

BIOLOGICAL ADAPTATION IN HUMAN SOCIETIES: A 'BASIC NEEDS' APPROACH

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*"I do not think we have adequately determined
the number and nature of the appetites,
and until this is accomplished
the inquiry will always be confused."*

Socrates

(Quoted in Plato, *The Republic*)

ABSTRACT

The ground-zero premise (so to speak) of the biological sciences is the assumption that survival and reproduction is the basic, continuing, inescapable problem for all living organisms; life is at bottom a "survival enterprise." Whatever may be our perceptions, aspirations, or illusions, this tap-root assumption is applicable to the human species as well. Survival is the "paradigmatic problem" for all human societies; it is a prerequisite for any other, more exalted objectives. A key concept in biology is "adaptation" -- commonly meaning both the functional requisites for survival and reproduction and the specific means that are employed for doing so by a given organism in a given environment; an organism is, quintessentially, a "bundle of adaptations." Although the term "adaptation" is also familiar to social scientists, until recently it has been used only selectively, and often very imprecisely. Here a more rigorous and systematic approach to the concept of adaptation is proposed in terms of "basic needs." The concept of basic human needs has a venerable history -- tracing back at least to Plato and Aristotle. Yet the development of a formal theory of basic needs has lagged far behind. The reason, in a nutshell, is that the concept of objective, measurable needs is inconsistent with the theoretical assumptions that have dominated economic and social theory for most of this century, namely, "value-relativism" and "cultural determinism." Nevertheless, there have been a number of efforts over the past 30 years to develop more universalistic criteria for basic needs, both for use in monitoring social well-

being (“social indicators”) and for public policy formulation. Here I will advance a strictly biological approach to operationalizing the concept of basic needs, which is referred to as the “Survival Indicators” paradigm. It is argued that much of our economic and social life (and the motivations behind our revealed preferences and subjective utility assessments), not to mention the actions of modern governments, are either directly or indirectly related to the meeting of our basic survival needs. Furthermore, these needs can be specified to a first approximation and supported empirically to varying degrees, with the obvious caveat that there are major individual and contextual variations in their application. Equally important, complex human societies generate an array of “instrumental needs” which, as the term implies, serve as intermediaries between our primary needs and the specific economic, cultural and political contexts within which these needs must be satisfied. An explicit framework of “Survival Indicators,” including a profile of “Personal Fitness” and an aggregate index of “Population Fitness,” is briefly elucidated. Although this framework has been under development for some years, it is stressed that there is still much work to be done and much room for improvement. Finally, it is suggested that a basic needs paradigm could provide an analytical tool (a “bio-logic”) for examining more closely the relationship between our social, economic and political behaviors and institutions and their survival consequences, as well as providing a predictive tool of some value.

INTRODUCTION – ‘BIO-LOGIC’ AND THE SOCIAL SCIENCES

For our remote ancestors of the late Pleistocene, the basic problem that they confronted -- along with all other living things -- was the “struggle for existence” (in Darwin's pellucid phrase). Nothing fundamental has changed since then. Whatever may be our perceptions, aspirations, or illusions, biological survival and reproduction remains the “paradigmatic problem” of the human species. Furthermore, the survival problem is ongoing, relentless and inescapable; it will never be permanently “solved”.

This tap-root assumption about the human condition is not exactly news, although we very often deny it, or downgrade it, or simply lose touch with it. The survival imperative was recognized by Aristotle in various writings (Nussbaum 1988, 1993). It was also the underlying assumption in Darwin's treatise on *The Descent of Man*. Herbert Spencer and a slew of nineteenth century social theorists also took the survival problem as a given. Today it figures prominently in some of our public policy debates, most notably those concerning poverty and various environmental problems. It is also the ground-zero premise (so to speak) of the biological sciences; life is at bottom a “survival enterprise.”¹

In a very real sense, the ground-zero premise of the social sciences during the course of this century could be considered a “null-hypothesis.” Several generations of our forebears in the social sciences have accepted without question (and many still do) the assertion that “mere” survival and the provision of “basic needs” is no longer a real problem for humankind, at least not in the so-called “developed” countries. This despite the fact that in this century hundreds of millions of people have been left hungry, or in physical deprivation, or dead, as a result of two world wars, the Russian and Chinese Revolutions and the Great Depression, not to mention various lesser tragedies in more recent decades. Indeed, the influenza pandemic of 1918-19 alone killed more than 21 million people world-wide. And, as the millenium draws to a close,

the AIDS epidemic remains a major threat.

Furthermore, it is estimated by the Food and Agriculture Organization of the United Nations that some 20 percent of the population in the developing and less developed countries -- about 800 million people -- are chronically undernourished (BWI 1995; Pimentel and Pimentel 1996; Ehrlich 1998). All-told, about one-third of humankind suffers from the effects of undernutrition and/or malnutrition (WHO 1995; Combs et al., 1996), even though the world's total population is continuing to grow, if somewhat less rapidly than before (Bongaarts 1994; Smail 1997; Ehrlich 1998). More disturbing is the estimate by the well-known ecologists David and Marcia Pimentel that in the past 40 years almost one-third of the world-wide stock of arable land has been eroded (some of it irretrievably) (see also Lal and Stewart 1990; Pimentel et al., 1995) and that the per capita availability of fresh water (especially for irrigation) has begun to decline as well (Postel 1992; Gleick 1993; Pimentel et al, 1997). Perhaps most ominous is the fact that increases in world-wide food production, following the boom years of the so-called "Green Revolution," are no longer keeping pace with population increases. In 1997, the world food "carryover" (or reserve stocks) was the lowest since 1960. World population is now projected to reach 6 billion in 1999 and 9.5 billion in 2050. Although the large quantity of food wastage (mostly during storage and transport) offers hope for some significant short-term improvements in the developing and less-developed countries, there are currently no major opportunities available for dramatically increasing the world food supply over the long term (Pimentel and Pimentel 1996; Ehrlich 1998).

Finally, there is the looming problem of global warming, an "externality" that threatens to disrupt the very basis of the human survival enterprise.

Nevertheless, in the social sciences "value-relativism," "cultural-relativism," and "cultural-determinism" -- along with their co-conspirator, the Behaviorist "reinforcement" learning paradigm in psychology -- have long prevailed. Some social theorists (most notably the latter-day Marxists) blame human suffering largely on cultural factors, particularly capitalist economic and political institutions, and tend to discount the importance of basic needs per se. Then there are the phenomenologists, who deny that the concept of basic needs can have any external, objective meaning at all apart from the individual's subjective experience. Meanwhile, many other mainstream social scientists have proceeded from the assumption that basic biological needs are only marginally relevant to social theory and that individual motivation can be treated as a "black box" into which various cultural influences are poured. Our social, economic and political behaviors are therefore largely shaped by our "wants", "tastes", "revealed preferences," "subjective utility functions," and "social norms," which are said to be "infinitely variable" and culturally determined. (For more detailed discussions and critical analyses of this paradigm, see Corning 1983, 1996a, Doyal and Gough 1991, Edgerton 1992, Hodgson 1993, *inter alia*.)

Moreover, the so-called "is-ought dichotomy" in social theory, dating back to the philosopher David Hume, proscribes us from passing moral judgment on any given social practice or personal choice; we cannot deduce an ethical imperative from any empirical circumstance. Economist John C. Harsanyi's (1982) principle of "Preference Autonomy" (a.k.a. preference utilitarianism) epitomizes this posture: "In deciding what is good and what is bad for a given individual, the ultimate criterion can only be his own wants and his own preferences" (p.55).² Similar assertions can also be found in the literature of anthropology, sociology and psychology, not to mention social philosophy.

This tacit null hypothesis, and its philosophical underpinnings, is becoming increasingly untenable. Various developments in the life sciences and the social sciences alike over the past two decades -- ranging from behavior genetics and the neurosciences to ecological anthropology and welfare economics -- have, in effect, challenged the environmentalist/relativist paradigm. (Some of these developments will be discussed briefly below.) Nevertheless, a broad theoretical framework based explicitly on the ground-zero premise of the biological/survival imperatives -- what could be called a “bio-logic” -- has lagged behind (but see Galtung 1980; Corning 1983; and Doyal and Gough 1991).

Here a limited effort will be made to operationalize the survival problem as an explicit analytical paradigm. In essence, this effort involves a synthesis of three very different concepts and research traditions from three separate disciplines. From biology comes the concept of biological “adaptation”, which provides the theoretical foundation. From the social sciences, including welfare economics, comes the concept of “basic needs,” which provides an analytical framework. And from the public policy field comes the methodology and research tools that are associated with the “social indicators” movement. Together, these three elements are synergistic; they provide a new way of viewing and analyzing economic and social phenomena.

INTRODUCTION – ‘BIO-LOGIC’ AND THE SOCIAL SCIENCES

Theodosius Dobzhansky, one of the leading evolutionists of the 20th century, was fond of characterizing the evolutionary process as a grand experiment in adaptation. And biologist Julian Huxley, in his landmark volume, *Evolution: The Modern Synthesis* (1942), defined adaptation as “nothing else than arrangements subserving specialized functions, adjusted to the needs and the mode of life of the species or type....Adaptation cannot but be universal among organisms, and every organism cannot be other than *a bundle of adaptations*, more or less detailed and efficient, coordinated in greater or lesser degree [italics added]” (p.420).³

Adaptations are means to an end; they serve a purpose; they are “teleonomic” in nature. (Teleonomy is a term commonly used in biology to connote evolved purposiveness, as distinct from an externally imposed teleology.) In George C. Williams's (1966) phrase, an adaptation is a “design for survival.” Not everything in nature is adaptive, of course. Functional adaptation may be predominant in evolution, but it is not omnipotent; Darwin never took the position that everything in nature is useful, as Stephen Jay Gould and Richard Lewontin (1979) forcefully reminded us. There are also many fortuitous effects, some of which involve nothing more than the operation of the laws of nature. To use one of Williams's illustrations, when a flying fish leaps out of the water, that may well be the result of an adaptation, but its fall back into the water is not. On the other hand, what may be a fortuitous or random effect initially may well become an adaptation, should it persist and enhance the survival chances of the bearer and its progeny -- i.e., if it is positively selected.

The assumption of a need for adaptation, then, is nothing more or less than a “biological” deduction from the core premise stated above that biological survival is an existential problem and that organisms must actively seek to survive if they wish to do so. Richard Lewontin (1978) has written that “The modern view of adaptation is that the external world sets

certain 'problems' that organisms need to 'solve,' and that evolution by means of natural selection is the mechanism for creating these solutions.” Of course, the evolved internal needs and characteristics of an organism also set problems that must be solved. More important, the very definition of what constitutes a problem often has a relational aspect. For example, most plants do not have the “problem” of locomotion or the need to obtain energy by consuming other plants and animals, although they share with all other species the need for energy. Likewise, fish and people have very different sorts of problems in and out of water. Adaptation may also be a two-way street; an organism must adapt to its environments (living and nonliving), and in the process environments are often modified, perhaps in ways that in turn influence the organism. Ehrlich and Raven (1964) coined the term *co-evolution* to describe such dynamic interactions, citing as examples the stepwise directional evolution of predator and prey species via successive incremental adaptations to one another.

There has been much sloppy theorizing about adaptation over the years. Evolutionists often engage in *a priori* reasoning to the effect that there must be an adaptive (functional) explanation for every trait and, conversely, that natural selection can be invoked as an explanation for every biological phenomenon. Gould and Lewontin (1979) called such reasoning “just so stories,” after Rudyard Kipling’s fanciful tales. However, John Maynard Smith (1975) points out that *a priori* reasoning is not necessarily wrong and may well be the most efficient way to proceed. Unless one is ready to set aside the core premise that survival and reproduction is the basic problem and to discount the necessity for adaptation (something a field-trained naturalist would view as ivory tower theorizing), then most traits probably evolved in relation to the problems of earning a living, even though they may not currently be optimal or in any way adaptive. For example, the number of known or presumed nonfunctional aspects of human morphology is exceedingly small.

Maynard Smith (1978) notes that it may not be necessary (and might even be considered foolish) to devise ways of testing the obvious -- why animals have teeth, or why horses have legs. In such cases we can legitimately reason from a necessary function to be performed to appropriate structures for fulfilling that function, given the core premise. But when there is reason to be suspicious of the obvious explanation, when drift or allometry (non-functional correlated changes) might be plausible alternatives, or when the function of a trait or an organ is obscure to us and subject to debate, then experimental tests or evidence should be demanded and ad hoc explanations challenged. (For a discussion of the problems involved, see West-Eberhard 1992.)

Frequently supporting evidence can be found to buttress *a priori* functionalism. For instance, waterbugs are normally dark-colored on top and have light-colored bellies, as camouflage against predation from above or below -- according to the adaptationist explanation. The exceptions are those waterbugs that swim on their backs; as an adaptationist would “predict,” their color patterns are reversed. (Maynard Smith, 1975)

Another example, in human societies, involves some elegant field work (described in Vayda 1995). It happens that the Enga people of the New Guinea central highlands cultivate their staple sweet potato crops in large mulch mounds, typically more than half a meter high and three meters in diameter. Although the Enga, according to the researchers' informants, believe that sweet potatoes will not grow in unmounded bare ground, they do not themselves know exactly why the practice exists. One obvious explanation is that the mounds serve to enhance soil fertility and produce larger yields. However, the mounding practice is not universal in that

region. In fact, the most plausible hypothesis is that the mounds serve to protect the sweet potatoes from radiation frost damage, a significant hazard at high altitudes. Careful studies, primarily by Waddell but also Brookfield, have shown that the spatial distribution of mulch mounds corresponds with the distribution of the frost hazard in that region. Moreover, the size of the mounds and the minimum planting height increases at higher (colder) elevations -- a finding that is consistent with the fact that the warmest temperatures are to be found in larger mounds, and at the tops of the mounds. In short, mulch mounding appears to be an unintentionally adaptive cultural practice.

Accordingly, Huxley (1942) suggested that there are three basic kinds of adaptations: An organism must be adapted to the inorganic environment, the organic environment, and to its own internal environment (so to speak). At the time Huxley wrote, no one seems to have objected to the fact that he did not include a fourth category for the sociocultural environment -- that is, socially constructed behavioral constraints, opportunities, tools, information, and other resources that are a part of the adaptive environment for any organism that lives in a functionally interdependent group. In the 1940s the consensus was that "culture" is a uniquely human "invention" that sets humankind apart absolutely from other species. However, this was an extreme, ideologically-tinged reaction against the nineteenth-century social Darwinists and other advocates of biological determinism, not to mention the apologists for *laissez-faire* capitalism. Darwin did not accept either extreme separatism or extreme biologism, and he chided his co-discoverer, Alfred Russel Wallace, for exempting the evolution of the human brain from natural selection. Nevertheless radical separatism came to dominate the social sciences in the twentieth century, as noted earlier.

