

Gender Matters: Place Located Indigenous Knowledge Finding the Value of Per Capita Earth Resource Consumption Necessary for Human Sustainability

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Abstract: Indigenous knowledge (creation of human well-being with a modicum of Earth resources) in India was augmented in the twentieth century with new technologies. The new technologies have raised Indian well-being, but these improvements has been insufficient to motivate Indians to choose families small enough to achieve human sustainability. Fortunately, within India a stable population (29 million) currently meets the criteria for human sustainability -- modest per capita taking of Earth resources combined with small families. The one significant difference in the indigenous knowledge of Kerala contrasted to India is central to the human experience, family structure. We may identify weak patriarchy versus strong patriarchy. The fact that the rapid increases in the well-being measures of Kerala have occurred in the last half of the twentieth century suggests a strong synergy of the new technologies (especially public education and western medicine) with the weak patriarchy in the Kerala part of India. Within the low Indian incomes and low per capita consumption of Earth resources, the high well-being measures of Kerala have been sufficient to cause a rapid decline in total fertility rates to a sustainable level, lower than in North America. The low consumption of Earth resources in Kerala can be viewed as a benchmark for sustainability -- efficient human consumption. This efficiency benchmark is found in the weak patriarchy of Kerala within the strong patriarchy India -- a contrast of indigenous knowledge.

Keywords: Sustainability, gender, well-being, consumption, Kerala, India

Introduction:

The subtitle of E. F. Schumacher's famous book, *Small is Beautiful*, flowing from his India and Burma experience, is *Economics as if Humans Mattered*. This paper, an excursion in the field of evolutionary biology, takes the next step and could be titled, *Economics as if Women Mattered*. Observations and data concerning human behavior in the Indian culture collected during the twentieth century within the political and ecological boundaries of India are reported here. These measurements and observations are displayed within a process of evolution -- an evolution of the physical environment, an evolution of the living environment, and an evolution of the social environment. Observations and data concerning human behavior in the Indian culture collected during the twentieth century within the political and Among these evolutionary processes, we anticipate an adaptation in the social environment will be most observable, an evolution supporting human survival called sustainability.

Critical Variables

This analysis begins by identifying four critical (sequential and overlapping) variables which encourage human sustainability in a part of India. By reasonable analogy we can see a potential for human sustainability in

the whole of India. These variables are analyzed within the per capita shortages of Earth resources and the high birth rates; both are characteristics of twentieth-century India.

1. Female freedom and status supporting the full utilization of female skills in processes creating human well-being. This variable is low and has been declining in India. See Appendix A for more detail.

2. Application of female skills in a synergistic combination with modern technologies--efficient use of limited Earth resources maximizing human well-being. These new technologies (with less assist from female management) improved the well-being throughout India, but not enough to cause the birth rate declines needed for sustainability. See Appendix B.

3. High well-being motivating low birth rates leading to zero population growth. Higher well-being is measured as rising life expectancy, higher educational attainment, and especially declining infant mortality. Neither direct income nor direct consumption are among the measures of this well-being. See Appendix C. The absence of incomes from among this list of critical variable may be seen as unconventional or innovative.

4. Zero population growth allowing human sustainability. That is, the human behavior necessary to stabilize and

reduce the human taking from those finite ecosystem services within the control of Indian citizens.

A cause for the absence of female freedom and status in larger India may be found in the combination of two variables.

1. The strength of the extended family class system characteristic of the life experience in India. The family class system is found within the hierarchical Hindu caste system and extends to Muslims and other religious minority communities in India. See Appendix D.

2. Careful enforcement of the purity of patrilineal decent. The key variable allowing human sustainability in a significant portion of India (the state of Kerala, population 29 million) is matrilineal decent. We apply evolutionary biology (Mayr) to explain the significance of matrilineal decent in Kerala and its slow change to patrilineal decent in the remainder of India

Evolutionary Biology Applied

In the evolutionary concepts as applied to animals, each change which becomes a part of a species is maintained as an advantage for the survival of that species. That is, changes in the environment of a species drive adaptive changes in the gene pool. Accordingly, the surviving differences between species with very similar gene pools in an evolutionary process is an adaptive change.

Let us look at such a change in the human gene pool found in humans but not in other mammals. With the exception of the human species, mammalian females have brief intervals of time in their reproductive life when they are able to accept the attention of males driven by testosterone to impregnate females. Human females, in contrast, are able to manage their own desire for such male attention. That is, human females may copulate when they choose. This marker need not be displayed as absolute. Rather, a degree of distinction with a significance for human behavior on the order of the differences in language capability or tool use between humans and animals is sufficient to guide the balance of this analysis.

The mechanism for female influence on the behavior of human males is the male imagination that cohabitation might happen. This power of females over males is maintained and augmented by the greater intensity of the male sexual drive. Notice that we have a word, nymphomaniac, for a women with an abnormal sexual drive, and no equivalent word to describe a man. In biological terms, a male sex drive equivalent to a nymphomaniac may be normal. Sometimes the term, feminine wiles, is used as a marker for this female influence over men.

Application of rules (legal and customary) which deny this normal female advantage (counter balancing power) is the suppression of female freedom and status--institutionalized female inequality as if inequality were biologically preordained. We are considering here whether socially determined inequality is adaptive for human survival in the present century.

