MODELLING ENERGY AND SOCIETY: THEORY AND METHOD IN ASSESSING THE SOCIAL EFFECTS OF ENERGY POLICIES

VOLUME TWO

THE SOCIAL MEANINGS OF ENERGY

CENTER FOR RESEARCH
ON THE ACTS OF MAN

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MODELLING ENERGY AND SOCIETY:

THEORY AND METHOD IN ASSESSING THE SOCIAL EFFECTS OF ENERGY POLICIES

Samuel Z. Klausner
Robert H. Edelstein

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CENTER FOR RESEARCH ON THE ACTS OF MAN
3718 Locust Walk/CR
Philadelphia, Pennsylvania 19104

ABSTRACT

Common sense suggests that when more people are employed, more energy is consumed. However, this study of the social effects of energy policy finds a positive correlation between unemployment and per capita energy use. The social theory upon which the study model is based anticipates this otherwise counter-intuitive finding. It is not the number of men or machines at work but the number of social roles and the intensity of activity in those roles which determine the level of energy consumption.

This study assesses the feasibility of a society/energy model which, when completed, may be used to monitor and to forecast the social effects of energy policies. We find that such a model is feasible. An introductory chapter provides a philosophical grounding for relating social scientific concepts to social policy, in general. This chapter establishes a logical basis for the feasibility of the model. The report then consists of two parts. The first provides guidelines for the interpretation of social activities and rules for conceptualizing those activities in several institutional contexts, religious, political and economic, and in the energy social system itself. The second part is a mathematical statement of typical equations expressing "causal" relations between measures of physical energy consumption and both the attributes of various social institutions and the behavior of actors in those institutions.

The concluding pages of the report demonstrate a way of testing the proposed model with empirical data. National, annualized time series data from published sources for the period from 1960 to 1974 are used and empirical tests of the model were limited to three strategic types of energy policies: those involving fuel price controls, changes in employment rates, and changes in economic output. For the moment, we did not consider such issues as interfuel substitutions or comparisons of different price elasticities for different fuels in different geographic or institutional contexts.

The success of the selection of social indicators for the model, as expressed in a system of nested structural equations, is verified in the documentation supporting the technical report.

TECHNICAL SUMMARY AND RECOMMENDATIONS

Recommendations

1. The social indicator model has been shown to be feasible or, at the very least, merits additional examination and experimentation. It will contribute to improving general understanding of the society-energy systems and enhancing forecasting capabilities for public policy decisions.

2. The social indicator-energy use model should be coordinated with a model of physical energy systems as well as a pure economic model on both the national level and in various disaggregated forms.

3. Future studies might disaggregate our model for each institutional area, for consumer and institutional subsectors, by fuel types in relation to social purposes and by geographic subarea in the light of the characteristics of the society and physical environment of that area. This will permit the use of cross-sectional data (by geographic location, by energy uses, by energy source) in concert with time series (the same data over several years).

4. Indicators should be selected which provide quarterly data which increases the number of observations. This is especially useful when utilizing economic data series.

5. The unobtrusive indicators used in this study should be combined with survey data such as that now being collected on energy consumption behavior and attitude. This will facilitate the evaluation of the attitudinal component of social effects.

6. Additional effort is needed in the development and validation of indicators. Indicators are needed in several social subsectors called for by the social theory but not yet included in the model. More refined

"unobtrusive" social indicators should be developed to reflect social behavior variables more precisely.

Some Findings and Their Rationales

Illustrative Products of the Model

A scientific revolution, says Thomas Kuhn, is presaged by an anomaly, an observation not well explained in terms of current thinking. A seemingly anomalous finding puzzled the competent team validating our work--though something less than a scientific revolution is presaged. A positive correlation between unemployment rate and per capita energy usage was established and adumbrated in a positive correlation between a one year lagged unemployment rate and per capita GNP. Certainly common sense suggests that employment, not unemployment, rate should predict energy consumption, that when a greater proportion of the people are tending machines, more energy would be consumed. Our outside validators, committed to examine only the statistical aspects of our model and not its theoretical underpinning, nevertheless called the finding contradictory to what should be expected and suggested further investigation. Upon discovering the GNP-unemployment association, they said, "This equation should probably be discarded because it is highly contradictory to what a rational a priori expectation requires." Finally, when the finding refused to disappear, they wrote, "This is very contradictory to an a priori expectation that the more jobs would require more energy use...therefore, in spite of its very good fit to the historical data and the significance of all the coefficients of the explanatory variable, the equation should not be used in the subsystem."

Our project economist had accounted for the finding in two ways--one substantive and one methodological--in traditional economic terms. Substantively, during the fourteen years of observation, a secular increase in energy usage per capita paralleled a mild secular increase in the national unemployment rate. This suggests that some exogenous variable is affecting a long range trend in both. Methodologically, the size of the labor force may be increasing faster than the number of jobs. Indeed, in a period of affluence relatively more women, minorities and the young are likely to be in the labor force. These categories of workers have higher unemployment rates and so the (observed) unemployment rate grows while energy consumption grows.

The finding was anticipated in the social theory which had provided the basis for selecting indicators. That the outside validators failed to understand the relation, and were prepared to discard a finding that met traditional statistical criteria, had little to do with whether economic or sociological interpretations were called for--the paradox could be resolved in either frame of reference. The indicators of individual behavior had taken on common sense meaning, as ends in themselves, rather than as proxies for theoretical concepts. This approach was atomistic--presuming that a collective phenomenon has no more to it than what is given by the aggregate of the individual measures--an image of individual workers consuming energy at their individual machines. The employment measure was, in fact, selected as an indicator of intensity of social activity at the collective level. The reference was to roles as consumers of energy rather than directly to the occupants of those roles. More intense role and organizational activity means more energy consumption. In a high energy society, fewer people are needed to

control the roles and organizations. This led to the hypothesis, in the conceptual section of the report, about the "depopulation of the productive unit." The energy measure, in per capita terms, is a proxy for per role (or per operating unit).

The analysis of the social effects of energy consumption must be conducted at the social organizational level and in the context of social institutional or cultural factors. Neither the man nor the machine but the social role or the social activity is the energy consumer. Our social effects model was constructed from this perspective.

The empirical models developed in this study used national annualized data (1960-1974) to examine the relationship between energy use and the social system. A policy component, a social behavioral component and an energy usage component became three interdependent elements of a "general" social effects model. Social sector variables are, thus, explicitly incorporated into the energy use-public policy model.

Three related empirical examples, each representing a subsystem of social behavior and energy use, are presented: (1) the interrelationship between "exogenous" socioeconomic variables and "endogenous" variables representing automobile purchases and use; (2) the well known GNP-unemployment-energy use triangle and its social behavioral determinants and (3) a composite of five endogenous variables in which the energy use-GNP-unemployment triangle is simultaneously considered endogenous along with automobile purchase and use. In general, the findings are statistically significant in terms of individual social indicators as well as overall fit.

Some results of the analysis may be of intrinsic interest--though the purpose of the examples is heuristic. Total energy usage per capita

is positively related to current GNP per capita but negatively related to GNP lagged one period. This latter result reflects the social system's feedback mechanism and is consistent with the social theory underlying the model. The "feedback mechanism" consists of social activities.

In quantitative terms, for instance, a one percent increase in GNP per capita in 1974 would have increased energy consumption per capita in 1974 by about 0.58 percent. These results translate into a change in GNP per capita of $46 (or approximately $10 billion in aggregate) and about 2.04 million BTU's per capita. Similarly, an increase in the average national unemployment rate in 1974 by one percent from 6.7% to 7.7% would have been expected to reduce energy consumption per capita in 1975 via its lagged effect by about 0.8 percent, or 2.8 million BTU's per capita.

The purchase of smaller automobiles will have significant impacts on energy usage. For instance, in 1974 if new small automobile purchase patterns had shifted from 62.9% to 63.6% of all new automobile sales, total energy consumption per capita would have been reduced by 1.35 million BTU's. This energy saving is not generated solely from the smaller automobiles being purchased. The purchase of a small automobile is a declaration that travel plays a relatively smaller part in the lives of the purchasers.

As manufacturing employment increases relative to total employment energy usage per capita decreases. Since a factory worker consumes more energy in his occupation than a bank employee, this seems to be an anomaly. Manufacturing employment, however, means more blue collar workers who, in their personal lives, are less energy demanding than white collar workers. The latter live increasingly complex lives--joining voluntary organizations, participating in community politics, travelling for

recreation--and the organizations themselves proliferate as they support this more complex social life.

Several other indicators were successful predictors of social behavior. An increase in the fuel component of the CPI relative to the total CPI is associated with an increase in the proportion of smaller households and in teenage employment. Smaller households imply structural differentiation of the family--a factor increasing intensity of social interaction. This increases the per capita level of energy consumption despite a relative increase in the price of fuel. The increase of teenagers in the labor force signals more ties with the economy on the part of each family--for teenagers living at home--and thus more intense social activity and energy consumption. For teenagers not at home, it signals the establishment of new independent social units, each a new energy consumer.

The Model as a Policy Tester

The Mathtech report, Appendix A to Volume Three, presents an illustrative policy impact analysis. Since only a small sector of the social effects model has been constructed, the exercise should be taken as a demonstration of how the model may be used to forecast policy outcomes but not as a realistic guide for policy.

The policy sensitivity of the model was tested for three types of energy policies.

(1) a fiscal policy, causing the price of fuel to increase more rapidly than the CPI. Such a policy would increase unemployment, gross energy consumption, lagged GNP, the total number of miles driven and the proportion of large cars purchased.

(2) employment policies, one introducing a larger proportion of teenagers into the labor force and a second increasing the non-white component of the labor force. The effect of the first parallels that of the fiscal policy and the second decreases the GNP per capita and decreases energy use and increases the general unemployment rate.

(3) encouraging productivity--however that would be accomplished--and measured by one year lagged GNP per capita. The outcome would be a positive effect on current miles driven. A policy which increases the three year lagged GNP per capita would increase current year fuel efficiency. These findings, though counter-intuitive in a supply/demand framework, are consistent with the underlying social theory that the driving variable is the increasing intensity of social activity and the process of structural differentiation.

A Sketch of the Theory

The concepts needed for analyzing society and energy are the same as those for analyzing social action implicating any physical environmental object. Further, the manner of analyzing environmental disamenities is the same as that for analyzing society in relation to its resources and technology. The environmental object is treated in terms of the meaning it has for social action--and, thus, not necessarily the meaning it might have for a physical scientifist or an engineer. Social groups enter into relations with one another in virtue of their common concern with an environmental event and the nature of that relationship gives the meaning to the environmental object. Social actors may compete for energy as a resource or one actor may produce a disamenity for another in the process of conversion or extraction. The social contention produces an environmental issue.