Today many contemporary theorists accept the views that were first developed in Roe and Simpson's *Behavior and Evolution* (1958) and Dobzhansky's *Mankind Evolving* (1962), which stressed the mutual interdependence of human nature and human behavior. It is obvious that there are unique aspects to human cultures. However, most theorists today seem to agree that the sociocultural category of adaptation is not unique to humankind, is not independent of biological evolution, is not unconstrained by biological imperatives, and should properly be added to Huxley's list as a class of biological adaptations. (See especially Wilson 1975; Barash 1977, 1986; Alexander 1979; Bonner 1980; Cavalli-Sforza and Feldman 1981; Corning 1983; Boyd and Richerson 1985; Durham 1991; Smith and Winterhalder 1992). First, many species have the rudiments of culture, at least according to Bonner's reasonable definition (the transfer of information by behavioral means, especially via social learning and teaching). Second, the functional products of culture -- organized physical structures and social processes -- have survival relevance and may therefore be instrumentalities of natural selection (properly understood). As Bonner writes, culture is "as biological as any other function of an organism, for instance respiration or locomotion" (1980:11).

To be sure, many cultural adaptations in human societies do not involve a direct, conscious pursuit of biological/adaptive ends. These may be the farthest thing from our minds as we struggle with rush-hour traffic, income tax forms, final exams, or deadlines at work. In cultural adaptation, where most of our conscious efforts are focussed, biological needs and purposes are often served in oblique and roundabout ways -- and may even be ill-served. There is a very imperfect fit between what serves biological adaptation and the processes of sociocultural adaptation; in other words, there are many "degrees of freedom" and the potentiality for a disjunction to occur between our cultural practices and their biological/survival consequences. A great many factors -- lack of information, bizarre social customs, destructive

economic practices, malevolent political forces -- may limit or constrain biological adaptation in humankind. If this were not the case, an adaptationist perspective and the “traditional” social science paradigm would be isomorphic -- end of discussion. For instance, the Bena Bena of highland Papua, New Guinea, have a taboo against eating either chicken or eggs, which are plentiful in their environment, even though the population suffers from a protein deficiency (Edgerton 1992). Or consider the Shakers, a small religious sect in the United States during the 19th century whose strict celibacy rule guaranteed their ultimate extinction.

Furthermore, human cultures often display a mirror-image of biological adaptedness -- traits or behaviors which are strictly-speaking “maladaptive” and may significantly lower biological fitness. This was documented extensively by anthropologist Robert Edgerton in his important study, *Sick Societies* (1992). As Edgerton puts it (paraphrasing George Orwell's famous line): “All societies are sick, but some are sicker than others” (p.1). Even when a population/society as a whole may be reasonably well-adapted, Edgerton notes, there are likely to be some practices or behaviors that are harmful to health, well-being and reproductive success. This is equally true of the “folk societies” studied by anthropologists and of contemporary Western societies. In his extensive and detailed review of the evidence, Edgerton cites the following maladaptive practices, among others: infanticide, torture, wife-beatings, witchcraft, human sacrifice, lethal competition for women, patterns of feuding and revenge, female genital mutilation, female foot-binding, rape, homicide, suicide, slavery, drugs, alcoholism, smoking, celibacy, and environmental pollution, not to mention many dysfunctional food and health care practices that increase infant mortality, reduce life-expectancy and/or lower personal productivity. Some societies, in fact, seem to be systematically maladapted. Edgerton identifies both historical and contemporary examples, including the Tasmanians, the Siriono, the Montegrano (Italian farmers), the Mayans and the inhabitants of Duddie's Branch in Eastern Kentucky, among others. At various times over the course of human history, entire populations have disappeared: The Hopi, Maasai, Maori, Papago, Yahi, and many others.⁴

Accordingly, biological adaptation (and its antipode, maladaptation) are “variables” for humankind just as they are for any other species.⁵ Adaptation involves much more than simply “filling our bellies,” as one critic of an adaptationist paradigm charged, and even in affluent Western societies the provision of adequate food and shelter are problematical for a significant number of people (Riches 1997). But more to the point, the problem of meeting basic survival and reproductive needs is an imperative for every one of us, whether we are aware of it, or care about, it or not. In fact, our biological needs routinely impose themselves on the daily rhythms of our lives. And if our basic needs are not met, there will be significant biological/adaptive consequences, not to mention psychological disturbances. What the value-relativists overlook is the fact that survival and reproduction are inescapable daily problems for all of us; we must actively pursue the meeting of our survival and reproductive needs or we will fail to do so. In this light, an economic science that is focussed exclusively on the psychology of human preferences/satisfactions and is studiously indifferent to the bio-logic of adaptation excludes by fiat a bedrock source of psychological motivation and causation in economic life.

THE PROBLEM OF MEASURING ADAPTATION

The core analytical challenge, then, is how do we measure adaptation? The ultimate biological criterion of adaptation is Darwinian “fitness”. Traditionally, this has been defined as the ability of an individual to produce viable progeny, or of an interbreeding population to reproduce itself. However, in recent years the concept of inclusive fitness (the summed proportion of one's own genes shared by close relatives as well as progeny) has been increasingly favored as a more satisfactory measure. In population biology, which dominated evolutionary theorizing during the middle years of this century, the primary tool used to measure adaptation was (and is) the “selection coefficient,” a quantitative measure of the *relative* reproductive efficacy of different genotypes in discrete breeding populations (demes). This rigorously analytical approach has been widely used in laboratory and field studies of microevolutionary change. However, the problems involved in applying this approach to the larger evolutionary process, including sociocultural evolution in humankind, are manifold. Only recently have biologists come to appreciate the complex relationship between adaptation at the micro level (individuals) and at higher levels of organization (trait groups, social organizations, demes, species, ecological communities). Yet in dealing with complexly organized species such as humankind, nothing less than a multi-leveled approach will do. The most important unit of adaptation in humankind must often be defined in relation to units of economic and political organization -- that is, units of functional interdependency -- that go beyond anything in the rest of nature. By the same token, there has been a growing appreciation in recent years of the complex relationship in humankind between economic, social, psychological and biological measures of “well-being.”

These and other limitations in the classical formulation have prompted calls for a less restrictive approach to measuring adaptation in *Homo sapiens* (e.g., Coelho, et al. 1974; Hardesty 1977; Durham 1991; Smith and Winterhalder 1992). Various candidates have been proposed. There have been (1) efforts to develop criteria for defining and measuring the “optimal” population size; (2) attempts to specify in some concrete way the property of adaptability, or flexibility; (3) efforts to measure adaptive functions directly; and (4) applications of bioeconomic analyses, particularly benefit-cost analyses utilizing various “proxy currencies” (such as time or energy).

Energy-oriented analyses were especially popular in the 1960s and 1970s. Two different approaches were utilized. One, following the lead of anthropologists Leslie White, Marshall Sahlins, Elman Service, and others, stressed the *amount* of energy capture in various cultures. The other, which includes most of the empirical studies done to date, stresses the *efficiency* of energy capture (or the benefit-cost ratios). The shortcoming with this approach is that energy capture is not the only important adaptive problem. Some of the constraints that have been encountered in energy-resource development, especially environmental constraints, testify to the multi-dimensional nature of the adaptation problem. From a biological perspective, energy throughputs are but a means to the larger end of sustaining and enhancing the overall life process. A relative scarcity of energy may be a limiting factor in societal development, in conformity with the “law of the minimum,” but there are many other limiting factors: protein, for instance; and water; and the basic “raw materials” that have also become requisites for sustaining complex economies.

Accordingly, many theorists believe that we need a more inclusive and multifaceted approach to measuring adaptation. The anthropologist Eugene Ruyle (1973) urged us to

concentrate on the “struggle for satisfactions.” The psychologist Robert W. White (1974), calling adaptation the master concept of the behavioral and social sciences, applied it to any means-ends, or goal-oriented behavior (though surely he did not mean to include actions that are biologically maladaptive). Others, especially ecological anthropologists, have adopted an explicitly biological orientation. Donald Hardesty (1977), for example, defined adaptation as “any beneficial response to the environment,” and it is clear from the context that he meant *biologically* beneficial. Anthropologist John Bennett (1976) conceptualized adaptation in terms of how human actors realize objectives, meet needs, and cope with conditions. Bennett wished to stress the cognitive/purposive elements in human behavior; he wished to treat adaptation as a goal-oriented process that is embedded in a cultural milieu. But he also made it clear that biological problems lie at the root of the process. Vayda and McKay (1975) were also concerned with the “existential game” of survival and reproduction; in an article whose objective was to identify “new directions” in ecological anthropology, they argued for an emphasis on “health” and various “hazards” and “stresses.”

More recently, the burgeoning new disciplines of evolutionary ecology and evolutionary psychology have focused on attempting to explain human behaviors in terms of Darwinian adaptation. Thus, the anthropologists Eric Alden Smith and Bruce Winterhalder (1992) stress that adaptation in human cultures involves a “propensity” toward Darwinian fitness, even though it may not reflect a tight fit with the Darwinian criterion of survival and reproductive success. (See also Richerson and Boyd 1992.) Meanwhile, the evolutionary psychologists John Tooby and Leda Cosmides (1990:375) take the position that “present conditions and selection pressures are irrelevant to the present design of organisms and do not explain how and why organisms behave adaptively, when they do.” Evolutionary psychologists seek to explain present behaviors in terms of postulated “ancestral environments.” (The term “environment of evolutionary adaptation,” or “EEA” is also frequently employed in this context.) Needless to say, neither of these movements seek to measure adaptation per se. Rather, they aspire to account for various human behavior patterns in terms of their past/present contribution to adaptation.⁶

To our knowledge, there have been at least three noteworthy attempts in anthropology to operationalize a broadly-defined conception of adaptation. One is Raoul Naroll's *The Moral Order* (1983). Hoping to initiate a systematic science of cross-cultural evaluation (which he called “socioeconomics”), Naroll produced a data-rich comparative study of adaptation and maladaptation across all human societies. However, Naroll's purpose was not explicitly related to biological adaptation. His main concern was the cultural practices and core social values which support, or undermine, what he called the “moralnet” -- the moral and ethical framework which he held to be the foundation of any society. Naroll's agenda was frankly normative. His objective was to develop a set of “indicators” that could monitor the ongoing condition of the moralnet. Though the United Nations, the World Bank and other agencies publish data on the needs and adaptive problems of various countries, Naroll asserted that there was no “scoreboard” for the overall status of the global moralnet. His goal in developing such a scoreboard was to provide a policy/planning tool for “the creation of a stable human world order,” which he called “the deepest historical task of our times” (p.20). His proposed indicators for monitoring the moralnet included suicide, divorce, child abuse, mental illness, alcoholism, drug abuse, and crime, among others. Naroll also developed a summary index of the quality of life in these terms that allowed him to rank the performance of various nations.

While *The Moral Order* was an impressive effort and a useful source of comparative data on adaptation, from our perspective it ultimately amounts to a partial view of the overall

adaptation problem. It is a tool for assessing one important aspect of biological adaptation in human societies. From a strictly biological adaptation viewpoint, the moral and ethical framework of a society is a means (an “instrumental need,” in our terminology) that serves, or ill-serves, the broader adaptive needs of a society and its members.

Another noteworthy effort to apply the concept of adaptation in anthropology is the theoretical program of Benjamin Colby and his co-workers, which is concerned with the concept of “adaptive potential” (see Colby et al., 1985, Colby 1987). Colby defines the term adaptive potential broadly (it includes “altruism” and “creativity”, as well as what Colby calls “adaptivity”), and it is seen by Colby as a basis for developing predictors of adaptation (he prefers the term well-being), including physical health, satisfaction and happiness.

More recently, the concept of adaptation was discussed in some detail by Edgerton in *Sick Societies* (1992), although his primary concern, as noted above, was with adaptation's antithesis -- maladaptation. Edgerton notes that the terms “adaptive” and “maladaptive” can have various meanings, depending upon which criteria are used and which “level” of cultural organization is involved -- individuals, families, groups, or societies. By the same token, the causal dynamics of maladaptation are both multi-levelled and multi-faceted. Some forms of maladaptation are the direct result of genetic influences that predispose an individual to poor physical or mental health, ranging from Parkinson's disease and Down Syndrome to schizophrenia and manic-depressive psychosis. Other forms of maladaptation involve personal behavioral patterns with significant health or mortality implications, from smoking to high-fat diets. Still other forms involve harmful cultural practices -- say, unhealthy or highly stressful working conditions. As Jerome Barkow points out in his influential book, *Darwin, Sex and Status* (1989), maladaptive cultural traits can also occur when there are environmental changes and the population fails to respond effectively, or when shortsighted ecological practices lead to environmental destruction, or when powerful elites serve their own interests in such a way as to harm others in the community.

Edgerton in his study ultimately adopts three “self-evident” criteria for cultural maladaptation at the societal level: (1) the outright failure of a population to survive; (2) a context in which a sufficient number of the population are deeply enough dissatisfied with the status quo to threaten the viability of the society and its institutions; and (3) when a cultural practice severely impairs the physical or mental health of a population, so that its members cannot adequately meet their own needs or maintain their social and cultural system (p.45). (In the “Survival Indicators” paradigm, the emphasis will be on the third of Edgerton's three categories -- but we also adopt a multi-level approach.)

Closely related in spirit to these anthropological writings but very different in its disciplinary focus is the literature in the field of welfare economics, and especially the work related to the concept of “well-being.” While the term “welfare” has a long and distinguished history in economic theory, it has been used in widely varying ways over the years. One tradition is associated with the orthodox neo-classical formulation, which seeks to derive individual and collective well-being from the sum of individual “utility functions” or subjective “satisfactions” (see especially the discussions in Sen 1982, Elster and Roemer 1991 and Hanley and Spash 1993). Others define welfare in terms of the preferences or goals of some collective entity -- an organization, agency, or polity (e.g., Faber and Proops, 1990, who utilize a multi-level approach). Still others have advanced various external criteria, from GNP per capita to average life expectancy (e.g., Streeten 1981).