Viewing this difference between humans and animals as one of several evolutionary links establishing the human species, we may properly ask: Why this evolutionary step? What is it adaptive to? How does female freedom and status improve the present century survival of the human species? And conversely, how does the suppression of female sexuality threaten human survival?

Time Dimensions

In evolutionary biology, answers to these questions have time dimensions. Consider first, the millions of years in which the human species barely survived in a very small ecological niche. Second, consider the thousands of years in which humans learned to control the environment for their benefit. Third, reflect on the recent centuries in which humans have displayed great success exploiting the environment. And finally, look into the next century in which humans will suffer from a shortage of additional Earth resources to exploit.

In their competition with other life forms, the survival of early humans may be attributed to their ability to act as a family unit incorporating both males and females in specialized roles. The females managed family nurturance and at the same time by using their capacity to choose when to copulate were able to direct the destructive energies of males beyond the family to the tasks of hunting and family defense. Without rituals, later associated with the functions of large scale leadership, women managed the processes of human survival during the earliest millions of years of humanoid existence--high death rates matched by high birth rates.

Strong female management may have continued through much of the learning-to-exploit-the-environment millennia. The technologies of hunting and warfare were greatly improved, adding to the importance of hunters and warriors in human society. Hierarchical leadership roles were formalized as exclusive male activities and extended to the recognition of males as family and community spokesmen. Females continued to manage family nurturance and participated in external affairs via influence on their men folk. In a very dangerous Earth environment presumed to be limitless, exploitation skills (identified as male activity) had more status than the skills

of environmental accommodation (identified with female work).

As humans continued to improve their skills and technologies to include writing, religious treatises such as the Bible and the Koran (basic to the larger organization of tribes and nations), proclaimed a condition not obvious within families, the inferiority of women and the male duty to subjugate inferiors. Honoring of ancestors in the male line, patrilineal decent, was ritualized. The Biblical begats display the significance of this male-line organization in higher status families.

Exploitation as Success

Male skills exploiting the environment on the large scale proved their value in the recent centuries--human successes increasing the size of the human niche from one billion to six billion. Male management successes (environmental exploitation) were manifest a millennium earlier in the East than in the West. Mixed into the sophisticated family caste and class system of India, the importance of male skills was elevated to male lineage purity. As male line purity was ritualized in Hindu practice, the question for Indian patriarchs became, How can each man be certain that his and only his genes are carried forth into his children? Given the religious injunction of husbands to control wives, the method applied has been the suppression of every opportunity of women to utilize female power, sexuality... That is, the disempowerment of women.

The supreme importance of male-line purity as applied within the family hierarchies of the caste and class system in India causes and supports the suppression of female sexuality. The social change from female freedom and status of earliest human behavior to female suppression occurred over the millennia in sophisticated societies nearly everywhere on Earth. That is, as human skills exploiting Earth resources increased, the relative value of accommodation skills decreased.

Given their knowledge and technology, our early human ancestors survived in a struggle with other life forms for the limited Earth resources available to them. These humans, unable to control their environment, accommodated to it. Recently humans have grasped the finite size of the Earth resources available for human use, and we have observed clear indicators that the exploitation potential of these resources is limited. Today humans may be able to control much of their environment, but in the twenty-first century, humans are running out of environment to control. The new formula to save the human species from extinction is sustainability. In human behavior, sustainability is accommodation to a limited environment.

Lineage Purity

Let us return to the case of the male line purity of India. Is there a workable alternative? Yes, female line purity. When we trace our ancestors through our mother to her mother to her mother and so on there are seldom mistakes. The line is clear. While some management of male sexuality and female sexuality is desirable in a well ordered society, female line purity may be maintained, more or less automatically, without the suppression of female sexuality. Allowance for female freedom and status correlates with accommodation, our word for the human behavior, human sustainability.

Inasmuch as the purity of male lineage is not absolute in India, we only need to look into the proximate reality of female lineages within the culture and economy of India to examine the different human well-being outcomes. A necessary thesis in this analysis holds that the female freedom and status are associated with female lineage -- female lineage systems persisting in a part of India. That is, in spite of the civilizing experiences of millennia which have changed family structures in most of India into patrilineal forms, matriliney still exists in the state of Kerala. See Appendix E. Stated in a modest and generalized perspective, we now find strong patriarchy in India and weak patriarchy in Kerala. See Appendix F.

Accommodation as Success

We have referred specifically to one of the several evolutionary changes from mammals to humans--the very limited time interval (in some animals called heat) for female acceptance of sexual intercourse to the almost continuous potential for sexual activity in human females. And we asked: What is this change adaptive to? This change is adaptive to the sharing of power in cooperative efforts creating well-being for human families. That is, this female capacity can equalize or neutralize larger body size and the male special male capacity for destruction. The exploitive tendency of males can be moderated, that is, directed toward an accommodation with the environment, and toward the accommodation of family nurturance.

In reference to the survival of the human species, we also asked: What are the advantages of female freedom and status? Given the answer to our first question, this question becomes: What are the advantages of accommodation with the environment? as contrasted to exploitation. In the earliest history of humans on Earth, the environment was so dangerous to humans that accommodation was necessary for survival. In the middle history, humans learned to control the environment for their benefit. Accommodation became a matter of convenience. In the most recent human history, the finite nature of the environment of the Earth denies the

possibility of increasing the numbers in the human ecological niche. Human survival now requires accommodation.

