PHYSIOECONOMIC THEORIES OF CULTURE AND CONSUMPTION

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"No person who examines and reflects, can avoid seeing that there is but one race of people on the earth, who differ from each other only according from the soil and the climate in which they live." -- J. G. Stedman (1790)

INTRODUCTION

The literature has long recognized that consumer behavior varies across cultures. Attributing these differences to causal mechanisms, however, has been elusive. The quandary of attribution faced in consumer research is not unlike continuing debates in anthropology and sociology. It has been argued that social phenomena are self-contained entities that can only be explained in terms of other social phenomena (Durkheim 1895), that "culture is a thing *sui generis* which can be only explained in terms of itself ... *Omnis cultura ex cultura*" (Lowie 1917, p. 25-26; p. 66).[1] Geertz (1973) altogether rejects the "scientific approach" to understanding cultural differences and instead calls for a thick description of culture as one would interpret literature. In essence, this approach claims that one can only explain the difference between the French and the Germans by gaining a contextual, or hermeneutic, understanding of their *Frencheness* and *Germaness*; that is by labeling differences in observed cultural dispositions. A limitation of this *within culture* approach lies in the fact that explaining "the success of the American economy," for example, based on its observed "Protestant work ethic," lacks the theoretical degrees of freedom to test alternative explanations of behavior. Moreover, such explanations leave researchers with a number of unanswered questions. If cultural variations explain variations in consumer behavior, what then explains variations in culture (e.g., what generates a Protestant work ethic?)? If one can identify forces driving cultural variations, to what extent do these directly affect consumer behavior (thus reducing the pre-supposed explanatory roles of cultural traits)?

In this paper we describe how physioeconomic models, introduced in Parker (1995), can begin to answer these questions. These models posit various causal mechanisms as being responsible for variations in consumer behavior across cultures. Physioeconomics is defined as the study of human behavior by combining concepts developed in human ethology with those in economics. Central to physioeconomic theories is the principle of *cultural adaptive radiation*. This principle holds that *variations*[2] in cross-cultural behavior are an outcome of a long-run

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[1] For further discussion, see Tooby and Cosmides (1992).

[2] Variation may be the result of environmental conditions. For example, water supply and light intensity affect the height and leaf size of a plant -- differences of this kind, acquired during the lifetime of an individual plant, are not

cultural adaptive radiation process. Common to populations of animal species, as the population of an original culture increases in size, it diffuses from its geographic center of origin to exploit new habitats and food sources. Over time, this results in a variety of populations each adapted to its particular habitat; eventually these population groups differ sufficiently from each other to be identified as new cultures. At any given moment, global variations in social, cultural and economic behaviors are hypothesized to reflect time-specific local equilibria of this process.

Physioeconomics hypothesizes that physiological and economic adaptation arises from both *abiotic* factors (climate and terrain) and the resulting *biotic environment* (florae and fauna). We will discuss why these factors can be responsible for causal mechanisms driving cross-cultural variations in numerous behaviors. In essence, a significant portion of human behavior is hypothesized to result from physical and physiological processes, which are endogenous to variations in environmental factors. Culture and consumer behaviors are both endogenous to these causal mechanisms. This proposition stands in contrast to the conventional view, as voiced by Murdock, that culture is "independent of the laws of biology and psychology" (1932, p. 200). Rather, physioeconomic theories would predict that biological mechanisms have more to do with cross-cultural variations in consumer behavior than cultural traits or institutions. These theories would further predict that such cultural traits are themselves the result of physioeconomic processes.

We begin by reviewing physioeconomic theories of human behavior. In doing so, we explain why the principle of cultural adaptive radiation leads to a variety of causal mechanisms affecting cross-cultural variations. Based on this framework, we present a number of propositions covering a selection of relevant global consumption, sociocultural, and psychological processes across cultures or countries. By using the term "global," we refer to all of the world's individuals in some 230 countries or nation states.

PHYSIOECONOMICS: AN OVERVIEW

Historical Origins

Physioeconomics, in contrast to micro- or macroeconomics, incorporates *physiological*

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transmitted to succeeding generations since the genes are not affected. Likewise our treatment of culture is distinct from the biological notion of variety which is genetically inherited, such as race. Human culture, on the other hand, may be transmitted from generation to generation via social processes.

and *physiographic* constructs into cross-cultural models (the word element *physio-* represents physical). The basic premise of physioeconomics is that many human behaviors are inherently constrained by laws of physiology, among other physical laws, which prevail irrespective of racial, religious, ethnic, cultural, sociological or economic origins and situations. These laws define physiological and psychological mechanisms which in turn result in culture, social structures, and economic activity.

In contrast to the 19th and early 20th century views of culture evoked in the introduction, it is useful to think of this framework as joining thoughts originating from the 18th century Enlightenment, and, in particular, those of French *Philosophes* (e.g., Montesquieu and other *Encyclopedists*)[3] and classical economic thinkers (e.g., David Hume and Adam Smith). Of the Philosophes, Montesquieu (1748), a correspondent of Hume, has been regarded as a forerunner of modern social science (Durkheim 1895), in particular through his *The Spirit of the Laws,* which showed the interrelation of economical, geographical, political, religious, and social forces in history. Based on several anecdotal and 18th-century physiology-based arguments, Montesquieu devotes substantial attention to the influence of climate and physical terrain (marine biology, mineral resources, and topology) on capital formation, labor, technology, and general national socioeconomic conditions including culture, work ethic, suicide, alcoholism, aggressivity, religions, mortality, fertility, stature, obesity, sexism, combativeness, and industrial development (income, labor productivity, agriculture, trade, and commerce) across countries or cultures. His basic argument was that human need arises from the needs to eat, protect ones' self, re-produce, and enjoy life. Both need and need fulfillment, in turn, vary across cultures based on exogenous environmental conditions facing each population having undergone what we term cultural adaptive radiation.

Smith (1776) echoes this thinking by arguing that income is generated (caused by) the need to consume, and that, in particular, "After food, clothing and lodging are the two great wants of mankind" (p.128). Smith's argument, that land (terrain) is an important input into economic models, is based on the *physiological* premise that all humans must eat to survive.

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[3] The Encyclopedists include, among others, Montesquieu, Voltaire, Rousseau, Melchior, and Baron von Grimm who participated in the writing of the 18th-century *Dictionnaire Raissoné des Sciences, des Arts et des Métiers,* edited by the French philosopher Diderot.

Since food demand is inherent, it provides a motivation to generate income and food production becomes the basic source of wealth. However, because food production inherently depends on the availability of land (and labor, technology or capital), land (terrain) becomes a necessary condition for wealth. Moreover, from the need for food and its subsequent supply derives profit and the satisfying of demand for other goods and services: "Food is, in this manner, not only the original source of rent [profit], but every other part of the produce of *land* which afterwards affords rent, derives that part of its value from the improvement of the powers of labor in producing food by means of the improvement and the cultivation of the land" (Smith 1776, p.131, emphasis added).

Montesquieu considers land more broadly as "terrain" which in turn has numerous effects on social and cultural structures: forms of government, natural defenses, work ethics, migration, and industriousness. To Montesquieu, cultural adaptive radiation leads countries with similar natural environments to develop in similar fashions, though quite differently than countries with different environments. This argues that economic development occurs based on utility maximization constrained by the natural endowments one is forced to or chooses to live with. In general, physioeconomics theorizes that income is endogenous to a desire to consume; desires to consume, in turn, are endogenous to physiological mechanisms (including physiological need) which may vary across individuals, but, more important to the study of global behavior, also across geographic habitats. Global variances in long-run equilibrium behavior can, therefore, in part, be explained by variances in desires to consume and generate income, constrained by the capacity to realize these.

Model Structure

Figure 1 summarizes the basic model behind physioeconomic theories. While the variables identified as affecting variances in behavior can be broadly classified as encompassing (1) abiotic factors (climate and terrain -- land, marine and mineral resources) and (2) resulting biotic factors (florae and fauna), these do not represent the theoretical mechanisms driving the model (i.e., climate does not directly generate human need or behavior). Rather, these are forces behind causal physiological and physiographic mechanisms which vary from one country or culture to another.

Among the various factors evoked by Montesquieu, the least understood is climate.

During the early 20th century, certain geographers, among others, were labeled as holding a deterministic view of climatic effects; climate not only correlates with cross-cultural differences in behavior, but also determined these (e.g., the works of Huntington [1913]). The lack of strong theoretical underpinnings, spurious inferences, and certain extremes in early writings, especially as directed toward individual behavior including generalizations concerning racial differences, led to a general discredit of climate-based theories of behavior in geography, sociology and economics. Though some authors have recently argued that these early criticisms were themselves suspect of certain extremes or lacked rigor (see, for example, Rotton·1986), the most important problem in attribution is the identification of causal mechanisms.

Recent advances in physiology and psychology, however, promise to fill some of these gaps by identifying mechanisms lacking in earlier debates and show that many racial and cultural attributions are indeed misplaced. Rather, physioeconomics suggests that mechanisms common to all humans, irrespective of genetic origins, are potential sources of the cross-cultural variations observed and foreseen by Montesquieu. We now turn to a review of the more important mechanisms often lacking in earlier discussions: physiological and physiographic. Much of the next section is based on the interdisciplinary review by Parker (1995) which cites over 3000 works relating to environmental effects on human physiology, psychology, sociology and economics. Table 1 summarizes the scope of that review and illustrates relevant classes of behaviors that have been studied previously.

Table 1

PHYSIOLOGY AND CONSUMPTION: AN OVERVIEW

Substantial attention in medicine and physiology has been focused on environmental influences on human psychology via chemical substances (e.g., hormones and neurotransmitters), some of which result from thermoregulation, acclimatization and light absorption. Many differences in human behavior superficially attributed to culture are theorized to be the result of various such physiological differences across populations which have adapted to local environments. Central to this thesis is the stability of the body's internal environment, homeostasis. Homeostasis is the result of a system of control mechanisms whose key neuronal mechanisms are

concentrated in the hypothalamus, an area comprising less than 1% of the brain. The hypothalamus acts through three major mechanisms: (1) hormones (the endocrine system), (2) neurotransmitters (the autonomic nervous system), and (3) neural "reflexes," an ill-defined neural system concerned with emotions and drives (motivation) (Kupfermann 1991).[4] Differences in hormonal or neurotransmitter levels, for example, across cultures are theorized to generate variances in many basic needs, and preferences for goods and services. Of the large number of differences generated, we review the more critical mechanisms relating to consumer behavior.