Jon Elster and John Roemer (1991), in introducing the second volume of an important collection of conference papers concerned with interpersonal comparisons of well-being, point out that there are a number of complex issues associated with the concept, namely: (1) how do you define it? (2) how do you validate it? (3) how do you measure it? and (4) how does the analyst's values or goals affect the answers to questions 1-3? (See also Elster and Hylland 1986.) Thus, interpersonal comparisons of well-being might be used variously to achieve distributive justice, or to establish some "intersubjective" standard for measuring well-being, or to explain economic behavior when interpersonal comparisons are among the factors that are influencing the actors themselves (i.e., when keeping up with the Joneses is an important motivator). Significantly, many of the participants in the well-being conference objected to the use of any purely subjective measure of psychological "satisfaction" as a standard, without regard for the objective situation. Two of the contributors to the conference, James Griffin and Thomas M. Scanlon, argued strongly for more "impersonal standards" that are based on widely-shared values. Indeed, Scanlon observed that the very process of evaluating well-being is value-laden, no matter which standard is used. Scanlon's preferred alternative was to construct "a more concrete conception of welfare in terms of particular goods and conditions that are recognized as important to a good life even by people with divergent values" (Scanlon 1991:39).⁷

Perhaps the best-known attempt to construct such a framework is philosopher John Rawls's *A Theory of Justice* (1972), which has inspired an enormous critical literature (pro and con). Briefly, Rawls attacks relativistic notions of justice and equity and sets out to develop a "universalistic" foundation. Using a highly-contrived "thought experiment" that is reminiscent of the social contract theorists, Rawls posits a negotiation process which, he claims, could be expected to produce a shared interest in the mutual provision of what he calls "primary goods" - that is, basic "rights and liberties, opportunities and powers, income and wealth" (1972:92-93). Rawls sees his primary goods as necessary prerequisites to being able to formulate any other life goals and to act upon them. Because all participants in this imaginary negotiation are required by Rawls to come to the bargaining table with a shared understanding about the world but behind a "veil of ignorance" about their own pre-existing personal interests, the game is actually rigged: everybody must start out "equal" in terms of perceived needs and presumed benefits. Rawls calls this the "original position," but it is obviously a very hypothetical construct, which various critics, both on the political left and the right, have attacked.⁸ (There is, in fact, something a bit disquieting about the notion that willing consent to a universal concept of justice may be possible, but only if people are kept in ignorance of their real-world stakes.)

The movement toward objectification of welfare economics has been given further impetus by the prolific and important theoretical work of Amartya Sen and various colleagues over the past three decades (see especially Sen 1982, 1985, 1992; also Nussbaum and Sen 1993). In a series of writings that date back to the 1970s, Sen has mounted a major assault on the utilitarian, subjectivist model of well-being. To some extent paralleling and expanding the arguments of Rawls, Sen challenged the adequacy of various "psychological" formulations of welfare that rest on desires, tastes, subjective utilities, or what have you. Sen charges neo-classical economics with circularity, vacuity, gross oversimplification and the use of psychological premises that are without foundation. Noting, for example, that "sympathy" and concern for others can also affect a person's welfare, or that individual welfare functions can be interdependent (as highlighted in game theory), or that social commitments may affect behavior, Sen argues that a narrow, materialistic concept of "self-interest" is not a sufficient definition of behavioral motivation, much less well-being. Furthermore, Sen points out, consistency in

making choices is a pretty weak definition of rationality. In one famous passage from his Herbert Spencer Lecture at Oxford University in 1976, entitled “Rational Fools,” Sen concludes: “The *purely* economic man is indeed close to being a social moron. Economic theory has been much preoccupied with this rational fool decked in the glory of his *one* all-purpose preference ordering. To make room for the different concepts related to his behaviour, we need a more elaborate structure” (1982:99).

Sen does not try to define what the end-state should look like for any given individual but rather directs our attention to the *means* that are necessary for setting and pursuing personal goals. However, in contrast with Rawls, who was concerned about the “goods” (say food) that are needed to create various “opportunities”, Sen focusses on the “capabilities to function” -- the nutritional benefits of food versus food per se. Sen describes it as “a particular approach to well-being and advantage in terms of a person's ability to do valuable acts or reach valuable states of being” (Sen 1993:30). In the current political jargon, Sen's focus is on “empowerment” rather than a person's subjective sense of satisfaction, which, as Sen notes, may or may not be concordant. Sen tells us that the functionings which may be relevant for well-being can vary from “elementary” ones like escaping mortality, morbidity, or hunger, to more “complex” and subtle conditions such as achieving self-respect or enjoying social interactions. However, Sen demurs from proposing “just one list of functionings” (quoted in Nussbaum 1988:152).

Sen also addresses the issue of poverty and “basic needs” in his framework. He speaks of a subset of capabilities which he calls “basic capabilities,” and he defines these as “the ability to satisfy certain crucially important functionings up to certain minimally adequate levels” (1993:41). Noting the extensive literature in recent years on the concept of basic needs (see below), Sen argues that the basic capabilities approach is compatible with a basic needs approach and can greatly improve on the use of income measures for defining poverty.

Sen's theoretical stance can perhaps be illustrated with the following diagram (inspired by Doyal and Gough, 1991, but significantly modified):

((FIGURE I GOES HERE))

A final point is that Sen clearly recognizes the concept of “basic needs.” Indeed, he and various colleagues have been much concerned about such pressing real-world problems as hunger and global poverty (e.g., see Drèze and Sen 1989; Drèze, Sen and Hussain 1995). And yet, Sen's paradigm does not provide any explicit theoretical basis for his distinction between “capabilities” and “basic capabilities.” Like so many other treatments of the concept of basic needs, its status in Sen's paradigm is at once intuitively obvious and theoretically adrift. In short, what is missing in Sen's work is a way of grounding the concept of capabilities (requisites) that is both independent and directly measurable. Sen has demurred from elaborating his concepts in more specific detail, so they remain elusive as analytical tools for real-world situations. Sen leaves that task to others. How, then, can we apply and test Sen's concepts? As Scanlon (1993) argues, what is required is a “substantive list” of the elements that are needed to sustain life and make it valuable. Scanlon calls for an “objective index” of well-being that can pass two tests: (2) adequacy and (2) practicality.

BASIC NEEDS AND THE SOCIAL SCIENCES

Actually, concerted efforts to measure the quality of life more objectively date back at least to the emergence of the so-called “social indicators” movement in the 1960s. While the origins of this movement could perhaps be traced to the sociologist William F. Ogburn's *Social Trends* (1929), contemporary researchers generally identify Raymond Bauer's *Social Indicators* (1966) as the catalyst for the more recent and sustained efforts in this area. Following the publication of Bauer's path-breaking book, social indicators research enjoyed a period of rapid, well-funded growth.

Much of the impetus for the creation of a distinct body of data called social indicators arose out of a reaction against our heavy dependence on economic indicators as measuring rods for societal progress or well-being (especially the GDP and per capita income). The goal of the social indicators “idealists,” as they were sometimes pejoratively called, was to develop a broad definition of the “general welfare” that subsumed economic growth and also accounted for various diseconomies, or economic externalities. Perhaps the most frequently quoted statement of this energizing vision (at least in the U.S.) can be found in *Toward a Social Report* (1969), a benchmark report sponsored by the (then) U.S. Department of Health, Education and Welfare and written principally by economist Mancur Olson:

A social indicator may be defined to be a statistic of direct normative interest which facilitates concise, comprehensive and balanced judgments about the condition of major aspects of a society. It is in all cases a direct measure of welfare and is subject to the interpretation that, if it changes in the “right” direction, while other things remain equal, things have gotten better or people are “better off” (p. 97).

Just as economists had been able to articulate a theory of economic activity that established a framework for aggregating data on the production and consumption of goods and services, so the social indicators proponents aspired to develop a coherent system of objective measures of well-being. The goal was not only to augment and improve an ad hoc collection of social statistics that already were being gathered for sometimes obscure or narrow purposes. The hope was that it would also be possible to create a comprehensive statistical portrait, a tapestry by means of which we could view a society at once as an integrated whole and in all of its major facets.

Needless to say, the concept of “basic needs” has also played an important role in the social indicators movement. In addition to the present author's early work on measuring basic needs (Corning 1970, 1975, 1978), which was little-noticed at the time, there was a study by the Stanford Research Institute (1975) for the U.S. Environmental Protection Agency concerning “Quality of Life Minimums” (QOLMs), which analyzed existing political standards in this area; also, the important work sponsored by the Overseas Development Council on a “Physical Quality of Life Index” (PQLI) (Morris 1979); also, the voluminous writings on a basic needs strategy for world development emanating from the World Bank (Streeten 1977, 1979, 1981, 1984; Streeten and Burki 1978; Hicks and Streeten 1979; Streeten et al., 1981); also the manifold efforts of various United Nations agencies since 1975 (see especially the so-called McHale and McHale Report, 1978).⁹

Unfortunately, none of these efforts was rigorously grounded theoretically. All rested on

intuitive (albeit often compelling) pragmatic criteria. Although there was considerable overlap among the various attempts to formulate a shopping list of basic human needs, there were also significant differences among them, not surprisingly. Hicks and Streeten (1979), for instance, included nutrition, education, health, sanitation, water, and housing. Geist (1978) included among his basic “normative criteria” for human health the social milieu, education, nutrition, exercise, natural surroundings and emotional security. Mazess (1975), a specialist in high-altitude peoples, had a physiologically oriented list of nine “adaptive domains”. (See also Streeten et al., 1981; Streeten 1984; Miles 1985; Stewart 1985.)

Attacks on the social indicators proponents came from the many social scientists who claimed that well-being is necessarily a personal and subjective affair (value relativism). Included in their number were the many workers in the survey research field who, for obvious reasons, had a strong preference for “perceptual indicators” of well-being. The Survey Research Center's director, Angus Campbell, for instance, noted “the obvious fact” that “individual needs differ greatly from one person to another and that what will satisfy one will be totally unsatisfactory to the other. Indeed, the same individual may find the same circumstances thoroughly unsatisfactory at one stage of his life but quite acceptable at a later stage” (Campbell et al., 1976:9).

Likewise, the sociologist Erik Allardt (1973:267, 272) asserted that: “A level of need satisfaction defined once and for all has hardly any specific meaning....To a large extent, needs are both created by society and culturally defined, meaning that the satisfaction and frustration of needs have to be studied in a systematic context in which societal feedback processes are considered.” Rist (1980:241) was even more dogmatic: “Needs are constructed by the social structure and have no objective content.”

In the same vein, the writers of a synthesis volume on the quality of life, published by the U.S. Environmental Protection Agency in the 1970s, claimed that: “Quality of life means different things to different people. It can be stated that at the present no consensus exists as to what it is or what it means...QOL is viewed by many as not applying to the nation as a whole. In their view, the only way QOL could be applied at the macro-level would be by homogenizing the country and forcing everyone to accept the same value standards.”(1973:1,11).

Finally, advocates for Third World countries attacked the very concept of social indicators as an imperialist tool that was meant to deflate the legitimate economic aspirations of the developing countries and/or deflect attention from the then-popular focus on redistributing wealth between the Northern and Southern Hemispheres (see Miles 1985; Wisner 1988). Still others accused the social indicators advocates of being politically naive. It was not realistic, they claimed, to think that the powers that be, especially in Third World countries, would allow the development and publication of such politically-sensitive social outcome statistics.

Len Doyal and Ian Gough (1991) conclude in their important book on basic needs (see below) that: “The movement for social indicators and human development appears to have run into the sand...The decline and fall of the social indicators/human development movements was due first and foremost to the lack of a unifying conceptual framework” (p. 154). True, but that was only part of the reason. As Nussbaum and Sen (1993:4) point out: “The search for a universally applicable account of the quality of human life has, on its side, the promise of greater power to stand up for the lives of those whom tradition [read economic and political forces] has oppressed or marginalized. But it faces the epistemological difficulty of grounding such an

account in an adequate way, saying where the norms come from and how they can be known to be the best.” Doyal and Gough agree: “The earlier theoretical innovations...all suffer from one overriding defect. None of them demonstrates the universality of their theory, nor, the other side of the same coin, tackles the deeper philosophical questions raised by relativism” (ibid). In short, the search for a satisfactory metric, or measuring rod for well-being and the quality of life has been severely hampered by the lack of a compelling theoretical foundation.

BASIC NEEDS AND ADAPTATION

We propose that the concept of basic needs can be grounded in the biological problem of survival and reproduction. To our knowledge, the first social scientist to espouse in significant detail a basic needs approach to adaptation was the anthropologist Bronislaw Malinowski (1944). For Malinowski a society is preeminently an organized system of cooperatively pursued activities. It is purposive in nature, and its purposes relate to the satisfaction of basic needs -- i.e., “the system of conditions in the human organism, in the cultural setting, and in the relation of both to the natural environment, which are sufficient and necessary for the survival of the group and organism” (p. 90).

In contrast with the hyphenated structural-functionalism (so-called) of Comte, Durkheim, and their descendants, Malinowski's “pure functionalism,” like Herbert Spencer's before him, was concerned with relating the complexities of cultural behavior to “organic processes in the human body and to those concomitant phases of behavior which we call desire or drive, emotion or physiological disturbance, and which, for one reason or another, have to be regulated and coordinated by the apparatus of culture” (p. 74). The structure that Malinowski developed for his essentially biological functionalism is reproduced here in synoptic form:

Table I. Malinowski's Framework

Basic Needs		Cultural Responses	
1.	Metabolism	1.	Commissariat
2.	Reproduction	2.	Kinship
3.	Bodily comforts	3.	Shelter
4.	Safety	4.	Protection
5.	Movement	5.	Activities
6.	Growth	6.	Training
7.	Health	7.	Hygiene

Malinowski drafted this listing only for the sake of simplicity; his textual discussion provides more detailed and more sophisticated treatment. For example, his “health” need has a dual significance. In a narrow sense it refers to the absence of physical impairment or sickness, but in a broader sense it is a condition that is affected by all the other categories (see below). Malinowski also went on to show that these primary needs give rise to a set of “derived” societal needs. (Our concept of “instrumental needs,” discussed below, is at once similar and different.)

Malinowski used the fork as an example. Can anyone doubt that the function performed by a fork (a “capability” in Sen's terminology) is a significant part of the explanation for the existence and the design of this commonplace cultural artifact? Yet the fork is not a cultural universal. So more information is needed to account for how the fork was invented and diffused and why it is used in some cultures and not in others.