The size of niche for each life form within the total environment of the Earth is usually limited by the changing conditions of the niche's environment. That is, the niche of any life form usually expands and contracts in reaction to the other elements of the environment. A tiny human niche in an accommodating mode survived for a very long time with short lives and high birth rates. As humans learned to exploit the environment for their benefit, life spans increased, increasing numbers of humans. In an exploiter mode, the number in human niche was increased to Earth size.

Summary One

We began with a set four critical variables which may allow human sustainability in India. Neither wealth nor high per capita incomes were among these variables. As a condition of sustainability, zero population growth was necessary. As a condition of zero population growth, sufficient well-being was necessary. As a condition of sufficient well-being, the application of female efficiency skills was necessary. And as a condition of maximizing these female efficiency skills, female freedom and status was necessary.

Well-being Efficiency

Kerala, a state within India with less than four percent of the Indian population has been identified as the significant place where the indigenous knowledge included female freedom and status. What is the maximum application of female freedom and status? And what is sufficient well-being? Sufficient well-being means measures of well-being high enough to cause moms and dads to voluntarily choose a small number of children establishing zero population growth in the society measured.

An efficient process (in this case, the application of female skills) is easily defined as the maximization of a desired output and the minimization of a some input in short supply. In this case, the desired output to be maximized is human well-being. And the input in short supply to be minimized is ecosystem services or Earth resources. Further, in the case of India and Kerala within India, the supply of Earth resources is fixed at a low level by the ecological and the political factors, that is, India. The efficient process observed is the maximization of female skills use in Kerala. See Appendix G. And conversely, the inefficient process creating well-being in larger India is the inefficient application of female skills.

Per Capita Consumption

Our analysis of efficiency in the creation of the desired output, well-being, shows us a way to answer another question of particular interest to ecologists and economists. Measuring the amounts of Earth resources which are consumed (taken from the ecosystem) per capita in Kerala may be a difficult but not impossible scientific work. In view of the evidence that this amount of Earth resources has been converted into levels of well-being sufficient to establish zero population growth, we may define this amount as an efficiency benchmark. That is, the amount of Earth resources taken per capita in Kerala is shown to be the smallest known value which can establish zero population growth.

In the event that another society may be discovered which has established zero population growth with even less taking from the ecosystem, an even greater efficiency standard will have been located. Applying the Kerala benchmark and measures of the amounts of Earth resources taken per capita in those societies which have also achieved zero population growth, we have a method to display a scale showing the relative efficiencies of these societies. Note that such a scale incorporates much more than the usual efficiencies of production of goods and services. All unpaid contributions to the creation of well-being, largely women's work, are within the formula.

Summary Two

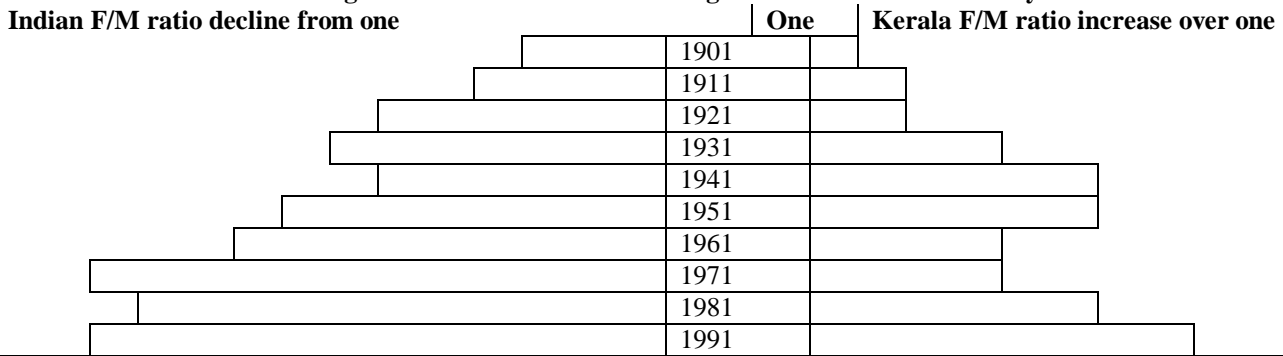
The ecological and political parameters of India have provided a set of controlled conditions for the measurements of the effects of useful indigenous knowledge (weak patriarchy contrasted to strong patriarchy) in the place, Kerala. The effects of weak patriarchy are well-being sufficient to cause low birth rates and zero population growth. Measurement of the per capita value of the consumption of Earth resources in Kerala is possible. Such measurements set a benchmark for the minimum Earth resource consumption necessary for human sustainability. In addition, the relative efficiencies of the well-being processes of various cultures and societies may be known.

Appendix A: Female Freedom and Status

The evidence of low and declining female freedom and status is found in census data displaying a century of abnormal human behavior in India. The female/male ratio displayed on the right side of the One baseline in Figure 1 shows the female/male ratio increase for Kerala. This increase in the female/male ratio is the normal pattern almost everywhere in the world. The left side of the One baseline shows the decrease of the female/male ratio in India -- a regular but abnormal decrease throughout the century. The distance between the extent of the Kerala increase and the India decrease is a measurement of the significant difference in the freedom and status of females in Kerala and in India

Large samples of humans show one sex determined difference favoring males and another sex determined difference favoring females. The number of live births of males exceeds females by about six percent. That is, the female/male ratio at birth is 94 females for each 100 males. The female child is slightly stronger than the male and in normal populations by or before twenty five years the female/male ratio in an age cohort approaches one. The female strength continues to show itself throughout life with females outliving males by five or more years. Normal female/male ratios in whole populations of industrialized countries ranges form 103 to 108. Life expectancy for males is ten years longer in Kerala than in India, and life expectancy is fifteen years longer for Kerala females.

