COMBINING ECONOMIC AND NON-ECONOMIC OBJECTIVES IN DEVELOPMENT PLANNING: Problems of Concept and Measurement

by

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PREFACE

The gross national product (GNP) is our principal measure of economic progress. It enables us to make reproducible quantitative statements about the same economy at different points in time and about different economies at the same point in time. Operational methods for measuring GNP flow directly from the theory of general economic equilibrium.

GNP describes the performance of an economy. However, political leaders must be concerned about the performance of a society. The absence of accepted measures of societal performance (in addition to GNP) inhibits scientific discussion of social objectives. The current interest in "social indicators" and measures of "the quality of life" is directed toward bringing some order into this discussion.

In this paper we suggest the extension of general equilibrium theory to all outputs of a society. This leads us to the concept of a gross social product or GSP which includes the GNP and gives symmetrical treatment to economic and noneconomic societal outputs. Such a measure (GSP) would facilitate the task of combining economic and noneconomic objectives in development planning. It would also facilitate intersocietal comparisons at a given time.

The extension from GNP to GSP involves more than a notational exercise. We will introduce some concepts from sociological theory (Talcott Parsons), from individual and social psychology (Eric Berne), and from ecological psychology (Roger Barker) and comment on some practical problems of measuring the noneconomic components of the gross social product.

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1. Introduction *

The development problem starts at the world level with three interrelated systems, (1) societal, (2) technological and (3) biophysical or enviromental. These systems correspond roughly to the labor, capital and land of classical economic theory. As factors of (economic) production, elements of the three systems are linked via a set of activities into a world economy. The outputs delivered to final human demand constitute the gross economic product. These outputs are exhaustively allocated to consumers, producers and resource holders, so that gross world (economic) income is identically equal to gross world (economic) product subject to the initial distributions of income and resource holdings.

Any functional system can be characterized as a set of inputs, a set of outputs, and a set of relationships for transforming inputs into outputs. Leontief's input-output model clearly fits this description, and the money value of the vector of final outputs in Leontief's model is the gross economic product.

In the United States, some 40 percent of the population is in the labor force. On the average, members of the labor force devote 35 or 40 percent of their waking time to "gainful employment". Hence, employment directly reflected in the gross national product occupies only 15 percent of the population's total waking time.

Every hour of human behavior has some value to the participants. The other 85 percent of total waking time includes the leisure time of

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workers and all of the waking time of persons not "gainfully employed".

It follows from this that the economy is a very open system. Workers enter it in the morning and leave it in the afternoon. Members of the labor force may withdraw from it for protracted periods to become full time students or housewives. The activities of college students may be interpreted in part as a foregoing of current income in order to produce human capital which will raise the income stream in subsequent years. Calculations of the economic value of a housewife reflect some ambivalence about the accounting convention which excludes her unpaid services from the GNP while including the same activities when performed by domestic servants. The boundary between the family and the economy is also unclear in the case of self-supply of food.

The world societal system can in principle be characterized in terms of inputs, outputs and transformation functions comprising all human behavior and occupying total living time. To quantify this system at suitable levels of aggregation, we need exhaustive classifications of inputs, outputs and activities, economic and noneconomic alike. We also need to clarify the formal conditions under which the world society might be able to function as a self-optimizing system, maximizing world GSP subject to the initial distributions of all relevant resources, including cultural and behavioral resources used in noneconomic activities.

The basic problems of concept and measurement in proceeding from GNP to GSP can best be discussed at the levels of individual human beings and their interactions in "behavior settings" (to be defined shortly) and in small relatively self-contained communities. This is the approach we will use.

Talcott Parsons [1] lists eleven "generalized media of social

interchange", one of which is money. All social system outputs are delivered to persons ("personalities"), who perceive them as rewards; all social system inputs are provided by persons ("personalities") who perceive them as contributions. We can adapt Parsons' concepts to our purposes by stating that social system outputs are allocated exhaustively to the members of the society so that the gross social product is identically equal to the gross social income. If we can specify a complete system of prices (equivalent money values in some sense) for all of these outputs we will obtain a measure of the gross social product (GSP) in dollar terms. The GNP will be seamlessly incorporated in the GSP; we can, of course, retrieve the GNP by selecting out those activities, outputs and inputs which are included in the current operational definition of GNP.

Eric Berne [2,3] asserts that people allocate their time exhaustively among withdrawal, rituals, pastimes, activities, intimacy and "games". Roger Barker [4,5] states that all human behavior occurs in spatially and temporally bounded entities which he calls behavior settings. In principle, the total living time of members of a society can be classified in terms of the categories of behavior settings in which it is spent. From our standpoint, this separates the problem of measuring the gross social product into two subproblems, (1) measuring the inputs, outputs and transformation functions of individual behavior settings and (2) aggregating behavior settings into appropriate categories analogous, for example, to a Standard Industrial Classification code with its successive levels of detail.