Homeothermic Mechanisms

Thermoregulation. At the close of the Pleistocene when the last of the major Ice Ages ended around 10,000 BC, migration to all corners of the globe marked the beginning of the modern era of cultural adaptive radiation. Habitats populated then and now range across the planet's ten major biomes: from the Arctic tundra, to the Sahara desert, to the alto-plano region of the equatorial Andes, to the Amazon basin in Brazil, to the temperate forests of Asia, Europe and the Americas. Based on the principle of cultural adaptive radiation, humans like other species, either avoid certain habitats or learn to adapt to their local environment. Of the adaptive mechanisms required to survive across these habitats, the most necessary of these for basic survival is biological. Unlike ectotherms whose body temperatures adapt to their surroundings, humans and other endotherms (i.e., mammals and birds) must constantly maintain an internal core body temperature of 37 degrees Celsius, irrespective of where they live or the environments that they face. Human physiology, via chemical secretions, constantly adjusts to external factors (e.g., climate) of radiation, ambient temperature, moisture/humidity, and air movement in order to maintain this homeostatic equilibrium. It is theorized that these adjustments, in turn, ultimately affect basic thermoregulatory needs and preferences.

Controlled by the hypothalamus via nervous and hormonal mechanisms, the human body

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[4] The neural system transmits information along fixed pathways by the aid of chemical neurotransmitters, whereas the hormonal system makes use of blood circulation to send information to the target organs. There is extensive reciprocal influence between these two systems. Neurotransmitters are chemicals secreted at the synapse (connection between neurons) used by a nerve cell to transmit electrical impulses and to communicate with other cells both in the brain itself and peripheral parts of the body, especially in the sympathetic *(fight and flight)* and parasympathetic *(rest and digest)* nervous system. The brain's approximately 40 neurotransmitters fall into two categories of effect: excitation and inhibition. Still other chemicals serve as neuromodulators, affecting the intensity of excitation and inhibition (for an overview, see Kandel, Schwartz and Jessell 1991).

balances energy absorption and production. The basic thermoregulatory equilibrium required for human biological survival can be expressed as follows (Stanier, Mount and Bligh 1984):

$$R = M +/- CD +/- CV - E \quad (1)$$

where R is radiated heat energy, M is heat generated from metabolism, CD is heat gained/lost by conduction, CV is heat gained/lost by convection, and E is heat loss due to evaporation. Basically, humans have four adaptive responses to variations in ambient environmental radiation, R, across habitats. Metabolism involves the ingestion of food and the generation of body heat via exercise or shivering. Convection involves insulation from or the transfer of external radiated heat to the body (e.g., air conditioning, heating, clothing, housing). Conduction requires the direct contact of the body to a cool or heated surface (e.g., tiles, shoes). Evaporation involves the cooling of the body's surface via sweat glands that secrete perspiration. In order to maintain body temperature, therefore, at a minimum we constantly vary physiological and economic behaviors to avoid discomfort and, in the limit, prevent biological breakdowns (illnesses such as hypothermia or heatstroke, or death).

Acclimation. A second homeothermic mechanism of note, related to the first, affects physical comfort which is dependent on changes in and long-run levels of ambient temperature and humidity. Acclimation (or acclimatization) involves an internal physiological adjustment process, also controlled by the hypothalamus. For each climate there exists a temperature-humidity threshold, TH, which, if passed, generates physical discomfort or illness for those acclimated to a particular climate. This relationship can be expressed as:

$$TH = f(Td, Tw, Z), \quad (2)$$

where TH is a temperature humidity index, Td is the dry-bulb temperature, and Tw is the simultaneous wet-bulb temperature (i.e., incorporating humidity), and Z is a vector of constants, which vary across climatic habitats. Psychological perceptions of comfort are based on hormonal responses to deviations of a habitat's environment beyond threshold levels. Persons acclimated to colder climates are able to feel comfortable at lower TH levels; in hotter climates, human physiology acclimates to allow for higher TH levels before discomfort is generated. In part, acclimation results from changes in base-rate metabolisms which are slower in hotter climates (Roberts 1978). Persons living in the tropics, for example, have less discomfort than tourists visiting the tropics from temperate regions (and vice versa). Thresholds are generated by both

mean climatic conditions and seasonal variations. Persons living in climates with marked seasons (very cold winters and very hot summers) have, for example, highest levels of discomfort all year round, and will have greatest physiological utility for simultaneously owning both indoor heating and summer air conditioning (other non-climatic factors being held constant).

Non-Homeothermic Mechanisms

Homeothermic consumption is only one aspect of human homeostasis affected by cultural adaptive radiation. Originating with the pioneering work of Bernard (1878-1879) in France and Cannon (1932) in America, medical physiologists, immunologists and epidemiologists, among others, note that humans acting as natural organisms strive for balances in both physical and psychological health and comfort. Humans constantly react to external stimuli, ranging from microscopic organisms (tropical diseases) to ocular light absorption, in order to maintain homeostasis. These homeostatic reactions/adaptations have long been the subject of immunology (e.g., the body's response to local antigens), etiology (e.g., the body's resistance or reaction to various diseases), epidemiology (e.g., the extent to which human diseases are bounded in time or geography), nutrition (e.g., regulating the body's requirements for vitamins, minerals, alcohol, protein, carbohydrates, fats and oils required for various body functions), and physiology in general (e.g., the effects of habitat on oxygen consumption, circadian rhythm, stress, sexual cycles, and irritability); see Parker (1995) for a general review of these effects. While these environmental effects are directly related to a variety of consumer behaviors (e.g., preferences for pharmaceutical/medical products/services), less well known are recent advances on the role of the physical environment on human psychology.

Consistent with the concept that human strive for thermoregulatory balance, so too is there a maintenance of psychological homeostasis. Freud's (1915) work on *Triebe*, or drives, includes only those serving life (sex, hunger, thirst, pain avoidance, and others protecting or prolonging life) and those with death as the ultimate aim (the conscious or unconscious wish to die), but he rejects behaviors not related to these as true drives, such as curiosity or play. However, post-Freudian analysts (e.g., Hartmann 1964; Rapaport 1960; Tolman 1932) *do* include activities such as play and creative thinking as "primary drives." In the consumer behavior literature a similar drive has been termed the "variety drive" and has been associated with

boredom with same stimulus (Faison 1977). Recent advances suggest that these behaviors are indeed based on well-defined physiological deprivation and also involve arousal and satiation.

Research on these drives is based on the notion of an optimal stimulation level (Hebb 1949; Wundt 1893) or arousal (Yerkes and Dodson 1908), which has long been linked to the reward centers of the brain (Berlyne 1967). The biological basis involved in this reward center is dopamine activity (possibly interacting with serotonin). Many consumer behaviors appear to share this physiological link. These may include sensation seeking, impulsivity, food consumption behaviors (novelty, variety and gourmet types), liking for designs, complex and ambiguous art, intense music, sexual and nonsense humor, and other emotionally laden behaviors and products, as well as ethanol, nicotine, and drug (e.g., cocaine) consumption (Zuckerman 1994).

Physioeconomics proposes that consumption behaviors related to such "hedonic homeostasis" (Koob 1996) can be regarded as neurochemical surrogates of specific motivational stimulus properties of conventional reinforcers, such as sunlight. Sunlight affects physiology through an eye-brain modulation. Photic energy is delivered to a part of the hypothalamic region in the brain believed to affect neurotransmitter and neuroendocrine activity and direct circadian rhythm. The consumption of certain foods (e.g., carbohydrates; Wurtman 1982), and other substances (e.g., alcohol, cocaine, coffee, tobacco; Wise 1987) stimulate the production of serotonin and dopamine, and -- based on climatic and seasonal patterns of consumption -- may well be considered as a surrogate to natural sunlight.

Summarizing, physioeconomics theorizes that cultural adaptive radiation is a result of universal human physiological mechanisms responding to fundamentally different physical environments. These mechanisms, in turn, affect basic consumer desires, preferences and economic behaviors (e.g., by shifting local demand functions). Physioeconomics addresses general cross-cultural differences but not specific ones. Specific behaviors require a thorough understanding of motivated behaviors not related to physiological mechanisms. Even homeostatic responses, like feeding and drinking, are regulated by learned mechanisms and habits, and subjective feelings of pleasure that can override interoceptive feedback signals. Moreover, non-physiological factors that regulate motivated behaviors include the particular ecological constraints (type of food available, the price of foods) and psychological factors (e.g., skipping lunch to enjoy dinner more; going hungry to be skinny).

PHYSIOGRAPHIC EFFECTS

Following Montesquieu and Smith, physioeconomics combines the influence of physiological adaptations with physiographic adaptations to explain cross-cultural variations. It is important to incorporate physiographic factors when trying to explain differences across countries or cultures, in order to make informed causal attributions. Physiography is defined as all aspects of terrestrial topology, oceanography, zoology, biology and botany. Physiographic effects are generated from a variety of local physical assets and constraints discussed at length by human and economic geographers. These often reflect necessary physical conditions to various behaviors at the individual or societal level, including a culture's capacity to produce certain forms of resource-based income (e.g., societies generating oil-based wealth). Variances in these necessary conditions, it is argued, affect equilibrium behavior (e.g., by shifting supply functions). Certain sports, for example, can only be practiced in geographic areas having appropriate topologies which may interact with climate (e.g., ice fishing, coral photography, alpine skiing).

Virtually all animal and plant species are geographically bounded by prevailing environmental conditions -- climate and terrain combined (e.g., oak forests and their animal inhabitants), the proximity of which affects the economics of human consumption and transformation (e.g., cultures geographically closest to resources have greater economic access to these). Likewise, certain animal and plant diseases are limited to exist in nature to areas which have not experienced frosts over the last 10,000 years (e.g., tropical and certain desert regions). Various human activities are also directly bounded by the severity of climate: e.g., the economics of mineral extraction varies by climatic conditions; elevation and/or solar radiation prevents the cultivation of certain crops and directly affects soil fertility. While physiographic factors often act as resources to a given culture, they also act as exogenous constraints on behavior. These exogenous constraints, in turn, affect the supply and demand of various goods and services, certain cultural traits of populations, economic development patterns, and various vital statistics.

Combining both physiological and physiographic adaptations, we will now introduce physioeconomic theories of relevant classes of consumer behavior across countries or cultures. While a large number of behaviors might be considered, for the purposes of this review, we will focus on those receiving the greatest attention in the consumer behavior literature. These include a sample of (1) consumption behaviors, (2) social behaviors, and (3) psychological behaviors.