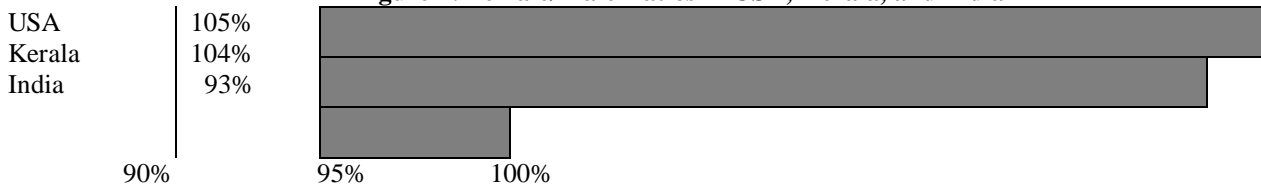
Figure 1: Female/Male ratio changes in the Twentieth Century



(Data from statistical appendix of Dre'ze and Sen 1996)

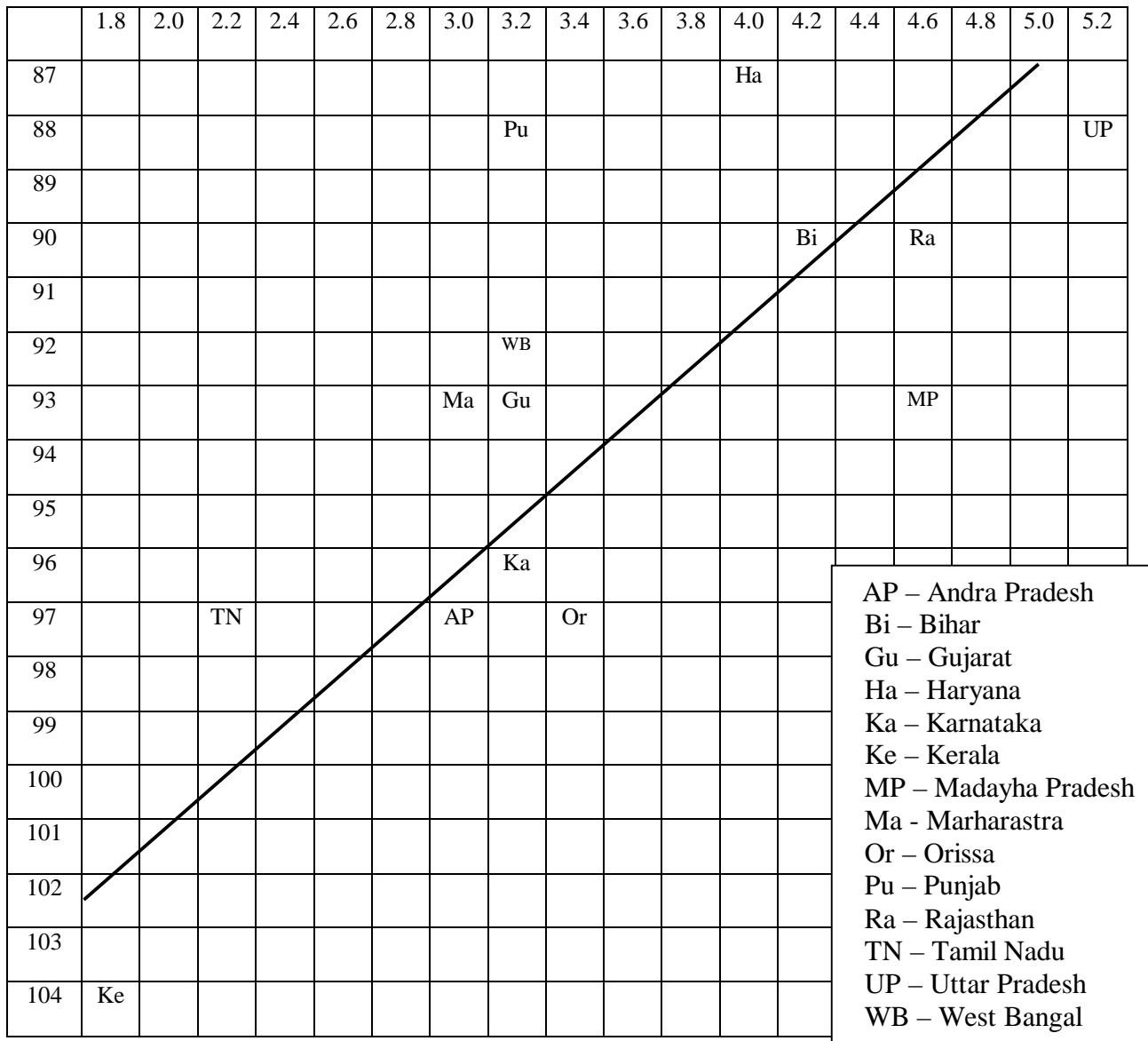
In Figure 1 above, the 1901 Indian ratio stood at 97.2 females for each 100 males and by 1991 this low ratio had decline to 92.7 females per 100 males. In Kerala the ratio was 100.4 females per 100 males in 1901 and increased to 103.6 by 1991. The significance of the different female/male ratios measured in 1991 may be displayed in a Figure 2 comparing place differences of USA, Kerala, and India in the range 90% to 105%.