The basis for an environmental social conflict is set by the fact that the physical environment is not divisible in accord with the partitioning of social activities. Groups may have incompatible ways of relating to the same resource, as when hunter and harvester of timber eye the same forest. One group may change the values of an environmental attribute to which another is oriented, say, by polluting the air. Resolutions of environmental conflicts may take the form of changing the boundaries of the social system, as in enlarging a market to internalize externalities.

Environmental social conflict serves a social purpose. Human conflict has a tendency to develop around social and cultural institutional foci--around life style, around religion. An environmental issue restructures the axes of social conflict making allies of groups otherwise in conflict, realigning groups with respect to interests in physical features such as territory or the allocation of material resources.

The physical environment also has a direct impact on society. It is incorporated within, becomes constitutive of, social activity as a facility or a reward--or their opposites. Energy is a social potentiator, functioning as would surplus labor. It allows society to become more complex and social activity more intense and, as a further consequence, increases the rate of social differentiation. Energy creates the conditions for the social and technical division of labor but does not, by and large, determine the axes along which that differentiation takes place. The direction of social development is determined by culture.

Culture is a key to the social influence of energy, in its role in organizing social activities around energy as an environmental object and in its direct impact on society. The institutional context in which

energy is used, the social purposes which it facilitates, defines its cultural significance. The significance is expressed in the way people organize to use or control it and in the type and severity of struggles that ensue.

So accustomed are we to thinking of physical objects, in general, and of energy, in particular, as tools by which social actors achieve their ends that we forget that religious action is their most fundamental source of meaning. In religion, the physical object is a vehicle for the dramatic expression of meanings which evoke social action. Religious meanings rarely appear in pure form but tend to infuse economic and political meanings, introducing non-rational elements into them. Totemism is the prototypical religious action respecting an environmental object. In this dramatic form, the natural and the social orders symbolically interpenetrate. As the mundane activities of the social order are sanctified, they enjoy a "surplus" meaning. This "surplus" meaning restricts the license to use holy things. Wilderness, taking on a sacred meaning, was the abode of evil to be purified and tamed by the frontiersman. Tamed nature may be withdrawn from the sacred--becoming neither good nor evil but neutral. When energy is itself withdrawn from the sacred but used in the pursuit of sacred aims, a basis is established for the exploitation of nature and of energy. Economically and politically defined physical objects never lose their parentage in religious meanings. A "surplus" evocative meaning adheres to the most rationally defined economic "commodities."

A physical object in political action is, prototypically, a means of coercion, a weapon. In religion, meanings are part of the relation to the object, a symbol of community. In a political context, the relation to the object is instrumental. Energy resources are strategic.

Having a potentiating effect, they aid in extending the range of control over physical objects. Political power reacts on itself, promoting self-growth and the development of an independent system of power relations.

Where political control is of the processes of exchange, it combines with the economic meaning of objects. Economic action, prototypically, is directed to the acquisition of resources by society, for subsistence, among other needs, and the allocation of those resources among sectors of society. Physical objects become resources, or have social utility, when the activity implicating them has some positive social function. Exchange or the transfer of rights in utilities is at the core of economic actions. The price and utility attributed to the object define its value on a matrix of exchange. Evaluated on these two abstracted dimensions, it is a commodity.

Political and economic are the most salient meanings of energy in contemporary society. Six socially relevant characteristics of energy from natural resources promote its "rationalizing" role in political and economic relations. Unlike animal and human labor, (1) it is detachable from biological and psychological constraints. (2) It has no inherently social location and so may be used indifferently by prince and pauper. Giving it an economic location, a price, is a limitation imposed by our form of economic organization as a condition for its social availability. (3) It is divisible into units of almost any size. (4) It is deliverable continuously and at whatever rate desired. (5) It is generally storable, in its state as a resource, and, thus, free of many constraints of time. (6) It is generally transportable and, thus, free of many constraints of space.

Social activities developing around the processes of acquisition, conversion and distribution of energy determine the character of social

relations and, thus, of culture. In this sense, these attributes of energy influence the direction of social change. The characteristics of detachability, divisibility and transferability facilitate its exchange through markets and so support social change in the direction of "rationalization." In this spirit, energy related activities may be expected to have twelve more specific influences on the direction of social change.

(1) Special occupational groups develop around the acquisition and processing of each energy resource. Their particular conditions of life produce distinctive cultures. A society of coal miners is politically different, for instance, from a society of nuclear engineers.

(2) A specialized energy industry emerges as energy activities become encompassing enough to claim their own staff. Other social organizations relinquish command over self-produced energy in return for cheaper and more efficient energy. These specialized producers and distributors of energy develop peculiar social characteristics and forms of exchange with the rest of society.

(3) The social role of the working class changes from its traditional role as shaper of materials to that as laborer administrator as tasks become more complex.

(4) The increasing control available to each actor extends the social and physical space of activities producing a social centrifugality and a depopulation of the productive unit. On the battlefield, massed troops with muskets give way to a few men who control wide spaces with automatic weapons. The battlefield becomes a barren silent area.

(5) As the potency of human acts increases, the problem of social control becomes insistent. In our culture this has turned attention to the psychological control of "instincts."

(6) The content of culture changes as property law becomes more important relative to personal status law. With the depopulation of the productive unit society has fewer norms controlling face-to-face relations and more social norms governing activity in relation to products.

(7) Social and spatial centrifugality also diminishes the role of traditional groups in society relative to forms of secondary association for instrumental purposes.

(8) The basis of social power shifts from land holding to industry and the power holder from the landed aristocracy to entrepreneurs. Stratification based on control of material processes becomes more important than stratification based on lineage.

(9) The allocation of social power among social institutions shifts from solidary social relations, such as kinship and religion, to economic and political relations. The institutions dealing with social means, instrumental action, make more telling use of energy supported technological innovation.

(10) The allocation of social power among ecological organizations shifts among geographic regions depending upon their access to energy resources and among specific industries according to their energy dependency and their contribution to the energy needs of other organizations.

(11) Industry, transportation and warfare, as social forms most susceptible to energy potentiation, become especially prominent types of social organization in high energy societies.

(12) Social contraction around energy depletion does not reverse social expansion around energy increments. As energy becomes less available the initial social strains are located in and radiate from those social relations most, directly or indirectly, energy dependent

and so most vulnerable to its withdrawal. Actors in relationships formed around energy become a vanguard in the struggle against energy reduction.

The content of each of these consequences may be specified further by examining them in the light of the type of fuel, whether coal, gas, wood, oil or atomic, and the character of the technology through which it is consumed.

Comments on Method

These theoretical considerations guided the selection of unobtrusive indicators from published sources. The total United States was taken as the unit for analysis and annual data from 1960-1974 were collected. The indicators tend to be rates or ratios such as the proportion of employment in one industrial sector compared with total employment or the amount of energy consumed per social unit such as per capita, per household or per firm. Measures were selected of social behavior and of energy use in the several institutional spheres: economy, polity, religion, family, etc. Social indicators were meant to reflect (1) the intensity of social interaction and of structural differentiation in each setting, (2) the levels of energy consumed and the allocation of energy among various social activities, (3) possible policy interventions and (4) acts which function to cope with stress in response to energy changes. These indicators became the variables in structural equations which, if read in one direction, show the social effects of changing levels and allocations of energy and, if read in the other direction, the effects on energy consumption of varying social arrangements. Multicollinearity is dealt with by residualization and autocorrelation assessed through the Durbin-Watson statistic. The model, being but a first step, does not deal with issues such as interfuel substitution, the fact that a reduction in the use of one energy form

may not reduce the overall consumption. It also stops short of comparing the differing price elasticities for the different fuels in different situations and institutional contexts.

The aim of the study was not to develop a finished social model but to demonstrate the feasibility of such a model. Not all of the proposed indicators are used in equations and the theory is tested for only three types of social policy--that involving energy price adjustments, changes in levels of employment and in levels of economic output. Data availability on a national level and time and budget considerations constrained this phase of the work.

The technical success of the system of equations and the substantive findings, as sketched above, attest to the feasibility and support the recommendation that a more complete model of the social effects of energy policies be pursued. Empirical analyses of complex social systems and energy usage are fraught with implementation pitfalls. We are, however, sanguine about the long run viability and usefulness of the social indicator approach used here but should emphasize three types of choices to be made.

(1) Forecasting versus structural analysis. If the principal focus of the model is forecasting rather than "structural" analysis, the model would be "simplified" to engender testable results. For example, in econometric studies, forecasting equations are reduced form models, with strictly endogenous dependent variates of interest. On the other hand, if structure is the primary concern of the analyst, the "proper" specification of the model would be to set the dependent variable as a function of exogenous and endogenous variables. The latter approach is more complex in terms of underlying theoretical requirements and estimation procedures, but yields results pertaining to the structure and behavior of the system.

(2) The choice of method. Several competitive methodologies might be considered for forecasting. The analysis above utilizes econometric methods, which we believe are appropriate for examining social behavioral systems in relation to energy demand. To study physical energy systems or energy supply or energy cost equations, deterministic programming or probabilistic programming models might be more useful. This dichotomy is dealt with by the government energy agency in its development of the PIES and subsequent models for energy use in the United States.

(3) Assessment and evaluation. Assessment and evaluation of a model involves a rigorous examination of both the forecasts or results and the methods employed to derive them. This has been done for our models by Mathtech and reported in the text.

Three types of error might enter future work with the model. Errors in the basic data would vitiate the final outputs. Common causes of data errors include inadequate sample size, poorly constructed data collection methods (e.g., poor interviewers or questionnaires for survey data collection) and data manipulation errors. Survey or indicator data may evidence substance error. Here the analyst has failed to choose the proper variables for study. In the social indicator approach, this is likely to occur because the data surrogate used may not be characteristic of the underlying social behavior. Causal validity error may mask cause and effect results but this might not prevent the analyst from, say, generating forecasts of energy use.

Variables that allow prediction of changes in energy use, even though they do not necessarily cause these changes, are to be incorporated. Since, in long run analyses, basic underlying structural relationships may change, the analyst should build models based upon the existence of

a logical set of causal relationships (i.e., the theory). Ultimately, the operationalizing of empirical work requires the judgment of the analyst. There is no substitute for the "common sense" of the analyst, particularly in forecasting.

The Limits of Scientific Knowledge as a Basis for Policy

Success of a social policy rests upon the policy-makers' grasp of the "total" social phenomenon--not that one must know all of it but that one must know it concretely and strategically. Any social science analysis is bound to be abstract. Demographic and ecological analyses are abstract because their frame of reference isolates social actors as objects in space and uses only external descriptive data on their past mechanical movements to anticipate their future movements. A disciplinary analysis, psychological, sociological, cultural, is also abstract because its perspectival method isolates analytic variables. Any combination of disciplinary abstractions, of the economic and the political, for instance, is still abstract.

