⁰ we cannot help but wonder what mechanisms are in play. Are these maladies the result of the negative effect of envy-of-others upon personal motivation and social discourse? Or is it disappointment-in-oneself that does the damage? Both are possible: chronic psychological states can have profound social and economic consequences upon everyone, which then exacerbate and justify those very states in more people. Or are extreme inequalities in income or wealth correlated with the social pains listed because they cause practical, operational, inequalities-of-access to higher education, political influence, skilled legal representation, and repositories of human capital—inequalities that favor the rich and thus entrench themselves if not amplify? The answer is probably: both, even as liberals and conservatives disagree about which comes first.⁸¹

What seems clear enough for our purposes is (1) that we ought to examine how equity contributes to the achievement of economic progress through quality-of-*life* differences, not simply through quality-of-*product* differences, and (2) that we should aim for *equity* in income and wealth outcomes, not equality, even if perfect equality remains a reasonable aim in the realm of basic human rights and economic opportunity.⁸²

⁸⁰ Wilkinson and Pickett (op. cit.). The correlation between economic growth and income inequality at the scale of nations is very weak (Barro, 2000). This falls in line with our analysis inasmuch as the variable *change-in-GDP* is not a salient measure economic *progress* while lowering *Gini*s.

Some researchers, however, do report an “inverted U” relationship between *GDP* growth and income inequality, similar to Figure One in this paper (Cornia and Court, 2001, esp. “Chart 3”). A preliminary investigation by the first author indicates that using the complexity measure, *C*, on quintile percentage (therefore probability) distributions of income yield the same result: *C* is very low at very flat (i.e. near maximum entropy) income distributions (*Gini* = 0), and very low also at very *unequal* income distributions (*Gini* = 1). *C* is maximum in the middle range that Cornia and Court recommend (i.e., *Gini* = 0.3 or so). Alas, the *Gini* index is non-linear with respect to *C*. Pursuing the correlation between the *Gini* index, the *complexity*, *C*, of income distribution, and *GDP*-growth would take a separate study, one which would want to include a careful comparison of *C* (income distribution) to the statistical-entropy-based income-inequality measure proposed by Henri Theil (1967) as an alternative to *Gini*, and known as the “Theil Index.”

⁸¹ Wilkinson and Pickett, for their part, argue that the data strongly support the inference that the causal arrow goes from inequality to health and social problems, not the other way around (Wilkinson and Pickett, op. cit., pp. 187-193). Admit of self-perpetuating feedback loops however, and one can take one's pick, malady by malady. What seems insupportable, however, is the notion that class/wealth *mobility* is sufficient to justify extreme inequality with the argument that nobody is poor for long. Or rich. Only a tiny number of people, proportionally speaking, *actually* moves from poverty to wealth in their own lifetimes, and even fewer move the other way.

⁸² Japan and Sweden have the lowest wealth- and income-inequality levels in the world, with the least of the kinds of problems Wilkinson and Pickett report. But surgeons there still earn more than street-sweepers do, to no one's chagrin. That there should be monetary returns to higher education and training, to greater self-application, and to the social consequentiality of one's work—and that there should be some room, too, for dumb luck—seems as reasonable, just, and necessary to “socialist” Swedes as to “free marketeering” Americans. It's all a question of degree.

Most Americans are not aware of the extreme degree of wealth inequality that characterizes their country, and would, given the choice, choose a more “Swedish” distribution (Norton and Ariely, 2010). This preference for “equitable inequality” is as true of rich Americans as it is of poor ones; which leads one to think that acute wealth inequality in the U.S. is neither an American “value” nor “in

Returning to point (1) above: a good part of people's *QOL* does depend on the affordability (to them) of decent-quality goods and services. Improving their variety and availability through improving market efficiency, stoking effective demand, and encouraging technological innovation might be the most to which any advising economist, *qua* economist, should aspire. But if improving and equalizing *QOL* involves more, we need to ask: what is that "more?" Does it lie outside the purview of economic theory? Perhaps not.

The token economy. If *QOL*, quality of life, depends on the availability high-quality, affordable, market-available goods, services, and experiences, it also depends on the feelings we have about them and about each other: feelings of security, belonging, identity, legitimacy, envy, effectiveness, confidence, freedom, and so on. Whether in the workplace or in the marketplace, these feelings are generated, in part, by the production, acquisition, and/or experience of "psychic income," as Fisher (1906) called the psychological component of most goods' utility. But exactly what is "psychic income?" It consists in large part, we propose, of goods generated and traded in a parallel economy whose "GDP" is only loosely correlated with the real GDP. Here, in purely social exchanges often similar to formal markets, the goods produced, exchanged, and consumed (or redeemed) are not things or services or experiences exactly, but *tokens*, which are discrete bundles of information like approvals, compliments, handshakes, votes, titles, tickets, awards, and so on (and also their negatives, like depreciations, snubs, threats, duties, fines, and obligations), which address our needs directly and/or which construct and maintain the social bonds required to satisfy them.

Certain tokens attach to physical goods and activities automatically, but others take their own form and vehicle; they may be materially embodied, like a medal, or not, like a gesture; they may be certified by some institution, like a letter of recommendation, or not, like a word of encouragement. Tokens include many of things classed as "considerations" in contract law; like money (in this use) and promised actions. Providing quanta of security, legitimacy, approval, confidence, and freedom, tokens are social-psychological goods at the outset—like nods and blown kisses—which we produce or earn at some cost, offer, trade, store (i.e. remember or record), and consume or redeem without cease.⁸³

the American character." It may be, rather, an unintended consequence of their—of our—whole economic *system*, and in particular of our financial system (Cowen, 2011).

⁸³ The distinction between the normal economy (of goods and services) and the psychological economy (of tokens) is not the same as that between the "formal economy" (where goods and services appear in organized markets and have market-wide prices) and the "informal economy" (where goods and services are mostly bartered, or are free, or are illegal). Trade in tokens underlies and pervades both formal and informal economies. There's a reason salespeople are especially nice to you. Their success stimulates the normal-formal economy, true. But their very "niceness" has substance too: it is fast and furious token production and exchange, with its own

Does such an economy actually exist? We think so. We alluded to it earlier when we spoke of the “persuasion machinery” of politics, which consists, we can now say, of the manufacture and trade in tokens that give, take away, and modulate one’s stock of “authority,” which itself is constituted by stable inflows and outflows of security-, legitimacy- and approval-tokens whose major function is to presage or prevent physical violence. Receiving the token we call a “vote,” for example, is the culmination of, and the reward for, all the assurances and promises (and sometimes threats) offered to every potential voter, and which he or she accepted.

As Hobbesian as this sounds, theorizing the existence of an economy of tokens gives us another way to describe social phenomena long noted by social scientists and dealt with in other ways: distinction, ostracism, trust, cooperation, even love. All happiness studies, for example, point to importance of “the relationship factor” (cf. Layard, 2005), concluding that more and closer relationships are better than fewer and more distant ones. Through the concept of a token economy, we can ask: what does “closeness” really consist of? What sorts of exchanges of what sorts of tokens? Theorizing a token economy gives us new phenomena to look for, new ways to explain behavior, and new windows on our economy’s true complexity.