In light of contemporary anthropological theory (not to mention the technical literature on social indicators), one finds many shortcomings in Malinowski's formulations (see especially the critique in Harris 1968). One might take exception, for instance, to Malinowski's claim that his basic needs approach was the only valid set of external, or “etic,” criteria for cross-cultural classification and comparisons (1944:176). Nevertheless we believe that his basic approach was sound, indeed essential to a view of human societies that is in touch with the biological fundamentals.

Another major progenitor of the basic needs approach is the humanistic psychologist Abraham Maslow (1954; 1962; 1967). Maslow's famous hierarchy of human needs involved nothing less than a theory of human nature and motivation. According to Maslow, the human being is neither a behavioral sponge (as the Behaviorists implied) nor a tormented neurotic (as some Freudians hold) but a natural innocent endowed with an array of biologically based needs that ascend hierarchically through five categories from “deficiency motivations” (which derive from such physiological needs as food, water, shelter, sleep, sex) to “being motivations,” at the apex of which is “self-actualization,” a kind of beatific state in which one achieves the full use of one's talents and potentialities. Maslow's five categories are: (1) physiological needs, (2) safety needs, (3) “belongingness” and love needs, (4) esteem needs, and (5) self-actualization or “growth” needs (1954:80ff).

Despite its popularity among various psychologically oriented social scientists, Maslow's hierarchy per se gained only marginal status among experimental psychologists because it did not have empirical support. Although it has been frequently invoked to justify a particular moral position or to anchor a model of social behavior, such uses are pseudoscientific. Fitzgerald concludes: “Most psychologists regard the purely empirical study and validation of a hierarchy of needs in Maslow's sense as presenting immense and (perhaps) insurmountable problems. It is clear that insofar as a potentially verifiable aspect can be abstracted from this ambiguous amalgam, Maslow's theory of human needs has not been empirically established to any significant extent” (1977:46). Nevertheless, Maslow's more expansive vision of “human nature” had a kernel of truth, as we shall argue below.

Another attempt to create a theoretical foundation for the concept of basic needs, and a major contribution to the debate, is Doyal and Gough's book, *A Theory of Human Need* (1991). As stated in their introduction, their goal was a “coherent, rigorous theory of human need.... We shall argue that basic needs can be shown to exist, that individuals have a right to the optimal satisfaction of these needs and that all human liberation should be measured by assessing the

degree to which such satisfaction has occurred” (pp.3-4).

Doyal and Gough's theory has a frankly normative aspiration -- in their words, to undergird “the moral importance of the needs of individuals,” and to support “the maximum development of the individual as a person” (p.5). They also proclaim themselves to be strong advocates for a “political economy of needs-satisfaction” as a constraint on the free play of market forces. Although their theory is convergent (and to a degree compatible) with the Survival Indicators paradigm, it also differs in some significant respects (most especially in its theoretical foundation and normative implications). It is important, therefore, to describe and discuss the Doyal and Gough theory very briefly, although we cannot do full justice here to their detailed explication and analyses.

Doyal and Gough begin with a full-dress rebuttal to the neo-classical/relativist attacks on the concept of basic needs. First, they point out that the relativist position is fatally compromised once it is acknowledged that there is such a thing as “perfect knowledge” (an objective external state that transcends the individual's subjective perceptions); or when it is recognized that wants can be manipulated externally and may not reflect a person's “true” wants; or if it is conceded that market forces may distort a person's “real” wants. The relativist claim to moral superiority (allegedly because it is the road to greater personal freedom) also leads to a *reductio ad absurdum* unless hedged with externally-imposed limits, or constraints. Do our children (or worse, our teenagers) always know what is best for them? Should we indulge the strongly-held preferences of rapists, bank robbers, swindlers and other anti-social actors? In fact, the argument for a moral order as a necessary (objective) constraint and precondition for economic and political freedom goes back to Adam Smith (and to Plato and Aristotle before him).

Doyal and Gough also address the problem of defining basic needs. To be sure, the term is used in many different ways, from psychological motivations or “drives” (*sensu* Maslow) to strictly physiological requisites (food, water, sleep, waste elimination) to any conceivable want or preference whatsoever. Following the lead of philosopher Garrett Thomson (1987) in his thoughtful monograph on the concept of “needs,” Doyal and Gough argue that the bedrock implication of the term should be that some specific “harm” will occur if the posited need is unfulfilled, whether we are aware of it or not. (Galtung, 1980, advanced a similar idea under the term “disintegration”.) Furthermore, some needs are universal. To quote Thomson (1987:27): “Fundamental needs are inescapable; we cannot escape the fact that we must all ail and eventually die without [among other things] food, water, and air.” Accordingly, Doyal and Gough focus on “goals which are instrumentally and universally linked to the avoidance of serious harm” (1991:42).

The concept of objective and universal human needs is thus central to their theoretical task. Doyal and Gough argue that: (a) our basic needs are equally needed by all (within a clearly bounded range of variation); (b) we are all equally harmed if these needs are not satisfied; (c) it constitutes an injustice if these needs are not fulfilled; (d) our needs take normative precedence over non-essential “wants”; and (e) most of us do desire the satisfaction of our basic needs. (The latter point is linked by Doyal and Gough to the recent rediscovery of “human nature” by the social sciences. However, they rightly stress that biological influences shape but do not determine our choices and behaviors.)

In keeping with their normative agenda, a conspicuous feature of Doyal and Gough's argument is that “harm” in their terms refers to the broad concern for human fulfillment -- most

importantly “participation” in the life of the community -- and not biological adaptation strictly speaking. Thus, Doyal and Gough remain within the Western, humanistic moral tradition, which supports human aspirations as ends in themselves. A “basic need” in their terms refers to the preconditions for the fulfillment of our “being motivations” (in Maslow's terminology), in addition to bottom-line survival. Indeed, Doyal and Gough cite an array of theorists whose writings are supportive of this viewpoint, including Plato and Aristotle, Kant, Gewirth, Rawls, Habermas, Sen, Thompson, Braybrooke, Dworkin, and others. (Maslow could also be added to their list.) So, in the final analysis, their use of the term basic needs overlaps with, and embraces, the broader aspiration for human self-actualization and well-being. It is really a theory of well-being disguised as a theory of basic needs.

Accordingly, Doyal and Gough posit two global “basic needs.” One is “physical health,” which encompasses physical survival but means much more to them than “mere” survival. (They cite the so-called “biomedical model” of health as a reference point and claim to be operationalizing the famous WHO definition of health as “a state of complete physical, mental and social well-being, not merely the absence of disease and infirmity.”) The second basic need, Doyal and Gough claim, is “autonomy”, by which they mean (a) a person's level of “understanding”, (b) his or her psychological capacity to make choices and act upon them, and (c) objective opportunities to act upon these choices, with an emphasis on participation in social activities (see Figure II below). While they acknowledge wide personal and cultural differences both in perceptions about autonomy and in the forms of expression that autonomy may take, Doyal and Gough insist that meaningful evaluations can be made both within a given culture and comparatively between cultures in terms of the relative degree of need-satisfaction. The concept of “optimum need-satisfaction” is universally applicable, they claim, whatever may be the differences in specific cases.

((FIGURE II GOES HERE))

In order to satisfy these two broadly-defined basic needs in any given society, Doyal and Gough also posit a set of “intermediate needs,” which they see as encompassing the range of specific “need-satisfiers” (a concept similar to Sen's notion of “capabilities”). “Basic needs, then, are always universal but the specific satisfiers are often relative” (1991:155). These “satisfiers” generally refer to the goods and services provided by the economic, socio-cultural and political systems of a given society. However, embedded in each specific satisfier (say a particular type of food-stuff) is what Doyal and Gough call their “universal satisfier characteristics” (i.e., the nutritional properties of the food). It is those universal satisfiers (what Sen refers to as “capability characteristics”) that Doyal and Gough identify as the basis for their concept of “intermediate needs.” To use a concrete example, the specific “need-satisfier” in the package of snack-bars that I currently hold in my hand corresponds to its list of ingredients, but the “universal satisfier” is the percentage of various daily food values that are documented in the table of “Nutrition Facts” printed on the side of the box.

Doyal and Gough note that there are many different lists of basic needs. As Braybrooke (1987) has pointed out, a large “family of lists of needs” has resulted from the various social indicators projects sponsored by international agencies like the International Labor Organization (1976), national governments like Sweden (Erikson 1993), and private organizations like the OECD (1976). There is even a consolidated list produced by Braybrooke himself (1987:33-36).

By contrast, Doyal and Gough claim that their theory provides clarification because it dictates which intermediate needs (read universal satisfiers) are important in any culture for the satisfaction of their two overarching basic needs. “The only claim for inclusion...is whether or not any set of satisfier characteristics universally and positively contributes to physical health and autonomy” (p. 158). Their list of eleven intermediate needs includes:

- | | |
|--|--|
| 1. Nutritional Food and Clean Water | 7. Protective Housing |
| 2. A Non-hazardous Work Environment | 8. A Non-hazardous Physical Environment |
| 3. Appropriate Health Care | 9. Security in Childhood |
| 4. Significant Primary Relationships | 10. Physical Security |
| 5. Economic Security | 11. Appropriate Education |
| 6. Safe Birth Control and Child-bearing | |

Doyal and Gough then proceed to support their claims with a detailed, two-chapter review of the efforts that have been made by various workers to develop standards and measurement techniques related both to their two postulated basic needs and to the array of supportive intermediate needs. Their conclusion: “One thing, we hope, is clear. Our theory of human need has a purchase, albeit a tenuous one, on existing evidence of need-satisfaction throughout the world” (p.221).¹⁰

One other “historical” use of the concept of basic needs should also be noted in passing. Even though it has been regularly debunked by cultural relativists, the concept has nonetheless played an important political role in the development of the so-called Welfare State in Western societies over the past century. Beginning in 1883, when Chancellor Otto von Bismarck established the first “social insurance” program in the then new German nation-state, an appeal to basic needs has figured in the development of a broad spectrum of social programs in Western countries. These programs include workmen's compensation, public assistance, social security, health insurance, and the minimum wage, among others. The concept was also an explicit element of the New Deal philosophy of Franklin Roosevelt. As FDR put it in one of his famous fireside chats: “One of the duties of the State is that of caring for those of its citizens who find themselves victims of such adverse circumstances as makes them unable to obtain even the necessities of mere existence without the aid of others. That responsibility is recognized by every civilized nation...” Thus, it seems paradoxical, to say the least, that the concept of basic needs has been regularly invoked in connection with social policy and regularly rejected in social theory.

SURVIVAL INDICATORS

The Survival Indicators approach is not grounded in any normative concern or public policy objective. It is grounded in the empirical problem of biological survival and reproduction (adaptation) for the human species. It attempts to measure the current status of an individual, or a group, or a population as objectively as possible with respect to this transcendent human concern. It is not about what ought to be -- about well-being or happiness. It is about basic needs, *sensu stricto*. It is addressed to the widespread criticism that the concept of social indicators, particularly in relation to basic needs, lacks a theoretical foundation. It does not seek

to promote any desirable political objective but rather to specify and measure human adaptation as precisely as possible. It does not contradict various ad hoc, pragmatic or normative approaches, nor is it antagonistic to the concept of well-being. But it does have a distinctive analytical focus that seeks to rationalize and give logical coherence to the effort to measure relevant aspects of the human condition in a systematic way. Finally, it is designed for use not only with the many millions of people who daily experience the deprivation of their basic needs, or who have a genuine anxiety about the problem, but also for those fewer among us whose basic needs are so well provided for that we may be complacent, or even oblivious to the problem. To repeat, biological adaptation is a problem that exists for all of us, whether we are aware of it, or care about it, or not.

The Survival Indicators paradigm has its roots in some empirical work that was done in the 1970s on the relationship between income and basic needs-satisfaction for welfare recipients in the State of California (Corning 1970, 1975, 1978). An initial attempt to develop a Survival Indicators framework, and an attempt to formulate a master indicator of adaptation called the "Population Health Index," was presented in the author's 1983 book called *The Synergism Hypothesis: A Theory of Progressive Evolution*. (It should be noted in passing that the term "progress" was used in that volume with reference only to the evolution of functional complexity, not in any normative sense.) The Survival Indicators framework is also briefly described in Corning (1996b) and (1997a,b). The present rendering includes an elaboration and refinement of the original formulation.

In the Survival Indicators paradigm, the term **basic need** is used in the strict biological/adaptive sense as: **a requisite for the continued functioning of an organism in a given environmental context; that is, denial of the posited need would significantly reduce the organism's ability to carry on productive activities and/or reduce the probability of its continued survival and successful reproduction.** So defined, basic needs are not unique to humans alone; the term applies to all living things. Moreover, we agree with Thomson, Doyal and Gough and others that the term "need" connotes a requisite for lack of which significant "harm" will occur, but we specify the nature of that harm in bio-logical rather than moral terms - i.e., in terms of "normal functioning" and "productive activities" related to meeting basic needs. (For elaboration, see below.)

Several brief comments are in order with regard to this definition. One is that the concept of basic needs is not interpreted in a narrow, physiological sense. It is not just about food and water and waste elimination. Like Doyal and Gough (and Sen, Rawls, Edgerton, Naroll, Maslow, and Malinowski, as well as numerous researchers in the social indicators field), we recognize that "human nature," and the very nature of the human survival enterprise, entails cognitive/psychological needs and a need for social relationships of various kinds. But these are not ends in themselves. Most of us are dependent upon a "collective survival enterprise" of some sort; our needs are satisfied through socially-organized activities. More than that, the Survival Indicators paradigm recognizes that basic needs have a life-cycle -- a trajectory which includes growth and development, reproduction, child nurturance and aging. The longitudinal dimension of the survival enterprise, often overlooked in other paradigms, is reflected in several of the basic needs domains listed below.

A second point is that the term basic needs is used here in both of the senses described earlier under the concept of adaptation, which we have traced back to Huxley (1942). Here adaptation refers both to the functional requisites for survival and reproduction in a given

environmental context and to the specific means that may be required to do so. For example, we have a physiological need for a defined quantity of uncontaminated fresh water (a “primary need” in our terminology), as well as an “instrumental need” both for a source of fresh water and for appropriate technologies to enable us to satisfy this primary need -- what Sen would call a “capability” and Doyal and Gough would call a “satisfier”. We go beyond both of these important conceptualizations by attempting to specify in concrete terms the primary survival and reproductive needs that are served by various capabilities and satisfiers, and the linkages between them (the “substantive list” called for by Scanlon, 1993).