The opening section of the report places social science knowledge within the context of the types of knowledge necessary for a picture of a concrete society and for acting in society. Several levels of social science knowledge which can be articulated into a reasonably complete image--from a cognitive perspective--are delineated. It is possible to think of a series of nesting social and cultural systems, each with its own *sui generis* reality. The orientation of society to its physical environment, at the most general level, is controlled by cultural paradigms, a fundamental mental structure which delineates the categories of

culture, defining the forms in which events appear to the social actor. At another level, institutional rules, specified for social action by the paradigm, cluster in accord with the tasks that society must fulfill to persist as a system. In doing the everyday work of society, the actor draws upon these institutional directives to develop organizations for the attainment of specific goals in space and time. These are as yet another level and include governments, churches and financial institutions.

An additional caveat is in order. The articulation of knowledge from all of these levels of generality provides only cognitive knowledge. Such knowledge of fact is insufficient for action since action implies value determinations. Cognitive social science studies values and offers a perspectival understanding of them but provides no further basis for choosing and acting on them. A policy analysis would bring to bear, at this point, value positions which are legitimated through philosophical and religious orientations and selected for application through the political process.

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CHAPTER I

A CRITIQUE AND AN APPROACH TO AN ENERGY-SOCIETY MODEL

A mural in the National Academy of Sciences shows Abraham Lincoln standing with some of the nation's most astute scientists, on the occasion of the presentation of the federal charter to the Academy. Congress needed technical information for legislation. It also had to believe that its information was not shaped by political interests.

In the century and a quarter since Lincoln, government power has gravitated from the legislative to the executive departments. The Academy, following the trend, has increasingly offered its advice to the executive branch. The Academy's style has been, upon contractual assignment, to assemble an advisory committee. These committees have come to include not only scientists, engineers and physicians from university faculties, but individuals with technical and scientific backgrounds who serve in commerce, industry and government, and the members serve without personal compensation. The government's questions are not merely scientific and technical, but have a political component. The committees, following this trend, now balance advocates for various positions as well as expertise.

In 1975, the Energy Research and Development Administration was encountering public doubts about its program to develop the Liquid Metal Fast Breeder Reactor. Environmental organizations were asking about the health and environmental threats posed by the Light Water Reactors already becoming operational. At the same time, the administration, caught in interagency conflicts, was buffeted by constituencies promoting coal, solar and geothermal, among other alternative energy resources.

Perhaps as much to defer a decision as to make one, ERDA contracted with the Academy to establish the Committee on Nuclear and Alternative Energy Systems. Some 300 consultants held complex and acrimonious meetings over the next four

years. Academy President Philip Handler described the first meeting at which "the tension seemed almost physical; profound suspicion was evident..." Four years later, wrote Handler, "that polarization persists." The client, now absorbed in the Department of Energy, terminated support of the committee in 1978 some two years before a report was completed, but certainly well beyond the planned consultative period. The Academy, with its own funds, continued work toward a report that would balance the interests of the members of the committee.

The Co-Chairman of the Committee, Harvey Brooks and Edward Ginzton, close their letter of transmittal by saying that

> "energy policy involves very large social and political components that are much less well understood than the technical factors. Some of these sociopolitical considerations are amenable to better understanding through research on the social and institutional characteristics of energy systems..."

This statement is true but insincere. It is a litany used to excuse the committee from any sharp conclusion and from responsibility for firm recommendations. The documentation in the committee's multivolume report does not inspire confidence that the technical problems of the LMFBR or of solar or geothermal energy, for that matter, are near solution.

The only sociologist on the committee, Otis Dudley Duncan, resigned in frustration two years before the report was released. He was unable to induce any serious consideration of social and institutional questions.

The Socio-Political Effects Resource Group, an advisory group to the Committee, included social scientists. This group, however, was sequestered within a so-called Risk and Impact Panel and thus mandated to consider health dangers and ways of containing popular responses to energy systems. In place of a sophisticated analysis of the effect on society, its communities, its institutions, of one or another energy regime, the Committee was prepared only to view society as a source

of pernicious forces which may inhibit the implementation of programs which the technical members of the Committee had already concluded must be beneficial to society.

At about the same time that the Academy Committee was launched, the Center for Research on the Acts of Man was asked by the Federal Energy Administration to develop an approach to a method for assessing the social effects of energy policies. This report establishes a framework for the development of a model obtaining objective information on the social effects policy. The model and its data are, to the extent possible, free of political preferences. Its aim is to provide the facts needed for intelligent and just policy and politics. The underlying idea is that knowledge for social policy is developed in two related steps. In the first, a net of "causal" associations is established and in the second, the discovered associations are interpreted in meaningful social categories.

To set our approach in perspective, we begin with a few words of critique of the effect of the Committee on nuclear and alternative energy systems. The report recommends continued development of the Liquid Metal Fast Breeder Reactor, at least as a research effort, and looks toward a balanced combination of coal and nuclear fission as the only large-scale intermediate-term options for electricity generation. Three justifications are offered for these recommendations: cost, safety and energy supply. The cost factor involves both economic and energy costs of the proposed systems; the safety factor is assessed at the various stages of production, and includes consideration of the safety of individuals, such as health and radiation effects, environmental safety, as is involved in nuclear waste disposal and national security, particularly the problem of proliferation of fissionable material; the third justification is in terms of the potential supply, the level of megawatts of electricity that would be available from the system. Computations are provided for the contribution of the LMFBR and other energy regimes to the

overall 60, 80 or 100 quad energy regimes that are anticipated under several scenarios.

These words, cost, safety and supply, refer to abstractions from the social processes in which the technologies participate. Other words might have been used to assess the role in society of technologies. These include energy consumption and societal complexity, the division of labor, the institutional distribution of social power, or the scope of control which could be exerted by leaders of a society with a Breeder reactor. These words, too, if used in isolation, would refer to abstractions from social process. Why, however, could the Committee not have demonstrated the interplay of the two sets of concepts and so draw closer to a model of an actual society and its energy technology?

The words selected by the Committee are those which occur in government policy decisions around technical innovation. These are relevant to decisions or the development and commercialization of a technology, as the issue might be described in a board room of a firm.

Cost is a primary indicator when the profit account is central to a firm's organizational decisions. Profit, while relevant to an intrafirm decision, is not, by itself a measure of the contribution of the firm, and its energy and technology, to society. Not even Adam Smith would say that. Contributions to society are measured in terms of the production of material goods, the facilitating of transportation for members of the society and improved levels of physical health or education. Profit, from a social point of view, is an indicator of the relative efficiency of productive organizations operating in the same market. It is a basis for selecting among providers. However, the measure is of limited help in deciding whether the society needs the provision. Yet, that is the measure which the Committee isolates for a society selecting among energy regimes.

The question of safety was of interest to the Committee because of political opposition to certain technologies. The safety question should be on the agenda.

It cannot, however, be isolated from the array of social activities around the technology. The level of safety is a function of the way those social activities engage characteristics of a technology. The social relation to the technical system influences the willingness to assume risks. Further, the safety issue cannot loom as a proxy for the wider societal consideration. The story of impact of the automobile on world society is hardly told in a discussion of driver safety despite the fearsome level of danger associated with that technology.

Arguments advanced for proceeding with nuclear development seem to involve what Brooks and Ginzton refer to as the "social and political components." They are, however, disconnected scraps of societal analysis. Aside from cost, these include: (1) the fact that fuel can be stockpiled. Thus, the production of the reactor is less sensitive to strikes, to weather, or to difficulties in transportation than would be the case with coal; (2) that the reactor operates with fewer environmental and health effects than coal, and (3) that the problem of the effect of carbon dioxide on global climate does not arise.

The arguments for supporting coal are: (1) that coal plants are less subject to sabotage; (2) that the hazards associated with them are predictable, (3) that the proliferation question and its foreign policy implications are avoided; (4) that coal is better for generating intermediate load power; (5) that there is a larger resource base to draw upon; and (6) that nuclear energy introduces the nuclear waste management problem. These reasons, technical problems of industrial operation and some health and military impact issues, neglect some significant societal ramifications that should enter a national decision.

A few of these might be mentioned. The decision between coal or nuclear energy regime is relevant to the structure of power in society. For one thing, contrasting labor forces are involved in coal and nuclear development. On the one hand, there are coal miners, geologists and mining engineers. Deep-pit miners have organized in effective labor unions. The bolstering of the United Mine Workers

would influence the entire American labor movement. Were the mine union to be relatively more influential than the United Automobile Workers within the councils of the AFL-CIO, this would influence the policy of the labor movement. The nuclear option would involve nuclear engineers and technicians with almost no implications for the national labor movement. It would, though, by increasing the demand for technicians and engineers, influence the professions and professional and technical education.

Secondly, coal introduces conflict over land rights, such as with the Indians in the Western states. This has implications for treaty relations and, more utlimately, for the relation of Indian rights movements to other ethnically-based movements. With nuclear development, the high requirement for water for cooling could lead to a conflict over water rights, particularly in the dry areas of the Southwest. This conflict could affect relations between state governments. The choice between coal and nuclear energy also has judicial implications. The legal history of land law differs from that of water law.

Why would a blue ribbon committee mandated to consider social welfare take the perspective of a board of directors of a firm? The answer is not far to seek. The recommendations guide budget allocations by the Departments of Interior and Energy for the development of energy technologies. Allocations for research and development would, indeed, go to firms. Thus, the agency officials, in their day-to-day work, are oriented to technical operations of energy systems. Their questions to the committee are phrased in these terms. The leadership of the committee had had experience with industrial operational problems. With one exception, they had not had experience in analyzing issues of social welfare. Economists on the Committee were sensitive to social welfare questions but they were relegated to narrow modelling of energy scenarios. Thus, the advice available to government is phrased in the categories posed by government agencies. Even so intellectually powerful a body as the National Academy of Sciences does not question those

categories. As a result, they may contribute documentation rather than reconceptualization. Even at that, the committee was ill-suited for careful documentation. The members were volunteers on a part-time assignment.

As another example, the report holds that: "With sufficiently high energy prices, an energy-GNP ratio one half of todays could be reached over several decades without significant adverse effects on economic growth." The thinking behind this is primarily one of technological efficiency. High energy prices would provide an incentive for improving the efficiency of the technology. Therefore, less energy would be consumed while obtaining the same GNP. The notion of no significant adverse effect on economic growth derives from the coefficients of the energy-GNP equation itself. With the increasing price of energy, the lowest consumption would still impose the some cost. To have economic growth, which is a growth in GNP, at some point one still needs increased energy consumption.

Strangely, despite sensitivity to market forces, they do not consider the relationship between price and economic growth. High energy prices have an income effect. An increase in price of fossil and synthetic fuels means an increase in the levels of income in states producing these, such as Alaska and Texas. Energy consuming states would have less income available for other activities. This is true for community budgets and for household budgets. As a result, in household decisions, for instance, one would expect a reduction, say, in vacation driving. This would affect those businesses that depend upon roadside services and recreational centers at some distance from population concentrations. Reduction of attendance at national parks already attests to this. The amounts expended by households for food and clothing, the prices of which would also be high, would decrease. Increasing energy prices have a differential impact by industry.