We raise the subject of the token economy here, however, because *equity* is well analyzed by it. It’s in the exchange of tokens where equity is computed and felt.

Consider: no successful exchange is perfectly fair, if by “perfectly fair” one means that it has perfectly equal value to both parties. Most exchanges are simply equitable—*fair enough*—to proceed, which condition is achieved by the on-the-spot generation of mutually-noted obligations: promises to correct any present imbalance of utility/value in future exchanges. In informal exchanges, phrases like “I owe you one” or “you owe me one” (in what J. L. Austin called “speech acts”) constitute, once uttered, a token offered; while “OK” signals the token’s acceptance by the other. Notice that the content of “one” in the previous sentence is deliberately left unspecified beyond the fact that it’s (probably) “a favor” or “a consideration.” In formal exchanges, records are kept and obligations are spelled out. In formal exchanges, more likely than not, law governs. Not so with informal and daily exchanges. There custom rules. Informal exchanges broadly follow economic logic nonetheless. Indeed, there is a spectrum of formality going from the strictest, short-term, formal exchanges at the one extreme (say cash in amount x for commodity Y in quantity z , now, from a stranger you will not meet again) to the most lenient, “who’s counting?” long-term and informal exchanges on the other (say, taking care

spacing and rules. See Benedikt (1996, 1997, 2003). Certainly the token economy is both revealed and capitalized-upon by the commercial process called “gamification,” for more about which see <http://en.wikipedia.org/wiki/Gamification>.

of one’s mother for the years she spent raising you). The ratio of values of the goods or services *clearly* exchanged to the values of the obligations incurred, as well as the time period envisaged for perfect fairness finally to obtain (as well as how much the past still counts), varies along the same spectrum according to the nature of the bond: between politicians and constituents, between firms and customers, between managers and workers, between members of the same tribe, between individuals who are strangers to each other, or friends, or family members, or co-workers...all in patterns that are culturally specific.⁸⁴ But no matter the culture, multiplied in networks and networks of networks, this striving for fairness, for equity, exchange by exchange and using remainders, obligations...acts as a bottom-up, complexity-generative force of just the kind that helps generate economic development and progress over mere growth.⁸⁵

Only when an exchange is both fair and “cut-and-dried”—i.e. when no obligation terms are generated and/or when old obligations are cleared up and no new ones are put in place, and fairness itself is equally valued by each party—can we speak plausibly of exchange *equality*. When the exchange is fair enough—i.e., when obligation terms remain or are newly introduced, and/or when the value of fairness itself is compensatingly different to each—we must speak of exchange equity or equitability. It follows that, pathologies aside, *value equity*, fair-enoughness, in exchange *is more effective at generating social complexity than is value equality*, which idea lends support to those who think that our lives are impoverished to the extent that long-term social exchanges are converted into short-term commercial ones, efficient as they are.⁸⁶

⁸⁴ Some readers may be put in mind of sociologist Ferdinand Tönnies’ 1887 distinction between *gemeinschaft* (family and community) and *gesellschaft* (market and civil society), the former “essential” and “organic,” the latter “arbitrary” and “rational.” Here we posit no clean break.

⁸⁵ ...provided, that is, that the token economy in its complexity does not crowd out or hinder the production of the material necessities of life. Communities riven with gang violence, for example, may well be found to have “rich” token economies, with everyone expert in producing tokens and keen to follow their smallest nuances of value; but a closer look would reveal failure, in fact, to evolve trade in the tokens that prevent retributive violence, and a lack of trust in any token—short of a blood oath—having long term value.

⁸⁶ Here is a glimpse of the inherent complexity of “simple” two-party economic exchange. Let *i* be the good or token P(aul) offers to Q(uentin), and which Q accepts; and let *j* be the good or token Q offers to P in exchange for *i*, and which P accepts. The exchange is *fair* if the

$$\text{Value of the exchange to Paul} = \text{Value of the exchange to Quentin}$$

$$V_p(i, j) = V_q(i, j), \text{ or}$$

$$\begin{array}{cccccc} \text{getting} & \text{giving} & \text{obligation} & \text{getting} & \text{giving} & \text{obligation} \\ V_p(j \leftarrow Q) + V_p(i \rightarrow Q) + V_p(\mathbf{e}) & = & V_q(i \leftarrow P) + V_q(j \rightarrow P) + V_q(\mathbf{e}) \end{array}$$

where

$$V_p(\mathbf{e}) = V_p(\mathbf{e}_q \leftarrow Q) + V_p(\mathbf{e}_p \rightarrow Q), \text{ and}$$

Another reason that equitably unequal wealth or income distributions are acceptable is precisely because, within limits (and as we noted earlier), effectively-equal *qualities-of-life* can occur across quite large income and material wealth levels. And this is true partly because of the hidden-to-economists “well-being input” of the token economy.⁸⁷ Imagine: here is a relatively poor person who is experiencing greater feelings of belonging, independence, identity, effectiveness, freedom, safety, and purpose than a relatively rich person, thereby making up for the fewer and/or lower-quality of material goods, services, and experiences he or she can *buy*. Far fetched? Not at all. It’s a truism that with basic health and security needs met, living lower down on the income scale *can* involve denser human interactions, with more varied customs, more quality time with friends and family, and more diverse sensory environments than living higher up on the income scale insulated from life’s variety and permanently anxious about losing one’s lease on privilege. Is the temporary or vicarious living of a richer, more relaxed life lower down on the income scale (and preferably somewhere else,

$$V_Q(\mathbf{e}) = V_Q(\mathbf{e}_P \leftarrow P) + V_Q(\mathbf{e}_Q \rightarrow P).$$

Here, \mathbf{e} is the token of debt or obligation generated to make the present exchange “solve for fairness.” It implies that the exchange game will be played one or more times by Paul and Quentin, at which time(s) the obligation token(s) will become the dominant token(s) in exchange and/or yet further debts and obligations will be generated. Note that we must allow that the value of *giving* i , or j , or \mathbf{e} might be positive or negative for P and/or Q, just as the value of *getting* i , or j , or \mathbf{e} might be positive or negative for P and/or for Q. Although in commercial exchange the value of “getting” is usually positive and the value of “giving” is usually negative (and thus called “paying”), on Christmas morning an exchange, no less fair, can have the reverse polarity: the value of giving being greater than the value of getting for both parties. Truth is, with (at least) three terms in play on each side, permutations of positive and negative sign are many, as are permutations of relative value; and each permutation characterizes a type of social bond or occasion.

One might also introduce a time-sensitive discount coefficient on the value of an obligation: the further away its promised redemption, the less its present value; the older it is, the lesser or greater its present value. And to that we could append a separate coefficient of *trust*—P of Q, and Q of P—which would be the probability, in the opinion of one, that the other would honor on the obligation when they said they would.

A window to further complexity is opened if and as either P or Q value, disvalue, or are indifferent to *fairness per se*. This factor adds another term to each side of the equation: as a meta-value becomes a participant value. Should there be a difference in how each values fairness per se, it would allow exchanges between saints, cads, martyrs, sadists, masochists, egotists, and paternalists to go forward—exchanges that would seem quite unfair to impartial observers. Such people need only find their complementary partners.