Berne [3] specifically avoids using "work" as a separate category in structuring time, noting that from the standpoint of social psychiatry

many noneconomic activities are also "work". Barker applies the same concepts to behavior settings in schools, churches and government agencies as to those in business firms. Zytowski [6] in reviewing schemes for classifying work satisfactions, lists three main categories of satisfactions (extrinsic, intrinsic and concomitant) each containing several specific values. Thus, "economic return" is included among the extrinsic values along with security, prestige, achievement, advancement and recognition.

All the authors cited evidently use frames of reference which apply equally to economic and noneconomic settings. They are not inconsistent (for example) with the notion of a generalized input-output model in which deliveries to final demand would include the entire gross social product. The corresponding set of social accounts maintained over time could also be used as a basis for projecting alternative futures and anticipating social disruptions more clearly and objectively than we now do. Estimates of social costs and benefits could be expressed in terms of gross social product rather than of gross economic product only.

How far are we from being able to implement gross social product measures and models? This depends upon the quality and amount of effort that may be applied to developing them. In this paper we will juxtapose conceptual frameworks that have been put forward by other social scientists in recent years, make some suggestions toward implementation, and list some problems of concept and measurement that remain to be solved.

2. Talcott Parsons' "Human Action System".

Talcott Parsons [1] has presented a recent summary statement of his theories. We shall make use of his concepts of organism, personality, society, culture, and generalized media of interchange.

Parsons includes in his conceptualization of the "human action system" (1) the organism, (2) the personality, (3) the social system, and (4) the cultural system (including beliefs, ideas and symbols that give the action system its primary "sense of direction"). Our interest here centers on the social system and we will discuss it first.

The social system. Parsons says (p. 461):

> ... "I shall define society as the category of social systems embodying...the greatest self-sufficiency of any type of social system...
>
> "The core structure of a society I will call the societal community. More specifically, at different levels of evolution, it is called tribe, or 'the people', or, for classical Greece, polis, or, for the modern world, nation. It is the collective structure in which members are united or...associated..." The nature of this association is reflected partly in the patterns of citizenship (civil-legal, political and social)."

The other three primary subsystems of a society are the economy, the polity, and the cultural (or pattern-maintenance) subsystem. Each of the four subsystems of a society is characterized by its own medium of exchange: the societal community by influence; the economy by money; the polity by political power; and the cultural or pattern-maintenance subsystem by value commitments or "generalized commitments to the implementation of cultural values..." Influence is interchangeable for power, money, and value commitments.

Personality, social system and roles. Parsons states (p. 469) that:

> "The personality as analytically distinguished from the organism, constitutes the third primary environment of a social system. It interpenetrates with the organism in the obvious and fundamental sense that the storage facilities of learned content must be organic, as must the physical mechanisms of perception and cognition, of the control of learned behavior, and of the bases of motivation.
>
> "...the primary goal output of social systems is to the personalities of their members. Although they interpenetrate crucially with social systems, the personalities of individuals are not core constituents of social systems (nor vice versa) but precisely environments of them...

> "The unit of interpenetration between a personality and a social system is not the individual but a role or complex of roles. The same personality may participate in several social systems in different roles.
>
> "From the viewpoint of the psychology of the personality, the positive outputs from the social system are rewards. Indeed, I would even say that...except for intermediate cases specially involved at the crux of differentiation between organism and personality (notably, erotic pleasure), all rewards are social system outputs. Conversely, outputs from the personality to the social system are personal goal achievements which, from the viewpoint of the receiving social system, are contributions to its functioning..."

Generalized media of interchange. We have already mentioned the four media of exchange (influence, money, power, and value commitments) which, according to Parsons, are used within the social system proper. In addition, Parsons (p. 471) indicates that "other generalized media seem to operate in the zones of interpenetration between the social system and the other primary subsystems of action". These media include erotic pleasure; affect (including recognition and response); technological know-how and skill; ideology; conscience; reputation; and faith.

The concept of media of exchange (in addition to money) "circulating" in particular subsystems of the social system as a whole is a fruitful one, and we shall make use of it in subsequent sections.

The organism. Parsons (p. 466) is careful to distinguish between the organism and the personality:

> "...it should be emphasized that all relations between the social system and the physical environment are mediated through the behavioral organism. The perceptual processes of the organism are the source of information about the physical environment... The organism is also the source of the 'instinctual' components of the motivation of individuals' personalities."

Evidently, the health of the organism places some limits on the behavioral contributions of the associated personality. Barker [5] speaks of five behavior mechanisms--gross muscular activity, affective behavior,

manipulation, talking, and thinking--all of which draw on capacities of the organism. Gross muscular activity and affective behavior have a very long evolutionary history; manipulation, talking and thinking are closely interrelated in the most recent phase of human organic evolution which, according to Washburn and Avis [7], was increasingly dominated by the use of tools:

> "...Increase in brain size resulted from the new selection pressures stemming from tool use. Speech, made possible by the larger brain, was correlated with a complicated technological tradition; and the larger and more complicated society was made possible by the larger food supply. Human hunting depended on tools, and hunting brought about greater mobility... Increase in brain size was associated with a slowing of the growth rate and a much greater period of dependency. This changed the social life, establishing long-term social relations. Thus the hunting life changed man's psychology and the way of life of the human group."