CONSUMPTION BEHAVIORS ACROSS CULTURES

Consumer research has traditionally focused on understanding *why people buy what, and when*. This stream of research has considered consumption of products and services as diverse as home ownership (Silver 1988), food consumption (Wallendorf and Reilly 1983; Sirsi, Ward and Reingen 1996), attendance of performing arts (Andreasen and Belk 1980), and solar energy demand (Berkowitz and Haines 1984), to name a few. In addition to these, demography (e.g., fertility) has been regarded as a consumption behavior itself and an important factor influencing general consumption behavior (Bagozzi and Van Loo 1978). Very few consumption studies propose comprehensive theories on how variations in these behaviors might be explained across the world's cultural groups. If culture *is* considered, the studies are typically limited to two or very few national groups. For example, cultural assimilation in food consumption patterns has been examined for Mexican-Americans compared with income-matched Anglos, and Mexicans in Mexico City (Wallendorf and Reilly 1983). "Unique cultural style," ethnic differences and acculturation are often used to explain such differences across cultures (Penaloza 1994; Wallendorf and Reilly 1983).

In order to extend these studies to explain and predict global variations in consumption behaviors, we will broadly classify products as being "homeothermic" and "non-homeothermic." Homeothermic products find their demand being dependent, to some degree, on thermoregulatory functions and human adaptation. Non-homeothermic products find their demand origins in non-thermoregulatory adaptation to local environments. Though the demand mechanisms for each product type differ in their origins, Figure 1 presents a physioeconomic model from which predictions can be generated.

Homeothermic Products

For humans, the relationship in equation (1) implies that heat energy must be obtained, transformed or retained from the environment in order to maintain homeostatic balance. In that sense, homeothermic products are created and consumed in response to requirements imposed by homeostatic thermoregulation. This transformation process is defined (obtaining, transforming and retaining heat energy) as *homeothermic consumption*.

Bioclimatology and biometeorology attributes a variety of behaviors to *homeothermic*

consumption: dressing behaviors, caloric intake, the consumption of energy, and architectural design. Reflecting the need to produce energy via metabolism, physiologists note that some 80 percent of food consumption is required for thermoregulatory needs (the rest being attributed to variety seeking and other behaviors). For instance, there is an inverse relationship between caloric intake, or digestive energy, and ambient temperature (R^2 = .47; Table 2). In hotter climates people will eat less, especially of foods which require high energies to digest such as meat. For example, Belgians (per capita incomes of $19,200) who experience an average annual temperature of 10° C consume an average 3850 calories daily. Bermudans (per capita income of $24,000) who experience an average annual temperature of 22° C consume an average of 2545 calories daily (Parker 1995). Understanding the influence of climate should, therefore, expand our understanding of, and ability to predict differences in food consumption behaviors in particular.

Table 2

In the aggregate (see Table 2), physiological differences across populations therefore affect dietary preferences (caloric/protein intake), housing preferences (heating, insulation, architecture), and clothing preferences (light versus heavy). Moreover, based on relatively stable causal mechanisms underlying these variations, we should also not expect to see a homogeneous consumer market worldwide with respect to this class of products (Levitt 1983). The following propositions provide a basis for explaining some of the global variation in preferences across homeothermic products:

P1: Consumption desires (i.e., demand) for homeothermic products are positively related to thermoregulatory imbalances generated from environmental factors.

P2: Consumption desires for homeothermic products will not converge across dissimilar physioeconomic domains.

Based on this line of reasoning, a culture's basal utility, or overall level of well-being, needs to be assessed relative to the physical environment. Aggregate measures of consumption may be a grossly inaccurate measure for this purpose. Instead, countries' basal utilities need to be measured while controlling for inherent biological, environmental and geophysical differences. To illustrate, consider Figure 2 which is taken from *The Limits to Growth*, by the *Club of Rome* (Meadows et al. 1972). In

that figure, the authors concluded major deficiencies in caloric and protein intake across a number of the world's regions. Arguments in favor of major food subsidies (which risk damaging local farming economies) were forwarded by the authors to prevent famine. They concluded this assuming that all persons, irrespective of where they live, should have the same absolute level of caloric consumption which was defined as the level consumed by the *average American male*. Physioeconomics would suggest, however, that regions warmer than the United States would require, in order to obtain the same basal utility, less caloric intake. This lower physiological requirement for caloric and protein intake in warmer regions has been documented in dozens of medical and physiological studies (see Parker 1995). Indeed, even within Europe, where there is little concern for famine, there is a negative correlation between caloric intake and ambient temperature (Parker 1995). Similarly, U.S. military soldiers (i.e., controlling for sociocultural milieu) are given less food rations and clothing, and have lower shelter costs when stationed at bases towards the equator (e.g., Diego Garcia in the Indian Ocean) compared to others stationed near the poles (e.g., Adak, Alaska). Such baseline differences need to be considered by global marketers (e.g., when estimating product demand), public policy makers (e.g., with respect to comparative measures of well-being), and consumer researchers (e.g., when comparing consumption behaviors).

Figure 2

Non-homeothermic Products

Non-homeothermic homeostasis is manifest in our desires to consume such products as foods, medicine, leisure, art, and entertainment. Introducing a homeostatic perspective provides a cross-cultural basis and a deeper understanding to research on the experiential aspects of consumption (Holbrook and Hirschman 1982), leisure activities (Wells 1975), the consumption of "play" (Holbrook et al. 1984), the multibillion dollar industry for hedonic goods such as rock music (Lacher and Mizerski 1994), the meaning of leisure (Unger and Kernan 1983), and high-risk leisure consumption such as skydiving (Celsi, Rose, and Leigh 1993). It also promises to provide insights into consumer behaviors related to exploratory consumer behaviors such as variety-seeking (Pessemier and Handelsman 1984), and curiosity-motivated behavior which are influenced by individual differences in consumer's optimum stimulation levels (e.g., Steenkamp

and Baumgartner 1992). The "variety drive" (Faison 1977), which is based on the notion of an optimal stimulation level, appears to behave like the classic homeostatic drives; if the stimulation derived from the environment is too low, individuals will attempt to increase it; if it is too high they will attempt to decrease it. The stimulation in all of these behaviors has been linked to a common biological basis (Zuckerman 1994), which itself is modulated by the physical environment (Roberts 1995).

Specifically, we will discuss one climatic variable, namely, the amount and intensity of natural sunlight (angle to the sun, seasons, cloud coverage, etc.). As discussed earlier, sunlight is a conventional stimulant to dopamine and serotonin activity (involved in feelings of pleasure), among others (Roberts 1995). Cultural adaptation in terms of "hedonic homeostasis" to environments with less intense sunshine, and marked short-daylight, should demonstrate consumption behaviors that suggest a higher utility for neurochemical surrogates of sunlight. This consumption could include dopamine-stimulating behaviors such as impulsivity, sensation-, risk-, or variety seeking, and the direct consumption of pharmacological agents such as coffee, alcohol, tobacco, or other drugs (Zuckerman 1994). Caffeine, ethanol and nicotine have long been known to stimulate dopamine activity (Wise 1987). Related "deviant" consumer behaviors have been extensively explored previously, such as alcohol and drug consumption (Rose, Bearden and Teel 1992), and addictive behaviors such as compulsive consumption (Hirschman 1992).

The consumption behavior of dopamine-stimulating products indeed appears to conform to the physioeconomic model. For example, coffee which is produced in tropical climates (e.g., Brazil, Colombia, Ethiopia, India, Indonesia, etc.), is consumed to a larger degree in colder climates (R^2 = .36; Table 2). The consumption of alcohol, which initially acts as a stimulant but induces lethargy at higher levels of consumption, provides an even more vivid example of climatic drivers. Because of potentially lower "natural" levels of dopamine, the stimulating effect of ethanol on dopamine production should have higher utility in higher absolute latitudes (and in areas with heavy cloud coverage). Moreover, the marginal utility of ethanol should be higher in hot climates because individuals acclimated to hot climates have a slower metabolism than those acclimated to cold ones (Roberts 1978). A slower metabolism should take longer to breakdown ethanol which would extend ethanol's pharmacological effect and also accelerate the occurrence of undesirable sedative-hypnotic effects. Complementing these hedonic effects, alcohol's high

caloric content (70 kcals in a typical drink) should have higher utility in colder climates (and seasons) and, conversely, its dehydrating properties should have lower *disutility* in colder climates. Indeed, alcohol consumption varies positively with absolute latitude (e.g., R^2=.32 for beer consumption; Table 2), even within the narrow climatic confines of the United States (London and Teague 1985).

Montesquieu argued that laws need to conform to such climatic effects (e.g., dehydration) in order to be accepted. For example, from a social marketing perspective, the effectiveness of alcohol control laws in the U.S. has been shown to be weak at best (Ornstein and Hanssens 1985). Based on 18th-century physiology (e.g., humors), Montesquieu would argue that this is because such laws are not commensurable with the local climate (p.228):

> "The law of Mohammed, which prohibits the drinking of wine, is, therefore, fitted to the climate of Arabia: and, indeed, before Mohammed's time, water was the common drink of the Arabs. The law which forbade the Carthaginians to drink wine was a law of the climate; and, indeed, the climate of those two countries is pretty nearly the same."
>
> "Such a law would be improper for cold countries, where the climate seems to force them to a kind of national intemperance, very different from personal embriety. Drunkenness predominates throughout the world, in proportion to the coldness and humidity of the climate."

To summarize, utilities for consumption behaviors related to hedonic homeostasis appear to be related to environmental factors such as the amount and intensity of sunlight, as well as temperature. Activities, products, and services related to these should therefore systematically vary as a function of the physical environment and should not converge globally. Research on these topics is nascent, but understanding environmental effects such as sunlight, temperature, humidity, altitude, can only expand our understanding of these consumption behaviors. For example, heat may prove to moderate the utility derived from some of these activities and behaviors by stimulating the release and synthesis of the neurotransmitter norepinephrine, causing excitation (Anderson, Deuser, and DeNeve 1995). We can summarize the effects discussed above in the following propositions:

P3: Consumption desires for hedonic products are positively related to psychological imbalances generated from environmental factors.

P4: Consumption desires for hedonic products will not converge across dissimilar

physioeconomic domains.

Finally, the environment has a much more obvious influence on activities such as leisure and play (indoor versus outdoor), sports (mountains versus oceans), health behaviors (e.g,. immunology), and economic activities (e.g., fishing, hunting and agriculture). Besides themselves being instances of consumption behaviors, such activities have also been shown to mediate the effect of the environment on certain cultural and psychological behaviors.