Yet further terms are added if i or j are animals, old trees, sacred sites, or beloved works of art, i.e., “things” that have interests of their own. (Some would add *guns* to that list...)

Sometimes the value of an obligation, \mathbf{e} , is counted by one party but not by the other, or it is later denied or revalued. This makes it impossible for any exchange to be judged fair-enough to proceed even if both sides are committed *in principle* to fair-enoughness (equitability) rather than perfect fairness (which, they agree, would doom most proposed exchanges). Failure to exchange under these circumstances can usually be traced to large obligations remaining in play—possibly unspoken ones—which are thought never to expire. Think of the relations between Israelis and Palestinians. Or between abused children and their parents decades later. Indications are also that certain people are incapable of seeing the computational logic of exchange at work in social situations, and vice versa (Ermer and Kiehl, 2010). Just as disturbing are indications that socio-economic class alone changes one’s capacity to empathize: the richer we are, even temporarily, the less empathetic and less accurate we are in reading others’ emotions (Kraus, et. al, 2010).

For more about the logic of two-party exchange along these lines, see Appendix Three to this paper at <http://soa.utexas.edu/files/csd/wps201101-app3.pdf>.

⁸⁷ There are other reasons that equitably unequal income distributions are acceptable, also as we discussed earlier. Living at peace in a healthy and esthetically pleasing physical environment does not *everywhere* require great material wealth or social capital.

on cobbled streets with fishing boats and open-air markets) not the motivation of much high-end tourism? And what of talented people who consciously choose low-income careers—who choose to be artists, craftsmen, park rangers, EMTs, or social workers, for example—for the camaraderie, variety, self-determination, or social usefulness these occupations offer?

Once we admit tokens into the company of goods-in-exchange, the conventional boundaries of economics are re-described. In conventional economics, as in law, promises don't count until they are contracts to buy or sell. The *currency* of trust, that psycho-social good essential to economic development as well as to happiness (Francois and Jabojnik, 2005; Helliwell, 2006; Knack and Keefer, 1997), remains under-examined.⁸⁸ Behavioral economics in the main studies how our psychological proclivities limit our rationality as actors in formal markets, but it has not gone so far as to apply economic laws (such as they are) to assurances, gifts, scowls, grades, "brownie points," titles, seconds of undivided attention, and to the hundreds of other psychological goods—tokens—anticipated, devised, offered, traded, rated, remembered, discounted, and dissipated in everyday life that may, in their informal trading, be the major cause of our money-measured "irrationality" rather than some cognitive deficit.

Say we find a demographic group, or people of a certain region, who have a much lower than average *QOL* as objectively measured (e.g. Hills and Argyle, 2002; Kahneman et. al., 2004); and say, too, that we are resolved to help. We would look first to their material conditions and try to improve them directly, especially if hunger, illness, or an unsafe physical environment were the root cause(s). But if these factors were not the cause or the only cause, what else could be done?

This: set about finding ways to promote social inclusion and more open social networks through the "economic development" and progress of the token economy, where *progress*, in parallel with the regular economy, depends (1) on the *quality* of the tokens devised and exchanged in functionality and reliability (if not equally in the other component qualities), and (2) on the *equity* with which all people have the opportunity, and

⁸⁸ Almost every great economic theorist since Adam Smith has noted of the importance of feelings and of "purely social" interchange to material economic life. Irving Fisher was at pains to point out that much of the value of goods and jobs was due to their provision of "psychic income:" pride, prestige, and friendship (Fisher, 1906, Chapter X). But none of these theorists took as seriously as Marcel Mauss did the idea that social exchange exchanges "spiritual matter"—matter (actually information) that generates stocks of goodwill or ill-will using risk-reducing strategies, that suffers depreciation or appreciation over time...stocks whose figurative whereabouts and possession is tracked by elaborate, if largely mental, accounting systems. "Food, women, children, possessions, charms, land, labor, services, religious offices, rank—" wrote Mauss, "everything is stuff to be given away and repaid. In perpetual interchange of what we may call spiritual matter, comprising men and things, these elements pass and re-pass between clans and individuals, ranks, sexes, and generations." (Mauss, 1924, p. 11, of the Maori of his time. Mauss was the pioneer of the exchange theory of social cohesion in modern anthropology.) It's easier to see the psychoeconomy at work in cultures other than one's own. Tokens are framed, noted, valued, and returned almost unconsciously. They disappear, in one's own culture, into the "natural way to do things."

the opportunity to acquire the ability, to produce and trade in the full range of tokens. Indeed, progress in the regular economy may depend on progress in the psychological economy. The process of community development, we think, looks a little different through this lens, focusing as it does on the market-like mechanisms of symbolic exchange by which happiness is felt, social capital is formed, and justice is approached.⁸⁹

In this enterprise, as in so many, education stands at the center.⁹⁰ But the quality of the physical environment counts a great deal too. The condition of our streets and parks, houses, civic and business buildings, playgrounds, storefronts and parking lots frame expectations, constantly giving off messages about the condition of the people who use them and about what tokens are in general circulation there. Indeed, all themselves, constitute permanent outpourings of tokens saying “thought about,” “legit,” “welcome,” “safe,” “clean,” “friends here,” as well as provide stable locations that, in supporting spatial habits, increase the success with which people can find each other “by chance.”⁹¹ Gigantic new stadiums, hotels, and convention centers covering blocks of American downtowns with blank walls and super-hardy landscaping do little to promote the local token economy, and probably hurt it.⁹² They might bring tax revenues to the city and

generate some local jobs, but they do not themselves increase the complexity-based *QOL* of anyone except

⁸⁹ ...up to and including formal changes in the law. On the concept of social capital see Putnam (1995), Portes (1998), Halpern, (2005), Helliwell and Putnam (2006). See also De Soto (2000) for an account of how granting property rights to squatters (i.e., rights to the land they occupy and buildings they have built), and establishing the concomitant bureaucracy, stimulates entrepreneurship and economic development.

⁹⁰ The education required might be informal (e.g. beginning with family rituals, participation in clubs and societies, all as Putnam [op. cit.] advocates). As for formal education: interestingly, among people with less than high school educations, increased social capital does not lead to increased well-being or a greater sense of mastery, but often to less [Moore et. al., 2009]. It would seem that the social networks of people with higher education extend more vertically into the power and wealth structures of society and thus do contribute to their “owner’s” greater well-being and sense of mastery. In short, beyond a certain point, it matters not how many friends you have, but *who your friends are*. And, of course, what they can and will do for you at any risk to themselves. Addicts of *Facebook*: be appraised.

⁹¹ There’s research to be done on how the widespread use of cell phones replaces the need for towns and cities to provide a coherent system of physical addresses, or habits of movement, or places of waiting.