A related point is that the Survival Indicators paradigm involves a highly nuanced conceptualization of basic needs. In particular, we attempt to distinguish between (1) **primary needs**, (2) **instrumental needs**, (3) **perceived needs**, (4) **dependencies**, and (5) **wants** (or tastes and preferences). Basic needs refer only to the first two of these categories (primary and instrumental needs). Primary needs are irreducible and nonsubstitutable. One cannot substitute food for water, or sleep for sex (well, not as a rule). Primary needs coincide with the broad functional requisites for adaptation. (They include a number of what Doyal and Gough define as “intermediate needs.”) Instrumental needs, on the other hand, are the derived adaptive means (capabilities or satisfiers). Instrumental needs may be reducible to primary needs (may be subsumed), may be substitutable for various functional equivalents (e.g., beef, versus chicken or eggs) and may vary widely, depending on the precise adaptive context (internal, external and cultural).

Thermoregulation, for example, is a primary human need, but the instrumental needs for clothing, heating fuel, electric power and/or thermally insulated shelter will vary from one climatic environment and culture to another. Similarly, mobility is an irreducible primary need, but within that category there may be instrumental needs for horses, bicycles, snow shoes, automobiles or wheelchairs, depending upon the context. In fact, it could be argued that walking, though pancultural and biologically primordial in humankind, is not always essential -- not a primary need. There are cultural contexts in which various substitutes for walking are available, among them prosthetic devices, the services of others (caretakers and carriers), and transportation and communications technologies that provide functional equivalents. Walking can be viewed as a biologically evolved capability that is derived from a primary need, just as a compact body build or a thick layering of subcutaneous fat may represent physiological adaptations for cold climates that have evolved in relation to our primary need for thermoregulation. By the same token, cultures may significantly alter the adaptive value of various physiological adaptations like walking -- or, for that matter, running. Human technologies may also compensate for various physiological deficiencies, say myopia, or diabetes, or even a defective organ.

It is also important to distinguish between needs and so-called “drives”, or internal sources of motivation. Needs are functional requisites; drives are psychobiological mechanisms (and various correlates) that we may perceive as needs. Human sexuality involves a drive that we sometimes colloquially call a need, but in reality it is an evolved instrumentality for serving our primary reproductive need. The empirical distinction between the two concepts (need versus drive) is evident both in the practice of birth control and in artificial insemination. By the same token, a person may eat either more or less than is nutritionally-necessary in response to the promptings of hunger. Accordingly, in our paradigm the various motivational states (from whatever source), as distinct from basic needs, are categorized under (1) perceived needs, (2) dependencies, and (3) wants.

The litmus test for a primary need, according to this formulation, has nothing to do with whether or not the need is reflected in correlative psychobiological motivations (although most are). Nor does it matter that these primary needs vary -- as they do in systematic ways that are more or less well understood (see below). Rather, it matters how much they vary, why they do so, and with what consequences. Primary needs vary within a relatively narrow range, are pancultural (universal), cannot be substituted for one another or replaced by functional equivalents, are largely independent of our “higher” motivations and the specific environmental and cultural context, and may vary significantly as a result of biologically-based individual differences (notably including age) and somewhat less so in relation to the environmental and cultural context. But most important, they are tightly linked to the potential for doing “harm” in the biological/survival sense.

Instrumental needs serve the primary needs. Some instrumental needs are so pervasive as to be close to primary needs in their importance: e.g., exogenous energy, protective shelter, basic utensils and tools, clothing, language skills, and walking. Such instrumental needs are in fact the focal concern of many recent efforts to develop basic needs indicators. In our view, many of the items in these paradigms are not primary needs at all but actually refer to instrumental needs. Our intention here is not to slight instrumental needs or diminish their importance but to categorize them properly with respect to their functional significance for our analytical objective.

It should also be emphasized that instrumental needs can vary widely, depending upon the context. For instance, the instrumental need for a means of waste removal can range from dug latrines to open sewers to the latest high-technology waste treatment plants. Likewise, telephones and automobiles may be of little use in a simple folk society but may constitute a “need” in the strict sense of the term for people who live in a complex developed society. Also, some instrumental needs take the form of economic goods and services, while others relate to features of the cultural environment. Naroll's “moralnet”, for instance, could be viewed as an important instrumental need.

Finally, it is important to recognize that, over the long sweep of our cultural and technological evolution, our various primary needs have generated complex hierarchies of instrumental needs. Our need for mobility, for instance, has resulted not only in the invention of automobiles but in the creation of additional instrumental needs for auto mechanics, paved roads, stop signs, the oil industry, gas stations, highway patrols, traffic courts, and so on. In fact, many inventions have been catalysts for others; if necessity is the mother of invention, as the old saying goes, the reverse is also true; inventions are the mother of necessity. Moreover, many of our instrumental technologies involve complex networks of economic interdependency. Take away the tire industry, for example, and it would cripple the automobile and trucking industries and very likely devastate our economy.

Dependencies are induced, often non-survival-related needs, some of which may even be destructive (such as an addiction to heroin, alcohol, or sugar; or compulsive gambling; or smoking). Perceived needs are those desired objects that the individual thinks he or she needs, regardless of the actual situation. And wants reflect the individual's less urgent motivations, goals, and aspirations, very possibly unrelated any biological requisite. Of course, these categories often overlap. For example, a person's primary nutritional need for protein, carbohydrates, vegetables and various vitamins and minerals may lead to the selection of a particular instrumental need, or “satisfier” (say a Big Mac), which could also become a dependency if the person developed a strong psychological craving for Big Macs, or if Big Macs

were the only food available. The person might also accurately perceive Big Macs as an instrumental means and, what's more, might actually enjoy them.

A special word is in order here regarding the role of income as an instrumentality for basic needs-satisfaction. Income is often used as a surrogate social indicator, but there are many problems associated with this approach (see Goldstein 1985; Ram 1985; Sen 1985; Doyal and Gough 1991). Sen argues strongly against the use of an income-based measure of well-being. On the other hand, income is also a necessary prerequisite (a means) for meeting basic needs in a great many human societies, as numerous social indicators theorists have recognized (e.g., Selowsky 1981; Ram 1985; Doyal and Gough 1991; Erikson 1993; Erikson et al., 1987). It is therefore highly relevant as an instrumental need, even though it is inadequate as a summary measure of primary needs-satisfaction, much less of well-being.

The distinction between our category of “instrumental needs” and Malinowski's “derived needs” should also be pointed out. Malinowski's concept refers to the cultural arrangements upon which humans have become dependent -- that is, systems of economic co-operation, systems of rules and rule enforcement, educational systems, and political systems (1944:125 and passim). These derived needs include Radcliffe-Brown's structural functions and Talcott Parsons's functional requisites for social systems. In the Survival Indicators paradigm, by contrast, cultural modalities of various kinds are a subset of the much larger class of instrumental needs, only some of which are based on culture per se.

Likewise, it is important to draw a distinction between our Instrumental Needs and Doyal and Gough's “Intermediate Needs.” Recall that Doyal and Gough defined intermediate needs in terms of their postulated status as “inputs” to their two basic needs -- physical health and autonomy. The result, from our point of view, is a mixed bag that includes some primary needs (like food, water, and physical security), some instrumental needs (like education, health care services, shelter and a non-hazardous work environment), and some items that we find questionable (like access to cross-cultural knowledge). At bottom, the distinction between the two paradigms rests on how the concept of basic needs is defined.

There are several other preliminary points that should be mentioned briefly. First, primary needs vary, but not as much as the relativists imply. Nor are the variations a consequence of personal whim. The obvious case in point is nutritional needs, which are known to vary systematically (and to a substantial degree predictably) as a function of genetic and physical endowment, age, sex, reproductive status and levels of physical activity. (For a sophisticated model, which has been tested with various folk populations, see Leslie et al., 1984.) Indeed, our nutritional needs vary not just in terms of the number of calories but also in relation to a range of required nutrients. Nevertheless, adequate nutrition constitutes a universal primary need.

Second, a complex set of interrelationships exists among the various primary needs; all needs are not equally urgent at all times, and there is an implicit hierarchy. This circumstance greatly affects the organization of our behavioral systems and the patterning of our daily activity cycles. For example, if an individual's life or physical safety were suddenly threatened during a meal, it can confidently be predicted that the person would stop eating. Likewise, we routinely, and at times even mindlessly, interrupt other activities to respond to the promptings of hunger, thirst, fatigue, discomfort or pain, a physical threat, the need for waste-elimination, and the like.

Third, there are many interactions among our primary needs; even though they cannot be

reduced to one another, neither are they entirely independent. For example, communications (information flows) are at once an irreducible primary need and a prerequisite for the satisfaction of other primary needs -- nutrition, physical safety, physical health, effective nurturance of the young -- not to mention facilitating instrumental needs like gainful employment. Likewise, waste elimination is a primary need that can also impact on our physical health, just as a lack of proper nutrition, sleep, or satisfactory social relationships may affect a person's mental health, or physical health, or both.

Fourth, there are many potential conflicts between our needs. The obvious examples are situations where physical safety or physical health might have to be jeopardized in order to obtain food or other necessities, or where personal nutrition, health, and safety might have to be sacrificed for the sake of one's offspring. Other things being equal, however, the individuals who are best able to satisfy the entire gamut of primary needs, including those of their progeny, will be better adapted (*sensu stricto*) and more likely to be successful in reproducing well-adapted offspring.

Fifth, harking back to Elster and Roemer's concerns about the validation and measurement of any concept of well-being, it is important to distinguish between the analytical and measurement problems that are associated with determining more precisely what our basic needs are (and their functional relationship to survival and reproduction) and the more "applied" problem of how best to measure needs-satisfaction for the purposes of social intelligence and social indicators. Our knowledge in many basic needs domains is still far from perfect, and we do not underestimate the problems involved in establishing more precise criteria for each need. In some cases, it may be that surrogate measures such as personal income or an individual's perceptual self-assessment might suffice as an "indicator," as various researchers contend. But, in the end, even any "objective" measure will be only as good as the state of the art in the biological, behavioral and social sciences. Accordingly, we must view the Survival Indicators paradigm as a work in progress, not as the actualization of some Platonic ideal.

A further point is that the Survival Indicators paradigm is designed primarily to measure current adaptation. It is not explicitly future-oriented, even though it is certainly relevant to "adaptability" (*sensu* Colby and others). It is obvious, after all, that one factor in determining the future adaptability of an individual, or a population, is the current level of basic needs-satisfaction. However, the fact remains that the Survival Indicators framework is not designed to make forecasts. It cannot anticipate such contingencies as automobile accidents, lightning bolts, earthquakes, tsunamis, plagues, wars or asteroid strikes -- or the effects of global warming. It can only enable us to make various "if-then" predictions. For instance, the Survival Indicators paradigm can provide some guidelines for assessing future survival challenges; it can help us to calibrate the full dimensionality of the problem of future adaptation. We noted earlier that the world's population is expected to increase to perhaps 9.5 billion in 2050. This projection has served to focus our attention on the problem of how to affect a major increase in food production (roughly 60 percent), a formidable task. But this is only a part of the problem of providing for the basic needs of 9.5 billion people. We must also collectively provide for a comparable increase in the "satisfiers" for the entire spectrum of needs: of uncontaminated fresh water, adequate clothing, housing, fuel, waste disposal (and appropriate pollution control facilities), public health services, education, etc., not to mention the vast quantities of such instrumental needs as capital and raw materials of various kinds.

A related point is that a basic needs approach to measuring adaptation is not the same as

an explanation of culture in terms of basic needs (as Malinowski also insisted). Nor does it follow that every aspect of a cultural system is adaptive (as Edgerton has shown). A particular item of culture may be adaptive, neutral, or maladaptive in relation to basic needs. Some items may be more or less directly related to a particular need. (Following Maynard Smith's argument, would anyone doubt the adaptive function of toilets -- aside from some playful toddlers?) Other cultural items may be only indirectly related to basic needs (how do we account for sidewalks, or umbrellas?). Still other items may be apparently unrelated. (Can anyone provide an adaptive explanation for television game shows, baseball, or amusement parks?) Indeed, "leisure" activities are survival-relevant only for people whose livelihoods depend upon them.

In addition, there are almost always some cultural practices that are unequivocally maladaptive, as was documented in Edgerton's grim catalog. Nevertheless, it is proposed that cultural systems do tend to track basic needs-satisfaction over the course of time, however imperfectly, and that concern for meeting basic needs (adaptation) is very often the implicit motivator for various individual and collective actions. To the extent that cultural practices are functionally related to the meeting of these needs, they can be viewed as instrumentalities of human adaptation, whatever may be our perceptions or, equally important, whatever the precise mix of causal influences that may have produced such practices in the first place.¹¹

Finally, for heuristic purposes we find it useful to distinguish between the levels of needs-satisfaction required for (1) minimal life support, (2) minimal ability to sustain transgenerational continuity (meaning successful reproduction and the nurturing of the young during the maturational process), and (3) optimal life support (meaning maximally efficient functioning and optimal reproductive output). In general, the analytical focus utilized in this paradigm is the second category. Minimal life support is relevant in some circumstances (say, when there is a short-term crisis like a drought, a war, an earthquake or a blizzard), but over a prolonged period of time and for an entire population, minimal life-support would be maladaptive in the strict sense; the population would be unable to reproduce itself. Conversely, the concept of optimal life support involves a much greater degree of uncertainty and normative judgments (as evidenced in Doyal and Gough's convoluted treatment). Optimal need-satisfaction, like the concept of well-being, involves criteria that are difficult even to define with any precision. Moreover, in strictly Darwinian/biological terms the notion of optimal success in leaving progeny is problematical. For the most part, evolutionary biologists rely on a relative standard -- that is, differential reproductive success. Our approach strives to approximate the functional requisites for biological adaptation in human societies, but there are obviously some tradeoffs involved.

THE SURVIVAL INDICATORS FRAMEWORK

Figure III (below) shows our fourteen primary needs "domains" (so called because several of them have more than one element, or aspect). These represent what are postulated to be the irreducible functional requisites for biological adaptation in the human species. However, these domains are not entirely separate from one another; as noted above, there are many interrelationships among the primary needs. We will draw attention to some of these interrelationships in the course of our discussion. It should also be emphasized that our categories are not ad hoc or arbitrary, but neither do they have the status of Mosaic law. They

were initially formulated more than a decade ago and, in retrospect, still appear to be valid. (Only one has been added since -- respiration). Nevertheless, our framework remains open to challenge and revision at any time if more, or fewer, or different, categories can be justified. (The order of presentation and the distinction between the top and bottom rows on our diagram are somewhat arbitrary; all of these needs are viewed as being equally important in terms of their relationship to adaptive success, or “harm”.)