Rising energy prices will also produce new choices for municipal and state governments. One image, not uncommon, is that an energy-short society, or one in which energy prices are high, will increase its emphasis on service activities

since those are labor but not energy intensive. Actually, a rational conservation policy might lead in that direction. It assumes, however, some community complacency about relinquishing the energy consuming activities. It is likely that the communities will try to sustain their commitment to the now more expensive material things. The budget for service activities will be reduced, expressed as a reduction in municipal and state work force. Thus, one can expect higher unemployment among white collar and civil service workers, especially those in education, fire and police.

The reduction in personnel when related to the total local budget, or to the national GNP, will contribute to an appearance of increased efficiency or productivity. Thus, for example, the cost of catching the nth criminal is more than the cost of catching the first. The nth one will not be pursued. Thus, the last cost-effective activity will have to be dropped.

As a first example, higher energy prices would restrict transportation. Increasing freight cost would constrain the scope of the market for industrial products. This would impact on those more specialized industries which depend on a wide market and lead, in general, to a decline in industrial specialization. There would be a restructuring of the effective market for regional products.

By pursuing the analysis from the perspective of a firm and of government agencies, the report falls into the error of parochialism. The world does not behave in accord with the interests of a particular social location. Another error arises from the confusion of history and utopian ideals. The tendency is to depict the future in terms of policy output variables. In the example above, these were profits, safety and supply. The analysts then reconstruct history in terms of the behavior of these variables in the past, develop scenarios about them and extrapolate these scenarios to the future for purposes of planning. The variables of interest are not the objective factors controlling historical development.

In seeking objective factors, it is a useful exercise to ask, historically, what has been the effect on society of changes in energy regimes? What has been the effect, for example, of the shift from hunting and gathering to agriculture as a way of harnessing solar energy. We immediately respond in terms of the increasing complexity of society, the rise of urban centers, the effects of this on domestication of animals, the shift in organization of political power from kinship to community and from community to the state, and the expansion of the resource base for the society. Certainly, these historical shifts in energy regimes were not based on a cost calculation. Sedentary agriculture is not cost competitive with hunting and gathering, particularly at a time when the distinction between labor and leisure had not yet emerged.

The task of this report is to develop a way of discussing the social effects of energy policy. Our approach will begin with a general theory of energy-society relations. With this general understanding, we may then ask policy questions. The next chapter deals with the problem of translating social service knowledge into policy statements and then into policy implementation. The energy-society model has two phases. First, it is necessary to establish causal relations between societal and physical environmental events and then, it is necessary to interpret their relations. Actually, the process begins with some crude interpretation which enables us to specify the relevant variables. Therefore, the policy chapter will be followed immediately by a discussion of the social meaning of physical objects, such as energy in a variety of social institutional interests--religious, political and economic. There follows a discussion of formal social cooperation and social conflict around environmental objects. The next chapter sets forth the specific role of energy in society and offers some basic general propositions. This is followed by the presentation of indicators of social process and of energy consumption for the establishment and testing of more specific propositions. At that point, we begin the construction of the causal model of energy-society interactions.

Chapter II

THE IDEA OF KNOWLEDGE FOR SOCIAL MANAGEMENT

Paul F. Lazarsfeld, as President of the American Sociological Association in 1962, called for annual convention papers on "The Uses of Sociology." Lazarsfeld asked whether "the rapidly mounting stream of empirical studies and the increasing number of publications on social theory have contributed to anything the educated citizen would find worthwhile." Among other things he asked specifically about unavoidable gaps between research findings and advice for action. After the convention he and the co-editors of the proceedings, William H. Sewell and Harold L. Wilensky wrote, "However far knowledge goes, there will always remain a gap which will have to be filled by additional assumptions and most of all by creative imagination which thinks of devices--institutional, technical and symbolic--to turn factual knowledge into operational procedures" (Lazarsfeld, Sewell and Wilensky, 1967, Introduction).

This chapter will argue that the gap derives from an exclusive reliance on a positivist epistemological framework for our social science knowledge. The knowledge creating process, in this framework, abstracts ideas from the actual world and has no meaningful way of discovering the "devices--institutional, technical and symbolic" for returning from idea to action. This paper will outline a Whiteheadian critique leading to the appreciation of knowledge as an element in social activities, in both research and social policy activities. Positivist knowledge is preparatory, not final knowledge. It is a stage in the development of knowledge for utilization.

The positivist tradition rests on Hume's notion of sensations and experience and Descartes' subject-object assumptions. Science in this tradition aims at objective, contemplative knowledge, gathered by abstracting the properties of entities. All the paradigms of science, the positivist, idealist and Whiteheadian, deal with the status of empirical knowledge. A shift from one paradigm to another does not negate the knowledge gathered under the first paradigm. They all are ways of conceptualizing the same phenomenal world. The status of knowledge, the relation of the concept to the datum changes.

If every paradigm shift meant abandoning previous knowledge, mankind would ever be beginning anew in learning about itself and the world. The watershed of the neolithic revolution would be ever upon us. According to Kuhn (1970), the abandonment of an old paradigm is a social group phenomenon. It has to do with social commitments to ideas rather than a final judgment on the metaphysical status of ideas.

What, then, is the relation between knowledge and action? The idea that man, in freedom, dominates nature or manages society is a euphemism serving our pride. In controlling nature and in managing society we concede freedom, we submit to the laws of nature and society. We do not command the hammer or the nail to be human. Our arm is lent to nature as an extension of the hammer. It becomes part of a lever transmitting vectorial force to the nail. A horseman is part of a horse-man system. In general, a man-machine system is one in which man learns how to respond to mechanical movement, flashes of light, torque and the like.

A social policy system is one in which the intervenor engages and is engaged by the target of intervention. An aspect of this interaction emerges in both of their consciousnesses as knowledge. Along with cognition, this subjectively appreciated aspect of action includes passion and value. The knowledge for social policy does not emerge in a single act but depends on a social system of action. Social research is a rehearsal for social action.

The knowledge which monitors the interaction with nature is instrumental or technical knowledge. The hammer and arm example is, of course, quite narrow. More commonly, a variety of pieces are to be put together in some arrangement. For example, an artisan sees and acts upon a pattern of materials of nature. Levi-Strauss (1970) called the knowledge accompanying this type of activity bricolage. The activity is that of a craftsman arranging components including himself to achieve a proposed outcome. The knowledge of the bricoleur consists of symbols which, in an iconic fashion, represent the prospective actions including an end-in-view.

Instrumental action, like Newton's inertial law, anticipates a reaction from a given action.[1] From the perspective of nature, the instrumental act is symmetric, action and reactions being interchangeable. The nail strikes at the hammer with a force equal to that which the hammer delivers. From the social perspective, however, the relationship is not symmetric. The nail harbors no plans for the carpenter.

The term "social engineering" embodies the fantasy that social

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[1]Parsons and Bales (1953, p.100) suggest that the inertial model may be generalized to all systems of action since they are all equilibratory systems.

policy can proceed as instrumental action. Alas, the manner in which the individual, or better, the social group, acts on a social object is not symmetric with the response of that social object. Further, learning about an object is not symmetric with controlling an object. Part of the fantasy is the belief that since knowledge derives from experience, as David Hume held, then that knowledge can be turned around and directed at the world to reproduce the experience. Were the relation symmetrical, the policy act would recreate the social conditions which provided the original experience or some derivate of it.

Social control, then, is interactional. It is not always clear that the direction of the controlling action is dominated by the social policy maker. The ability of China to culturally absorb her conquerors is proverbial. An example on a more restricted level is that in which the targeted person or group seeks to control the situation by submission, like the defeated animal exposing its throat to the attacker. This is an expressive rather than an instrumental relation. The dominant may adapt to the submissive one in the process of controlling him--the master being enslaved to the slave, to borrow Camus' image.

The laws of causality which constitute the usual social science knowledge cannot be recast as a purposeful plan, as social policy. Having learned that income level is inversely related to fertility we cannot manage income to control fertility. There are two types of reasons for this: one concerns the transformation of knowledge that occurs in conceptualizing experience; the other concerns the social

psychology of the situation of learning. First, in learning from the world, a transformation of modes of knowledge takes place. Already in Hume, the association of sensory experience is transformed into the association of ideas. The expectation of an isomorphism between the pattern of sense experience and the pattern of ideas is untenable--Durkheim (1953) cited this lack of match to argue for the independence of psychology from physiology, and then extended the argument to assert the sui generis character of the social. The transformation cannot be reversed, going from ideas to sense, from concepts to acts, as if we were running a film backwards.[2]

Secondly, learning about society is a social-psychological event. A spectrum of social stimuli are synthesized by the individual or the social group receiving them. Acting upon society is, however, a psycho-sociological event. An act diffuses from a single origin to a system through target actors. These actors are in different positions in the flux of social reality from that of the policy intervenor and, further, the target actor's responses are interdependent. One adaptation to this asymmetry is to derive knowledge from situations beyond that of the immediate observer--such as by the sample survey. Mannheim's (1936)

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[2]Another reason that reversal is not possible is that the observer has not simply constructed the world, but reconstructed it. More than that, the construction is in a symbolic form appropriate to the personality of the person having the experience. The scientific experiment is an effort at developing symmetry in the discourse with nature. The success of the venture in avoiding or minimizing symbolic transformation is greater in narrow deterministic systems. In a sense, these mechnical processes that are subject to automation define the boundaries of the possible here. Those systems that depend on feedback learning loops attempt to approximate the transformations. Social science models that cast the social actor in the role of the scientist, those that Pareto called logico-experimental (1935) are attempts to undercut this difficulty. Were the knowledge to be a realistic representation of society, social experimentation and social policy would be mirror twins.

characterization of the knowledge of the intellectual as free of class ties was a response to the problem of the parochial knowledge of the observer.[3]

All of this is to suggest the limits to the technological image of knowledge utilization. Social science knowledge is but a fraction of social knowledge. Some of the difficulties in applying it were already apparent in its philosophical roots—as social science became differentiated from social knowledge in general.

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[3]The symmetry issue is that knowledge derived genetically in the mode of causality, cannot be reversed to execute policy which operates functionally in a purposeful mode. Ernst Nagel (1957) has pointed out that, logically, every genetic statement may be translated into a functional statement, and vice versa. Thus, one may say that the function of the incest taboo is to assure social linkage between different kin groups in a society. The equivalent genetic statement is that the pressure to stabilize relations among kin groups in the same society leads to the establishment of the incest taboo. The magic of this reversal is methodological. The same cannot be said for the substantive linkage. On the one hand, let us imagine, enforcing the taboo as a social policy may or may not contribute to social integration. On the other hand, relations among kin groups can be stabilized by mechanisms other than that of the incest taboo.