⁹² Urban theorist Richard Florida (2010) touches upon all our points. This passage, in the tradition of Jane Jacobs, occurs the end of a chapter on the history of urban renewal in developed countries: “As with so many things in life, the small stuff really can make a difference to people living in cities... (and) there is considerable research to back it up. The quality of life in the place we live is a key component to our happiness, according to surveys of tens of thousands of people conducted by the Gallup Organization. There are three key attributes that make people happy in their communities and cause them to develop solid emotional attachments to the place they live in. The first is the physical beauty and the level of maintenance of the place itself—great open spaces and parks, historic buildings, and an attention to community aesthetics. The second is the ease with which people can meet others, make friends, and plug into social networks. The third piece of the happiness puzzle is the level of diversity, open-mindedness and acceptance: Is there some equality of opportunity for all? Can anyone—everyone—contribute to and take pleasure in the community?” (p. 86).

those who fly in and fly out.

Much of the prior two paragraphs could apply to international aid. While infusions of money, gifts of medicine and technology, and the hands-on work of NGOs have done a great deal to alleviate suffering around the developing world, rarely do these ameliorations create long-term self-sufficiency in the country aided. As is becoming increasingly clear, important to economic development is *cultural* development, not in respect of local music, art, literature, or religion, nor even, necessarily, in respect of productive and reproductive practices (e.g. farming methods, family planning), but in respect (we can now say) of the healthy functioning of the token economy, especially in tokens with legal weight, like promises, licenses, votes, guarantees, receipts, certifications, and titles to property, which, in their variety, quality, trustworthiness, and sheer multiplicity across family and business life, form the matrix from which higher-level institutions, jobs, and professions can emerge (cf. De Soto, 2000; Easterly, 2001; McCloskey, 1999, 2010).

Tokens are the “pre-economic” or “subatomic” psychological micro-goods whose constant manufacture/devising, trade, and consumption/redemption sustain the human bonds necessary for more-obviously economic, obviously material transactions to proceed. Indeed, in all countries, working at creating and maintaining such bonds for their own sake—and importantly, *as though* for their own sake—provides a major source of life-satisfaction for many and real incomes for some. Ask the business-getting partner of any growing firm.⁹³

Many of the decisions we say are purely personal, cultural, or social—decisions dealing with friendships, memberships, marriage, emotions, virtue, esthetics, and the like—are covertly guided by economic concerns like property transfers, monetary gain, earning potentials, and the prospects for our children, just as Jane Austen portrayed and economist Gary Becker has studied.⁹⁴ The next step is to posit that social life and economic life are not just adjacent to each other and mutually influencing, but continuous with each other in substance and meaning.⁹⁵ Whereas Becker’s method is to prove the predictive power of “the

⁹³ Our approach should also help us think more kindly about bureaucracy, or at least about efficient and honest bureaucracy, since it is the practice of bureaucracy that keeps tokens conferring legitimacy flowing and accounted for. This is not to sanction the alliances forged in the token economy that flourishes in Washington DC among politicians, lobbyists, and wealthy campaign donors. This economy probably needs *de*-construction. Here, trades of favors for favors and money for influence make a mockery of the claim that our democracy acts in the best interests of ordinary people. As has been observed for centuries, to enter into the echelons of political power is to enter into the persuasions of the rich.

⁹⁴ Conversely, many “purely social” decisions and transactions can be incorporated into market-based economic models, as Becker has also demonstrated. Becker (1993, 1996), Becker and Becker (1998).

⁹⁵ This was one of Karl Marx’s basic insights. Or as welfare economist S. Herbert Frankel (1952, p. 2) put it: “The creation of ‘income’ is of a piece with social communication—even if the accounting or economic symbolism which we employ in more advanced societies is

economic approach to life” (Becker’s phrase) by representing a chosen social phenomenon—racial prejudice, say, or prestige—as a single algebraic variable or small set of variables in an expanded but otherwise conventional economic model, token economics would set itself to observing and modeling such social phenomena *in action*: in the devising and exchange of tokens that satisfy (or undermine) people’s needs for security, legitimacy, approval, confidence, or freedom in *patterns* that are (or are not) peculiar to different pairings and groups. This requires close observation and useful theory.⁹⁶ Certainly, it would not treat money as a neutral, overarching measure or store of Value, but rather as one of the many types of tokens in circulation, each having its own characteristics.

Token economics does not aim to reduce the richness of social and cultural life to economics, that still-dismal science to many. It asks economics, rather, to loosen its fixation upon material quantitative growth and attend to the richness of social and cultural life. Situated between psychology, economics, anthropology, and law, token economics, we think, could someday make contributions to filling in the picture of social theory, to understanding how material wealth does or does not translate into quality-of-life, to addressing endemic and chronic differences in *QOL*, and to effecting economic progress where much of it begins, which is in the equity-driven relations between people.

Adam Smith asked for no less in *The Theory of Moral Sentiments*.

7. Some practical implications, and a conclusion.

Burgeoning complexity is behind everything we call “better.” In support of this assertion we have been idealizing, mathematically, and idealistic, politically. We have tried, in short, to *do theory*.

Now we would like to reprise some of the implications for policy that we mentioned in passing, and offer a couple more. Our recommendations are modest compared to Restructuring the Corporation, Ending Capitalism As We Know It, or Transforming Human Consciousness.⁹⁷ The aim, it seems to us, is to not to

such as to disguise this fact.”

⁹⁶ If Becker’s approach could be called macroeconomic, this approach could be called micro, even pico-, economic, a step downward in granularity. “Picoeconomics” was coined by psychiatrist and author George Ainslee to name a method by which one can study such psychological difficulties such as addiction, indecision, and weakness of will by treating the mind itself—at least with respect to time, motivation, and valuation—as though it were organized like an economy. See Ainslee (1992, 2001). Becker too has modeled addiction, but by devising utility functions that include a “consumption capital” term, *S*.

⁹⁷ Speth (2008) provides a nice overview of these far-reaching proposals.

Overhaul Everything, but to identify as many new ways of doing things as we can that will take root and spread (a) because they are profitable or gratifying as well as conducive to economic progress, and (b) because the choices they offer are posed in frameworks that help producers and consumers choose well.⁹⁸ Quality, after all, yields pleasure and should need no *special* pleading. Equity lets us live with unlocked doors and easy hearts. Who does not want that too?⁹⁹ The price of having both is “simple:” it is the mastery of new complexity.

Developing better measures of complexity. At present, complexity is understood in three ways: (1) as a kind of I-know-it-when-I-see-it attribute of certain places, people, institutions, works of art, natural objects and engineered things, akin to liveliness, characterized by a rising cognitive load as we try to fathom how they work or what they will do next, (2) as an objectively measurable characteristic of a small range of finite, many-componented systems—like melodies, games, codes, certain mechanical and electrical devices, and networks, and (3) as something to be minimized if possible.