Consumption and Income

The physical environment -- climate and physiographic factors such as a coastline, mountains, deserts or oil reserves -- have a profound effect on the economic pursuits of a culture. A climate with low rainfall and low temperature, such as in the circumpolar regions, does not permit agriculture and largely restricts pastorals; in the absence of massive technology to overcome these environmental characteristics, people are limited to economic activities such as fishing and hunting. However, the environment does not only act in a limiting fashion. It also encourages certain forms of economic exploitation. For example, cultivation was found to be the main economic pursuit in 208 of 271 societies studied by Murdock (1969) inhabiting regions where cultivation is possible, while fishing or raising animals was preferred by just 39 of the remaining 63, and only 24 societies preferred to hunt or gather (Berry 1976). These results are consistent with our view of physioeconomic effects. The environment does *not* determine economic pursuits (i.e., culture), but it has a strong probabilistic influence on their general form.

Important also, is the relation between climate and income generation (R^2=.51, even when ignoring physiographic factors such as oil reserves; Table 2). Building on Montesquieu (1748) and Adam Smith (1776), physioeconomic theory suggests that this relationship reflects the effect of variances in consumption desires on desires to generate income. Moderating this relationship is the capacity to generate income as constrained by physiographic factors (e.g., oil and mineral wealth, soil fertility, ocean resources etc.). This consumer-behavior driven reasoning complements macroeconomic theory which models *actual consumption levels* as a function of income (e.g., GNP). We summarize these arguments with the following propositions:

P5: Desires to generate income are positively related to consumption desires.

P6: Capacities to generate income are positively related to physiographic resources.

P7: Aggregate income is positively related to desires and capacities to generate income.

P8: Aggregate incomes will not converge across dissimilar physioeconomic domains.

In essence, peoples across the globe can be broadly characterized as having a continuum of thermoregulatory and hedonic desires (from low to high) and income-generating capacities (from low to high). Proposition 5 which refers to the *utility of generating income* across cultures, has previously been approached by van Praag (1985) who asks "why is it that some people are more satisfied with a specific level of income than others?" (p.294). Van Praag's climate index (temperature, humidity and precipitation) for 8 European cities was highest for northern cities like Berlin (1.11), Copenhagen (1.10) and London (1.08) compared to the southern ones like Nice (.91), Rome (.95) and Sicily (.94). This index suggests that similar sized families living in Berlin stated that they feel they need 16% more in income to obtain the same level of satisfaction compared to those living in Rome.

This discussion further relates to the concept of basal utility. Montesquieu had conjectured that overall utility levels might be similar across countries or cultures, despite these having taken radically different development paths. Montesquieu, for example, suggested that Southern Europeans would have equal or greater overall utilities than Northern Europeans, even though the latter would have greater material or industrial wealth. This conclusion is based on the explicit assumption that natural endowments not only affect one's income generating capacity (P6), but also the utility of consumption itself (P1 and P3) and the underlying motivation to generate income (P5). This also suggests that the relationship between global variations in consumption and income may be spurious, to some degree, as both may be influenced by physioeconomic factors. Moreover, when comparing behaviors across countries or cultures, it may be necessary to control for these *relative* rather than *absolute* differences in basal utilities and incomes.

A culture's basal utility, or overall level of well-being, therefore needs to be assessed relative to the physical environment. To illustrate this point further, consider the positive relationship between the dollar amount required in income needed to surpass the absolute poverty threshold across countries. Figure 3 shows the corresponding latitude for a sample of countries for which this level has been established (very few countries publish this poverty threshold statistic). Clearly, the absolute

requirements in income vary from one country to another and this level is greatly explained by basal requirements, for which latitude is a proxy (R^2 = .66; see Table 2 and Figure 3). While it is useful to have such benchmarks within a country (e.g., the poverty threshold level within the U.S.), it may be dangerous to assume that a unique international benchmark exists, and that this benchmark must be exceeded by all countries of the world in order for each to obtain similar basal levels of utility. In essence, a proportion of what has been described as "poverty" globally may instead be ascribed to "temperate climate" bias.

Figure 3

This line of reasoning also relates to proposition 8. Free trade and technological diffusion should not cause a cultures' consumption desires and capacity to generate income to converge in any absolute sense, but toward the consumption desires relative to the environment. This further questions the idea of McLuhan's (1989) global village or Levitt's worldwide homogeneous consumer market. In fact, if technology permits cultures to optimally satisfy their consumption desires and to exploit their physiographic resources, physiological and physiographic variables may explain more of the variance in absolute consumption levels across countries over time and not less. The next section expands upon this idea and discusses how some important classes of social behavior may also vary as a function of the physical environment.

SOCIAL BEHAVIORS ACROSS CULTURES

This section is devoted to a selection of topics that have received growing attention in the consumer literature: (1) cultural convergence, (2) materialism, (3) materialism and religion. These topics reflect the broadening agenda of consumer research, which has become less managerial and more social in nature, including topics such as gambling, materialism, prostitution, and religion, and those discussed above, such as play, addiction, compulsive buying, and thrill seeking (e.g., Belk 1995). As Mick (1996) points out "this research is still in nascent stages, building nomological nets surrounding these varied constructs and behaviors." By applying a physiological and physiographic perspective, physioeconomics has the potential to provide a theoretically valid foundation. It also questions the independence of existing explanatory constructs used in the literature (e.g., the effects of Protestant doctrine on materialism).

Cultural Convergence

Physioeconomic factors shape cultural dispositions (e.g., collectivism-individualism, materialism) which in turn affect consumer behaviors. We have already postulated that *culture,* to a large degree, does not have an independent effect on consumer behavior and that certain attributions to culture (e.g., a Protestant work ethic) suffer from omitted constructs and may, therefore, be misplaced. Recently, popular literature has speculated that cultures are globally converging (e.g., Levitt 1983; McLuhan 1989). In order to address these conjectures, it is important to disaggregate culture into at least two broad dimensions. The first dimension has been popularized by ethologists such as Eibl-Eibesfeldt (1976), Lorenz (1970) and Morris (1968). Their models refer to the *Vorprogrammierung* (universal level of mental "pre-programming") which includes, for example, a range of expressive behaviors (e.g., laughing and crying), need for association, joking, courtship, and aggressive behaviors. All humans share this *Vorprogrammierung* irrespective of race. However, physioeconomic principles hold that the environment moderates the expression of culture and individual behavior even at this level. That will be the topic of the next section.

In this section, we consider *subjective culture,* a second dimension of culture which includes deference to elders, physical distance we maintain, ceremonials, eating habits, and so on. These collective phenomena *socially* transferred and are also not equal to race (Durkheim 1895). Most important, as discussed in the introduction, many anthropologists adhere to a Cartesian mind-body dualism and do *not* admit any role for physiological factors. In contrast, we postulate that there is an often complex interaction between the physical environment, culture and behavior. To be precise, we view culture as a socially shared "cognitive map" which functions to represent the environment; the idea that this is the brain's main function can be traced back to the school of Hippocrates (for a review, see Laszlo and Masulli 1993). Cultural cognitive maps can be viewed as memory traces and transient patterns of neuronal excitations which are shaped by sensory inputs from birth. Early learning and socialization therefore has profound effects on the development of cultural cognitive maps and serve to shape future inputs and transformations (thought), and establish rules of conduct and roles in society. Societies "replicate" themselves by transmitting their shared cognitive maps via language as well as other cultural artifacts and institutions. Similar to evolution, cultural cognitive maps reduce uncertainty the species has about

the environment -- they symbolically represent (past) environmental challenges and functionally orient society to successfully respond to these (Laszlo and Masulli 1993). Due to its linguistic possibilities, for example, culture can explore the environment faster than say genes; *cultural evolution has the ability to unfold much faster* than biological evolution. Although the environment "selects" successful cultural inventions (i.e., "mutations") it does not determine these or their exact nature. Culture therefore has the function of assisting individuals in adapting to their local environment.

In sum, cultural cognitive maps emerge from the interaction with the environment during the course of cultural adaptive radiation. Physical factors shape, limit and motivate culture. In that sense, our discussion of "culture" is most closely related to the view of *some* cultural ecologists, a branch of anthropology:

> "Culture is man's most important instrument of adaptation. A culture is made up of the energy systems, the objective and specific artifacts, the organization of social relations, the modes of thought, the ideologies, and the total range of customary behavior that are transmitted from one generation to another by a social group and that enable it to maintain life in a particular habitat." (Cohen, 1968, p.2)

Central to the physioeconomic approach is the idea that culture does not develop in a vacuum but in a meaningful confluence of biotic and abiotic factors interacting with human physiology and psychology. The physioeconomic context thus becomes a defining feature in human behavior and the development of culture and values. Cultural cognitive maps are shaped by adaptive processes which evolve to capture recurrent features of hominid environments, relevant to species survival. Central to the physioeconomic theory is the belief that these cultural cognitive maps may be by and large functionally isomorphic across similar physioeconomic environments. Moreover, cultural difference that reflect such adaptations should not converge over time. These views are summarized in the following more general propositions:

P9: Variances across some classes of cultural dispositions reflect adaptations to each population's physioeconomic domains.

P10: Some classes of cultural dispositions will not converge across dissimilar physioeconomic domains.

We discuss these more general propositions with respect to two classes of cultural dispositions:

materialism and religious values relating to possessions and work. We revisit them again in the section on *Psychological Behaviors Across Cultures*, where we discuss another important cultural construct: collectivism-individualism (Hofstede 1980; Triandis 1995).

Materialism

Materialism has been characterized as (1) a personality trait characterizing the importance a consumer attaches to worldly (i.e., secular, or non-spiritual) possessions (Belk 1985, p.265), or (2) as a cultural orientation on consumer value representing an individual's orientation toward the role of possessions in life such as the importance of acquisitions, and their effect on happiness and possession-defined success (Richins and Dawson 1992). Such values serve to *guide* the types and quantities of goods purchased (see Mick 1996). The transferal of these cultural values to children occurs via imitative or instructive learning. The source of materialistic values may be religion (O'Guinn and Belk 1989), material rewards (toys, candy) and punishment (e.g., withholding desserts; Whiting 1960), or by imitating behaviors including those found in the conspicuous portrayal of materialism in popular culture, such as on television (e.g., in "Dallas and Dynasty"; Hirschman 1988) and comics (Spiggle 1986). Even though materialism has been found to permeate Western cultural values it has been predominantly examined under the domain "the negative side, or 'dark side,' of consumer behavior" (Mick 1996).