SOCIAL SCIENCE KNOWLEDGE AS A TYPE OF SOCIAL KNOWLEDGE

Knowledge of society preceded contemporary social science. Historically, social action has been analyzed in four aspects. Two aspects concern the structure of relations--(1) the relations of man to nature, and (2) the relation of man to man. Two concern the rules and springs of action in these relations--(3) the motivation and the ability to act in the face of the contingencies affecting the outcome of acting, and (4) the criteria of legitimation of social rules governing that action and rules for interpreting man's relations to nature and to other men. Traditionally, the study of nature has been the province of cosmology and the relation between man and man the province of philosophical anthropology. The contingencies of action and of the social rules and their legitimation have, respectively, been treated within eschatology and axiology.

This traditional framework assumes certain characteristics of social reality. These include the assumptions that (1) the social act is at the heart of social reality, (2) the act is engaged in by agents of action, social actors, (3) whose activity can be understood by positing that they are biological creatures responding to sensory input, (4) that they have the ability to symbolize, interpreting the experience by (5) imputing it to an environment which includes norms and values.

Social science, by its own definition, specializes in the anthropological problem in its relativized form. The problem is relativized in the sense that traditional philosophical anthropology asked about the fundamental nature of man. Such an inquiry could include reference to a

soul, creation, a Divine spark, objective sinfulness and so forth. The relativized form of the anthropological question limits itself to man as observable, as an actor in the phenomenal world. More precisely, social science deals with a relativized anthropological perspective on each of the other three problem areas. It is concerned with the meaning for man of the eschatological, axiological and cosmological questions.[4]

Two things happened in the process of relativization which limit the usefulness of the knowledge. Positivist science, in its concern for objectivity, has limited itself to abstract and contemplative knowledge and to cognitive knowledge. Thus, practical interest is in the observable world as it appears in space and time. Human ecology, for instance, deals with the spatial organization of activities, taken at face value and abstracted from the other aspects of reality in which they nest. An effective social policy requires knowledge of ecological phenomena in their context of social, cultural and psychological events. Further, all of these cognitive abstractions must be meshed with symbols of commitment and passion. To sharpen the issue, the next section deals with the character of social scientific knowledge as developed in the positivistic tradition and how some of these characteristics limit its contribution to social policy.

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[4]Eschatological anthropology considers the purposes and means of human action and the problem of acting in the face of uncertain outcomes or acting despite relatively certain pain. Axiological anthropology is the study of values as they inform human relations and human action. Cosmological anthropology concerns man's orientation to and participation in nature, physical and biological, including his biological self.

THE UTILIZATION OF POSITIVISTIC SOCIAL SCIENCE KNOWLEDGE

The Character of the Knowledge in Relation to the Empirical World

The chances that a policy will succeed is enhanced when informed by more than an ad hoc understanding of the situation in which it is implemented. A truism? What is it to understand a situation?[5] For contemporary "main-stream" sociology, understanding implies having an intellectual image, now often called a "model," of social relationships and social activities. The model may include explanations of those relationships and activities. The elements of the model are abstractions. The abstractions are ideas about properties of some units of observation and rules for classifying those properties.[6]

A net of isolating abstractions constitutes a disciplinary theory--sociological, psychological, anthroplogical--depending on the direction of abstraction. The properties may be described in common sense terms. A statement about the probability of joint occurrence of such properties is an empirical generalization.[7]

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[5]Brodbeck (1968) lists five kinds of understanding: referential, empathic, knowledge of associated feelings, of motives and of correlates.

[6]These are termed classificatory concepts or variables. The references of the concepts are categorized according to their relative values on the variable--as characterized by more or less of the attribute. Non-classificatory concepts, sometimes termed "orienting concepts," point to or name an area for examination. The concepts of "role" and "legislature" are examples.

[7]Among the most popular of these are the large-scale, national and world-wide models developed by Forrester (1969) and his students (Meadows, 1972). These begin with computer-assisted simulations of empirical generalizations, both cross-sectional and time-series. The measures are of events as conceived in the world of policy. These might include tax rates, unemployment rates, levels of air pollution or oil

Laymen and scientists alike commonly assume that infinitely variable appearances of the social world can be accounted for by a relatively more parsimonious set of underlying social processes. Pragmatic modelling of the events observed in space and time world is a valuable stop-gap. To anticipate more fully the future and to develop policy, it is necessary to grasp the unseen but powerful underlying processes, whether as "latent" variables or concepts in abstract theory.

The discussion, thus far, points to five characteristics of knowledge developed in the positivistic tradition which impede its utilization in policy. These characteristics apply to disciplinary knowledge in sociology, anthropology, economics, political science, and psychology as well as to that knowledge connected more directly with manifest events in the space/time world, such as is represented by the human ecological and natural history approaches.

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reserves. These generalizations are extrapolated to predict the future. The future projected on the basis of a limited number of common sense measures is never a recapitulation of the past. Nevertheless, policy-makers work with these projections, faute de mieux, adjusting the model as they go along. An advantage of this approach is that it provides baseline and monitoring measures in a language of immediate social, especially political, interest.

Econometric modelling is another popular form. The Wharton Econometric Forecasting Associates model developed by Lawrence Klein is a good example. These models do not focus directly on the variables of social administration and governance. The terms of the model are taken from commercial and commodity market activities and the production and consumption acitivities which frame them. Business indicators are suggested by traditions in economics and finance. Data made available by the government, firms, and surveys of consumers, the input/output variables, are exploited in these models. They, thus, include continuous, time-series measures of national cash flow, interest rates, automobile sales, housing starts, and many, many more. The future is also an extrapolation of the past and three month predictions are offered with a modest sense of security. Improvement of the model is a matter of continuous "tinkering." The information and the formulas in the model are adjusted with each new period of experience.

First, the knowledge is abstract. In this context, abstraction does not mean that information or a piece of the puzzle is missing. Neither knowledge nor society are mechanical complexes. Rather, certain observed properties of entities are isolated and examined in their own right as if they might exist in this way. For instance, take the concept of "scope of control" from the sociology of organizations. There is heuristic value in comparing the measure of this property with that of another property, say "size of organization," in a series of similar entities. Additional factors may be added by the modeller until some acceptable amount of variance is accounted for. The model is then considered a good representation of the actual world. However, no combination of abstractions constitutes concrete actuality.

Second, following from the first, the complex of properties becomes the definition of the entity. An organization may be defined as a network of relations among the referents of the variables: "scope of control," "size," "shape of authority pyramid," etc. An organization is not the sum of such properties as given by a series of classificatory concepts. It is the orientational or non-classificatory concepts which locate the object of research in social science. These may include the organization, a socialist planned economy, or a physician-patient role. These real objects of study and of policy tend to disappear after the first few moments in the research process. The object is located and then classified on the basis of some property. Research then offers knowledge about these properties.

Third, the concepts are in themselves all cognitive. They are

intellectual, rational reconstructions of reality. They refer to non-cognitive and non-rational aspects of behavior, to motives, emotions, psychopathologies and so forth but they always place those events at a distance, as objects. Society is represented by a matrix of points, a "property space," as an accounting ledger, as a set of instrumental operations or rules of behavior logically related to standards or principles. Such concepts provide a language for talking about reality. They are not intended, as poetic imagery would be, to communicate a subject's emotion by evoking it in the reader, nor are they intended, as would a political slogan, to urge action.

Fourth, deriving from the above, the personal and social activity with which the concepts are associated is contemplation. They are not, like religious and ideological symbols, action tendencies. When they seem to carry such baggage, perhaps in the names of the concepts, such "surplus meaning," is expunged. Utilization is, by definition, social action. As action, it must incorporate these additional meanings. Since the "surplus meaning" is not given in the knowledge-generation process, it is likely to be derived from the social situation of the policy-makers--as they reify the researcher's concept in their effort to make it useful.

Fifth, the degree of association of properties is determined by the method of joint occurrence. The correlation coefficient is the dominant measure of strength of association. A correlation tells "what" is related but not "how." The "how" may be a "mchanism" explaining how the "what" comes to be. An hypothesis about such a mechanism is, in turn, tested by measuring the joint occurrence of some mediate events. Thus, the description of the organic network is again approached

asymptotically, by minute steps. Alternatively, the original relation may be explained by subsumption, as an instance of a more general case. A "test factor" may be introduced to see if it deprives the previous independent variable of its effect on the dependent variable, a variant in the same method of joint occurrence. This method would not avail were the relationship dialectical--such as that between Crusaders and Saracens--but, then, the method is for attributes, not for relations among the entities themselves, and the requirement is that the properties be substantively independent--and measured independently.

The term "utilization of knowledge" itself is misleading in suggesting that it is a matter of knowledge on one side and action on the other. Policy involves a relationship between two or more systems of action. The systems may be agencies, organizations, or a community. Neither the organization developing the policy nor the target group are organized solely around policy. Social processes in the policy organizations which are not part of the implementation system, such as the informal groupings, impinge on policy.

Policy groups also, in self-protection, specify those events not subject to their intervention. The notion of being subject to intervention is not simply factual but is also normative. Thus, in American society, it may be judged that fertility should not be controlled by social policy--at least not directly by a coercive policy. Another society may deem a eugenic program acceptable. The policy variables considered subject to intervention are a function of social relationship between the controlling and the controlled systems. These are but a few of the variables which the knowledge producer might explore

about the system in question.

Policy Needs Ideology

To recapitulate, social scientific knowledge in the positivist tradition is contemplative knowledge. It provides an intellectual understanding of the world, which may be tested through predictions. Scientific knowledge, cast in an instrumentalist framework, may inform technical knowledge. Technical knowledge, guiding the bricoleur, may be tested in attempts to control nature and society. Technical, instrumental control, impressive with respect to the natural world, has but limited relevance to the social world.

Social knowledge is an aspect of social action. Social control involves interaction and the mutual control of the putative policy maker with the target group. As a system of action its symbols, aside from their cognitive content, involve ideology, passion, value. To serve this purpose, the abstract isolating variables of positivist social sciences are reified, must have "surplus meaning" attached to them. Knowledge infused with passion, value and purpose is, essentially, synthesized as religious or ideological knowledge.

Pure scientific knowledge, cognitive and ethically neutral, is about as stable as an elementary particle in the atomic nucleus, sparking to life for a milli-second and then coalescing with its environment. The tendency of scientific knowledge to acquire surplus meaning and to become ideological knowledge is evidence of the instability of cognitive abstractions as they enter the policy world.

Abstract cognitive knowledge is an achievement of Western society.

In the form of technical knowledge, it has aided in the attainment of certain Western social values—a reduction of illness, mortality, and poverty. Particularly in its technical version, this type of knowledge has an affinity for the relationships of rational bureaucratic organizations, distinguished by the separation of role and person. An effort is needed to resist those social processes which insist on joining idea and role to person and passion.