Between understanding-(1) and understanding-(2), alas, lie most of the things we are interested in: the complexity of an everyday good, service, or experience in its context; the complexity of an organization, procedure, or production process; the complexity of a poem, an open field, a “day in the life...”.¹⁰⁰ The complexity of such phenomena is only roughly approximated by overall component- or part-counts: number of people, departments, cells or cell-types, steps, notes, words, species, lines of code, instructions... In the attempt to make headway, this paper cast its lot with the information-theoretical approach pioneered by Shannon and Weaver in the 1940s, which adds probability-estimates of ensembles of component-states to the mix, so that research can be undertaken into optima like the “life-zones” we theorize to exist around $H_{\max}/2$.¹⁰¹

⁹⁸ Thaler and Sunstein (2008) speak of using *nudges*: “A nudge, as we will use the term, is any aspect of the choice architecture that alters people’s behavior in a predictable way without forbidding any options or significantly changing their economic incentives. To count as a mere nudge, the intervention must be easy and cheap to avoid. Nudges are not mandates. Putting the fruit at eye level counts as a nudge. Banning junk food does not.”

⁹⁹ We understand that this rhetorical question might strike some as naïve. In fact, we do not underestimate human (or corporate) cupidity. We are well aware that a minority in every country locks its doors, lives behind gates, and rationalizes away its conscience for the sake of keeping its riches and/or securing its families against the threat of predation. We do not believe however, that this is anyone’s *preferred* way to live—that even the rich would prefer that their wealth be considered by all to have been merited and that they and their children should be able walk safely everywhere, admired.

¹⁰⁰ The idea that the economy as a whole is a complex system consisting of complex systems (i.e. of people and organizations of people) is not new to theoretical economics, of course, nor, within that, is the idea new that the complexity of the global financial system in particular (a) has grown to the point of fragility, and (b) always will (e.g. Minsky, 1986; Mirowski, 2010).

¹⁰¹ There are other definitions of complexity, and other ways to measure it, which we did not pursue, e.g., the algorithmic complexity of Kolmogorov and Chaitin (1992). For an accessible overview of these see Mitchell (2009, especially pp. 94–114). In no way is it this paper’s purpose to dissuade or criticize the use of other models of complexity in economic theory. See also Note 16 above.

Complexity measures of higher practicality than ours need to be developed also—ones that can be standardized, at least within certain domains of application, and that are reliable and simple enough to be used by designers, managers, investors, policy-makers, and entrepreneurs. It's leverage we're looking for: some useful methodology by which to limn how complexity might be managed in specific cases so that the universal desire to minimize complexity (understanding-(3) above) can be both honored and ignored.

Identifying quality as the business opportunity it is. For a "culture of quality" to happen, quality-seeking must become a popular movement that "nudges" the ability to discriminate quality from mere preference to insistent demand. Earlier we suggested that Quality Studies in high school was a good place to plant the seeds, both of connoisseurship and expertise. Given the conservatism of today's public education establishment, however—and given, also, state control over curricula—adding Quality Studies might be wishful thinking. Certainly, though, in the larger arena, it has to be shown again and again, by example, how *quality pays* for its producers and purveyors too.¹⁰² It has to be shown how "what goes around comes around" as those producers and purveyors start to demand—and are able to afford—higher quality products from others. The logic of this upward spiral might start in the abstractions of economics and go from there to case studies at business schools, but then it should appear in public as airport bestsellers, as stories in *Inc.* and *Wired*, *The Wall Street Journal* and *USA Today*, and as a message to policy makers: qualitative growth is what we need to get unemployment down, salaries and happiness up, and the environment protected. The investment to be made is learning how to deal with increasing complexity in our lives, both directly and as leveraged (where it can be) by elegant interfaces and intelligence-assistive technologies.

Developing national measures of qualitative growth. Whereas general *equity* (and changes in general equity) can be gauged from income- and wealth-distribution statistics like Gini coefficients or Theil indexes (Conceicao and Galbraith, 1998) combined with statistics about class-mobility, crime incidence, and other data used by Wilkinson and Pickett (op. cit.), a singular, *GDP*-like measure of *quality of production*—like a Qualitative Growth Index (*QGI*)—cannot be found.

¹⁰² As Phillips, Chang, and Buzzell (1983) show empirically, across a wide range of goods, a firm's turning to higher quality production neither adversely affects its return on investment nor decreases its market share, both as standard economic theory might predict. Indeed, it usually has the opposite effects (pp. 38-41).

One important beginning (in the U.S.) is the effort by the Bureau of Labor Statistics (BLS) to build product-quality improvement into the Consumer Price Index (*CPI*). To separate inflation-based price increase from quality-based price increase, economists at the BLS have developed a system of “hedonic quality adjustments” to the prices of goods in the *CPI* market basket. The adjustment system is elaborate, careful, and growing in scope.¹⁰³ At its center is “decompos(ing) the price of a specific consumer product into *implicit* prices for each of its important features and components, thereby providing an estimate of the value for each price-influencing feature and component”—features, components, and capabilities the total number of which, in most product classes, goes up every year. Using this technique, Paul Liegy of the BLS, for example, offers a detailed appraisal of the quality of seventeen brands of clothes dryers available in the U.S., several of which were demonstrably improved over a period of one year (1999-2000; Liegy, 2003).

The BLS technique points to a way of assessing and measuring qualitative improvement in all goods. Indeed, the number and extent of “hedonic quality”-adjusted price increases compared to the number and extent of simple inflation-adjusted price increases in the *CPI* market basket from year to year might well offer a reasonable, if indirect, first-approximation measure of a national Qualitative Growth Index (*QGI*), expressed as a year-over-year percentage growth (or decline) in overall good and service quality. This measure would not, however, substitute for a more representative and comprehensive quality tracking system, one that uses methods like those of the BLS (or *Consumer Reports*, or *Digital Photography Review*, which is exemplary in its field) and that included the seven component qualities we suggest, to cover a sample of hundreds, perhaps thousands, of products and services, that distinguishes imports from exports, and so on. Required is a change of emphasis from the contemporaneous, inter-brand comparisons typical of the consumer guide literature to an historical, model-year or generation-to-generation, *intra*-brand comparison of quality at the same, inflation-adjusted retail price points.

We should also note the contribution to qualitative growth made by other U.S. agencies charged with setting minimum quality standards, such as the Food and Drug Administration (FDA), the National Institute of Standards and Technology (NIST, formerly the National Bureau of Standards), and those in charge of state, national, and international building codes (like the ICC). None of these institutions, to our knowledge, yet produces annual indexes of quality improvement. The NIST might also take on a new task: rating the raters,

¹⁰³ See <http://www.bls.gov/cpi/cpihqitem.htm>.

from *Consumer Reports* to *J. D. Powers & Associates*, from *Zagat's* to *Moody's*.¹⁰⁴

One interesting potential measure of quality production at the macroeconomic level is the sum of unit-price-differentiated, export-over-import surpluses, where a *unit* is defined not as a piece (e.g. a car or computer), but a unit of mass (or volume or duration). On the knowledge that price-per-piece and quality are only roughly correlated, the hypothesis is this: that *unit value* (= price per pound or cubic ft., normalized by product type) and quality are more closely correlated.¹⁰⁵ Aiginger (1997), using a sophisticated application of this measure to real world data, finds an easy way to categorize industries, namely,

...those where unit value predominantly signals costs, and those where it signals quality. If a low unit value of exports leads to a quantity (export over import) surplus...then it is revealed that the cost side dominates, since economic theory tells us that most goods are price elastic. If a high unit value leads to a quantity (export over import) surplus...then demand is dominated by quality, since economic theory tells us that prices can be higher for a good only if the market is vertically differentiated and one firm concentrates on the higher quality (p. 586).