Figure 2: Female/Male Ratios in USA, Kerala, and India



The place location of the high and low female/male ratios in India may be displayed on a chart contrasting the 14 major states in India. Figure 3 plots female/male ratios against the desired outcome, total fertility rates. The female/male ratios are shown as going up the left side of the chart and the total fertility rates increasing from the left to the right.

**Figure 3: As Female/Male Ratios decrease,
Total Fertility Rates increase in 14 major Indian states**



(Data from the statistical appendix of Dre'ze and Sen 1996)

Total fertility rate is the computed number of children which are born to each female in a given society during her reproductive life. When this number drops to two or less the society measured is on the way to zero population growth. The total fertility rate for India in 1991 was 3.7 and at the same time the total fertility rate for Kerala was 1.8.

The isolation of Kerala in the lower left corner of Figure 3 above emphasizes the place difference of Kerala from the other major states of India on these cause and effect measures, that is, low female/male ratios maintaining high total fertility rates. The other states are scattered upward with declining female/male ratios and scattered to the right with increasing total fertility rates.

Appendix B: Synergism of female skills with new technologies

The most revealing measure of well-being in short time periods is infant mortality rates. IMR is the number of infants which die in the first year of life per 1000 live births. Infant mortality rate reveals the quality of life in the whole society--an indirect measure of the quality of

the food and water, the quality of housing and clothing, and the availability of education and health care. The higher IMR of India divided by the lower IMR of Kerala produces a ratio larger than one which may be ordered in a time series, top to bottom in the Figure 4 following.

Figure 4: India/Kerala ratio of Infant Mortality Rates in the Twentieth Century

Calculated from census data to 1970	
1911 to 1920	1.15
1921 to 1930	1.09
1931 to 1940	1.19
1941 to 1950	1.25
1951 to 1960	1.16
1961 to 1970	1.73
Sample Registration data from 1971	
1971	2.22
1976	2.30
1981	2.97
1986	3.56
1991	5.00

(Data from Table 10 of Ramachandran)

Figure 4 above shows that the infant mortality rates of Kerala and India during the first 60 years of the past century were only marginally better in Kerala than in India. This early period contrasts dramatically with the improvements in the Kerala's infant mortality rates in the latter half of the century. Why did these more recent well-being measures in Kerala improve so much more rapidly relative to India's slower improvement?

The significant background occurring equally in Kerala and in India during this time period (last half of the twentieth century) was the infusion of western technologies. The significant difference between Kerala and India was the support of female skills in Kerala and the suppression of female skills in India. Figure 4 displays the evidence of a synergetic effect produced by the combination of female skills and western technologies.

Appendix C: Well-being and Birth rates

Well-being closely approximates the general goal of human societies. A dictionary defines well-being as "a good or satisfactory condition of existence; a state characterized by health, happiness, and prosperity; welfare". In the low income Indian context of this analysis, the higher income implied in the words prosperity and welfare may be set aside. Here we are following the lead of two authorities (Dodds and Ger). In addition, we note the general poverty in India and Kerala, and the lack of evidence of any income advantage in Kerala. Thus we are able to exclude income from our place definition of well-being in both India and Kerala within India. The near negative economic growth of Kerala shown in the following table. Figure 5, defies the usual economic wisdom of wealth first.

Within this analysis of the effects of female freedom and status, we have a need for specific and widely accepted measurements clearly displaying the higher well-being in Kerala -- higher well-being which is the essential cause of voluntary declines in human birth rates everywhere. We find such measurements in infant mortality rate, life expectancy, educational attainment, and total fertility rate. In Figure 5 we display these and related measures for Kerala and India in a comparative context adding meaning to these measures. Kerala is compared with two leading Indian states, and India is compared with its four of close neighbors. All higher well-being measures correlate strongly with lower total fertility rates. Only in the case of China, with mandated small families, does higher economic growth correlate with smaller families.

Figure 5: Comparative Data Table: India, three Indian states, and four Indian neighbors

	Kerala	West Bengal	Uttar Pradesh	INDIA	Bangla -desh	Pak-istan	Sri Lanka	China
Females Per 100 Males	104	92	88	93	94	92	99	94
Infant Mortality Rate	17	66	98	79	91	95	18	31
Female Life Expectancy	74	62	55	59	56	59	74	71
Male Life Expectancy	69	61	57	59	55	59	70	68
Female Literacy Rate	86%	47%	25%	39%	23%	22%	74%	68%
Male Literacy Rate	94%	68%	56%	64%	49%	49%	94%	87%
Economic Growth	0.3%	2.5%	2.2%	3.1%	1.9%	3.0%	2.6%	7.7%
Total Fertility Rate	1.8	3.2	5.1	3.7	4.0	5.6	2.5	2.0
Population, Millions	29	68	139	884	114	119	17	1162

(Data selected from Statistical Appendix of Dre'ze and Sen 1996)

Appendix D: Familialism and Family Hierarchies

An often puzzling aspect of Indian culture is the absence of the western individualism -- the belief that human actions are determined by and take place for the benefit of the individual. The individual interests of mature adolescents and adults in the West are expected to be served before responsibilities to extended families. The individualism of economic theory holds that each citizen must be allowed freedom in the exercise of his business pursuits and any financial rewards are his to distribute as he pleases. In the Indian experience, the contrary belief to this powerful western doctrine might be labeled *familialism*. For example, in India, marriages are not arranged between individual men and women but between families.