The type of ideology which adheres to the scientific concepts influences its effectiveness for social policy. Knowledge becomes ideology as it absorbs the values and passions of the group creating or bearing it. It may become the ideology of the scientific community, the ideology of the policy community, and the ideology of the target community.

Abstract knowledge is a preparatory step in the more complete development of knowledge for application. To derive knowledge more attuned to utilization, social research resting on philosophical sources different from those of contemporary sociology is needed. The Whiteheadian orientation promises such a widening of social research horizons.

The Historicist Alternative

The idealist or historicist model offers an alternative to the positivistic way of thinking about knowledge and its utilization. The focus of idealist social science is on the entity rather than on its attributes. Its observation units are components rather than abstracted properties. The problem of change is not viewed in terms of the shifting values of variables but as a problem of development of the entity. The system, or a cultural configuration, is internally "programmed" to evolve

through stages. Environmental events affect the rate of development of the several components and of the entity as a whole. The theme of the relationship, the direction of development, is expressed in the geist or spirit dominating the "historical individual." The famous examples of such cultural wholes are capitalism and particular nations. Activities are carried out by types of actors. These are general types defined by their function in the system.

The policy-maker comes to understand, verstehen, the "target" group by comprehending the meaning of the situation for the actors. The policy-maker may also control outside environment events. The system is encountered as objectified in time and space. The scientific concepts are realistic. The conceptualized ideas are analogs of the social process. The Whiteheadian approach, to be examined now, has some roots in this idealistic model of social reality.

THE WHITEHEADIAN CRITIQUE

The Whiteheadian Orientation

Empirical scientific knowledge is based on experience of the world and interpretations of that experience. Interpretation is constrained by a posture on the nature of the reality presented by experience as well as by our understanding of the nature of the process of experiencing. This posture is determined by answers to three basic questions. What is the nature of social and physical reality? What "out there" (if there is an "out there") provides us with the experience of a physical world and of a society? Second, why does the experience of reality seem coherent and, at the same time, seem to have separate parts? What is the nature of freedom and of order among the components of the reality? And third, what, if anything, is permanent about reality and what is changing? What is the relationship among changes, in magnitude and direction, of the components of that reality? What influences components to change? What is the effect of change in one component on other components?

Like all questions, the formulation of these questions anticipates their answers. The answers given by Hume, Locke, Descartes prepared the way for positivist social science and Kant's and Hegel's answers prepared the way for idealist social science. The characteristics of their approaches were sketched above.

The proposal here is that social science knowledge related directly to living in the world, to social policy, may be grounded in the philo-

sophy of Alfred North Whitehead. The following summary of his thought derives principally from his magisterial work, Process and Reality. Whitehead describes this work as speculative philsophy, that is, a philsophy about ideas. In this case, it is about ideas of the experienced world. His aim is, as he says, to frame a coherent, logical, necessary system of general ideas in terms of which every element of our experience can be interpreted. The Kantian tradition is, par excellence, interpretive. Yet, it restricts science to cognitive interpretative knowledge. Practical or moral interpretation is outside of science. Whitehead's interpretation refers to everything which is conscious as enjoyed, perceived, willed or thought. Thus, it will deal with what appeared in the positivistic setting as "surplus meaning."

Process in Place of Substance

In accounting for the experience of the actual, Whitehead abandons the notion of a world of substance and properties for one of process. For Whitehead, experience is what results when an individual with sensors encounters a datum. In fact, the agent of action is conspicuously absent from the Whiteheadian scheme. The agent, the experiencing individual, is a later derivative actuality. It awaits action of the subject in the encounter with the datum. Experience comes in sequences and in arrays, an interlacing of entities—a process he speaks of as ingression of one occasion into the other.

The ingression of current experiences with prior experiences relates occasions in the mode of causal efficacy. The sudden contemporary influx of experience, the rushing process of ingression, is in the

mode of presentational immediacy. Interpretation involves a symbolic interplay between these two modes.[8]

Interpretation is not a contemplative act. Symbolism arises from a common ground between two species of percepta, presentational and causal. Symbolic reference is a fusion, or a shift, of the feelings, emotions, and actions from one species of percepta to the other. The end of this process is called a meaning. A meaning is an event rather than the cognitive contemplation of an event. The symbolism is, in the language used above, religious, political or ideological.

Whitehead observes that, in the most naive sense, we have an experience of the "solidarity of the world." This, rather than analysis of abstraction, is what requires explanation. Fundamental to providing such an explanation is the notion that there is no isolated experience. Causal efficacy and presentational immediacy are two ways of relating experiences so as to account for the experience of solidarity.[9]

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[8]Some current theories of social science recognize these two constructions of experience. Freud's developmental theory begins with an influx of unorganized stimuli, the primary process experience. No inhibition stands between the influx and the "consciousness" of it. This is experience in the mode of presentational immediacy. With development, actually the cathecting or stabilizing of some of the experiences, the ego becomes organized. Inhibition of response becomes possible. Consciousness emerges from the energies inhibited. This is experience in the mode of causal efficacy. For Freud, primary process is antecedent to the secondary process. He was thinking in terms of simple mechanical energetics and of a system of decreasing entropy, from chaos to order. For Whitehead, the relation is the reverse. He is thinking in terms of symbolic processes of interplay among meanings. Causal efficacy is prior. It is the source of the meaning for the experience in presentational immediacy. That is, the sudden rush of experience is understood on the basis of past experience. The sudden fright of something or the sudden esthetic feeling in encountering a landscape is grounded in the relation of the immediate to prior experienees.

[9]Hume, who also begins with experience and perception of that experience, divides perceptions into those which answer with force and

The philosophy of organism, the name Whitehead gives to his work, is existentialist. It begins with existents. Those existents are not things, however, but processes. He calls them actual occasions, actual entities and events. The interplay of actual entities leads to ideas which, in turn, lead to operations of mind. The datum is met not by a formed subject but by feelings. Feelings are capacities or tendencies of an actual entity to engage aspects of a datum of a kind matching those particular capacities. At the same time, the datum, as an actual entity itself, also possesses feelings reaching out for other occasions. These data and feelings are drawn together and in the process, a subject is constructed. The subject rather than the datum becomes objectified. This reverses the Kantian doctrine of the objective world as constructed through experience. The subject, now objectified, Whitehead calls a superject. The superject is derivative from the encounter between feelings and datum.

Thus, in dealing with the question of what is there, Whitehead changes the question to what is happening, to a focus on the activity. Thus, he abandons the notion that the world consists of some substance which has various qualities, the subject-predicate distinction, and the secondary notion that the substance is permanent while the qualities

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violence and those which are images of these ideas in thinking and reasoning. Both of these he divides into simple and complex. Whitehead argues that when Hume tries to deal with the problem of the solidarity of the world, he speaks of associations among experiences and among ideas. He does not distinguish the ways these associations come about nor the manner or order in which many simple perceptions constitute one complex perception. The mere multiplicity of simple perceptions constitute one complex perception until that multiplicity is associated with an efficacious fact, says Whitehead. That is, the laws of association, as developed later in terms of contiguity, similarity and so forth, are insufficient to account for the newly emerging experiences of solidarity until some notion such as symbolic reference is introduced.

change.

The process becomes ordered. Instead of changeable properties, he looks at the formation of actual entities, activity patterns which are coming into being and succeeding one another. He calls them "drops of experience," complex and interdependent. He, himself, calls the ordering a cell theory, much like the quantum theory of energy in which bundles of energy come both continuously and in spurts. The wider activity of the world consists of nexi of actual entities. This family of entities he calls an event.

The Components of Experience

Actual Entities

Each actual entity has several types of more elementary components. These include prehensions and eternal objects. An eternal object is a principle influencing the direction in which the actual entity emerges. These are similar to the Platonic forms. Unlike Plantonic forms or even Kant's "thing in itself," they do not function in another realm, presenting an ideal or noumenal representation of what is phenomenally real. An eternal object cannot subsist by itself, only through its ingressions or the way in which it participates in an actual entity. Thus he says there is no general eternal object of redness but rather there are red entities. Through them we know red. There are capacitiees which are only known as they are implemented in carrying out activities. They are, as it were, "disposition" entities, to borrow a term from the positivist lexicon.

Actual entities cannot be isolated from some eternal objects and

from some other actual entities. Therefore, they cannot be described by universals. A universal is a statement about abstractions which are conceptually isolated from their contexts and then identified as aspects of a series of contexts. A universal classes entities together with reference to the isolable element.

Eternal Objects

This argument for the impossibility of subsuming actual entities under a universal can be made for eternal objects. Just as actual entities intermingle, so eternal objects intermingle. Whitehead talks of a multiplicity of eternal objects. The idea is to avoid bringing eternal objects together on the basis of a common isolable attribute but rather to join them on the basis of their common ground. A multiplicity he defines as a complex thing which has unity derivative from some qualification which participates in each of its components severally.[10]

Creativity

Creativity refers to the novel entity evolved in process.

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[10] In order to avoid a reductionism in which all of the world flows together into an undifferentiated process, it is necessary to account not only for the ingressions, the positive association between actual entities, but also for exclusions. In a sense, Whitehead says that every item in the universe, including all the other actual entities, are a constituent of any one actual entity. This is the principle of relativity. This avoids the issue of monism. However, not all actual entities are equally tied to others. This is the principle of intensive relevance. This opens up what he calls alternative possibilities for the constitution of events as well as the question of more or less or important or negligivle. The way an actual entity is established arises from decisions for it. Its existence provides decisions for other actual entities which supercede it. The particularity of experience of entities is guaranteed by incompatibilities among elements. When an element is omitted from an actual entity, Whitehead says, there is always some element of that entity contrary to it.

Creativity in the philosophy of organism replaces the quality of being a thing in substantialist philosophy. Entities are then organized creatures. These creatures, Whitehead says, are the ultimate matter of fact. Thus, the problem of order or of freedom and change is treated as the creative process. For Whitehead, fact is the principle by which the many, which are the universe disjunctively, become the one actual occasion, which is the universe conjunctively. The advance from the disjunction to conjunction creates a novel entity which is at once the subject experiencing and the superject of its experiences. In place of universals and generalities, Whitehead speaks of an insistent particularity of things experienced and of the act of experiencing.[11]

Prehensions

A prehension is a component of an actual entity which relates to a component of another actual entity. Whitehead says that each actual entity is divisable in an indefinite number of ways. Each way yields its definite quota of prehensions. A prehension arises from a need of the organism. The original organism, through the prehension, establishes a relation with another entity which produces the satisfaction of the need. An exchange takes place which binds the

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[11]Actual entities exist in a nexus which Whitehead calls an event. An event is a definite fact with a date, he says. Events are the fundamental units of the world as experienced. Some common element of forms, a defining characteristic, gives definiteness to each actual entity in an event. The event, then, has social order. A nexus with social order he calls a society. A society with a stable theme, as an enduring creature, has personal order. Personal order depends on a genetic relatedness among its members. An individual, a relatively stable actor or an historical sequence of actors, like an organization or an institution, has personal order.

two entities. The binding is the satisfaction of each one's need.[12] In Whitehead's terms, a prehension reproduces in itself the general characteristics of an actual entity. It is a referent to and from an external world and involves emotion, purpose, valuation and causation. It is the basis of the internal relation among actual entities. The solidarity of the physical world depends on the internality of these relationships.