((FIGURE III GOES HERE))

It follows, therefore, that the outcome state, successful adaptation, is postulated to be a direct consequence of the meeting of these fourteen primary needs. Conversely, the failure to meet any one of these needs will result in varying degrees of “harm” -- a decrement in the ability to engage in “normal functioning” and the pursuit of “productive activities” (defined below). However, these criteria do not fully determine (“predict”) ultimate reproductive fitness. As noted earlier, the relationship is probabilistic because the satisfaction of these needs cannot guarantee future adaptation. In other words, the satisfaction of our basic needs is necessary but not sufficient. Other things being equal, however, the chances of future survival and reproductive success should be greater for those whose basic needs are fully satisfied.

Some of these primary needs domains may seem to be self-evident. Many of them can be found on other lists of basic needs. (We are not, after all, venturing into unexplored territory.) Others of our postulated needs may appear to be puzzling or vague (or controversial) and may call for some elaboration. In actuality, there are complications (and ramifications) associated with every one of these needs, some of which we view very differently from those in more conventional treatments. Given the space limitations, however, we will be able to discuss only three of them here. (All 14 were discussed in the original version of this paper that was prepared for the 1998 Western Economic Association International panel on bioeconomics.)

Nutrition: It is a safe bet that nutrition is included on virtually every social indicators shopping list. Yet, as noted earlier, even an obvious primary need like nutrition has many components, many variables, and even perhaps some remaining unknowns. Appropriate quantities of calories are not enough to satisfy this need, no matter how many may be available to us -- a point that was underscored recently when it was reported that the Chinese diet is seriously deficient in iodine, which has resulted in a very high incidence of mental retardation in that country. (And this is only the latest example in an age-old litany of nutritional ignorance and its maladaptive consequences. Remember scurvy?) Indeed, malnutrition of one kind or another remains a serious problem in many parts of the world, despite our much better understanding today of what constitutes an adequate diet. Conversely, it is possible to consume too much of a good thing -- sugars, fats and overdoses of certain vitamins being especially notable problems in some developed societies.

Not only does a simple term like “nutrition” mask the complexities involved in providing for this primary need but it does not even begin to account for the vast human enterprise, and the enormous range of absolutely essential instrumental needs, upon which our nutritional needs also depend. The list includes, among other things: fertile soil, a suitable climate, water, irrigation systems, fertilizers, seeds, tools in great profusion, farm machinery of great complexity, pesticides, animal husbandry, processing and packaging industries and personnel, transportation

and distribution systems, plus exogenous energy inputs of various kinds in order to power farm equipment, move water, provide fuel for transportation systems, make fertilizers, process food stuffs and, not least, to cook the many foods that would be toxic or infectious if eaten raw. With the exception, perhaps, of the few remaining hunter-gatherer societies (and even they depend on primitive technologies), all the rest of the world's economies depend, absolutely, on a formidable array of food production technologies, and this says nothing about the enormous quantity of information and human skill that is also involved. If there is food on your table (or in your local restaurant) tonight, it is only because a vast human "food-chain" performed its job with only minor glitches. In this light, it is a bit fatuous to claim, as some theorists do, that this basic need is not an important consideration in a developed economy. It is an adaptive modality (in the strict sense) in which literally billions of people participate world-wide, and it is a relentless daily challenge everywhere (as we are reminded when there is a drought, a freeze, a flood, a hurricane, a famine, a trucking strike, or contamination of the food supply). Whether or not this system can be sustained, much less augmented, for the long term remains to be seen.

Mental Health: The inclusion of mental health as a primary need might seem questionable to some, except for the fact that biological adaptation also implies the capacity of an organism to engage in productive, life-sustaining activity. Mental health is not used here in relation to personal fulfillment, happiness or a carefree existence. Rather it refers to a "state of mind" that allows an individual to carry on "normal functioning" and self-care without significant impairment (harm). There is a very large research literature on various cognitive, mental, even emotional dysfunctions in animals and humans alike (reviewed in Corning 1983). Furthermore, in the case of a complex social animal like *Homo sapiens*, the concept of mental dysfunction extends to more subtle aspects of individual psychology like self-esteem, emotional stability and social integration and status (or its antipode, social isolation).

In the past, our perspective on this important aspect of human behavior was wracked by polarized attitudes and bitterly competing schools of thought (and methodologies). On the one hand, Sigmund Freud, the founder of psychoanalysis, argued that neuroticism is inherent in society due to the misfit between human nature and the unnatural demands and constraints of civilization (Freud 1961[1930]). At the other extreme, skeptics like Thomas Szasz (1961) have argued that mental illness is a "myth" -- a syndrome fabricated by therapists and supported by the tendency of a society to label as "sick" any behaviors that are deviant or eccentric (see also Hirst and Woolley 1982). In the past 20 years or so, however, a new consensus seems to have emerged to the effect that mental illness: (a) is a very real phenomenon, (b) is cross-cultural in nature, (c) takes many different forms, and (d) is affected by a great many different causal factors, both biological and environmental. (Among the many references, see Beck 1967; Foster and Anderson 1978; Clare 1980; Murphy 1982; Naroll 1983; WHO 1983; Gilbert 1984; Busfield 1986; Cohen 1988; Helman 1990; Edgerton 1992). Moreover, the consequences for mental functioning can range from mild anxiety, or minor cognitive dysfunctions to total incapacitation and even death.

The list of mental disorders for which biological causes are directly implicated includes, among others, schizophrenia and the schizoid spectrum, manic depressive psychosis, various depressive syndromes, Alzheimer's disease, Parkinson's disease, porphyria, Down syndrome, autism, aphasia (various speech disabilities), alexia (various reading disabilities), some forms of mental retardation, and possibly certain psychopathic behavioral disorders. Of course, many environmental and cultural influences can also greatly affect cognitive, emotional and behavioral functioning, from childhood experiences (see below) to the many stresses and traumas to which

adults are exposed. For instance, there is much evidence that the lack of productive employment can be a cause of serious depression (Beck, 1967; Gilbert 1984; Warr 1987). And so can the loss of a loved one, or a divorce, or the loss of a child, or the failure to achieve some desired goal. Needless to say, the instrumental needs related to mental health are very broad. Some are very personal and derive from the individual's genetic inheritance or family and community relationships (i.e., Naroll's moralnet). Others involve economic or political forces that can impact on mental health. But in any case, considerable progress has been made over the past two decades in developing a broad taxonomy of mental disorders, along with better diagnostic tools and better indicators of mental health (Naroll 1983; Beiser 1985; Warr 1987; Helman 1990). Particularly relevant is the American Psychiatric Association's *Diagnostic and Statistical Manual of Mental Disorders*.

Reproduction: This is one of two primary needs domains in our framework that may seem to be problematic and debatable. They are not usually found on lists of basic needs, with the notable exception of Doyal and Gough's dubious treatment. (We have broken the overall process down into two distinct needs (child nurturance will not be discussed here) because they entail distinct challenges and very different kinds of instrumental needs. Under the heading of reproduction, the focus is on conception and the status of the mother and fetus, along with attendant information, nutrition, health services and the like. The birthing process also involves a distinct set of health risks, services and skills.) Indeed, these needs beg the question: In a world where excess population growth may in fact seem to be a threat to our survival -- a part of the problem -- how can we justify including reproduction and child nurturance among our primary needs? One reason is that it is absolutely essential from a theoretical perspective; it happens to be an inescapable part of the "struggle for existence." Nature has made reproduction an integral part of the adaptation problem for all living species, like it or not, and a significant portion of our collective activity as a species is devoted to reproduction and its "aftermath". Indeed, the world population problem is not a result of reproduction per se but of too much reproduction -- an excess over what is needed to sustain ourselves, at least at the population and species levels. (We will address the "levels of analysis" problem below.) A second reason for including reproduction on our list of needs is that it is a very strong "felt need" and a conscious lifetime "preference" for vast numbers of us. According to various surveys on this subject over the years, the number of people who actively do not want children at all is rather small, although many more males than females seem to be somewhat indifferent on the subject (Wright 1994). There are also some people who make conscious sacrifices of their reproductive potential, while many more are doomed to be disappointed, or will reproduce as an unpremeditated consequence of following their biopsychological urges. Nevertheless, reproduction is a strongly-held human value. However, we are also aware that in recent times, at least, there has been a very imperfect fit between material abundance or wealth and reproductive success (see especially Coale and Watkins, 1986, and Knauff 1987).

However, two major questions are raised by the inclusion of reproduction and child nurturance as primary needs. One is, how do we interpret a failure to reproduce? Does this mean that the individual -- male or female -- is maladapted? In a strictly biological sense, yes (at the individual level). And many people, sad to say, are acutely disappointed if they are unable to produce children. However, this is preeminently a primary need that can also be viewed from an aggregate, population-level perspective. Even if many individuals in a human population do not reproduce, the population as a whole may be well adapted if it is able to reproduce itself over successive generations. And, indeed, many non-reproducing individuals may nevertheless contribute in various ways to the successful reproduction of a population. (We will return to this

point in relation to our Population Fitness Profile.)

The second question arises out of the fact that a conflict may occur between the primary needs of the parents and those of their offspring. The sociobiological term “parental investment” can involve a zero-sum relationship in which reproduction and child nurturance requires a sacrifice of parental needs, and of parental adaptation. How are these tradeoffs to be commensurated? The answer in strict biological/adaptation terms is that it is preferable (more adaptive) if parental sacrifices can be minimized. Indeed, the prolonged period of childhood dependency and the complex nurturing needs of human children puts a premium on long-term parental health, competence and supportive efforts. To paraphrase the Old Testament injunction, the adaptive failings of the parents may be visited on their children. So the adaptation of parents and their offspring are not so easily decoupled from one another. However, if a choice must be made, the biological/adaptive paradigm favors the children -- especially if it assures the “magic number” of 2.1 offspring (the replacement rate).

INDICATORS OF BIOLOGICAL ADAPTATION

We believe that these fourteen primary needs, and the instrumental means that are required to satisfy them in a given context, provide a solid foundation for evaluating adaptation in human societies in a manner that accords (albeit imperfectly) with Darwinian criteria.¹² Equally important, we believe this framework provides a logical and solidly-grounded definition of “basic needs” for the purpose of social monitoring and welfare economics. We postulate that the denial, or serious deprivation, of any one of these needs will cause significant “harm” in relation to an individual's chances of continued survival and successful reproduction. While this perspective is to varying degrees compatible with other paradigms, it has the advantage of providing a rigorous external criterion for defining and measuring basic needs in any given society.

So, how does one go about measuring basic needs-satisfaction? Where are the so-called Survival Indicators? If the problem of defining our basic needs is anything but simple and straightforward, measuring them is even less so. In fact, it is not possible to develop an all-purpose set of Survival Indicators. There are a number of different ways of measuring needs-satisfaction, depending upon the analytical focus, the analyst's objectives, and various practical data-gathering considerations (recall Elster and Roemer's cautionary remarks above). In addition, there are many complex measurement and validation issues, especially where instrumental needs are involved. What constitutes “adequate” shelter, for instance? Or an “appropriate” level of education and training? Or “sufficient” income? And who should make the call on these issues, the individual or some outside “expert” using bureaucratic or technical criteria?

However, none of these problems are *terra incognita*. As indicated earlier, there already exists a very large body of social intelligence -- the fruit of many years of research and development by many researchers. A great many ongoing data-collection activities are already in place, and a broad array of useful social indicators are already in being. Particularly notable are the “poverty indicators” that are published annually by the World Bank (e.g., 1996), which currently cover 191 economies world-wide.¹³ Other important sources of data include the Food

and Agriculture Organization of the U.N., the World Health Organization, the United Nations Development Program, and a number of national-level programs, especially in the Scandinavian countries. In the U.S., the Departments of Agriculture, Commerce, Education, Health and Human Services, Housing and Urban Development, and Justice, as well as a wide range of non-governmental agencies, collect data that are relevant to basic needs-satisfaction as we have defined the term here.

Especially important is the so-called “community health” movement (a term which encompasses many instrumental needs) in the United States, along with the parallel work on “healthy cities” sponsored by the WHO and supported by a large constituency of city governments around the world, which began in the mid-1980s (Stoto 1992; Hancock 1993). A culmination of sorts occurred with the publication by the U.S. Department of Health and Human Services of the massive “Healthy People 2000” report in 1990. This landmark report was the product of a broad national effort that involved a consortium of nearly 300 national and state agencies and organizations, including the U.S. Institute of Medicine, the National Academy of Sciences, and the U.S. Public Health Service. Among other things, there were inputs from 22 different expert groups, as well as from some 10,000 participants in various hearings and reviews.

The focus of this prodigious effort was the development of an array of national objectives for improving “community health,” along with the establishment of better measures for monitoring health outcomes. The report identified over 300 national health objectives, some with multiple parts, and called for the ongoing maintenance of some 400 statistical series, of which about one-quarter did not then exist. (Many others required significant improvements.) At the time that this report was published, there already existed some 25 different national surveys or data reporting systems that were deemed to be relevant for community health, ranging from the Annual Survey of Occupational Injuries to the Continuing Survey of Food Intake, the National Health and Nutrition Examination, the National Crime Survey, the National Household Survey of Drug Abuse, and the National Nursing Home Survey.

Consequently, many survival-relevant indicators already exist, encompassing many of the basic needs. These statistics include, among others: calorie consumption levels, the incidence of malnutrition, access to safe drinking water, availability of sanitation facilities, poverty levels (using various standards), unemployment, work-related injuries and illnesses, access to health services, immunizations, the incidence of violent crimes, schooling, and such sensitive health-related statistics as infant and maternal mortality and life expectancy. (Unfortunately, the implementation of these measures in the less developed countries has been spotty.)

What can the Survival Indicators paradigm add to this ongoing collective effort? First, it provides a framework for ordering and rationalizing various existing indicators in terms of the biological survival problem. Second, it expands the horizon of the existing body of social and health indicators to include some additional areas of concern that are often slighted (e.g., thermoregulation, mobility, and mental health), or that are typically defined and measured in rather narrow terms (e.g., fresh water supplies and sanitation). Indeed, the Survival Indicators approach is concerned also about the health of the economy and the environment -- in other words, all of the systems that are survival-relevant. But most important, the Survival Indicators paradigm has a broader, and deeper, objective than simply to provide better statistics for monitoring the social correlates of economic development, or social well-being, or optimum personal development or even community health, however important these objectives may be.