We explore this topic from a "brighter side." Physioeconomics holds that materialism varies across cultures as a function of the cultural adaptive radiation process (i.e., it serves a utility maximizing purpose) and can be considered instrumental in enhancing the long term survival of a group in response to prevailing physioeconomic conditions; this view is consistent with Propositions 1 and 3 on consumption and Propositions 5 and 7 on income generation. Both the climate and natural resources need to be considered when examining social or cultural values that have the *function* of motivating (or making it acceptable) to value work and material possessions. Proposition 11, which highlights the positive relationship between desires to consume (P1 and P3) and values relating to possessions and work, is qualified by proposition 12: the relationship should be stronger the more difficult it is to satisfy these desires given physiographic constraints.

P11: Cultural values relating to material possessions and work are positively related to

thermoregulatory and psychological imbalances (consumption desires) generated from environmental factors.

P12: Cultural values relating to material possessions and work are moderated by the gap between physiographic resources (capacity to generate income) and thermoregulatory and psychological imbalances generated from environmental factors.

While anthropology and archeology have long recognized the direct link between a civilization's possessions, rituals, or worship idols and their immediate environments (e.g., Parker 1995 reports over 250 studies), peripheral support for this thesis can be found in a cross-sectional study of the American population which reports a strong relationship between materialism and self-perceived needs (Richins and Dawson 1992). Furthermore, materialism has been argued to have a positive impact on economies -- reinforcing the utility for work -- with the desire for goods causing workers to work harder and longer to obtain higher incomes and standards of living (Cherrington 1980). The finding that materialism in culture is positively correlated with a people's need to consume and desire to work echoes Montesquieu's (p.273-4) original observations:

> "The barrenness of the earth renders men industrious, sober, inured to hardship, courageous, and fit for war; they are obliged to procure by labor what the earth refuses to bestow spontaneously ... Mankind by their industry, and by the influence of good laws, have rendered the earth more proper for their abode. We see rivers flow where there have been lakes and marshes: this is a benefit which nature has not bestowed; but it is a benefit maintained and supplied by nature."

Montesquieu (p. 332) further notes:

> "In Europe there is a kind of balance between the southern and northern nations. The first have every convenience of life, few of its wants; the last have many wants, and few conveniences. To one nature has given much, and demands but little; to the other she has given but little, and demands a great deal. The equilibrium is maintained by the laziness of the southern nations, and by the industry and activity which she has to those in the North ... the people of the North have need of liberty, for this can best procure them the means of satisfying all those wants which they have received from nature."

Materialism and Religion

Propositions 11 and 12 have direct implications on long-running debates over the role of religion, as a cultural value, on possessions (materialism) and work (income). Religion, being endogenous to cultural adaptive radiation, becomes a reinforcing mechanism by which one's

culture is defined, codified, and transmitted. Anthropologists have long realized that cultural values can be abstracted from religious rituals, writings and artifacts (Kluckhohn 1949). On the other hand, the direct influence of the physical environment is evident in the unfolding of many religious elements ranging from metaphors (e.g., regarding lambs versus seals) and myths (e.g., regarding rising rivers or monsoons) to gods (e.g., in personifying the sky, wind, sun, mountains or oceans) and the heavens (e.g., in the Norse mythology hell is a place of cold and mist, whereas it is a place of intense heat in religions of Palestine and Arabia) (Whitbeck 1918). And, "If we trace the religious history of countries, then the religion a population has embraced along with the version of that religion seem to have been a *result* of previously existing cultural value patterns as much as a *cause* of cultural differences" (Hofstede 1991, p.16). It is therefore likely that the physioeconomic environment took part in shaping peripheral beliefs and rituals across religions and their various *-isms*. Montesquieu (p.31) introduces this concept with the following:

> "When Christian religion, two centuries ago, became unhappily divided into Catholic and Protestant, the people of the North embraced the Protestant, and those of the South adhered still to the Catholic. The reason is plain: the people of the north have, and will forever have, a spirit of liberty and independence, which the people of the south have not; and therefore, a religion which has no visible head is more agreeable to the independence of the climate than which has one."

Max Weber's discussion of the influence of religious beliefs on material culture in *The Protestant Ethic and the Spirit of Capitalism* (1904-5) elaborates on this thesis. Martin Luther, and later John Calvin, gave moral justification to worldly pursuits: hard work and the accumulation of wealth (asceticism and not hedonism). For example, Calvinists view that material wealth reflects one's true worth or value as a person, which is also manifested through an emphasis on technology and science -- the ability to control nature and therefore chart one's own destiny (Poggi 1983). Such pursuits are at best morally neutral in Catholicism. Other religions are antithetical to goals such as acquisition, achievement and affluence. For example, in Hinduism and Buddhism (e.g., in the *Four Nobel Truths*, which lie at its heart) the focus is on the elimination of desires for possessions and selfish enjoyment.

It is still true today -- some 250 years after Montesquieu's observations -- that Catholics are more represented in warmer climates closer towards the equator (see Table 3) compared to Calvinists, Lutherans, and other Protestant denominations on both sides of the equator.

Moreover, Hindus and Buddhists are found in even warmer climates and closer proximity to the equator (Table 3). Proposition 11 predicts that it may be a more general phenomenon that consumption ideologies associated with religious beliefs have physiological origins, vary across climates, and are therefore isomorphic across similar climates. Moreover, physioeconomics predicts that these religious (cultural) beliefs are best explained by examining the gap between physiographic resources available (the capacity to generate income) and the desire (need) to consume (P12).

Table 3[5]

In sum, materialism and other social values including religious ones can be viewed as cultural adaptations to environmental pressures. Therefore, such consumer values should not converge over time (P10). These values, in turn, may affect consumption behaviors such as spending patterns (luxury items, compulsive buying), personal savings and consumer debt, charitable contributions, gift giving, as well as the relation between possessions and the self, and the signaling to others via possessions (e.g., Richins and Rudmin 1996).

PSYCHOLOGICAL BEHAVIORS ACROSS CULTURES

The approach to general psychology has been culture bound or culture blind rather than cross-cultural or comparative. Physioeconomic theories, however, predict that humans' *Vorprogrammierung* (Eibl-Eibesfeldt 1976), or "cultural universals," such as association, affective expression, concept of the self, and cognitive styles are shaped or moderated by the physical environment, either directly via the hypothalamus (e.g., hormones and neurotransmitters) or indirectly via sociocultural constructs (e.g., cultural cognitive maps). We use physioeconomic theory to explain global variances in (1) affective behaviors (expressed and felt affect) and (2) cognitive processes (cognitive styles). We thereby extend our explicit focus on physiological mechanisms beyond consumption and cultural behaviors to psychological ones.

Research on affect and cognition reflects the chasm between a Cartesian dualism and a

[5] Winkless and Browning (1975) produced a very similar table on religions and temperature following a discussion of Protestantism and Catholicism, and also leave it an open question as to whether ethical attitudes (religions) are a function of average temperature (p.127).

school of thought that embeds the "mental" (mind) in the "physical" (body). This debate closely resembles the one in anthropology and sociology regarding cultural analysis, discussed in the introduction. The Cartesian view is expressed by popular cognitive (e.g., Ajzen and Fishbein 1970; Triandis 1980) which explain behavior in terms of the interaction between (unobservable) cognitive elements such as beliefs, norms and attitudes, and intentions. In fact, it has been argued that the causes of behavior can be only understood in terms of these proximal variables and that the influence of physiology may be relevant but relatively uninstructive (Campbell 1970). In stark contrast, a number of theorists (e.g., Eysenck 1978) argue that measured "cognitions" are nothing but metaphorical labels for underlying physiological processes, and that cognition-based models are heuristically useful but explicitly *fictional descriptions* of social behavior (Lee 1992). The latter view seems to have been anticipated by Freud (1920):

> "Biology is truly a realm of limitless possibilities; we have the most surprising revelations to expect from it, and cannot conjecture what answers it will offer in some decades to the questions we have put to it. Perhaps they may be such as to overthrow the whole artificial structure of [psychological] hypotheses."

Affect and Physioeconomics

It has long been recognized that mood has both direct and indirect effects on consumer behavior, memory and persuasion (Cohen and Areni 1991; Gardner 1985). However, there appears a complete lack of cross-cultural work on mood in the consumer literature. The physioeconomic model offers a framework for exploring mood effects across cultures. In introducing a non-Cartesian perspective, we accept the universality of affective processes but theorizes that the environment influences the valence and the intensity of felt and expressed affect via physiological processes.

The main neurotransmitters linked to affective behaviors are, dopamine, norepinephrine, and serotonin (for a general review, see Kandel, Schwartz and Jessell 1991). It is generally believed that serotonin is an inhibitory neurotransmitter, having a calming influence by promoting behavioral inhibition (motivation) and cortical de-arousal (processing). Serotonin has also been associated with positive affect (Zajonc 1984), possibly interacting with dopamine which is involved in the brain's reward system (see earlier discussion). The neurotransmitter norepinephrine causes excitation. Moreover, these systems are extensively inter-related. For example

norepinephrine is synthesized directly from dopamine in the noradrenergic system, which itself is inhibited by serotonin. Moreover, they may interact in complex ways to affect emotions and mood.

Most important for our purposes, recent research has found that levels of these neurotransmitters are not independent of temperature, sunlight, and food consumption. As discussed earlier, sunlight leads to physiological changes in hormones and neurotransmitters; norepinephrine decreases with light activation, whereas, serotonin, and dopamine levels increase (Roberts 1995). Based on the effects of sunlight alone, persons residing closer to the poles should have lower levels of dopamine and serotonin, among other substances, on average, than persons living toward the equator (due to ocular light absorption).

Felt Affect. Depression was already described in Hippocratic writings (460-370 BC) as a seasonal disorder. A seasonal peak in unipolar depression (8 million Americans suffer from this per day), has been confirmed across countries and the amplitude of the peak is lower in lower absolute latitudes (Aschoff 1981). Suicides, an indicator of depression, mirror this seasonal nature (Durkheim 1897) and suicide rates across the globe are also higher in higher absolute latitudes (R^2 = .37; Table 2); even within the narrow climatic band of the United States (Lester 1970). Montesquieu hypothesized that climate may be the culprit behind these behaviors (p.231):

> "We do not find in history that the Romans ever killed themselves without a cause; but the English are apt to commit suicide most unaccountably; they destroy themselves even in the bosom of happiness ... [England is] a nation so distempered by the climate as to have a disrelish of everything, nay, even of life ..."