Prehensions may be positive or negative. A positive prehension, Whitehead writes, is a definite bond of an actual entity with every atom in the universe. A negative prehension, also a bond, is the definite exclusion of that item from positive contribution to the subject's own real internal constitution.[13]

Concrescence and Transition

The final topic is the question of permanence and change or development. In positivistic science, change in attributes occurs by efficient causation. In the philosophy of organism, the entity itself is developing. The basic line of development, the vector of development, is internally determined toward what Whitehead calls "a self-creative unity." The process of development is referred to as a concrescence and its end point, which is not a stationary moment but an end

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[12] Illustrating from the psychoanalytic model, the need to be nurtured is, when organized, an internalized representative of the outside source of nurturing. The need is, thus, a component of the personality of ego, a principle of order by which ego relates to the environment.

[13] Positive and negative prehensions are part of the selection of relationships. Decisions emerge from contrasts. Feeling a contrast between a theory which may be erroneous and a fact which is given gives rise to consciousness, a subjective form. Contrasts between eternal objects, such as between red and blue, are a source of judgment.

in view, is a satisfaction.

> The process of concrescence refers to the internal development of an existent. The concrescence is drawn forward by a final cause. Another form of development is a transition from one particular existent to another. This form of development is propelled by an efficient cause. The subjective aim of a transition is the vehicle of the efficient cause.[14]

In a way, the pattern is established at the beginning of the development of the entity. As he says, every actual entity possesses only such freedom as is inherent in the primary phase "given" by a standpoint of relativity to its actual universe. Here, though, the notion of repetition is fundamental, leading to the doctrine of objective immortality.

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[14]The relation of an actual entity to other actual entities is guided by its feelings. There are two component feelings. One links the actual entity genetically, moving it toward "concrescence." Concrescence is internal self-actualization. Genetic passage is marked by a sequence of phases but is not in physical time. Physical time, says Whitehead, expresses some features of the growth but not the growth of the features. Genetic passage involves growth of the features.

An actual entity has both a physical pole and a mental one--comparable to the ecological and institutional relations in our sociological model. Only the physical pole of the actual entity is divisable. The mental pole is always one, unified.

A NESTING SYSTEM AND ITS LEVELS OF GENERALITY

The Schema

Knowledge for policy is knowledge ingressed in the actual world. The manager and scholar sometimes mistake the visible world, as manifested in space and time, for the actual world. The visible world is a real component, an actual entity, participating in the nexus which constitutes an event of the actual world. The visibly abstracted components of society constitute the ecological organization of society. The visible space-time society consists of a variety of ecological organizations.[15] Knowledge about ecological organizations, in the traditional framework, consists of empirical generalizations. Future organizational performance is predicted by extrapolating past trends or generalizing from "similar" situations.

The need for transit lines for a city may be assessed on the basis of the "experience" of other cities having "similar" residential and workplace distributions. The ecological organization by itself is an abstraction from actual reality. Treating it as if it were whole is to reify the abstraction, to commit what Whitehead calls the "fallacy of misplaced concreteness." Ecological organizations are embedded within a nested system of social, cultural and personality

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[15] Ecological organization are, for instance, farm organizations (binding farmer, consumers and food processors to productive land and plants); industrial organizations (binding workers, management and markets to machines, materials and tokens of value); transportation organizations (binding drivers and dispatcher to mechanics, vehicles and routes--not to speak of supportive industries of vehicle or energy resource production).

systems, not to speak of physical and biological systems, which condition their behavior. Ecological organizations are, first of all, composed of man-environment units, the molecule of social systems. The environmental partner of the human actor may be another person or a physical or cultural object. The man-environment unit binds a capacity of a human actor and the lawfulness of the environmental element. The social and cultural systems which surround, inform and sustain the ecological organization include what we will term relational organizations, patterns of institutional rules and cultural paradigms. Like ecological organizations, any of these taken alone would be an abstraction from actual reality.

The social and cultural systems are not abstractions from the ecological organization in the sense of the isolating abstraction described above. The institutional rule is not an attribute of either a relational or an ecological organization. They might better be thought of as componential abstractions. In Whitehead's terms, they are actual entities and eternal objects. Ecological and relational organizations each have their own peculiar form of existence. Thus, institutional rules compare to Durkeim's (1938) "social facts," which Durkheim identifies as part of a sui generis reality because they maintain an existence exterior to but exert a constraint on social behavior of the particular group or individual. Relational organizations are comparable to "historical individuals," to draw from the idealist tradition.[16]

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[16] A classification of relational institutions, as presented in the positivist tradition, differs from historical individuals, as presented in the idealist literature. The relational institutions (e.g.

Whitehead's initiating idea is that of process. The vents are processural. The eternal objects which determine the form and the modes of relationship of the elements of the events, along with the principles of efficient causation and subjective aim, determine the direction of development and the order among events. Eternal objects move the proces toward its concrescence, its satisfaction, as the actual entity becomes self-actualizing. From our perspective, these events or the actual entities, are systems of action. Ecological organization, relational organization and man-environment units are a system of action or actual entities. The controlling paradigm and the systems of institutional rules are symbol systems and thus, eternal objects. The personal capacities and the lawfulness of environmental events are also eternal ojbects. All of these function as eternal objects in that they establish bounds to the form of development of the events. As we will see, this distinction between systems of action and symbol systems will be important for the way these various entities relate to one another.

Each Whiteheadian entity has its own system's character, its own laws of developmental process and structuring of its internal

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the pattern of norms governing marriage and kinship) classify social activity by the structure of a relationship and the function that that structure is presumed to fulfill in the social system. Relational institutions are thus classified as religious, or economic, or political. Designating these as the specification of an historical individual requires a more substantive idea. It is important to name the particular historical individual--capitalism, the German nation, the Chinese literati, etc. The idealist theoretician has some general ideas about the types of components that would constitute an historical individual--a geist, a social type of actor or organization, a vectorial motivating thrust, a final cause, and so forth.

elements and its boundary exchange processes. The systems of action also have a sui generis character.[17] Each entity on each level of generality may be analyzed from all four of the basic social knowledge problem perspectives--its man-environment relations, its man-man or social relations, the contingencies of action and ways of legitimating rules governing action, and the canons of interpretation.

These nested systems, constituting actual social process, are schematized in the following diagram. The more general systems are at the top and the less general in order below that. A system is "more general" when a single structure in it governs a variety of structures at a lower or less general level. Thus, the schema is formulated in terms of "control," which is conceived of as an asymmetric characteristic by which the activity on several levels is coordinated.

The nested system may be examined in terms of its structure, the dominant ingressive pattern. Elementary units are combined into larger configurations. The term "combining" is not solely mechanical but is the creation of interaction opportunities, the establishment of a nexus with social and personal order, to use Whitehead's terms. The elementary building block is here conceived of as a relationship between two or more actors with reference to another actor, a cultural symbol or some aspect of the natural world--termed here, for brevity, man-environment units. The relational and ecological levels are shown in the diagram with their component man-environment, or actor role, units. These units,

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[17] The term sui generis is familiar in sociology from its use by Durkheim to characterize society as a substantial system existing in its own right beyond a system of individuals. The term is also familiar in the idealistic tradition with reference to self-actualizing systems--and so the idea appears in Sombart and among phenomenologists such as Schutz.

in turn, may be analyzed into its human and physically based components.[18]

In brief, we may think of (1) basic cultural paradigms which are (2) specified for social action as institutional rules. These rules cluster around the functional problems of society constituting economic, political, religious, and other institutions. Institutional directives and constraints govern (3c) the formation of the basic relational man-environment units from (3a) capacities, talents and abilities which characterize individual personalities on the one hand and (3b) lawfulness in the behavior of physical nature as a culturally defined resource on the other. The institutions are "relational" because they are normatively defined social types—the general status of craftsmen-tools-patron or of priest-chalice-communicant. These units, with their three terms, are the basic social action "molecules."[19] Their components, the capacities of actors and lawfulness of nature, are the more elementary "atoms." The orientation of the actor is toward the expected behavior of the natural world and of the actor's role partners. These expectations are governed by lawfulness with respect to the natural world. The actor appreciates efficient causation and with respect to the social world, the actor appreciates efficient causation. With respect to the social world, the actor orients to final cause. Institutional meanings of physical objects for the actors vary according to whether they are implicated in the

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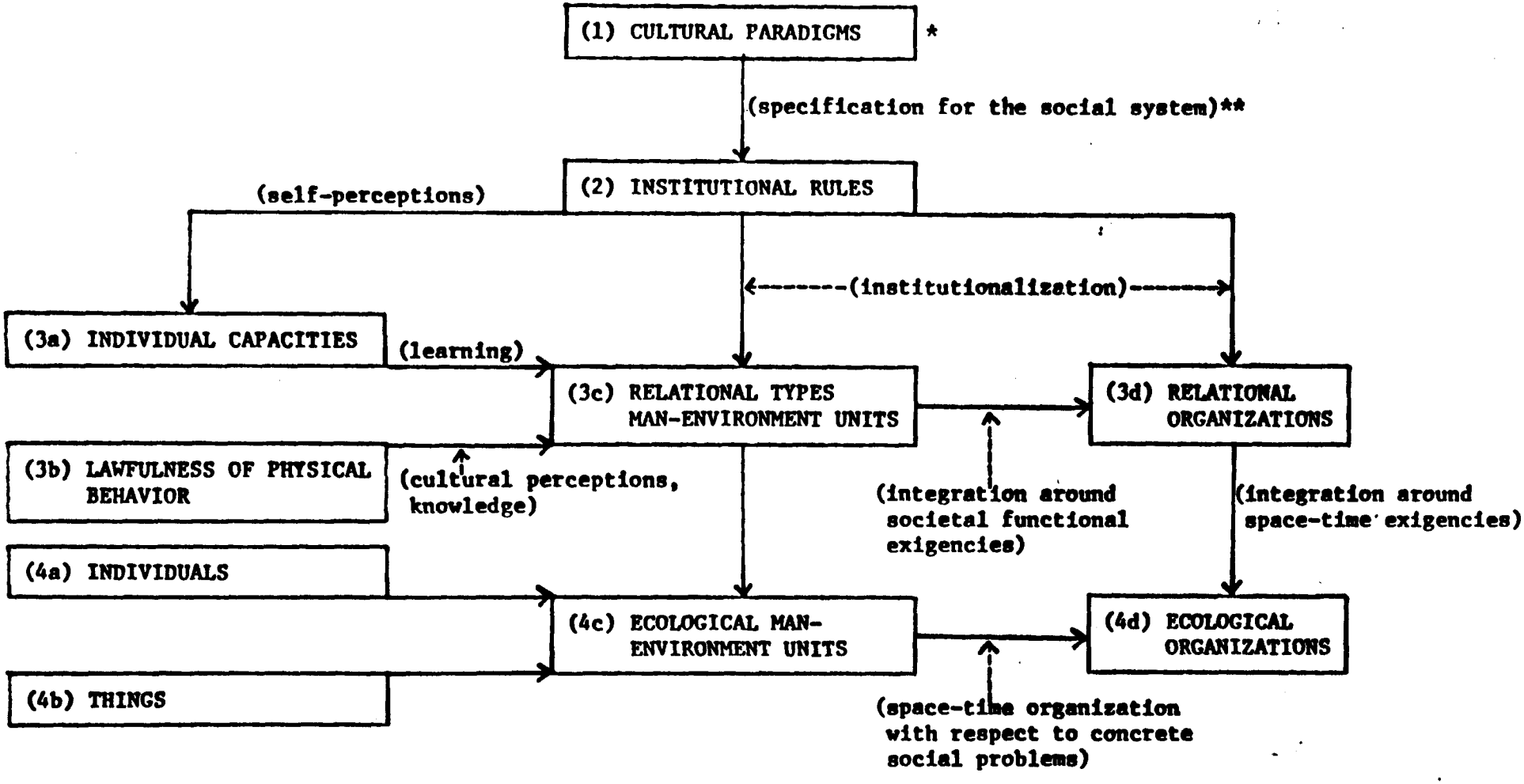
[18] In this example, we are concentrating on society as oreinted to its physical environment and so will not deal explicitly with roles in which actors are oriented to other actors or to cultural objects. The extension to these cases is straightforward.