The lineage system in India is generations deep, that is, persons related by blood and marriage as parents, brothers and sisters, aunts and uncles, and cousins. The family in India is a unit much larger and much stronger than the nuclear western families. In India, family interests take precedence over the interests (desires and choices) of each family member. Only those individual initiatives which are dedicated to and clearly benefit the entire family unit are tolerated and encouraged.

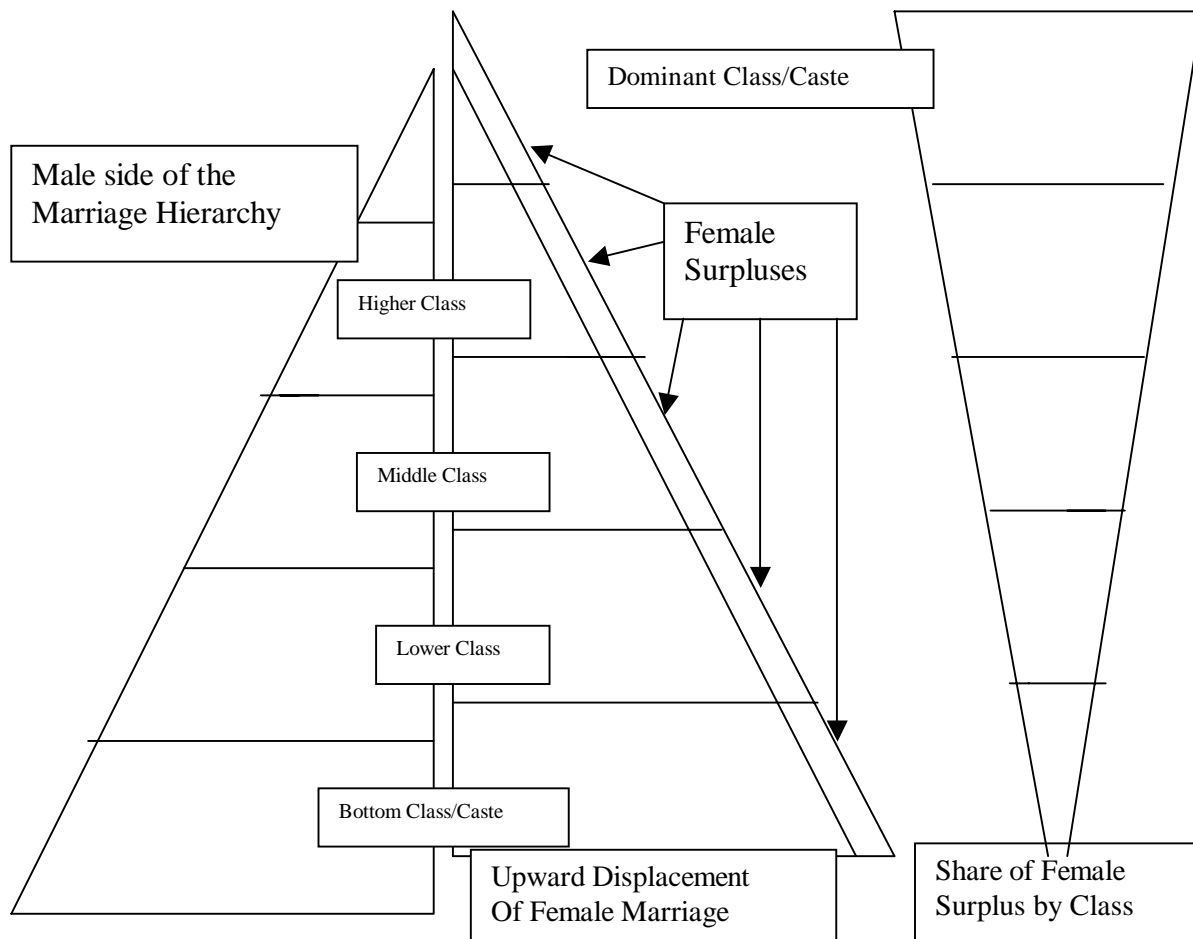
Individualism may be over emphasized in the explanations of human behavior outside of India. On the other hand, it is difficult to over emphasize the importance of *familialism* as a determinant of human behavior in India. This generalization applies both in India and Kerala within India. The individualism of the

West seems to need a doctrinal statement while *familialism* is so inherent throughout the culture of India that no rational is needed.

This *familialism* is firmly held within the Indian family class and caste system. Several powerful customary rules may be stated. First, pure male lineages are the basis for family organization. Purity of the male lineage can be guaranteed only by eliminating every possibilities of suspicion that a bride is not a virgin and by eliminating every suspicion that any wife might have an opportunity to be unfaithful to their husbands.

Second, families strive to maintain and improve their social, economic, and political class status. Social mobility of individuals is not possible. Third, marriages are the markers of family status. All females must be married and family status can be maintained only when the daughters are married into families of equal or higher class status. Fourth, as corollaries of the above rules, no wife may divorce, and no widow may remarry.