These factors have also determined the general nature of human personality and the process of its development. Personalities, in Parsons' sense, receive the various outputs of the social system and attach values to them as rewards which serve as justifications and incentives for their contributions to the social system.

To what extent can personalities recognize and respond to Parsons' various media of social interchange? We will cite several authors on noneconomic satisfactions associated with the choice of occupations and specific jobs to indicate that people recognize and respond to these media and that their evaluations of the different media are relatively stable over time.

3. Recognition of Noneconomic Rewards Associated with Economic Activities.

If Parsons' media are to serve their functions of rewarding current and stimulating future contributions to a social system, the people involved must be able to recognize these media wherever they appear.

There is a great deal of evidence that people recognize and respond to noneconomic media (as well as money) in choosing jobs. For example, Zytowski [6] surveyed some 72 references dealing with the concept of "work values", "work needs", or "work satisfactions". He cites with approval Eli Ginzberg's trichotomization of work values into intrinsic, extrinsic, and concomitant types. Zytowski compares lists used by several different authors, including from 7 to 20 "values" each, and finds that they cluster rather well into Ginzberg's three categories.

Extrinsic factors, which represent "the outcomes of work, as contrasted with the means," include security, prestige, economic return, achievement, advancement, and recognition.

Intrinsic factors, which are "part of the job itself", include independence, altruism, creativity, way of life, intellectual stimulation, variety, and similar terms.

Concomitant factors include surroundings, working conditions, company policy and administration, interpersonal relations (with peers, subordinates, and superiors), dominance, dependence, leadership, authority, and similar terms.

The extrinsic factors can be identified with some of Parsons' media of exchange (money, prestige, recognition, and perhaps influence and political power) plus a survival need, security.

The concomitant factors appear to center on interpersonal relations. They evidently relate in part to affect (including recognition and response) and to Berne's "procurement of stroking" [3, p. 19].

Some of the intrinsic factors reflect the use of behavior mechanisms (thinking, talking, manipulation, gross motor activity, affective behavior) in line with special abilities and preferences. However, as "altruism",

"moral values", "social welfare", "helpful to others", and "responsibility" are also classified among the intrinsic factors, it appears that media such as ideology, conscience, faith, and "generalized commitment to the implementation of cultural values" are involved here as well. In any event, it is clear that many if not all of Parsons' reward media may be involved in the total satisfactions associated with jobs.

4. Roger Barker's Theory of Behavior Settings.

According to Parsons, "the unit of interpenetration between a personality and a social system is not the individual but a role or complex of roles... The primary goal output of social systems is to the personalities of their members." Outputs from the social system to personalities are rewards; inputs from personalities to the social system are contributions.

Can we indeed find appropriate units for observing the performance of roles and estimating the rewards and contributions associated with their performance? A highly promising approach to these questions has been pioneered by the psychologist Roger Barker.

The concept of a behavior setting. Roger Barker spent a good many years observing the behavior of residents of a small midwestern community of about 830 people. He early addressed himself to the question of how the environment of human behavior was to be identified, described, and measured. He concluded that the community environment could be divided into parts or units which he called behavior settings.[1/]

1/ Barker, Roger G., Louise S. Barker and Dan D. M. Ragle, "The Churches of Midwest, Kansas and Yoredale, Yorkshire: Their contributions to the environments of the towns," in William J. Gore and Leroy C. Hodapp (ed.), Change in the Small Community: An Interdisciplinary Survey, New York, 1967, pp. 155-189; and Barker, Roger G., "On the Nature of the Environment," Journal of Sociological Issues, Vol. 19, No. 4, 1963, pp. 17-38.

Barker says [4, pp. 158-159]:

> "Behavior settings are units of the environment that have relevance for behavior. They provide the primary data of the study to be reported here. We have dealt only with the settings that occur outside the homes of the community, that is, the public behavior settings. The number of public behavior settings in the town is a measure of the size of the town's public environment.
>
> We must emphasize that a behavior setting coerces people and things to conform to its temporal-spatial pattern. This is not an incidental or accidental characteristic. The person or persons who maintain and control the setting (the performers) make a deliberate effort to insure that this is so, and that the setting therefore fulfills its function. This aspect of a setting we call its program. Two settings are said to have the same program when their parts and processes are interchangeable. When this is true, two or more settings belong to the same genotype. A Methodist and a Presbyterian minister could, and sometimes do, exchange pulpits. The number of behavior setting genotypes in a town is a measure of the variety of the town's environment."

Barker identified 198 genotype settings in his town of 830 people. Examples include grocery stores, hardware stores, ice cream socials, kindergarten classes, business meetings, religion classes, hallways, bus stops, and many others.