He goes on to show that Germany's trade surplus with most countries (including the U.S., but not Japan at the time), was due to the large number of its industries that were able to compete internationally on unit price, where the unit was kilograms.¹⁰⁶ Theoretically, "unit price" might be functioning here as a proxy measure of the amount of complexity embodied in a good—something like "complexity density," whose basic theoretical unit would be complexity-bits per kilogram-cubic centimeter-second, or *C/kg.cc.sec*. The higher the number of complexity-bits (vertical axis in Figure One) found meaningful, or consequential, or necessary

¹⁰⁴ After the passage of the Credit Rating Agency Reform Act of 2006, the task of rating credit rating agencies fell to the Securities and Exchange Commission (SEC).

¹⁰⁵ In architecture, construction cost per square foot is widely accepted as an indicator of building quality, which is a matter not just of the use (or avoidance) of "quality materials," but of construction time, precision standards, and design complexity. It is very, very hard to beat the cost-quality correlation in building construction, although every architect promises he or she can. This time.

For a \$/lb. measure of quality in cars, see Holloway and Hempel (1962), who found correlations in the range of $R = 0.92$ between car weight and car price, with luxury, compact, and imported models priced higher—around \$0.66/lb. for day-to-day domestic models, vs. \$1.08 for Cadillac and similar (= \$4.60 vs. \$7.66 in 2010 dollars).

¹⁰⁶ Aiginger's conclusions are supported by Anderton (1999) who, in addition to price elasticities, uses relative R&D expenditures and patenting activity as proxies for product quality in Germany and the UK. Grossman and Helpman (1991) earlier emphasized the importance of high levels of R&D to support constant product quality improvement, and in Grossman and Helpman (1995) examine the advantages of climbing "quality ladders" to trade, allowing countries to dominate in certain products.

These papers suggest that we might use R&D expenditures as a (changing) percentage of *GDP* as a proxy for macro-scaled qualitative growth, or perhaps as a leading indicator. By that measure, qualitative growth has been positive in the U.S., or soon will be: civilian R&D expenditures have increased at rates of around 6% (after inflation) for over a decade, which is more quickly than *GDP*.

for manufacture—per unit of weight, volume, or duration of the good—the higher the complexity-density of the good and probably the rated quality.

Another (more practical!) component of *QGI* might be $(GDP_{lux}/GDP) \times 100$, that is, the *GDP* associated with luxury goods and services that have standard counterparts as a percentage of *GDP* of all goods and services. Varying between 0 and 1, this measure presupposes that a consistent distinction can be made between luxury goods and ordinary goods, and moreover, that luxury goods are of higher-than-standard quality. Informing expert opinion on this score would be the good category's price elasticity with respect to income: "superior" or luxury goods would be those whose percentage-of-household-expenditure increased with increased household income (and decreased with decreased income). Something similar could apply to industry and its capital equipment and labor expenditures.

Any useful Qualitative Growth Index (*QGI*) should be incorporated into *GNH* (Gross National Happiness), *GPI* (Genuine Progress Indicator), and other quality-of-life measures (see Note 11). At the time of writing, French President Nicholas Sarkozy and British Prime Minister David Cameron had committed their governments to adopting their own national *QOL* indexes to aid in shaping policy, as Bhutan has already done.

Embarking upon "Grand Projects." Regional if not global in scale, Grand Projects might include beautifying the whole physical environment, building a continuously habitable international space station, constructing an ecologically sensible flood management/breakwater system around New Orleans, building super-fast train connections between major American cities, implementing a crash R&D program to advance energy storage technologies, even going to Mars. There are a score of other Grand Projects proposed for North America, waiting to be financed. The creation of a national infrastructure bank, issuing Build America Bonds among other strategies, is surely one way in which many Grand Projects could be funded (Tyson, 2011).¹⁰⁷

Many would harrumph that Grand Projects "don't address our real problems." Others would warn that they cost too much, invite waste and corruption, or upset the ecological balance. But we think they should be

¹⁰⁷ That said, spending on Grand Projects not the same as spending on infrastructure. For a project to be "*grand*" it needs to be other than, or more than, growth, more than a simple increase-of-capacity (e.g. doubling a freeway or adding a dockyard) or a coping-with-breakdown or a prevention of disaster (e.g., replacing a bridge, or building a sea wall [Hertsgaard, 2011] whose only purpose is to protect a coastal city from inundation). For a project to be grand, it's essential that it break new ground conceptually, technologically, and in design: *that it capture the imagination* in some way, that it be generous, and yes, beautiful, and multifunctional. Ouroussoff (2009) describes some relatively modest and yet eminently worthwhile Grand Projects that fit this bill. For the likely fate of high-speed intercity rail, and for which considerable infrastructure "stimulus" funds have actually been set aside by the Obama administration, see Anon. (2010).

undertaken if they meet two criteria (1) that no one person, group, or species would benefit unduly by them, or be harmed involuntarily, either in final form or in process (this is the *equity* criterion), and (2) that they promise to elicit superior workmanship, artifacts, research and knowledge from many sectors of the economy (this is the *quality* criterion). For the chief benefits of such Grand Projects would neither wait for nor stop at the benefits of their completion, like a nicer place to live, cheaper electricity, fast and easy travel, or true stories from Mars. Their benefits would include the meaning-generative effects of their very scope on the human spirit, as well as their wealth-generative effects upon the hundreds of thousands of people involved in their *process*.¹⁰⁸ Given the dreaming, the persuading, the planning, the research, the science, the engineering and coordination, given the needs met, the jobs created, the quality produced, the pride felt, and the money made, it may matter less *what* large project a society devotes itself to, than that more and better living gets done.

At the other end of the spectrum of singular and large Grand Projects are local ones, grand in the sense of being myriad and fundamentally *generous*.

It's the proper business of cities and states, for example, insofar as they oversee education, regulate markets, and encourage different kinds of development in their region, to promote the distribution of economic capabilities, roles, and rules for the benefit of all residents. This requires that the roles and rules promoted offer citizens a *range* of degrees of complexity to deal with—a range that allows all people to exercise their current cognitive abilities while giving them grounds for believing that, with further experience and education, they could move to a higher, more complexity-embodying plateau. It's poor policy, for example, to encourage only high-tech development in a given region if it creates jobs that only a small fraction of its population can handle. Such efforts must also include carefully incentivized life-support and financial aid for education and re-training¹⁰⁹ and a group of business leaders that sees its mission as the creation of what Porter and Kramer (2011) call "shared value."

This much is mainstream—if left-leaning—wisdom.

With our quality- and equity-based model of economic progress, however, public policy can go further and become in its own way, inspiring, *grand*. It can aim at preserving, honoring, and promoting many of the complex skill-sets, sensibilities, and modes of production that are no longer marketable at a profit, perhaps

¹⁰⁸ Cf. Bruno Frey (2008, Chapter 10) and his discussion of "procedural utility."