The Survival Indicators paradigm addresses a question that many social theorists are not even asking, even though they should be -- namely, how are we doing in terms of our paradigmatic survival problem? This question, in turn, implies a multi-levelled, multi-faceted approach to measurement. Adaptation is a phenomenon that can be addressed at the individual level or at the population level; it can be directed to the primary needs level or to the provision of instrumental needs; and it can focus “positively” on documenting needs-satisfaction or “negatively” on the evidence of “harm” -- that is, “decrements” (or failures) in terms of meeting basic needs. At the individual level, we refer to the use of a “Personal Fitness Profile” and a “Personal Fitness Index”; at the population level, we use the terms “Population Fitness Profile” and “Population Fitness Index.” We will briefly describe these alternative approaches.

Personal Fitness Profile: This involves direct assessments of an individual's status in relation to the fulfillment of each of his or her primary needs in a given context. The term Personal Fitness Profile does not refer to “physical fitness,” of course, but to fitness in the Darwinian sense. It is not equivalent to health, or well-being, or the absence of relative deprivation but focuses pointedly on a person's functional capacities and the resources of various kinds that are needed to support them. We define **personal fitness** here as: **the capacity to function effectively in relation to the activities that are instrumental to survival, reproduction and the nurturance of offspring in a given environment; it involves the ability to carry on normal functioning and to engage in productive activity.**

Several points are in order here regarding the concepts of “normal functioning” and the ability to engage in “productive activities.” We are not here referring to self-actualization, or optimum human development, or the like. We are referring to the more limited capacity to provide for one's own basic needs -- self-care and the ability to engage in whatever daily activities are required for adaptation in a given environment. Personal fitness is not unrelated to a broad definition of personal “health” but it is not as expansive as the WHO definition. Also, it should be stressed that the term “normally” is not as vague and imprecise as it may seem. “Normally” means in accordance with performance norms that can be specified in various ways that are not mutually exclusive: societal work and productivity standards, medical assessment standards (such as those used by WHO), specific physiological and mental tests (such as those that are routinely used by military and business recruiters and law enforcement officials), and (especially) self-evaluations. In fact the National Center for Health Statistics utilizes similar concepts in its routine surveys of a large sample (well over 100,000) of the U.S. population. Among other things, the survey reports on the number of people whose “activities of daily living” and “instrumental activities” (such as employment) have been “restricted” during the reporting year due to acute illnesses or various chronic conditions. The NCHS defines physical “disability” as a “reduced ability to perform tasks one would normally do at a given stage of life.” However, we use a somewhat expanded definition of “normality” to encompass the avoidance of “restrictions” caused by a “decrement” to any one of the basic needs -- lack of sleep, physical danger, family conflicts, a lack of gainful employment, etc.

How can this outcome state be measured “positively”? We believe that it is as necessary to couple aggregate data of various kinds, as well as evaluations made by outside “observers” who are informed by technical knowledge (e.g., nutritional standards and the nutritional content of various diets, or the objective safety risk in a particular environment), with survey protocols that permit self-evaluation in terms of need-satisfaction. In fact, many surveys of this nature already exist, especially in the health field. In the U.S., for example, there are the various Medical Outcomes Studies (MOS), the Sickness Impact Profile, the Duke Health Profile, the McMaster

Health Index Questionnaire, and the Quality of Well-Being Scale, among others (Ware 1993).

A major deterrent to the further development of a more comprehensive Personal Fitness Profile is the fact that it would be very expensive to develop and administer to a large population on a continuing basis, especially in Third World countries. It is probably not realistic for the foreseeable future. And this says nothing about various political constraints. Furthermore, many of the data that are collected, including various health surveys, provide only macro-level statistics -- the number of doctors per 100,000 persons, or the number of calories consumed per person, on the average, for a large population. However, the objective of the Personal Fitness Profile is to make individual assessments. An appropriate analogy might be the distinction between the individual health questionnaires that are administered by insurance agents, military recruiters, or personal physicians and the data that are collected by public health agencies for the purpose of monitoring specific categories of health-related problems. There are certainly possibilities for doing more fine-grained analyses of basic needs-satisfaction using macro-level data. For instance, inferences are often made about basic needs-satisfaction from the relationship between personal income and the costs for various instrumental goods and services (food, water, energy, shelter, etc.) in a given context. The various "poverty-line" income measures that have been developed exemplify this approach. (On this issue, see especially Goldstein 1985; Ram 1985; Doyal and Gough 1991.) By the same token, more could be done to evaluate whether or not people utilize their resources efficiently in providing for their basic needs (see especially Streeten 1984). (It has been pointed out that the pawnshops of Reno and Las Vegas are filled with evidence that people do not always use their financial resources wisely.) What the Personal Fitness Profile strategy can add to this process is a more coherent focus, a more comprehensive shopping list (our primary needs framework), and an emphasis on providing the wherewithal to be able to engage in productive activity.

Personal Fitness Index: Our proposed Personal Fitness Index utilizes a "negative" approach. That is, it is designed to measure degrees of "harm", or decrements to normal functioning by a given individual in a given context as a result of deficits in satisfying one or more of the fourteen primary needs -- that is, in obtaining the relevant instrumental means. Over the years, many researchers have fixed upon some version of personal health as a surrogate indicator for well-being. One notable example is the so-called Olson Indicator, "Expectation of a Healthy Life," which appeared in *Toward a Social Report* (1969). Another is the "State of Health" index developed by A. J. Culyer et al. (1972). A third example is the "Health Status Index" developed by Milton Chen and his co-workers (1975), which utilizes three scales to measure physical activity, mobility and social activity. Other well-known examples include the Overseas Development Council's Physical Quality of Life (PQLI) index, a composite of indices for infant mortality, life expectancy at age one and literacy (Morris 1979), and the United Nations Development Program's "Human Development Index" based on life expectancy, literacy and an "adequate" income (UNDP 1990). (See also the "Sickness Impact Profile" of Bergner et al., 1976, and the "Quality of Life Index" of Spitzer et al., 1981.) However, all of these indexes have been criticized. Not only are there numerous problems of definition and measurement but these constructs lack a coherent theoretical foundation. What do they measure (and not measure), after all?

Doyal and Gough are skeptical about the possibility of developing any summary index of needs-satisfaction. They write: "Though we should not foreclose the search for summary measures of human well-being, the idea of a single indicator (like GNP per head) will probably remain a search for the Holy Grail" (1991:167-168). Ironically, only three pages later in their text, Doyal

and Gough themselves point the way to a possible solution to the problem. Although we disagree with the normative focus of their approach, we share their view that some form of “restriction” (or harm) can serve as a summary measure of need-satisfaction. For Doyal and Gough, the focus is restrictions in the ability of an individual to participate in the life of the community and attain optimum personal development. For us, the concern is with restrictions in an individual's ability to engage in life-sustaining activities, whether alone or with others. Compare Doyal and Gough's graphic representation of their framework (Figure II) with our Survival Indicators Framework in Figure III.

Doyal and Gough even suggest an appropriate measuring-rod. They reference the WHO *International Classification of Impairments, Disabilities and Handicaps* (1980), but they see this construct as providing only one indirect indicator for their normative objectives. By contrast, we see various forms of physical “impairment”, from whatever cause, as a direct measure of a shortfall in the desired outcome state. Restrictions in the ability to engage in productive activities can arise from a deficiency in any one of our postulated primary needs domains (although reproduction and child nurturance are obviously special cases.) Such impairments could be due to malnutrition, a congenital disease (say rheumatoid arthritis), a disabling accident, a paralyzing mental illness, a dysfunctional family environment, a lack of relevant education or skills, racial or gender discrimination, or even unemployment (especially in the many countries that do not provide a “safety net” of social insurance). Note also that instrumental needs are fully accounted for in this formulation; they are an integral part of the process that produces either a full satisfaction of the primary needs or some level of deprivation. To illustrate, when a severe ice storm during the El Niño winter of 1997-98 knocked out electrical power to a substantial part of Eastern Canada for several weeks, many thousands of people who depended upon electrical heaters, stoves, etc., were severely affected and, in many cases, were forced to move to emergency shelters. In other words, there was a significant shortfall for these people in relation to their primary need for thermoregulation, due to a failure in the system of instrumentalities upon which they depended, and this imposed a significant restriction on their normal activities.

Accordingly, we posit that an appropriate personal **fitness unit** could be defined as: **one day free of restriction in the ability to function normally**. We call our fitness unit a “Darwin”, and we posit that each person has a theoretical maximum of 365 “Darwins” per year (366 in leap-years) - - assuming no functional restrictions of any kind. Our Personal Fitness Index number, then, can be derived from how closely a given individual approximates the theoretical maximum. The simplest method is to multiply the percentage attained by 100 or 1000. (Of course, partial restrictions of various kinds introduce a number of complications and require various forms of estimation -- see below.) Most of us fall short to varying degrees. Even a person in perfect health who is gainfully employed may suffer from jet lag, a hangover, a bout of the flu, a crushing disappointment at work, grief over the loss of a loved one, bad weather or a variety of other negative influences. Conversely, even an “unhappy slave” might come close to achieving the maximum index number; as we noted above, the Survival Indicators paradigm is not (directly) concerned with personal freedom, or fulfillment, or well-being.

A health assessment tool like the MOS SF-36 survey (Ware 1993) suggests the possibility of developing and implementing such an index. Each of the eight SF-36 scales measures decrements from “normal” functioning (although three of the scales -- for “general health,” “vitality”, and “mental health” -- are bipolar and, in effect, measure “optimum” levels as well). Likewise, the U.S. National Center for Health Statistics routinely collects data on disabilities as a

part of its annual National Health Interview Survey. (Some of the health indexes cited earlier might also be useful.) Accordingly, it may be possible to develop a scale that would permit more precise, quantitative self-assessments of restrictions to normal functioning, from whatever cause. (Ware, 1993, notes that various attempts have already been made to develop summary indexes using the MOS survey instruments. Apart from the serious methodological problems involved in trying to combine the eight SF-36 scales, Ware points out that they lack a theoretical basis. Although our proposed metric would, we believe, address the theoretical problem, it would introduce new measurement and scaling problems.)

Population Fitness Profile: This concept provides a framework for the use of aggregate indicators of adaptation, ranging from public health statistics to economic measures relating to the per capita provision of various instrumental resources. Measures of distributive equity would also be highly relevant. Among the obvious candidate measures at the primary needs level are life expectancy, infant and child mortality, accidental deaths and injuries, suicides, violent crimes, diseases, substance abuse data and pollution levels. Relevant instrumental needs would include such indicators as employment and income data, access to health services, immunizations, shelter, transportation, schooling, public health measures, and much more.

One primary need that was not addressed above at the individual level of adaptation was reproduction. Given the fact that individual reproductive output varies widely in any given population, even when the population as a whole may be growing, we believe that this aspect of human adaptation is most appropriately measured at the population level. For a very small population with abundant resources, overall population growth is obviously adaptive. But for large human populations, especially those that are pressing the limits of their resources, population stability over time is arguably a more adaptive strategy in strict Darwinian terms. This criterion, in turn, implies a bipolar measuring rod; reproduction at the “replacement” level would be viewed as optimal, and anything either above or below that rate would be less adaptive. (The analogy with Pareto optimality is often invoked in this regard.)

Population Fitness Index: It may be that the most inclusive and practicable measure of “fitness” for any given human population will be found at the aggregate level, where statistical sampling techniques and routine bureaucratic reporting procedures provide a more economical means of acquiring the necessary data base. Very briefly, our Population Fitness Index is based upon the degree to which a given population falls short of its collective capacity to function normally and engage in productive activity during a given unit of time. Thus, over the period of one year, the maximum number of “Darwins” available to an entire population would be equal to the size of the population multiplied by 365. (Births during the year would add units to the total “stock,” just as deaths would deplete it.) Of course, no population ever realizes its maximum potential productivity. Decrements or losses occur through mortality, morbidity, and a plethora of other restrictions to normal daily activity. The Population Fitness Index, then, represents a population-wide summary measure of the actual degree of “harm” to a given population -- the decrement to its aggregate functional capabilities.

Culyer and his colleagues (1972) used a somewhat similar measure in their composite “State of Health” index. However, they proposed an arbitrary ten-point scale ranging from 0 for “normal” to 10 for “dead.” (See also the “Population Health Index” of Chen, 1975.) Our approach, based on the use of a common measuring unit, allows each death to be quantified in terms of the number of days of productive activity lost during a given period. Similarly, days or fractions of days lost through morbidity and restricted activity can also be quantified. These can then be

summed and subtracted from the maximum number of fitness units potentially available to the population as a whole. When this total is divided by the theoretical maximum number, the result represents an overall measure of Population Fitness. We hasten to add that we do not underestimate the many difficulties involved in measuring losses to functional capabilities. Sometimes the effects of some negative influence -- insufficient sleep, jet lag, a hangover -- may be very subtle and difficult to quantify. Likewise, someone with a severe physical handicap may, with the help of various prostheses and other accommodations, lead a highly productive life with only limited impairment. Nevertheless, as Abraham Maslow put it: "What needs doing is worth doing, even though not very well."

For trial purposes, we offer the following tentative illustration, using the United States as our "model" population. In 1994, according to the 1997 edition of the *Statistical Abstract of the United States*, there were approximately 260,682,000 people living in this country as of July 1, which can be treated for our purpose as the average (resident) population for the year as a whole. This implies a potential total stock of some 95.15 billion potential person-days of "normal activity" (or "Darwins") for that year. However, on any given day during 1994, a total of about 5.47 million Americans were incarcerated in Federal and state prisons (1.05 million), local jails (486,000), mental hospitals of various kinds (516,000), elderly homes (1.38 million), nursing homes (1.55 million), and acute care hospitals (481,000). The total loss of "normal" activity was therefore about 1.9 billion "Darwins". On any given day in that year there were also 11.35 million Americans (about 4.4 percent of the population) who were reported to be restricted by illnesses or other disabilities, representing a loss of about 4.14 billion Darwins for the year. In addition, there were some 4.3 million more Americans each day who required home health care (1.9 million), hospice care (61,000), visits to outpatient or emergency room facilities (438,000), or to physicians offices (1.9 million). Assuming (for estimation purposes) that each reported case represents a total loss of productive activity for that day, the total cost in productivity for the year was about 1.57 billion Darwins.