Whereas Hippocrates suspected temperature to drive affective behaviors, it appears instead that the natural sunlight is the key driver (Hill 1992). Central to these effects may be light through an eye-brain (hypothalamus and pineal gland) modulation of the neurotransmitter serotonin (and possibly other neurotransmitters and/or hormones), as discussed earlier (Roberts 1995).[6] Light is associated with an increase in the level of serotonin, and phototherapy (bright artificial light) has an antidepressant effect (for a review, see Hill 1992; Rosenthal et al. 1988).[7] Serotonin deficiency

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[6] The neuroendocrine system may also affect mood. For example, 40-60% of depressed patients exhibit a hypersecretion of cortisol, which appears to be triggered in response to excessive secretion of adrenocorticotropin (ACTH) (Kandel 1991). ACTH is stimulated by norepinephrine (this is de-activated by light [Roberts 1995]), whereas it is inhibited by GABA (Kandel 1991; GABA is activated by light [Roberts 1995]).

[7] The light intensity of indoor lighting is about 30-300 LUX, of the sky on a cloudy day is about 1000-5000 LUX,

has been linked to depression (for a review, see van Praag 1982) and a wide variety of other psychological conditions, including other mood disorders (e.g., winter depression), and. Winter depression, or seasonal affective disorder occurs in parallel to disturbances in biological rhythms, whereas biological rhythms precede symptoms of unipolar depression (Hill 1992). More importantly for consumer mood research, these mood disorders may represent just the tip of the iceberg of people whose mood changes with the seasons. In the U.S., 92%-95% of the general population show seasonal mood and behavioral changes characteristic of seasonal affective disorder (for a review, see Spoont, Depue and Krauss 1991).

The physioeconomic model therefore provides a theoretical basis for exploring mood effects across cultures. These effects may be (1) in terms of chronic differences in mood and/or consumption behaviors to balance mood, and (2) in terms of seasonal patterns that gain in amplitude towards the poles. The effects of affect and mood on consumer behavior have been extensively reviewed elsewhere (e.g., Cohen and Areni 1991; Gardner 1985). It may be promising to approach this literature concerning associations, behavior, categorization, decision rules, evaluations, memory, negotiation strategies, and service encounters across physioeconomic domains. Moreover, as an extension of "hedonic homeostasis," people attempt to find surrogates for sunlight to correct neurochemical imbalances. One mechanism is light therapy while another is the use of drugs like Prozac, which blocks the re-uptake of serotonin and thereby increases its availability in the synapse. Another mechanism is through food behaviors. For example, seasonal affective disorder has been associated with carbohydrate craving (Hill 1992), the consumption of which increases serotonin levels (Wurtman 1982). Other potential surrogates related to serotonin as well as dopamine activity, a neurotransmitter that may also be involved in the complex biological underpinnings of mood and depression (Brown and Gershon 1993), have been discussed earlier.

Expressed Affect. In the psychology literature, the vast majority of cross-cultural studies on expressed affect have focused on the universality of facial expressions and other nonverbal behaviors since Darwin (1872) made the observation that humans not only share patterns of facial affective behavior across cultures but also with lower animals. Physioeconomics would suggest

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of the horizon on a cloudless day is about 10,000 LUX, and of the sky approaching the sun is over 100,000 LUX (Hill 1992).

that climate modulates the intensity of such universal emotional behaviors. Montesquieu hypothesized about the effect of climate on a people's emotional behavior, albeit based on now outdated notions of 18th century physiology:

> "In cold countries, they will have very little sensibility for pleasure; in temperate countries, they have more; in warm countries, their sensibility is exquisite. As climates are distinguished climates by degrees of latitude, we might distinguish them also in some measure by those of sensibility. I have been at the opera in England and in Italy, where I have seen the same pieces and the same performers; yet the same music produces such different effects on the two nations: one is so cold and phlegmatic, and the other so lively and enraptured, that it seems almost inconceivable." (p.223)

Montesquieu's hypothesis finds support in a study of stereotypes of social expressiveness. In the northern hemisphere people report that they perceive southerners in their own countries as more emotionally expressive (Pennebaker, Rimé and Blankenship 1996). (There was, however, a null effect in the southern hemisphere. The study did not consider terrain.) The authors hypothesized that it may be either or both a direct effect of heat or its indirect effect. For example, temperature potentially affects the social fabric such that people see, hear and interact with neighbors year 'round in warm climates. Social expressiveness may be an adaptation to maintain a social understanding of others (Pennebaker, Rimé and Blankenship 1996). Physioeconomics would suggest that this indirect effect may indeed be a useful adaptation, especially in light of the excitatory effect heat appears to have on individuals, discussed next.

The hypothalamus independently controls body temperature as well as cooling of the brain, a crucial physiological function. Zajonc (1994) recently suggested an interesting research-based chain of connections between nasal intake of air, the hypothalamic temperature, and affect. Specifically, "overheating" of the hypothalamus in response to nasal intake of hot air is associated with negative affect, and it appears to stimulate the release and synthesis of the excitatory norepinephrine. A cooling of an "overheated" hypothalamus, in turn, appears to be associated with positive affect, possibly via triggering the release and synthesis of serotonin (Zajonc 1994). Individuals may literally become "boiling mad" rather than stay "cool headed." In that sense, heat may raise the marginal utility of the consumption of affective stimuli via its effect on norepinephrine.

P13: Climate has both a direct and an indirect effect on the intensity of expressed affect.

P14: Climate has a direct effect on the valence and intensity of felt affect.

P15: Cultural differences in expressed and felt affect will not converge across dissimilar physioeconomic domains.

In summary, climate has a direct "non-cognitive" effect on affect and mood. There is a strong seasonal factor which increases in amplitude at higher latitudes, and there may be baseline differences in moods across latitudes as well. Moreover, people living in hotter climates may react more readily to positive and negative situations (due to higher levels of norepinephrine). Finally, affective states may themselves affect cognitive processes such as associations, categorization, evaluations, memory processes and decision making strategies, to name a few (Cohen and Areni 1991; Gardner 1985). The next section expands upon the indirect effect the physical environment may have on such cognitive processes.

Cognitive Style and Physioeconomics

The relationship between the physical environment and cognitive behaviors is less understood. Anecdotally, this link has been shown to be mediated by cultural cognitive maps, such as collectivism versus individualism (Hofstede 1980; Triandis 1995). Such research suggests that individual, social and cultural levels are largely inseparable (Rogoff and Chavajay 1995). Early research on cross-cultural cognition primarily focused on educational "deficiencies" (e.g., in literacy and numeracy) and the non-universality of Piagetian-type cognitive tests on children (for a comprehensive overview of research on culture and cognitive development, see Rogoff and Chavajay 1995). In contrast, our focus on indirect physioeconomic influences concerns the socialization of children and the transfer of this learning to other (cognitive) contexts. Introducing a physioeconomic model into this budding paradigm may have the potential to provide a framework for posing appropriate research questions in a cross-cultural context. We next discuss the effect of cultural adaptive radiation on cognition with respect to the related constructs of psychological differentiation (Witkin et al. 1962) and collectivism-individualism (Hofstede 1980).

Psychological Differentiation

The theory of psychological differentiation or "cognitive style" (Witkin et al. 1962) spans

several behavioral domains ranging from perceptual-cognitive functions to social characteristics. *Field independent* individuals demonstrate (1) a greater perceptual ability to disembedd visual objects from their context (i.e., judge their discreteness), (2) an analytical problem-solving approach, and (3) an internal frame of reference. *Field dependent* individuals (1) perform less well at tasks such as disembedding objects from their contexts, (2) use a more intuitive problem solving approach, and (3) are guided more by external situations, and are more socially oriented and sensitive.

Differences in cognitive style across cultures have been based on a host of socialization and ecological factors. For example, Berry (1976) forged a chain of links between the nature of (subsistence) economy, mode of socialization, and cognitive style. His model includes the physical environment -- temperature and rainfall -- as permitting agrarian compared to other economic pursuits. The socialization and ecological pressures for survival differ for, say, hunting communities versus agricultural ones, and these tend to be reflected in child rearing practices. Hunters are migratory, have small family sizes, and low population densities; they need to have refined field independent perceptual skills to *disembedd* prey from their context, and integrate multisensory stimuli (tracks, vapor, sounds, smell) and other perceptual cues (hills, clouds, sun, stars, wind) to locate prey and navigate their environment. Agricultural communities, in contrast, have higher population densities, family sizes, sociocultural differentiation and complexity, and therefore relatively higher pressures on field dependent perceptions and cognitions.

While this offers a perspective on an interesting group of consumers, psychological differentiation (Witkin et al. 1962) has broader implications for cross-cultural research than for subsistence-level communities (Berry 1976). Specifically, there are striking parallels to the well known collectivism-individualism construct. For example, the concept of a *field independent* cognitive style (Witkin et al. 1962) includes that of an individualistic society's *independent* self (Markus and Kitayama 1991). And a *field dependent* cognitive style (Witkin et al. 1962) reflects a collectivistic society's *interdependent* self (Markus and Kitayama 1991). Moreover, Triandis (1995) has made arguments for the development of individualism, which recognize the "physioeconomic" basis of collectivism in agrarian cultures, and links individualism to hunter-gatherer societies on the one hand, and complex urban settings on the other.

Individualism and Collectivism

About 30% of the world's cultures can be considered individualistic compared to collectivistic (Triandis 1995). Individualism represents the degree to which people prefer to act as individuals (self-reliance) rather than as members of an integrated group. Individualistic societies have an "I" orientation and find their opposite in collectivistic ones who have a "we" orientation (Hofstede 1980). Moreover, individualists think of others as individuals as well, whereas group membership (in-group versus out-group) is important in collectivist societies (e.g., Triandis 1995). The cohort of antecedents evoked for individualism versus collectivism can ultimately be traced back to the influence of climate and terrain.

Hofstede (1980) recognized the influence of climate and speculated that colder climates lead to a dependence in technology to overcome nature, which in turn leads to an investment in education, to greater social mobility and wealth and independence. Indeed Hofstede found that climate (using, as a proxy, latitude of a country's capital) correlates strongly with individualism (r = .75). Similarly, we find Triandis' ratings of individualism across 55 countries (in Diener, Diener and Diener 1995) to correlate strongly (r = .67) with a measure of latitude (Parker 1997b). Triandis (1995) explains individualism as a response to industrially complex environments (with social mobility, high population densities etc.), and relates this to another cultural construct: "tightness" versus "looseness" (Pelto 1968). Cultural tightness has been associated with cold climates which forbid "undisciplined" behavior, whereas warm climates should not necessitate personal "control" to "conquer the environment" (Triandis 1995; for an early review of climate and behavior, see Robbins, de Walt and Pelto 1972). Indeed, The corresponding link between collectivism and agricultural pursuits can also be tied to climate. We re-analyzed Murdock's (1969) data on 322 cultures and found that the level of involvement in agricultural pursuits is negatively correlated with latitude (r = - .43), and therefore less prevalent in colder climates.