¹⁰⁹ This point is well made by William Easterly (2001, pp. 71–84). In a chapter entitled "Educated For What?" Easterly is skeptical, however, of education being the panacea for chronic poverty. Required, he points out, is the incentive to become educated, yes, but also a low level of corruption, so that it is made only *partly* rather than completely true that "who you know is more important than what you know." Cf. our earlier remarks about social capital and education, Note 93.

never were, and/or might not be again: not just elite ones like the fine arts, the basic sciences, classical or jazz music, ballet, and literary publishing, already the beneficiaries of much private and public philanthropy, but also more “common” ones like small-audience arts, games, and sports, family-scale farming and business, skilled craft production, gardening in the public and quasi-public realm,¹¹⁰ care of the very young and very old, the staging of social events like festivals and weddings, specialized informal schooling, and home-making, all of which are essential venues for token exchange as well as of labor and material production. Under the sign of quality, these “uneconomic” activities are the humus in which new growth occurs, essential, in its diversity, to capital formation in the long run. In an age of mass automation, mass communication, mass entertainment, and mass capital-accumulation, the alternative to husbanding these local, complexity-creating and complexity-preserving practices among ordinary people is to promote, by default, the spread of inequity, anomie, crudity, and sham. This in turn leads to resentment and eventually to conflict, not just between the rich and poor, the franchised and disenfranchised, or the educated and ignorant, but between *somebodies* and *nobodies*, “nobodies” because there is no area of life in which *their* talents—*their* capacity for handling complexity—can find amplification, expression, or respect. These are the people most susceptible to taking extreme anti-social action.

In this context, it is ever to the credit of myriad grass-roots community organizations and of “Web 2.0” (marking the evolution of the Internet into a medium of individual expression, interaction, and community-building) that people well-off enough to have access to the Internet can attract attention to themselves and to what they care about. While *Twitter*, *Facebook*, texting, and blogging cannot substitute for face-to-face, information- and obligation-rich token exchange along the lines we have discussed, they do create new niches in the larger ecology of human association; and that is to the general economic good.

Redistributing (some) wealth. Recommending greater social equity through the redistribution of wealth or income is not very original. Here we present policies that we think are especially supportive of qualitative growth.

From a purely economic productivity point of view, equity is good because people who are being treated

¹¹⁰ In a classic case of a positive externality, the flowers you grow in your front yard give pleasure to every passer-by “for free.” Almost all private buildings are quasi-public goods in this way, and without formal and informal (psychoeconomic) control, generate positive and negative externalities willy-nilly.

fairly work harder and with less supervision.¹¹¹ When people think the system is rigged to reward the undeserving, they become unhappy, withdraw their efforts, or try to “game” the system themselves.¹¹² And as we saw earlier, the correlation is high between a country’s degree of income or wealth inequality and a wide range of other social maladies.

Equity is also an economic good when it enables the mass of productive people to *afford* a higher quality-of-life more easily. Since *QOL* is not “just psychological” but depends also on access to higher quality goods and environments, too-great and increasing economic inequality—as when, say, the top 10% of a country’s earners take home over 45% of the national income and the richest 1% take 18%, as they presently do in the U.S.—depresses effective demand from the broad majority of earners that make up the middle class (and whose real incomes in the U.S. have been stagnant for decades).¹¹³ The top 10% may consume high quality goods and thereby elicit their production, but their wealth is so large and their number so small that they cannot consume enough to spur qualitative economic growth at the macro-scale. All of their spending on luxuries, venture funding, and philanthropy, still leaves trillions of dollars on the table, so to speak, there to fuel financial speculation and buy political influence. Raising the relative incomes of the “spending classes,” and especially those whose incomes already allow for some educated discretionary spending, will attract a wave of capital investment dedicated to satisfying the growing demand for greater quality. For the evidence shows that as families become wealthier they lean towards higher-quality consumption naturally.¹¹⁴ Imagine

¹¹¹ People will also work harder, of course, if forced to do so by economic necessity or by the threat of violence; but they will not work more smartly or creatively or honestly. And as we have seen, fairness is a local and relative judgment. You may be treated no worse than—or perhaps better than—your peers, but your satisfaction with *that* depends on who you count to be your peers in the first place, and what you accept, or do not accept, about your “station in life.”

¹¹² Hidden in the ideal of “equality of opportunity” we realize, is the assumption that the opportunities presented are roughly equally ethical. Otherwise, someone who succeeded in life by dubious means or by gaming the system would be able to say to someone who did not succeed at all: “Hey, you had the same opportunities I did; you just didn’t hear them knocking, or do what needs to be done in order to Get Ahead in This World—like bend the rules, abandon ‘loser’ friends, tell people what to do, manipulate the truth, look out for your own, risk other people’s money...and never, never blame yourself, explain yourself, or complain.”

¹¹³ In the years 2000 to 2007, 65% of income growth in the U.S. went to the top 1% of earners (Feller and Stone, 2009). In 2008, income inequality in the United States had not been higher since 1928.

¹¹⁴ A greater quantity may be consumed too, with the *ratio* between them changing according to what is known as Engel’s Law, to wit, that the percentage of income spent on essentials like food tends to drop as family’s income rises, while the percentage spent on luxury goods goes up. “Luxuries” is a broad category. It consist of things you don’t need that are junk (plastic beads, breakable toys, popcorn poppers, etc.), as well as of things you do need but that are of “unnecessarily” high quality. It’s the latter we are interested in. Mani (2001) shows how demand for the latter influences, and is in turn influenced by, the composition of skill in the labor force (high, medium, and low, for high-quality, medium-quality, and low quality goods respectively), and thence flatter overall income distribution.

Few writers, recently, have been more eloquent about the necessity for income redistribution in favor of the middle class for economic (i.e. not “just” moral reasons) than Robert Reich (2010b, 2010c), although Reich does not make the case for quality over quantity or for the health of the environment.

how much stronger this trend would become if a “culture of quality” were to flourish, especially when supplemented by an understanding of the environmental and economic benefits of qualitative over quantitative growth.

The question of course, is *how* to raise the effective earnings of the middle and upper-middle “spending” classes. More-progressive taxation is a traditional answer; new forms and degrees of unionization is another;¹¹⁵ loosening wealth’s influence on government is a third. Making it easier to borrow money is not a fourth.

We would advocate special taxes on the financial sector, this in two forms (1) a higher capital-gains tax on profits and on remuneration from financial trading, and (2) a transaction fee on all swaps and sales of financial products.¹¹⁶ These monies—which could run to fifty billion dollars per annum in the U.S. with taxes on its financial industry on the order of 1% of its revenue—could be used to help finance Grand Projects and public education (including, of course, Quality Studies), to clean up and beautify our cities, to support creative community-developing activities, to lower taxes on the middle to upper-middle classes, and to offer a Living Wage Supplement that shrinks the gap between the Federal minimum wage and the local, age-dependent, living wage. Wall Street would hardly miss the money. Indeed, it might grow in absolute profitability with the qualitatively growing economy that would result, this as it turned its attention once again to orchestrating the efficient allocation of investment capital to quality-promising, real-economy enterprises.