These rules are illustrated in Figure 6 below showing a hierarchy of families stratified within the hard line rules of Hindu caste. Monogamous marriage requires one female on the right side for each male on the left side. The daughters must marry within the class of their natal families or higher. The reality of some daughters marrying higher in the class hierarchy shifts the female side of these marriage matches upward relative to the male side.

Figure 6: Location of Unwanted Daughters in Indian family class/class status

This upward displacement of females causes the surplus of girls set off along the right edge of the hierarchy shown in Figure 6. This daughter surplus must be disposed of as a cost of maintaining hierarchical family status. Note also that the surplus of girls relative to the population of boys at each class level is greatest at the top and declines toward the bottom as shown in the inverted pyramid to the right in the above diagram. Daughters disposed of do cause a small surplus of sons at the lowest class/caste level not shown in this illustration.

The model pictured above was created using the data and antidotal information about female infanticide from Northern India in the nineteenth century (Dickemann). The twentieth century daughter disposal method is neglect, known as fatal daughter syndrome (Alexander 2001), driven by the same status motivation and with the same effect throughout the twentieth century in India.

Appendix E: Matriliney in Kerala

An American tourist wearing feminist eyeglasses may easily see female freedom and status in India as ranging from bad to terrible--bad in Kerala and terrible in India generally. Both the data and the following observations shows Kerala female freedom and status as significantly better than in India.

Expression of female sexuality in India is restricted by community norms and strictly enforced within the family class hierarchies. The Indian marriage norm is monogamy negotiated between the families of the bride

and the groom. With exceptions for families with western connections, it is presumed that neither the bride nor the groom should be consulted in marriage arrangements. These marriages must be within caste and in addition the need of the families to maintain or improve their class standing prohibits the marriage of girls into lower class families. That is, marriage may be upward or laterally relative to a bride's natal family class, but never downward.

The hard-line rules limiting female sexual expression--enforcement of early marriage for girls, no divorce, and no widow remarriage creates for men a virtual monogamy within their class and caste. Male sexuality does find expression with females of lower class and/or caste. That is, male sex relations outside of marriage with women of lower class or caste is often tolerated. Such out-of-marriage encounters degrades the woman involved to the bottom of the status ladder, outcasting -- social standing in India little different from a domesticated animal.

Among the Rajput caste of Northern India, the restricted female expression of sexuality looks like a severe application of the sexual mores of the English upper middle class in the Victorian age. On the other hand, the freer pattern of female sexuality exemplified in the Nayar households of Kerala has no well-known western equivalent. The sexual expression allowed Nayar women is best understood in the history of a most important Nayar institution called a taravad -- extended matrilineal families resident in a large-home compound. The taravad institutions of Kerala based on matrilineality have survived nearly intact into modern times among the small Indian population residing on the Laccadive Islands off the coast of Kerala (Dube).

Patriarchy is evident everywhere in India; we find no evidence that matriarchy has ever prospered. On the other hand, different family structures have persisted in India for centuries. Consider matrilineality versus patrilineality and matrilocality versus patrilocality. As an example of a strong combination of matrilineality and matrilocality we may look at the Nayar caste in Kerala. For an example of a strong combination of patrilineality and patrilocality we may look at the Rajput caste of North India. Both of these land-owning castes contain an internal hierarchy of social-economic classes.

Displaying lineage through the female line -- matrilineal decent -- is evident; mothers can always be known. In contrast, lineage expressed through the male line, patrilineality, has the potential for error. In order to reduce all chance errors to zero, rigid restrictions on female sexuality are enforced. The patrilineality of the Rajputs accommodates the participation by female elders in marriage arrangements, but generally patrilineality disables females -- no exercise of feminine wiles, no female divorce, and no female remarriage. Nayar matrilineality enables females in the choice of marriage partners, divorces, remarriages and even polyandry.

As soon as Rajput girls reach menarche they are excluded from public sight and their families earnestly seek to arrange their marriages bargaining with as much dowry as possible. Although restricted by customs of propriety, Nayar girls are allowed to attend school and be seen in public. A Nayar man who finds a girl attractive may approach the girl's family with a marriage petition. The Rajputs are duty bound to marry every daughter; on

the other hand, a Nayar daughter retains her secure place in her mother's taravad whether married or not.

Within marriage, Rajput daughters are further disabled. The bride moves from her family home to reside with her husband's family -- patrilocality. In her new Rajput home, her status is low, subordinate even to children in the household. Initiatives by the bride are allowed only via her husband, a man she had not met before her wedding day, a man who values his extended family above his wife. She should not talk to and certainly not influence males other than her husband. Visits to or from her mother and her sisters are restricted and may be denied.

In contrast to the disablement of females in Rajput patrilocality, females are empowered by Nayar matrilocality. In Nayar marriages, wives stay within the shelter of their mother's households throughout their lives, and husbands continue to live in their mother's households. A Nayar wife lives with her grand mother, her mother, her aunts, her uncles, her sisters, her brothers, her cousins, and assorted children. These close blood relatives provide a sympathetic reference group empowering a Nayar female at every crossroad throughout her life. A husband is allowed to visit his wife in her family compound and her apartment at her convenience and pleasure.