From a physioeconomic perspective, collective-individualist behaviors are a product of climate and terrain via its limiting and motivating influence on the type of social processes (the amount of time spent indoors, population density, family size) and economic activity (e.g., Berry 1976; Murdock 1969). Social processes, such as leisure activities, make up a substantial portion of the cognitive opportunities children encounter. A Mediterranean climate, for example, is more conducive to outdoor activities and fosters higher social interactions; the development of broader

social sensitivities (versus towards the immediate family) in collectivistic cultures may therefore be highly adaptive. Economic activity, which is limited and encouraged by climatic conditions and terrain, reinforces these developmental patterns. Agriculture and livestock rearing foster complementary, cooperative activities, and community culture; factors which promote a more collectivistic culture (e.g., Triandis 1995). Economies founded on hunting and fishing, on the other hand, as well as mountain cultures with low population densities should be individualistic rather than collectivistic. Industrial urban settings dominated by technology, should promote an individualistic culture with a greater focus on personal achievement (and a decline in nepotism) and the focus shifted from kinship-based solidarity to individualism (Griswold 1994).

A large part in level of collectivism versus individualism of a culture can therefore be explained by inter-related factors which mediate the effect of the physical environment, such as economic activity, amount of time spent indoors, population density, and family size. Propositions 16 and 17 summarize these arguments:

P16: Climate and terrain influence cultures' social processes (interpersonal interactions) and economic activities.

P17: Social processes and economic activities influence a culture's level of collectivism-individualism and, thereby, cognitive style.

P18: Levels of collectivism-individualism should not converge across dissimilar physioeconomic domains.

Proposition 17 speaks to how cultural cognitive maps, in turn, have a profound influence on cognitive style and consumer decision making. This affects cognitions involving the "self," attentiveness and sensitivity to others, and the role of social context in cognitive elaboration (Markus and Kitayama 1991). Obvious candidates in the consumer literature are reference group influences (Bearden and Etzel 1982) and peer influences (Childers and Rao 1992). In sum, cultural adaptive radiation may more deeply penetrate consumer cognitions than currently assumed. Moreover, if collectivism and social expressiveness are an adaptation to maintaining social understanding, the excitatory effect of heat (Anderson, Deuser, and DeNeve 1995) may be seen as a catalyst to such adaptations. This may have interesting implications for communication and service strategies (e.g., Bitner 1990).

Finally, the physioeconomic arguments against cultural convergence also apply to collectivistic-individualistic cultural cognitive maps and, in turn, cognitive styles. While modernization has been found to increase individualism, for example, in Korea (Cha 1994) and, anecdotally, in Japan (Triandis 1995), this may represent a convergence across similar physical environments. Still 70% of the world's cultures are considered collectivistic (Triandis 1995), and development patterns closely follow physioeconomic fault lines. Because consumer needs should not converge (P2 and P4), motivations to generate income should also not converge (P5), and economic activities should not become homogeneous. Moreover, social processes, being a function of climate, should not converge either. This argues for limits to convergence in individualism-collectivism and, in turn, in cognitive styles (P18). Instead, the physioeconomic model can be used to predict convergence in collectivism-individualism across similar environments. This suggests that physioeconomic effects may actually better predict cultural differences (in explaining the remaining variance) in the long run.

CONCLUSION

In this age of globalization, there seems to be, on the one hand, a sense of urgency in developing a framework to discover and develop a cross-cultural strategies (e.g. Jain 1989). On the other hand, there is a strong belief that consumer behavior is rapidly converging globally (Levitt 1983; McLuhan 1989), which may explain the lull in cross-cultural research to date. In light of the increasing interconnectedness between cultures, will the world converge towards a single homogeneous culture, to Marshall McLuhan's "global village"? Paradoxically, we may be witnessing both a trend of convergence -- of cultures sharing similar environments -- and divergence -- of cultures with dissimilar environments. In fact, whereas Levitt (1983) has promoted a standardized marketing strategy and has been so bold as to proclaim "the earth is flat," physioeconomics suggests that a model based on the fact that the earth is a sphere is more appropriate. We also posit that the crucial question in the convergence debate is not whether brands will be available everywhere -- global brands have existed for over a century -- but whether consumers' utilities for these products will converge and whether consumer behavior itself will converge in terms of cultural dispositions and psychological behaviors.

Most importantly, the cross-cultural perspective of physioeconomic models promises new

venues for consumer behavior research. First, it provides a framework for predicting, understanding and responding to differences across geographies (e.g., understanding consumption dynamics, social systems, and individual differences) by providing a more rational basis for thinking (Clark 1990). Second, by helping to understanding why differences exist among groups of people, the physioeconomic framework also provides additional insights into fundamental issues studied within a purely domestic context (e.g., causal mechanisms, and seasonality in behaviors). In offering an explanation for consumption behaviors for homeothermic and several hedonic goods and services, physioeconomics essentially asks the question "why do we consume?" Therefore, at one level this aids in estimating differences in global demand (e.g., extrapolating requires a "weighting" procedure) helping make strategic decisions such as early entry choice and entry mode choice. It also predicts that consumption dynamics are affected such as variety seeking, materialistic values, affective behaviors and cognitive styles are influenced by physiological mechanisms.

While we present physioeconomic theories as a more general model of cross-cultural consumer behavior, it is important to note that we have only sampled a set of potential behaviors. These are meant to highlight the importance of a physioeconomic approach and are not meant to be exhaustive. There are also many consumer behaviors which may not benefit from a physioeconomic perspective. Our hope is to stimulate interest and research in this area that will further explore and qualify this paradigm. Moreover, the causal explanations advanced by physioeconomic theories are probabilistic in nature; the physical environment does not determine behavior. This is evident, for example, in the *individual* variations in behavior within any single physical environment. Instead, like any cross-cultural model, physioeconomics attempts to explain part of the variation in *aggregate* behaviors across the globe.

As such, physioeconomic theories provide insights on various aspects of consumer behavior, as yet considered from a purely sociological perspective. Physioeconomic theories, however, stand in contrast to functionalist sociology, which had its heyday in the 1950s and 1960s in America, and focused on the relationship between economic development and culture. Functionalist assumptions were challenged in the 1970s as it increasingly became an ethnocentric vehicle glorifying cultural values of the West, such as the Protestant ethic (Griswold 1994). In particular, factors such as other religions were seen as cultural barriers to successful economic

development of non-Western societies. Physioeconomic models would predict instead that one should find cultural values that are isomorphic across similar habitats and that both genetic and non-genetic attributions to race, color, religious creed or ethnic origins are indeed misplaced. Both cultural values and economic performance may co-vary as a function of climate and terrain. Correlations between cultural values and economic performance may therefore be spurious.

By providing an orthogonal view and explanation for cultural differences, this paper also highlights an additional contribution: explicitly incorporating physiological and economic dimensions in cross-national psychological and social research. These dimensions are all but ignored by the major consumer behavior models. For example, we have argued for a measure of national "well-being" which controls for inherent environmental or geophysical differences across countries. This calls for a reexamination of a number of commonly accepted development theories which have been based on absolute measures of well being (e.g., caloric consumption, GNP per capita, etc.); measures which have guided international development efforts, including those of the World Bank, the International Monetary Fund and national development agencies (e.g., the U.S.A.I.D.). Adjusted measures (e.g., Figure 3) reveal radically different policy implications than those generated from traditional measures. The same line of reasoning applies to a consumer behavior and marketing perspective. When comparing consumption, social, or psychological behaviors across cultures, or when designing global marketing strategies, it may be instructive to consider physiological-physiographic differences; and it may be critical to control for these when exploring other influences on behavior.

In conclusion, physioeconomic analysis should not diminish our fascination with consumer behavior or make consumer behavior trivial by reduction. Rather, physioeconomics expands our understanding, allowing us to predict unanticipated interrelationships between physiological and consumer behavior phenomena across cultures. The separation of consumer behavior and physiology-physiography has been arbitrarily imposed not by the natural boundaries of the disciplines, but by our lack of knowledge. Only at the points where these disciplines merge will our understanding of cross-cultural consumer behavior rest on solid ground.