When individual grocery stores, churches, and the like were recognized as separate or specific behavior settings, Barker found 884 public behavior settings in his town in 1963-64. He was able to record that the number of daily occurrences of behavior settings during 1963-64 was 53,258 and that the hours of duration of public behavior settings in 1963-64 totaled 286,909. Multiplying the hours of duration of each behavior setting by the number of persons participating in it, Barker obtained a record of "hours of occupancy" of behavior settings, totaling 1,129,295 in 1963-64. As there are 8,760 hours in a year, the total hours of "life lived" during the year by the town's 830 residents was 7,270,800. About 15 percent of these hours were spent in public behavior settings; the

remaining "hours of living" were presumably spent in private homes and in transit from one behavior setting to another.

Barker is definitely concerned with the reproducible measurement of all the aspects of behavior settings. His 1968 book (Ecological Psychology) is a rich source of ideas which may be useful in the development of social accounts and in measures of output applicable to both market and nonmarket institutions.

5. Combining the Economic and Noneconomic Outputs of a Society to Form a Measure of the Gross Social Product.

Our approach in this section is largely intuitive. However, a number of the concepts presented in previous sections lend themselves to a tentative synthesis.

Parsons' media of social interchange. Parsons' media include influence, money, political power, and value commitments; erotic pleasure; affect (including recognition and response); technological know-how and skill; ideology, conscience, reputation, and faith. Some of these media circulate mainly in specific "authority systems" (in Barker's sense): Money in the economy; political power in the polity; faith in churches; reputation in scientific and professional communities; technological know-how and skill in appropriate occupational groups and labor markets; influence in territorially based communities; erotic pleasure largely in the conjugal family system; and so on.

A number of Parsons' media seem to have "human capital" aspects. This is clearly true of technological know-how and skill. Higher wages paid to experienced workers imply that human capital is produced on the job as well as in schools. Influence, political power, and reputation usually require considerable application over a period of years--a

demonstrated capacity to deliver a specified volume of some desired output per unit of time.

Barker's behavior settings and related concepts. Several of Barker's concepts link up well with those of Parsons.

(1) Barker's five behavior mechanisms (affective behavior, gross motor activity, manipulation, talking, and thinking) occupy most if not all the time in public behavior settings: these mechanisms have a long evolutionary history. The established equilibrium for an individual at a particular stage of his life cycle would probably involve certain amounts (duration multiplied by intensity) of use of each of these five behavior mechanisms.

(2) Barker's authority systems include businesses, churches, governments, schools, and voluntary associations--these control "public" behavior settings. Families could no doubt be added as the authority systems that control behavior settings in private homes.

(3) Some of Barker's action patterns seem to have very nearly a one-to-one correspondence with specified authority systems, namely the action patterns called business, religion, government and education. Professionalism as an action pattern seems to interpenetrate the other four. The remaining six action patterns, nutrition, personal appearance, physical health, aesthetics, recreation, and social contact, seem largely independent of authority systems other than families and (in some cases, perhaps) voluntary associations.

(4) Barker's degrees of local autonomy (town, school district, county, state, nation) might be generalized into successive levels in an administrative decision-making hierarchy, regardless of whether the successive levels were located in a single building or in a hierarchy of

central places which controlled system operations over successively larger geographic territories.

We will make use of Barker's basic concept of behavior settings shortly in a more formal model.

A generalization of economic theory to all outputs of a social system. If we extend Barker's system of behavior settings to include all places of employment and all residences (plus settings occupied by residents of the community when they leave it temporarily on business or personal trips), we can establish an accounting system which is exhaustive with respect to living time, including sleep and private activities.

Each individual in a behavior setting has a role (student or teacher, grocer or customer, chairman or member, etc.). If two or more persons are involved in a behavior setting, "transactions" take place (in the terminology of Berne [3]) involving recognition and response. The utility of a behavior setting to an individual is a function of the setting as such, his own role in the setting, and his perception of his effectiveness in the role as evidenced by the behavior of other participants toward him.

We might postulate, then, that a "rational" personality will allocate his time among behavior-setting-and-role combinations in such a way as to maximize their (expected) total utility. If a role has a quality dimension, more preparation time may be required to perform it well than to perform it at the threshold of adequacy.

If we assume that a consumer can rate any two arrays of commodities as "A preferred to B", "B preferred to A", or "indifferent as between A and B", it may be equally reasonable to assume that a personality can make similar orderings of two arrays of behavior setting, role and quality-of-performance-in-role combinations.

In the case of economic transactions, we multiply observed market prices by quantities of the respective goods and services produced in a nation and compute gross national (economic) product, GNP. The ratios of market prices are (under certain restrictive assumptions) equal to the ratios of the marginal utilities of the corresponding commodities to each consumer. If the market prices for some base year are used as fixed weights, we can compute changes in "real" GNP over a period of years.