Rethinking “voluntary simplicity.” With its roots in the “drop-out” hippie culture of the 60’s and ‘70s, admixed with the much older strain of Puritanism in the American psyche, a substantial literature of books, journalism, and Internet activism has grown up around the anti-ostentation, anti-consumption, pro-environment, low stress, down-sizing, less-is-more, slow food, health-conscious, exercise-rich lifestyle movement called Voluntary Simplicity (see Alexander, 2009; Wann, 2007; Elgin, 1981; Gregg, 1936; also Schorr, 1993; Dillard, 1974; Schumacher, 1973; Eller, 1973; and of course Thoreau, 1854). Ironically, this movement has also spawned a small retail industry catering to it (e.g. visit <http://www.realsimple.com>)—or at least

¹¹⁵ Gratton (2011) cites the “rapidly emerging guilds of the future...like Sermo (for US physicians) and Lawlink,...(which) already play the role of the medieval guilds...”, but there are also innumerable professional accreditation organizations that could serve a more labor-union-like functions.

¹¹⁶ An FAT (Financial Activities Tax) and an FTT (Financial Transactions Tax) are under consideration by the EU. See http://ec.europa.eu/news/economy/101007_1_en.htm. See also EC (2010); Cottarelli (2010) and Zee (2004). In the U.S., proposals to tax finance are supported by only a few economists, notably Joseph Stiglitz. A national infrastructure bank in the U.S. (Tyson, 2011) might be a destination of a portion of FAT and FTT funds.

seeming to, because the desire for simplicity and for “realness” extends far beyond those who would actually sell their houses and move downtown, give up their cars and ride bikes, school their children at home and wear only cotton, live on one income and keep single flowers in vases, throw away their TVs and become culinary locavores. Choices like these attract people who find modern middle-class life wasteful, frenetic, fake, fattening, conflicted, and callous, many of them once-high-earning professionals who want to live gracefully nonetheless—and proudly—on their lower incomes (Blumenthal and Mosteller, 2008).

The question for us is whether the Voluntary Simplicity (VS) movement and its variants, in thriving, could help bring about economic progress. Answering this question requires thinking through what VS implies for (improvement in) product quality, quality of life, and equity. Let us apply Kant’s Categorical Imperative then (“act only upon principles you would have everyone act upon”), and ask: What if everyone adopted a VS lifestyle? If we all rode bicycles, what would happen to the auto industry? If we all ate locally, what would happen to Florida’s and California’s vegetable farmers (not to say Mexico’s and Chile’s)? And is it really simplicity if (a) I have to do more myself (hand-wash laundry, teach my children), and if (b) my escape from the middle-class working life and its inelegancies depends (i) on a steady source of private income from growth investments, or (ii) on long chains of supply lying behind every simple-on-the-surface product I use, behind my college education, my clean and pleasant environment, and the dozens of institutions I count on to uphold my rights, property, and freedom as well as everyone else’s?

In short, can we *all* live low-consumption VS lives without causing massive unemployment (and soon after that, a life of *in*voluntary simplicity)? Is VS a defection that depends on the vast majority of others *not* defecting from the quantity-driven consumer economy? We think the answers to the last two questions are: *yes* to the first, and *no* to the second: Yes, we can all live VS lives, and no, it is not a defection...*if and only if we can convert quantitative into qualitative growth*, locally and globally. It’s as though we all had a choice: not whether or not to spend (because what I spend you earn, and vice versa), but what to spend *on*. Will it be mass-produced, energy-wasteful, environment-harming, garage-filling “luxuries”? Or will it be the necessities of life—housing, transportation, furniture, food—raised to higher levels of functionality, reliability, beauty, attention to detail, simplicity in use, generosity, and ethicality.

Voluntary simplicity—if it is to be recommended for everyone—can mean living on (and with) *less* only if “less” means less *quantity* and more *quality* in a close-to-exact trade off, i.e., such that earnings and expenditures stay the same or go up, employment does too, and so does technological innovation. There is

nothing “retro” about qualitative growth. It represents the supercession of an older pattern of work and consumption by a newer one, one that recognizes *everyone’s* involvement in everyone else’s livelihood.¹¹⁷

Conclusion: Economics aims to discover and quantify the conditions under which a people might prosper in peace. Our paper has explored the possibility of an economics whose central concerns are *quality* and *equity*. These two, when they increase in tandem, comprise what we mean by *economic progress*. We argued that the quality we call “quality,” meaning being good to see, use, touch, or own, and “equity,” meaning a distribution of goods (broadly conceived) that is fair but not necessarily equal, are but manifestations of, and contributors to, a deeper evolutionary principle, which is life-on-earth’s “trying” to increase its own *complexity*.

We attempted to give that complexity a basic mathematical form: complexity, C , is a certain function of the number of behaviors of which a system is capable, and of the distribution of probabilities of that system’s different behaviors actually occurring. This function maximizes itself roughly halfway between zero and the system’s maximum potential entropy at a given scale of analysis. That halfway place between rigidity and chaos we called “the life zone.”

We proceeded to examine how equity and then quality generate and are generated by greater life-zone complexity in human technologies and human affairs. Our treatment of equity focused on the complexities entailed in trying to live up to the no-harm principle. Our treatment of quality was more extensive. We ventured to break quality down into seven “component qualities” (functionality, reliability, attention to detail, generosity, simplicity, and ethicality), with the observation that these seem to have application to a wide variety of goods, services, and experiences. Each master quality had its roots in complexity. We then examined when and why goods and services of higher quality cost more to produce, and then how countries that follow the high-quality production path prosper on that account.

Returning to equity and its interaction with quality, we offered that quality-of-life (*QOL*), not just quality of products, was the arena in which quality and equity interacted most clearly, since *QOL* depends on relative prosperity as much as on absolute prosperity. Our contribution to this argument was to propose the existence of a shadow economy to the one that economists typically study. We called that economy the token economy. The token economy is where equity is worked out between exchangers, using remainders and other variables.

¹¹⁷ These thoughts about VS conclude our list of implications. Certain others remain lodged in the text either because they are well-known (for example, the importance of properly pricing externalities), or because we have nothing to add beyond what we attempted to write there (for example, examining the workings of the psychological or token economy).

It is also where we could expect to see whether and how material wealth translated into actual quality of life. We ended with a series of implications—recommendations, really—which you have just read.

The motivation behind exploring these matters far exceeds the enjoyment of theory making. We are facing problems that are economic in cause and economic in solution: market-driven growth, and growth-driven markets are running headlong into natural resource limits and ecosystem failure. Global warming is only one such trend. It needs an economic response whether humans are two percent or eighty percent responsible for it. We believe, along with Herman Daly, that the answer lies in economies world over transitioning from growth in the mass and number of goods manufactured to growth in their sophistication and quality. We believe with many others that inequity is the enemy of happiness—the happiness, even, of the “haves.” The underlying metric of both quality and of equity is *complexity*. Complexity can increase without limit, without resource depletion, without pollution, and without asphaltting more land.

The future we want lies with better, not more.

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