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FIGURE 1

PHYSIOECONOMICS

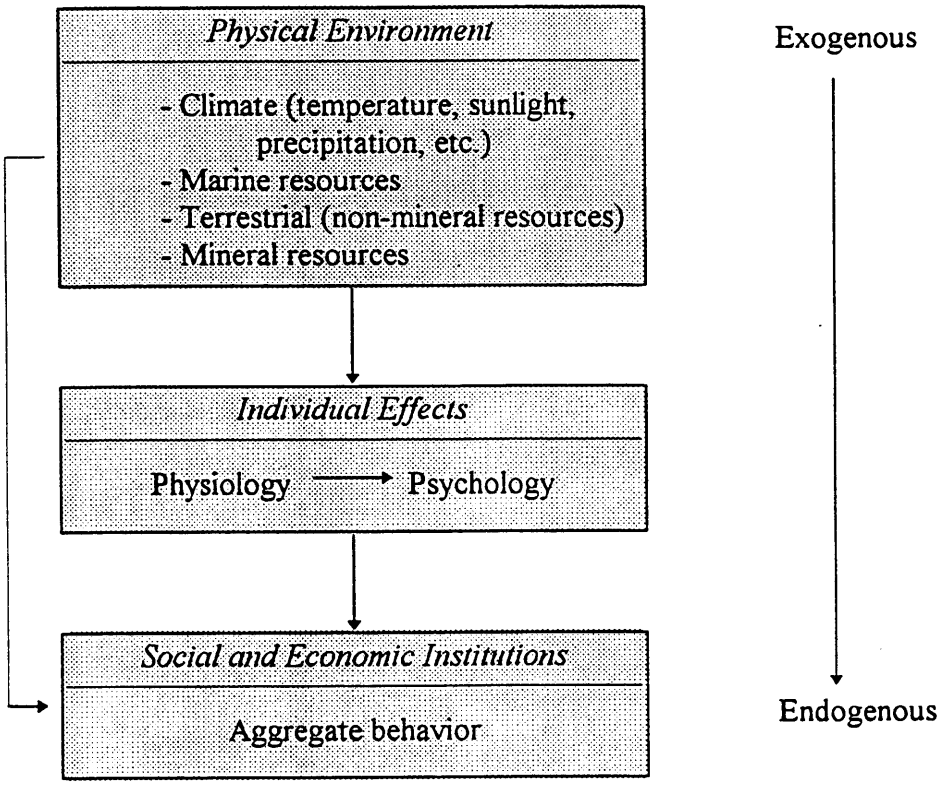
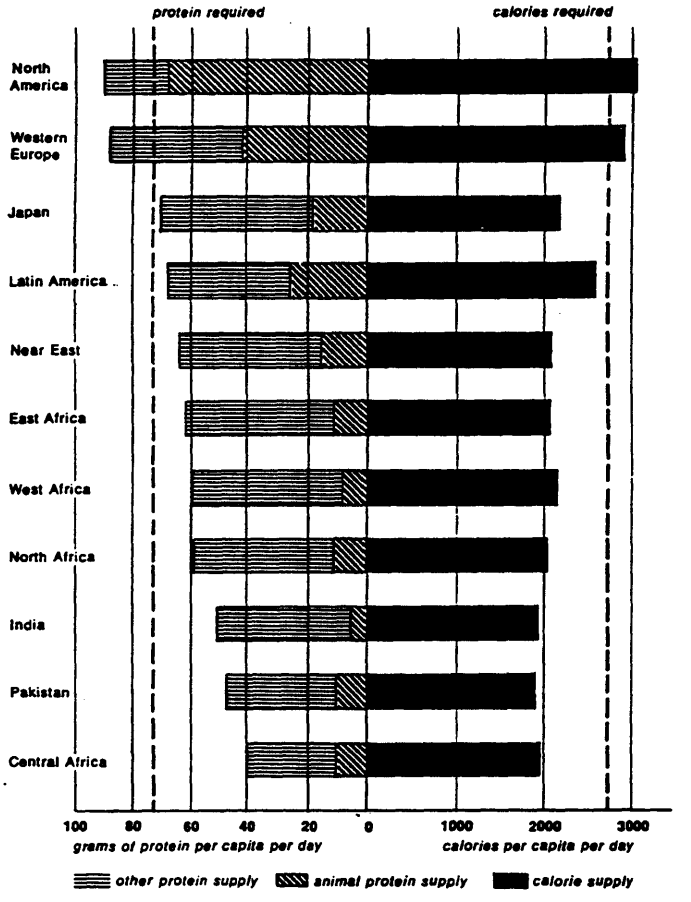


FIGURE 2

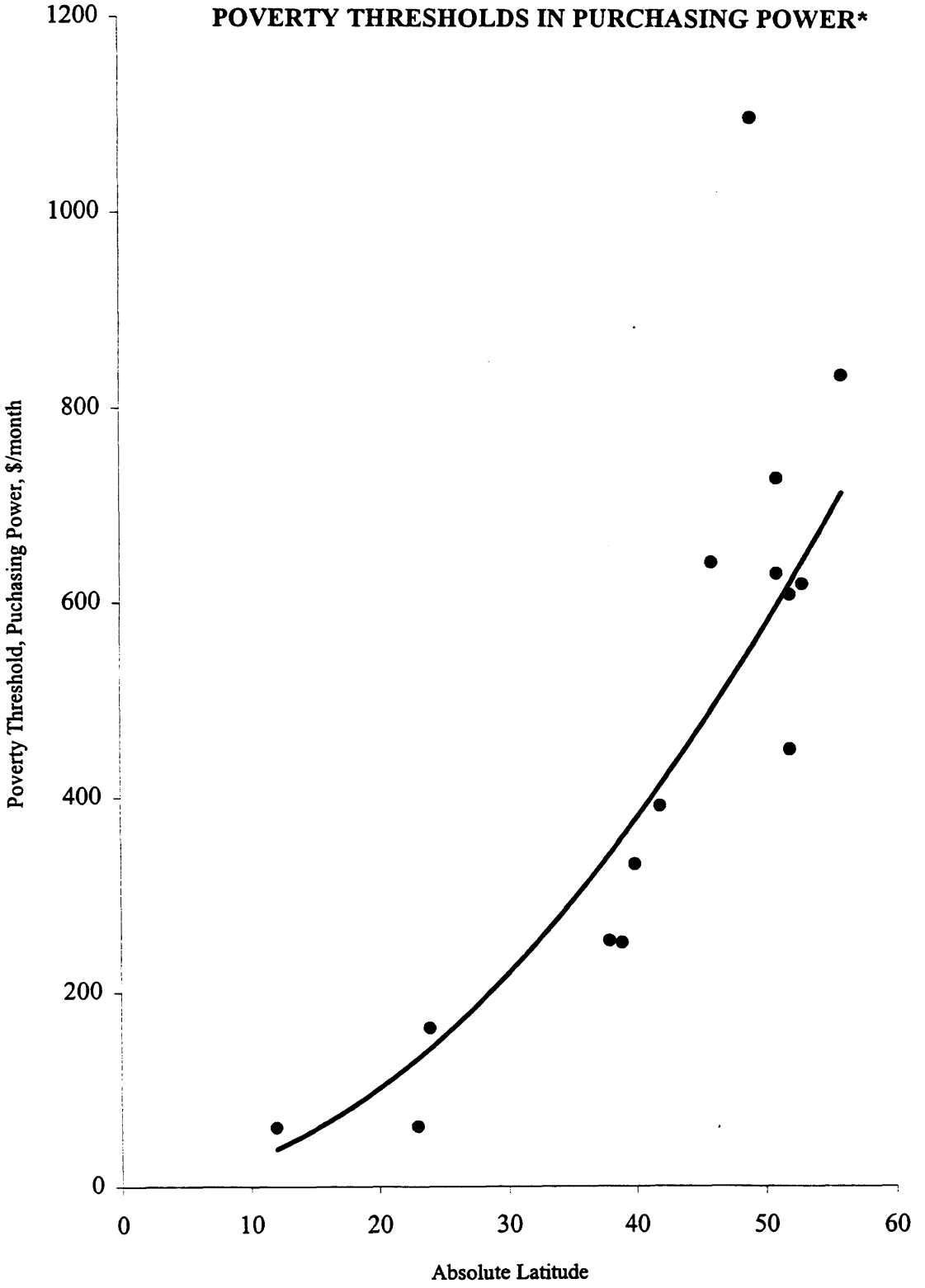
PROTEIN AND CALORIC SUPPLY AND "REQUIREMENTS" *



* Graph replicated from *The Limits to Growth* (Meadows et al. 1972, p.56).

FIGURE 3

POVERTY THRESHOLDS IN PURCHASING POWER*



**Data sources: Parker 1997b; U.S. Department of State 1996 Annual Report on Human Rights; EUROSTAT, Statistiques en bref: Population et conditions sociales (1997).*

TABLE 1

CLIMATIC EFFECTS ON BEHAVIOR (STUDIES CITED IN PARKER, 1995)

Discipline/Area	# of Studies Cited
Physiological Effects	**2,878**
Acclimation & Comfort	604
Allergies	315
Diet & Nutrition	684
Disease & Illness	584
Hormones	61
Metabolism	202
Thermoregulation	428
Psychology	**1,423**
Affective Disorders	390
Aggression	92
Cognition	148
Mood & Personality	213
Schizophrenia & Mental Illness	438
Stress	142
Sociology & Demography	**2,278**
Accidents & Injuries	114
Civilization, Culture & History	953
Crime & Homicide	142
Fertility	297
Infant Mortality	121
Migration	113
Mortality	413
Suicide	125

Discipline/Area	# of Studies Cited
Consumption & Industry	**1,908**
Agriculture	204
Alcohol & Beverages	59
Architecture & Housing	127
Clothing	140
Energy	282
Food	146
Health Care	213
Household Durables	55
Manufacturing	262
Mining	79
Savings, Debt & Income	201
Tourism, Leisure	140
Macroeconomics	**2,427**
Climatic Change Policy	719
Drought & Flood Policy	200
Labor & Unemployment	998
Macroeconomic Policy	510

TABLE 2

CONSUMPTION BEHAVIORS ACROSS COUNTRIES: CLIMATE VERSUS INCOME

Variable	Climate[a]	Climate & Income	Income's Increment	Income Only
Aggregate Social Measures				
Income Per Capita (n=203)	.51	--	--	--
Poverty Threshold (n=17)	.66	.89	.23	.88
Individualism (n=40)[b]	.52	.70	.18	.67
Suicide/1000 (n=64)	.37	.37	.00	.29
Thermoregulatory Consumption Per Capita				
Milk (n=42)	.30	.28	.00	.11
Cereal (n=38)	.35	.49	.14	.00 n.s.
Sugar (n=143)	.15	.18	.03	.16
Calories (n=164)	.47	.53	.06	.38
Protein (n=159)	.55	.62	.07	.44
Potatoes (n=40)	.44	.46	.02	.07 n.s.
Non-thermoregulatory Consumption Per Capita				
Sony Walkman (n=17[c])	.69	.68	.00	.35
Microwave Oven (n=17[c])	.55	.54	.00	.11
Personal Computers (n=17[c])	.31	.26	.00	.10
Coffee (n=17[c])	.36	.55	.11	.53
Beer (n=45)	.32	.33	.01	.26
Cigarettes (n=46)	.17	.16	.00	.03 n.s.

[a]Climate is measured in terms of latitude squared (to account for the earth's curvature).
[b]Data are from Hofstede (1980).
[c]Data are limited to European countries.
NOTE. -- Adjusted R-square statistics are based on a simple linear model. Sample sizes, n, are noted in parentheses.
Data sources: Parker (1997b); Euromonitor, *International Marketing Data and Statistics; European Marketing Data and Statistics*, various issues.

TABLE 3

MAJOR RELIGIONS, CLIMATES AND INCOMES*

Religious Affiliation	Average Temperature (°C)	Average Latitude	GNP per Capita (US$)
Animist	26	6	804
Buddhist	20	25	6740
Buddhist (official)	27	13	1670
Calvinist	9	47	10100
Christian (Total)	16	32	8230
Hindu	23	21	392
Hindu (official)	17	27	179
Jewish	14	41	16100
Lutheran	9	49	20200
Lutheran (official)	6	60	28600
Muslim (Total)	22	23	1720
Muslim (official)	22	27	1750
Protestant (Total)	15	36	13700
Roman Catholic	18	27	7510
Roman Catholic (official)	20	25	3600

*Adapted from Parker 1997a.