Would it mean anything to perform the same operation for all of Parsons' media of exchange? Perhaps so, if we visualize a personality as trying to maximize his total utility from a year of living by using his total capacities in the most effective way. If there are s media of exchange, n potential activities representing essentially all forms of human behavior, and s restrictions limiting the amounts of each medium that a given individual can use ("spend") as inputs into the social system, our model becomes:

$$\max U = f\,(t_1, t_2, \ldots, t_n)$$

subject to

$$\sum_{i=1}^{n} t_i p_i = Y = b_1$$

$$\sum_{i=1}^{n} t_i m_{2i} = M_2 = b_2$$

$$\sum_{i=1}^{n} t_i m_{3i} = M_3 = b_3$$

$$\vdots$$

$$\sum_{i=1}^{n} t_i m_{si} = M_s = b_s$$

$$\sum_{i=1}^{n} t_i = 8{,}760$$

Then

$$\frac{\partial U}{\partial t_i} - \lambda_1 p_i - \lambda_2 m_{2i} - \lambda_3 m_{3i} \cdots - \lambda_s m_{si} - \lambda_t = 0$$

for all

$$i = 1,2,3, \ldots n,$$

and

$$\frac{\frac{\partial U}{\partial t_i}}{\frac{\partial U}{\partial t_j}} = \frac{\lambda_1 p_i + \lambda_2 m_{2i} + \lambda_3 m_{3i} + \ldots + \lambda_s m_{si} + \lambda_t}{\lambda_1 p_j + \lambda_2 m_{2j} + \lambda_3 m_{3j} + \ldots + \lambda_s m_{sj} + \lambda_t}$$

Each unit of activity i uses up some time; many activities use up some money; some use personal influence; some use professional reputation; and so on. Each activity involves occupying a behavior setting and performing some role in it at a specified quality level. Each medium of exchange corresponds to a goal of activity for some if not all personalities. Some of Parsons' media seem to be <u>stocks</u> (for example, professional reputation) which yield a flow of inputs into the social system and bring in a flow of outputs or rewards from the social system. Intense application may increase professional reputation; diversion of effort to politics or gardening may cause it (or permit it) to decline. In measuring the utility enjoyed by a personality during a given year only the <u>flows</u> of rewards associated with possession of stock-like media should be included.

Some activities bring in only one or two of the s kinds of rewards from the social system and use only one or a few kinds of the s resources or "contributions," so there would be many zeros in the n times s + 1 "technology" matrix and hence in the expressions for the $\frac{\partial U}{\partial t_i}$, i = 1, 2, ...,n.

If the individual is free to convert time into money income and into flows of each of the other s-1 resources, the initial b_i's can be adjusted until the marginal utilities of time converted into all other limiting resources are equal.

Consider the following matrix of exchange rates among marginal utilities of the s resources (and time):

$$
\begin{array}{c}
 \\ \lambda_1 \\ \lambda_2 \\ \lambda_3 \\ \lambda_4 \\ \vdots \\ \lambda_s \\ \lambda_t
\end{array}
\begin{array}{c}
\begin{array}{ccccccc} \lambda_1 & \lambda_2 & \lambda_3 & \lambda_4 & --- & \lambda_s & \lambda_t \end{array} \\
\begin{bmatrix}
1 & k_{12} & k_{13} & k_{14} & --- & k_{1s} & k_{1t} \\
k_{21} & 1 & k_{23} & k_{24} & --- & k_{2s} & k_{2t} \\
k_{31} & k_{32} & 1 & k_{34} & --- & k_{3s} & k_{3t} \\
k_{41} & k_{42} & k_{43} & 1 & --- & k_{4s} & k_{4t} \\
\vdots & \vdots & \vdots & \vdots & & \vdots & \vdots \\
k_{s1} & k_{s2} & k_{s3} & k_{s4} & & 1 & k_{st} \\
k_{t1} & k_{t2} & k_{t3} & k_{t4} & --- & k_{ts} & 1
\end{bmatrix}
\end{array}
$$

The last row (k_{tj}) indicates the marginal rates at which time can be converted into each of the s media; the corresponding element in the last column, k_{jt}, is the reciprocal of k_{tj} (for example, $k_{1t} = 1/k_{t1}$).

If so, we have

$$\lambda_t = k_{t1}\lambda_1$$

$$\lambda_2 = k_{2t}\ \lambda_t = k_{2t}k_{t1}\lambda_1$$

$$\lambda_3 = k_{3t}\ \lambda_t = k_{3t}k_{t1}\lambda_1$$

$$\vdots$$

$$\lambda_s = k_{st}\ \lambda_t = k_{st}k_{t1}\lambda_1\ .$$

In this kind of equilibrium for the individual, we may write

$$\frac{\partial U}{\partial t_i} = \lambda_1 \left[p_i + k_{t1} (1 + k_{2t} m_{2i} + k_{3t} m_{3i} + \dots k_{st} m_{si}) \right]$$

If we multiply $\frac{\partial U}{\partial t_i}$ by t_i/λ_1 and sum over $i = 1, 2, \dots, n$, the first term, $\sum_{i=1}^{n} t_i p_i = Y$, is a component of GNP; i.e., the total consumption expenditures of the individual. The remaining terms are also expressed in dollars. The sum of all such terms would be the gross social product received by the individual. The corresponding sum over all individuals in a nation would be the GSP.