Neither the Rajputs nor the Nayars are regarded as the highest Hindu caste. This honor goes to the Brahmins, the exclusive caste of religious teachers. Brahmins do not restrict themselves to religious pursuits and have an internal class system somewhat like the Rajputs. As far back as written history will carry us, there has been in Kerala a caste of super Brahmins known as Nambudiris or Nambudiri Brahmins. Nambudiris practiced an extreme form of primogeniture. Only the eldest son was permitted to marry.

This practice of first-son-only marriage produces a number of sons and daughters who may not marry. Excess daughters were relegated to a long life as virgins unseen outside their household compounds. Excess sons may not cross caste barriers to marry lower caste daughters, but liaisons with Nayar females were permitted. These liaisons between Nambudiri men and Nayar women were essentially the same (from the Nayar point of view) as the marriage of a female into a higher Nayar class. That is, the children of Nambudiri men and Nayar women belonged to the Nayar mother and her mother's household. The Nambudiri fathers of children by Nayar women had no claim to these children and no ascribed responsibility for them.

We turn now to the population-growth effects of the differences in the expression of female sexuality among the Rajputs and the Nayars within their respective class hierarchies. Among the highest classes of the Nayars a few daughters entered into marriages with Nambudiri sons. At each step going down the Nayar class hierarchy, a potential for a few daughters to marry up was created.

In addition, a girl might choose to not marry at all, further reducing the number of girls who must find husbands. Available daughters -- were valuable assets of the female lineage households -- a potential for improvement of the status of the family class up the Nayar hierarchy. The families of Kerala do not have a surplus daughter problem as described in Appendix D.

With no upward possibilities for daughters at the top of the Rajput class hierarchy and almost no allowance for non-marriage, the Rajput class-improving strategy became more sons. Families with wealth impoverished themselves by paying large dowries to marry their daughters up. Higher ranking families replenished their wealth by accepting daughters and wealth from lower class families. As a family planning problem, the recognized strategy was more sons. Within the Rajput caste, the more-sons solution (by means of less daughters) long ago became female infanticide. In the twentieth century, excessive mortality of little girls is now accomplished by food, health care, and education discrimination against girl children called fatal daughter syndrome (Alexander 2001).

Appendix F: Weak Patriarchy

The generalized markers locating the difference between more and less female freedom and status have been weak patriarchy and strong patriarchy. The special markers were matriliney and patriliney identified with matrilocality and patrilocality within the strong extended families common to both place locations.

Wives are owned by families in India. Patrilineal extended patrilineal households contains the direct male descendants of a common male ancestor related as brothers, sons, and grand sons. Wives are brought in from other families. Brides arriving in the household are strangers with status lower than male children. Depending on her personal strength, a wife who has produced several sons may in time begin to share in the honor of the patrilineal kinship. Daughters, not part of the male line, must be sent by marriage into other households. Marriages are a family affair and divorce for males is

The effect of the Rajput, less-daughters strategy, was first noted in the ratio of females/males in the surviving populations in the states where the Rajputs have dominated. In addition, the effect of the less-daughters strategy is further revealed in the abnormally high death rates of Rajput girls ages 0 to 10 as contrasted to the death rates of Rajput boys ages 0 to 10. This abnormally high death rate for girls found in lesser degrees throughout the India (excepting Kerala) accounts for the long-time decline in the Indian female/male ratios. See Appendix A.

The Rajput solution to a perceived excess-daughter problem (when emulated by other communities and localities throughout India) is a fundamental cause for slow improvement of well-being in India. The crucial social-psychological question in this study becomes: What are the effects on millions of Rajput and other caste daughters who struggle and survive deprivations of food, health care, and other needs--deprivations not experienced by their brothers? We argue that the capacity of these girls to bond with other humans is impaired. This impairment limits their influence in the application of female skills (efficiencies in the use of limited resources) to the human life processes creating well-being for others.

difficult. For females, divorce and remarriage are not allowed.

Husbands are lovers in Kerala. Matrilocal extended matrilineal households contain the direct descendants of a common female ancestor. Daughters are not expected to leave their natal households. The adult women are married but husbands do not reside in the household. The males in the household are all kin of the females -- sons, brothers and uncles. A husband may arrive in his wife's household after dinner and will return to his own matrilocal household before breakfast. Close kin support, male and female, is immediately available to females. Responsibility for children lies with their mother and her extended family, not the children's father. Uncles are responsible for the training of nephews. Separation, divorce, and remarriage are in the Indian context somewhat easier.

Appendix G: Human Efficiency

Efficiency is the quality of being efficient. And efficient is performing in the best possible and the least wasteful manner. Humans are performing a task -- creating well-being for themselves. In the context of human sustainability, humans should be least wasteful of finite Earth resources. Thus, human efficiency is the best possible and least wasteful use of Earth resources. The best possible refers to the optimum amount of well-being which humans can create within the limits of Earth resources available and the limits of human capabilities. In the efficient processes of creating well-being in Kerala,

there is evidence of a synergistic relationship between new technologies and female freedom and status. See Appendix B.

Relative efficiency values of various human populations may be calculated within the context of sustainability. Such calculations began by locating the society which meets the population requirement (zero population growth) of sustainability while utilizing the least amounts of Earth resources per capita. The amount of Earth resources utilized per capita in that society is the base one. All other societies which have also achieved

zero population growth may be assigned an efficiency score -- the inverse of the number of times their Earth

resource utilization is greater than one expressed as a per cent.

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