Much more difficult to estimate but nonetheless very important were the productivity losses due to unreported ambulatory illnesses, lack of sleep, stress, obesity, the influence of alcohol or drugs, emotional difficulties, untreated chronic conditions, learning disabilities, injuries and a variety of other personal disruptions. This number could be nearly half the population by some estimates, but let us conservatively put the figure at about 52 million (20 percent of the population) and assign them an average 20 percent loss of functional efficiency on any given day, or a decrement of 3.8 billion Darwins. Adding up our estimates, we get a total functional loss of about 11.41 billion person-days, or 11.99 percent of the potential stock of "Darwins." Thus the overall Population Fitness Index number for the U.S. for the year 1994 is estimated to have been 880 out of a possible 1000. Another way of putting it is that the U.S. population had a loss of about 12 percent of its potential for productive activity in 1994. (Whether or not the remaining 88 percent was in fact used productively is another matter.)

Compared to a sophisticated economic measure like GNP, our Population Fitness Index is admittedly a very crude indicator. Some obvious shortcomings include the following: Much loss of productivity goes unreported, while some reported losses are bureaucratic artifacts and are not empirically-valid. Estimates of functional decrements based on various categories of disability can be very misleading, especially where compensatory prostheses are available. Some productivity losses are also implicit in the statistics on unemployment, but they were not included because the exact relationship is very uncertain. The functional losses suffered by our homeless population are also difficult to gauge. Conversely, the losses associated with the prison population may be overstated, since many prisoners do engage in various personal and/or prison-

related activities. Likewise, visits to doctors' offices may or may not be associated with a loss of functional capacities. Some of these visits involve routine medical examinations. Others may involve a variety of conditions that cause pain or discomfort but do not materially affect a person's functioning. Still others may involve conditions that are already reflected in our other categories of statistics. On the other side of the ledger, many patients endure much more than a single day of lost productivity in connection with a visit to the doctor, while those who visit non-physicians (say chiropractors) or various unorthodox healers are not even included in the statistics.

Nevertheless, we believe that our Population Fitness Index is theoretically sound. It attempts to synthesize and summarize the various sources of "harm" or interference with our collective ability to engage in self-care and productive activity. It represents a useful, if imperfect, index of adaptive success for a human population, as well as (in theory) permitting comparisons to be made either between populations or of the same population over the course of time. Furthermore, it is a measure that is susceptible to improvement. As noted earlier, this is a work in progress.

SOME IMPLICATIONS

Implicit in the Survival Indicators framework is a major shift in the way economic, social and political phenomena are viewed and analyzed. As suggested above, the ongoing survival/reproduction problem, and the basic needs that are associated with meeting this problem, apply to all societies at all times. Moreover, much of our economic activity is devoted to meeting these needs, even sometimes when we label them "luxuries". Fur coats, after all, do serve a primary human need; they also keep the wearer warm. (Of course, many substitutions for fur coats are available today, but for some of our remote ancestors living in high latitudes, or altitudes, fur coats were non-substitutable instrumental needs.) In a similar vein, king size beds enable us to satisfy our primary need for sleep, even though less imposing accommodations may serve just as well.

From a biological perspective, our primary needs provide the inner logic (the bio-logic) of economic life. They represent the skeletal structure upon which economies are built, and it is possible to view all of economic, social and political life in terms of its relationship (if any) to the survival imperatives. As we have suggested, much of our economic activity is in fact "instrumental" to our survival; it is either directly or indirectly related to the satisfaction of our biological needs. To be sure, some economic activity is very tangential or not at all related. In fact, some activities are destructive to our adaptive needs. Smoking and hard drugs are obvious examples, but so is almost any other activity that is carried to extremes -- for the simple reason that our survival and reproductive needs are manifold; if we satisfy any one of these needs to excess, we may well jeopardize other needs. In other words, there is an empirical, biological basis for Aristotle's venerable concept of the "golden mean."

Many insights about economic, social and political life may be gained by viewing them from an adaptation perspective. For instance, it might shed further light on such traditional economic concepts as "discretionary income," "demand elasticity," and the logic of "substitutability". But more important, our biological needs create economic imperatives which

allow us to formulate many “if-then” predictions about our economic choices and behaviors. Many of these predictions already make intuitive sense to us. For instance, we can predict in general (but not in every detail) what would happen if the water supply for a major metropolitan area (say the reservoirs that serve San Francisco) were to be suddenly, irreversibly contaminated. Likewise, we can make predictions at the individual level about how a person's priorities will change as a consequences of the prolonged deprivation of any one of their primary needs (excepting possibly reproduction and child nurturance).

As a thought experiment, imagine how difficult it would be to continue working, or studying, in the context of an extended denial of such primary needs as sleep, food, water, waste elimination or heat (on a very cold day). Similarly, an immediate physical threat is likely to interrupt whatever else we are doing. These things happen, often enough, and they produce predictable consequences. Moreover, most of us spend the vast majority of our available time and energy engaged in activities that are directly or indirectly related to satisfying our basic needs. (A small-scale survey of time-use by Americans some years ago suggested that the same is true in the developed countries as well) (Corning 1979). To deny the relevance of our primary biological needs is to deny reality.

One of the major challenges for bioeconomics, then, is to utilize the biological/adaptation perspective as an analytical paradigm. This, in turn, implies a revisioning of our basic assumptions about the human condition and the underlying purpose of human societies. An organized society may be viewed as, quintessentially, a “collective survival enterprise.” The bulk of our economic activities and processes are related to meeting our basic survival needs. Moreover, the functional interdependencies that exist within any complex economy are both profound and inescapable -- and contingent. Such a revisioning presents an important theoretical opportunity. But more important, at this critical juncture in our evolution as a species it is also an increasingly urgent moral imperative.¹⁴

FOOTNOTES

1. The noted biologist George Williams, in a rare lapse, asserted otherwise. In his legendary book, *Adaptation and Natural Selection* (1966: 159), Williams wrote: “The central biological problem is not survival as such, but design for survival.” On the contrary, survival is the central problem for organisms, and designs for survival are contingent solutions. Perhaps he meant that designs for survival are the central problem for evolutionary biologists.
2. Harsanyi later adds two qualifiers that would appear to contradict this bald assertion. One, following the example of Adam Smith, imposes the precondition of a “moral community” (There can be no anti-social preferences.) The other addresses the problem of having imperfect information. Harsanyi's principle applies only if a person's “true preferences” are involved -- i.e., if the actor has access to all the relevant information and has reasoned with care about all of the costs and benefits involved. As Scanlon (1991) points out, these qualifiers effectively nullify the claim that “autonomous” individual choice is the ultimate criterion of what is good for a person.
3. There are many other discussions of the concept of adaptation in the biological literature, including Williams (1966), Dobzhansky (1970), Lewontin (1979, 1984), Burian (1992), West-Eberhard (1992) inter

alia, not to mention the abbreviated definitions that can be found in the glossaries for most standard biology textbooks (e.g., Wilson 1975; Curtis and Barnes 1989; Ricklefs 1996). Some of these definitions emphasize traits that “enhance” the survival chances of an organism, or increase its fitness, which limits the term to relative advantages (positive selection) rather than the totality of an organism's survival needs and functional capabilities. Likewise, Burian (1992) insists that a distinction must be made between an adaptation as an artifact (as it were) of an organism's past evolutionary history and an adaptation in relation to the organism's current fitness, since these two foci (history and current function) may be at odds with each other. To further confuse matters, the term “adaptation” can be used either as a noun or a verb. For our purposes, we favor Huxley's broader, functional (nominative) definition of the term adaptation, which Mayr (1988) suggested should be called “adaptedness”.

4. A contemporary example of a maladapted society is Hungary, which the World Health Organization has cited as (currently) the least healthy nation in Europe. Hungary has a very high incidence of such risk factors as alcoholism, heavy smoking and high fat diets. As a result, that country has alarmingly poor health statistics and deteriorating life-expectancies (McKinsey 1997).
5. An important parallel in biological evolution involves the concept of “phenotypic plasticity” -- a term which encompasses a range of phenomena, from “physiological adjustments” (say callouses or high altitude changes in blood chemistry) to behavioral flexibility, which can be found even in bacteria and single-celled protists. Phenotypic plasticity is not, therefore, something recent or associated only with complex organisms or human cultures. It is a primitive and very basic “survival strategy” in the living world.
6. There has been a sharp debate in recent years among evolutionary anthropologists, evolutionary psychologists, and others regarding the proper relationship between Darwinian theory and the causal dynamics of human behavior and adaptation. Andrew Vayda (1995), in a sharp critique of what he terms “Darwinian Ecological Anthropology” (or DEA), attacks what he characterizes as their “naive functionalism” (a term borrowed from both Elster and Schwartz). Although DEA theorists claim to be “unleashing the power of Darwinism,” Vayda charges that they “cavalierly” posit explanations for every seemingly beneficial trait in terms of natural selection and fitness maximization, without regard for its evolutionary origins or, more important, the proximate causes involved. Vayda contrasts what he calls the “cardboard Darwinism” of DEA theorists with the work of the evolutionary psychologists, whose primary focus is the specific mechanisms of causation. While evolutionary psychologists account for the evolution of various mechanisms/traits in terms of our “ancestral” conditions as a species (i.e., the adaptive context within which human evolution took place), they do not necessarily see these mechanisms as being currently adaptive. (See also Caro and Bergerhoff Mulder 1987 and Symons 1989.)

A more ecumenical position was adopted by Blurton Jones (1990), who argued for the complementary value of both adaptationist analyses and the identification of psychological mechanisms. Alexander (1990) went even further. The adaptive significance and underlying mechanisms associated with any trait must be studied together. Behavioral adaptations are usually manifested in the phenotype -- the behavior itself, he points out. Moreover, many behavioral adaptations may not be linked to specific “alleles” but to general abilities (supported by many genes) to assess costs and benefits and engage in conditional behaviors using “mental scenario-building.” We agree with Alexander. In our view, both ecological and psychological approaches (and more) are relevant to the explanation of human behavior. We espouse a multi-levelled “interactional paradigm” (see Corning 1983).

7. Of course, the normative basis of welfare economics is axiomatic. To quote one of the classic economics textbooks (Samuelson and Nordhaus 1992:295): “Economics cannot have the final word on these controversial [ethical and political] problems. For underlying all these issues are normative

assumptions and value judgments about what is good and right and just. What an economist does, therefore, is to try very hard to keep positive science cleanly separated from normative judgments.” Even the traditional emphasis in economics on maximizing “efficiency” is, after all, normatively-driven (see especially the discussion of this issue in Hanley and Spash 1993).

8. It was, perhaps, an oblique compliment to Rawls's originality that he was attacked both by socialists/Marxists and neo-conservatives. Some objected to his willingness to accept class differences. Others found fault with his legalistic notion of rights. Still others charged that Rawls's respect for individual autonomy was compromised by his stress on “positive rights,” which could lead to coercion and a denial of “negative rights” (Nozick 1974). Some critics also held him accountable for not addressing the problem of implementation -- how to move from a philosophical argument to the real world. Unfortunately, there was also a great deal of chaff in this critical literature -- semantic hair-splitting, willful misunderstanding or misinterpretation, gratuitously putting the worst interpretation on a concept or phrase, or revelling in exceptions as if they were sufficient to disprove the general rule, among other things.
9. Actually the United Nations' efforts trace back to the so-called Bariloche Model, developed by workers at the Fundacion Bariloche in the early 1970s. The Bariloche Model in turn inspired the landmark "Declaration of Principles and Programme of Action for a Basic Needs Strategy of Development" that emerged from the World Employment Conference of the International Labour Office in 1976 (see Chichilnisky 1982). Also notable is the work of the World Health Organization (WHO 1980), and the United Nations Development Program (UNDP 1990). Other important theoretical works on basic needs include Lederer (1980), Braybrooke (1987) and Thomson (1987).
10. Doyal and Gough claim to have developed a “theory” of human needs, but it is not strictly speaking an empirical theory with associated testable hypotheses. Their framework is grounded in a set of propositions regarding the existence of two overarching human needs -- physical health and autonomy. As they put it: “The target standard of satisfaction of each characteristic is the minimum necessary to secure the *optimum* individual health and autonomy, in turn defined as the highest standard achieved in any nation state [italics added]” (p.169). Although their case is carefully presented and well-argued, in point of fact their core propositions must be accepted as a moral imperative, or an act of faith, not a decision based on the weight of the evidence. Once accepted, the rest of the enterprise flows logically from their premise, but the premise ultimately amounts to an “ought”, not an “is”. So, their framework begs the question: Is “optimal autonomy” a basic need which, if denied, will cause “serious harm?” Harm in what sense? In the final analysis, the Doyal and Gough framework represents a melding of a strong moral agenda with the pragmatic measurement tools associated with the social indicators movement. However appealing (indeed useful) it may be, their framework does not in the end establish a rigorous theoretical foundation for the concept of basic needs, in our view.
11. The precise relationship between our basic needs, our motivational states, prior learning (including cultural influences) and our manifest behavioral patterns is very complex and still imperfectly understood. This subject was discussed at length in Corning (1983). A more recent treatment can be found in Flinn 1997.
12. Actually, this approach most likely accords with the version of Darwinism that is often referred to as “normalizing” or “stabilizing” selection -- i.e., selection that maintains a gene, or an adaptation, or a population, in a more or less stable relationship with its environment (as distinct from “positive” or “negative” selection).
13. Unfortunately, there are many gaps in the Poverty Indicators tables. For instance, poverty line

income statistics are available for only about 25 countries. Unskilled and non-cash wages in Third World countries are especially hard to estimate, and household surveys of needs-satisfaction are non-existent in many countries. The lack of an economic safety net in the form of social insurance is also a conspicuous problem in many of these countries.

14. One critic of this paradigm asked: "How does this help explain and predict economic behavior? Human behavior is complex. By attempting to unite all these complexities and relating them to biological needs may be a useful exercise. But will it result in a theory of behavior? I'm skeptical." This and similar criticisms totally miss the point of the "survival indicators" project. It does not claim to be a theory of human behavior but only (obliquely) a theory about the consequences of our behavior for an objective, inescapable and multi-faceted human problem. It involves an analytical framework that attempts to specify, to a first approximation, the dimensionality of the survival/adaptation problem for humankind and the degree to which our biological/survival and reproductive needs are satisfied in a given situation. A full discussion of the many-sided complexities of human behavior can be found in a chapter of Corning (1983) entitled "The Interactional Paradigm."

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