If an individual is making an optimal allocation of his time, the marginal utility of an additional hour per year should be the same in each of the behavior settings in which he participates. If <u>cardinal</u> measures were devised for the s media of exchange and the quantities of each contributed and received per hour in each of $r > s$ behavior settings were measured, it appears that relative marginal utilities such as λ_2/λ_1, λ_3/λ_1, ..., λ_s/λ_1 might be estimated by statistical means. Each behavior setting would yield an observation equation as follows:

$$\frac{\partial U}{\partial t_i} = \lambda_1 p_i + \lambda_2 m_{2i} + \lambda_3 m_{3i} + \dots + \lambda_s m_{si} + \lambda_t.$$

However, $\frac{\partial U}{\partial t_i}$ should be the same for all $i = 1, 2, \dots, r$ and λ_t should be a constant; each observation equation could be rewritten as

$$p_i = \frac{1}{\lambda_1} \frac{\partial U}{\partial t_i} - \lambda_t - \frac{\lambda_2}{\lambda_1} m_{2i} - \frac{\lambda_3}{\lambda_1} m_{3i} - \dots - \frac{\lambda_s}{\lambda_1} m_{si}.$$

Now, p_i is the money cost per hour of occupying behavior setting i. The variance of p_i among the r behavior settings should be attributable to variations in m_2, m_3, ..., m_s among the r settings. A least squares

estimate of $-\frac{\lambda_2}{\lambda_1}$ would indicate that a unit difference in m_2 per hour between two behavior settings would offset a difference of $-\frac{\lambda_2}{\lambda_1}$ dollars per hour in the costs of occupying them. If an hour in each of two alternative settings is regarded as an offer with price and non-price aspects, $-\frac{\lambda_j}{\lambda_1}$ translates the jth non-price difference into a money equivalent; i.e. a trade-off between a price and a non-price offer variation.

The place of the organism in social system models. Parsons states that the outputs of the social system are delivered to personalities and not, except in certain borderline cases (notably erotic pleasure), to organisms.

The model in the preceding section is stated in terms of optimizing the flow of rewards to a personality. This model could perhaps be supplemented by a set of constraints relating to the welfare of the organism. Thus, we might specify upper and lower bounds for the amount of use of each behavior mechanism (affective behavior, gross motor activity, manipulation, talking, and thinking) to reflect the needs and limitations of the organism. Lower bounds might be specified for sleep, on behalf of the organism. The social rationale for these indulgences is that illness or fatigue on the part of the organism will reduce the ability of the personality to make contributions and to earn (and enjoy) rewards. The prevalence of life, accident and health insurance symbolizes this dependence of the personality upon the survival and good physical condition of the organism.

There is a tradition of cost-benefit analysis, damage suits and settlements, and percentage disability estimates on which social accounting measurements might build. In general, it appears that injuries to the

organism should be evaluated in terms of reward streams foregone, monetary and nonmonetary, as a consequence. Where population groups are suffering extensively from malnutrition and illness, the difference between actual GSP and potential GSP with adequate nutrition and with illness rates characteristic of higher income groups would be an estimate of the potential social value of the necessary health and nutrition programs.

Optimizing within a behavior setting. The concept of optimization in social transactions is at least implicit in Berne. For example, in describing a simple pastime [3, p. 41] he states that "the transactions are adaptively programmed so that each party will obtain the maximum gains or advantages during the interval. The better his adaptation, the more he will get out of it." Also, the transactions involved are "complementary", a word Berne uses quite frequently.

Barker's discussion of the various forces acting in and upon a behavior setting to maintain its function at a quasi-stationary level is also illuminating. In his classroom example, it appears that any change in functional level which would make some members better off would make others worse off. However, an innovation (such as dividing the class into a number of groups on the basis of proficiency or interest) might lead to a Pareto-better situation in which no student was worse off and most students were better off than before.

A behavior setting may be regarded as a "cooperative plant" which has no objective function of its own but should be managed in such a way as to maximize the total net benefits distributed to the members, each member profiting in proportion to the amount he puts into the setting. Each member tries to allocate his total resources between this setting and all others in such a way as to maximize his expected total utility.

If the setting is a classroom, the teacher is responsible for managing the setting for the maximum benefit of the students. The students share in proportion to what they put into the setting (including study outside of the class itself); the teacher may get various rewards for good management of the setting in terms of (1) implicit or explicit feedback from students as to how much they are getting out of the course, (2) self-approval for living up to her ego ideal, and (3) higher salary.

Optimization for sets of interrelated behavior settings. The cost to a person of participating in one behavior setting is the opportunity cost of not participating in the highest-valued alternative setting.

Suppose that all children aged six to eleven in a community are required to be in school for 30 hours a week. If each child has considerable latitude to choose his activities within the school, he may approximate a local optimum and realize most of the complementarities potentially available (from his standpoint) in the school as a whole. Mutually recognized complementarities might lead to near-optimal study groups without external pressure. Each constraint which was thought necessary by teachers or administrators could be evaluated in terms of perceived reductions in the outputs of the settings directly and indirectly affected by it.

As in the theory of general economic equilibrium under perfect competition, it would be possible to accept the results of a self-optimizing process without attempting to measure them. However, if pressures and restrictions have been imposed on the self-optimizing process (and the continuance of some restrictions is deemed necessary), measurement of the outputs associated with alternative sets of restrictions is needed for policy guidance.

Optimization for a small community. The optimizing model involved in the theory of consumer behavior may be expressed as follows:

$$(1) \quad \max \; U = f(q_1, q_2, \ldots, q_n)$$

subject to

$$(2) \quad \sum_{i=1}^{n} p_i q_i = Y,$$

where the q_i are quantities of n consumer goods and services, the p_i are the corresponding market prices, and Y is the consumer's income, assumed fixed; the consumer's utility function, U, depends directly only on the quantities consumed, q_i $(i = 1,2, \ldots,n)$.

This model implies that the weighted average price elasticity of demand for the q_i is -1 and the weighted average income elasticity is 1; if all prices and money income are multiplied by the same scalar, the q_i will be unchanged.

If there are no externalities of consumption, these elasticity properties apply also to an aggregate of consumers, such as the 830 residents of Barker's community, provided that each of the 830 incomes is fixed and that consumers pay the same price for any given commodity.

Do these elasticity properties apply to our model of a personality allocating fixed amounts of s media among n behavior settings? We assume that his input into any behavior setting, i, is a vector of fixed numbers per hour of occupancy and that the output (reward) he gains from that setting is also a vector of fixed numbers per hour of occupancy.

If the money income constraint for this personality is binding, then the price and income elasticity properties must hold with respect to his economic transactions. By analogy, it seems that the same properties should hold with respect to each of the other media taken separately.

If so, the elasticity properties should also hold for each medium separately over an aggregate of consumers whose resource vectors contain fixed amounts of the s media. (These amounts can vary both absolutely and relatively as between different personalities.)

Competition among behavior settings for the time of community residents could be conceptualized recognizing that the total living time of the residents per year is a fixed number, so an increase in occupancy time for one genotype setting will require a decrease in occupancy time for one or more other genotype settings.

Suppose a resident is allocating his yearly living time among the n genotype settings available in the community and receiving a vector of rewards per hour in setting i with an equivalent dollar value of r_i. Then, we may write $t = a + Br$ in matrix notation, or in expanded form:

$$(1) \quad \begin{bmatrix} t_1 \\ t_2 \\ \cdot \\ \cdot \\ \cdot \\ t_n \end{bmatrix} = \begin{bmatrix} a_1 \\ a_2 \\ \cdot \\ \cdot \\ \cdot \\ a_n \end{bmatrix} + \begin{bmatrix} b_{11} & b_{12} & \cdots & b_{1n} \\ b_{21} & b_{22} & \cdots & b_{2n} \\ \cdot & \cdot & & \cdot \\ \cdot & \cdot & & \cdot \\ \cdot & \cdot & & \cdot \\ b_{n1} & b_{n2} & \cdots & b_{nn} \end{bmatrix} \begin{bmatrix} r_1 \\ r_2 \\ \cdot \\ \cdot \\ \cdot \\ r_n \end{bmatrix}$$

and $\sum_{i=1}^{n} t_i = 8760$; the total social income of the resident is $\sum_{i=1}^{n} t_i r_i$.

Then the following measure might be taken as a surrogate for his <u>quality of life</u>:

$$(2) \quad \frac{\sum_{i=1}^{n} t_i r_i}{\sum_{i=1}^{n} t_i} \equiv \frac{\sum_{i=1}^{n} t_i r_i}{8760} = \bar{r}.$$

Now, suppose that the matrix B is stated in elasticity form, relating percentage changes in the t_i to percentage changes in the r_i. If every r_i is multiplied by the same scalar, the t_i should not change. Also, if the reward per hour, r_i, for occupying setting i is increased while all r_j's (j=1,2,) i (, ... n) remain constant, occupancy time in setting i should increase or, at the least, not decrease. Hence, the diagonal elements b_{ii} will be non-negative and the off-diagonal elements b_{ij} $(j \neq i)$ will, on the average, be non-positive:

$$(3) \quad b_{ii} \geq 0; \; b_{ii} + \sum_{\substack{j=1 \\ (j \neq 1)}}^{n} b_{ij} = 0;$$

therefore,

$$(4) \quad \sum_{\substack{j=1 \\ (j \neq 1)}}^{n} b_{ij} \leq 0.$$

The genotype behavior settings might be grouped according to "authority systems" in Barker's terminology: Business, schools, churches, government, and voluntary associations; (also families, since we are including private as well as public behavior settings in our conceptualization). Thus, a resident's living time could be allocated exhaustively (for social accounting purposes) among these six authority systems and an average reward per hour calculated for each one; the weighted average of these six quality measures would be the $\bar{r}$ of Equation (2), a surrogate for the overall quality of the person's life during the specified period.

The quality of life of a resident is improving over time if the value of $\bar{r}$ is rising. If we aggregate over all N residents and all n genotype

settings and divide by total living time of the residents, we obtain

$$(5) \quad \frac{\sum_{k=1}^{N} \sum_{i=1}^{n} t_{ki} r_{ki}}{\sum_{k=1}^{N} \sum_{i=1}^{n} t_{ki}} = \bar{r}_N;$$

$\bar{r}_N$ is the average gross social product per hour of living time for all area residents. If $\bar{r}_N$ increases over time, the quality of life in the community is improving.

In addition to the crucial problems of measuring exchange rates between media for a given person and of aggregating "rewards" over persons, there would remain some more conventional problems such as (a) comparing rates of change in $\bar{r}_N$ over time as between different communities and (b) comparing absolute levels of $\bar{r}_N$ at a given date across communities.

An increase in the value of output of any behavior setting per participant hour will tend (ceteris paribus) to increase its share of the community's total living time. Some behavior settings are selective with respect to age or other population subgroups; an improvement in recreational programs for the aged would have its primary impact on behavior settings normally occupied by them.

6. Concluding Remarks

Our generalization of consumption theory to all outputs of a social system is by no means rigorous. Considerable empirical research would be needed to make it operational. A start could be made with Barker's data for the 198 behavior setting genotypes in his community of 830 people. Barker specifies two quantitative indexes, the ecological resource index (ERI) and the general richness index (GRI), which are combinations of his ratings on certain of the characteristics of behavior settings listed

earlier. The basic ratings for any setting relate to the setting as a whole as seen by a trained observer and not to the subjective experiences of its participants. One crucial question is whether the outputs perceived by participants in various behavior settings can be translated into Parsons' media of exchange or some variant of them. Another crucial question is whether participants have reasonably stable exchange rates between money and other media. Would they be willing to pay more money (as taxes, donations, or admission fees) to participate in a behavior setting if its output per participant hour were increased by specified amounts in terms of other media?

Zytowski's list of "work satisfactions" suggests that exchange rates between money and other reward media associated with jobs might be estimated on the basis of interviews with individual workers. Also, collective bargaining negotiations between companies and unions must involve many implicit or explicit tradeoffs between money and other media.

The concept of a time budget for a small community should be useful in discussing socioeconomic policies. Proposed changes in the performance level of any behavior setting will have some effect on the allocation of time and effort among other behavior settings in the community. Even if reward vectors and occupancy response coefficients are specified _a priori_, the time budget format will facilitate recognition of probable impacts and stresses on other behavior settings; the distribution of prospective gains and losses among population groups and authority systems can be anticipated approximately in quantitative terms.

Typically, communities of different population sizes in a country can be characterized as a hierarchy of central places--villages, towns, small cities, regional capitals and so on in ascending order [8, p. 368]. A

village is approximately self-sufficient with respect to specified services; a town is self-sufficient with respect to village-level services and to additional ones which require the larger population base of a town plus several nearby villages. The successive levels can be defined in terms of the presence of certain types of retail trade, wholesale distribution, and service establishments--i.e. behavior settings in the business authority system. However, behavior settings in other authority systems--government agencies, churches, schools, and voluntary associations--could also be used in defining levels of central places.

Thus, if Barker's community with its 198 behavior setting genotypes is a typical American village, a typical American town would contain all or most of these 198 plus a limited number of additional ones. Distinctive arrays of noneconomic behavior settings would be closely associated with distinctive arrays of economic behavior settings at each level. Detailed data for a limited number of actual behavior settings could be used for estimating multiple regression relationships between occupancy times and behavioral output measures in specified noneconomic and specified economic behavior settings at each level in the urban (central place) hierarchy. Data from a large scale national sample survey for one year could be used as the bench mark for time series of behavior setting occupancy derived from smaller current samples and secondary data.

Representative time budgets could be estimated for the populations of successively larger central-place oriented communities. In the United States the regional capitals and their associated commuting fields or functional economic areas (FEAs) are of strategic importance for development planning and socio-economic policy [9, 10, 11, 12]. An FEA is approximately self-contained as a labor market in the short run and as a retail

trade and service area. The matrix equation used in Section 5 to represent the effects of changes in performance levels in some behavior settings upon occupancy times in all behavior settings in a small community should be equally useful at the FEA level. The leaders of economic and noneconomic behavior settings in the area are equally engaged in the competition for human time, money and behavioral resources. The rules for maximizing GSP in the area should be simple extensions of the rules for maximizing GNP.

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