[19] The metaphor "molecules" suggests the smallest unit with characteristics of the whole. In a larger sense, all of the components express the theme of the whole. This is the conception of the role of the geist or spirit of a cultural configuration in idealistic social thought.

LEVELS OF GENERALITY IN THE ANALYSIS OF MAN-ENVIRONMENT RELATIONS



* BOXES: Classes of Variables

** PARENTHESES: Mechanisms articulating the levels

process of production, the allocation of power, the orientation to salvation, etc. Institutional meanings also become components of the actor's personalities. Interacting with capacities they become actor attitudes governing the application of the capacities and the direction of development of the system of action. This last corresponds to Whitehead's subjective aim. These meanings also govern the assembly of the molecular units into (3d) relational organizations. Relational organizations differentiate around functional problems of social systems. These functional problems concern the allocation of resources, the integration of the system and the legitimation of norms and values. In line with this, social types such as industries, firms, governments, churches, are organized.

The relational types of man-environment units are objectified in the space-time world of ecological organizations as (4c) ecological man-environment units--an observable artisan and his tools and fellows and an observable lawyer complete with books, courtroom and other actors of the judicial system. These units incorporate (4a) aspects of individuals and (4b) aspects of things. Ecological man-environment units are assembled, under the direction of relational organizations, into (4d) ecological organizations, entities acting under the exigencies of space and time. These are spatially defined collectivities such as particular government agencies or particular local church groups. Each of these systems is articulated with the other through social or psychological mechanisms. These mechanisms are boundary exchange processes, the outcomes of which are designated in the diagram as learning, institutionalization and integration. The boundary exchanges are processes which relate

the systems internally as well as externally. Through them each of the systems participate not only in the environment of the other systems but in the internal life of the other systems. This presentation has followed sequential steps through the successive levels of generality. The system is, however, a nested one in that each system level has a boundary with each of the others.

This formal classification of social, cultural and ecological systems becomes a framework for substantive theories. They are theories about actual social systems--such as the Communist Party of the U.S.S.R. or the Seventy-second Congress. The systems are historical events which have a measure of typicality. These could be oligarchically dominated political parties, state socialism, or the family in industrial societies. The space-time event is the historical event toward which policy is evolved. Those are often unique events such as the election of Pope John XXIII. This paper will stop with the presentation of the formal model--the simple naming of components. The specification of this model for a typical substantive system and the selection of research methods and rules for policy choice must await a later paper.

A Short Commentary

A short commentary on each system within the nested system begins with the man-environment relational units, the "molecules." These are the fulcrum of the nested system of systems. The discussion will be conducted with reference to the diagram on page 31.

The Three-Termed Unit Act

Parsons opens his seminal The Structure of Social Action (1937) by specifiying a "unit act" as the sociological "molecule." Its elementary particles include an actor (individual or collective), a situation of action, an orientation to that situation, and motivation. The situation includes other actors and physical and cultural objects. The actors' orientation, itself a product of interaction, defines the significances of the objects for action. The objects may function as goals of action, means for attaining goals, or conditions of action, elements beyond the control of the actor.[20]

The actors in the fundamental man-environment unit are dually oriented--toward the lawful behavior of an environmental object and toward one another. The orientation to the physical object may be instrumental. The actor may treat himself as part of nature subjecting himself to the principles of the natural order--as he understands them. The orientation to the physical object may be expressive. Then, actor and object are considered as mutally animated. The object is humanized. Role relations, the institutionally given orientation to social or to cultural objects, are a major organizing principle of the man-environment unit. Man-environment action emerges as the socially interpreted laws of the natural order mesh with the rules of the social order.

Actor and object are two elementary "particles" constituting the "molecule." The relevant aspects of the actor are "capacities."

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[20] The "orientations" and the "motives" of action derive from the relational structures and the possibilities of interaction which they present. The motives, as part of the system of personality, and the orientations, as part of the system of culture, influence the molecular units of action.

Capacities include the skills and motor abilities for working with the physical environment. They also include the intellectual capacities for apprehending and integrating those skills with perceived laws of the natural order and rules of society; aesthetic and religious capacities are for responding to the social and natural orders with wonder or awe and a moral capacity for evaluating the actor's posture toward nature and society. The capacities do not arise independently within the personality. They emerge through the ingression of the cultural paradigm, the relational institutions and the space-time ecological experience, including the experience of the actor's own body in the course of social interaction. These ingressions create prehensions which then seek to complete themselves through the social relations in which a cognitive instrumental or expressive or moral act occurs. This seeking is Whitehead's "lure of feeling" and the outcome is a satisfaction linking the actor and the world in the actual entity. Motives, a type of capacity, are rooted both physiologically and in social norms. Motives are aspects of personality which serve to order the actor's behavior with respect to certain significances of environmental objects. The significance of an object is determined by its relevance for the functioning of the organism, the personality and society.

Capacities engage those aspects of the objects which, according to institutional norms, are relevant to social and personal purposes. For physical objects in general it is the lawfulness of their behavior, an understanding of the role of efficient causation in the relations among the objects themselves, which is engaged. The significance of physical characteristics is

the object for social action is given by an appreciation of these laws as conditions of action combined with a social decision about the role of the objects under those conditions. Physical things also participate in social activity as a facilitiy for action, as a tool, or as an object of consumption, a reward, or as an object of design and esthetic order, of contemplation or of play. The physical characteristics of an object, including its relevance to social action, may be transformed in the course of action. In the course of manufacturing, for example, a material resource is changed.

Capacities may also engage cultural objects as symbols for contemplation or respond to their power to evoke commitment and feeling. Capacities may engage social objects by entering directly into the constitution of the social relationship.

The two elementary "particles" of the man-environment unit are, in origin, independent of one another.[21] The properties of iron are independent of the smith's presence or absence, though the iron would not be in the smithy but for the miner, the smith and his customers, among others. As constituents of the man-environment unit, the capacity and the character of the resource are mutually conditioning. Characteristics of a thing are selected with reference to human capacities for relating to that thing. In fact, the very idea of a thing is that of the novel creature of human capacities guided by the subjective aim

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[21] Individual capacities are not elementary for personality analysis. In that case, the combined bio-psycho-cultural apparatus which produces the capacities would be considered. Similarly, the characteristics of resources are not elementary when viewed within the physical system underlying them and the cultural system in which they are interpreted.

and final cause toward the creative concrescence. Thus, the distinction between the two types of "particles," as they function in the unit, is analytic.

The systems of man-environment units, systems of institutional rules and systems of relational organizations also do not originate independently. All of the components of events arise in social interaction and include residues of the history of social interaction. The institutional rules and organizational forms emerge as solutions to problems of living. Upon emerging, they become, in some measure, autonomous of the conditions which gave them birth and subject to their own system rules. In this way, they crystallize as three levels of generality, each with its own systemic character. The cultural paradigm, too, arises from processes of interaction, the paradigmatic forms being inherent in the institutional rules and principles of institutional and ecological organizations. The principal concern of this paper is not, however, the question of origins but the question of theory, of how the symbol and action systems actually operate. Functionally speaking, institutional rules are a social expression of a cultural paradigm. They govern the mode of combination of human capacities and physical attributes in the man-environment units and the mode of assembly of man-environment units in relational and ecological organizations.

The Cultural Paradigm

The paradigm is a general cultural framework by which a society interprets its world. A fundamental "mental" structure, it delineates the categories of culture and forms acts and things into events within

to "ground." The paradigm defines man's role in the cosmos. In structuring thought about society, it provides a frame for assessing the legitimacy of social norms and values. This use of the term paradigm is consistent with Thomas Kuhn's (1970) description of the paradigm shift accompanying a scientific revolution. The paradigm influences religion, history and a concept of man, as well as science.[22]

While termed a "mental" structure, the paradigm also controls feelings, the allocation of affect, of emotional energy, among the activities of the world, and is a ground of value. The paradigm grounds value by defining the humanly relevant and thrusting forth that image of society as a factual order. The factual order is, in terms consistent with the paradigm, evaluate in terms of desirability or aversiveness, and in terms of its aesthetic or moral quality.

The paradigm underlies the directing principles of social and cultural development and thus has a teleological character. A growth vector operates internally to the system as a sort of "genetic code." Environmental influences, the external influences of other systems, are superimposed on this growth. Not all types of systems grow in the same way. For example, the laws of economic growth are not those of

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[22]The grand theorists of sociology have identified such paradigms or "weltanschauungen" of the societies they studied. Spengler (1962) divided societies into the Faustian and the Magian. The first, with a sense of history, sees time discursively. Faustian men, in struggling with one another, change their environment and, thereby, change their lives. Magian men shape themselves and their environment in the image of a changeless ideal, regarding time as a continuous present.

Sorokin (1962) describes a fluctuating relation between ideational sensate and idealistic cultures. The first is expressed in an interest in the spiritual and in the minimizing of physical needs; the second is expressed in an interest in modifying the external milieu to satisfy

political or of religious institutional growth.

Institutional Rules

Social norms are a specification of the paradigmatic principles in the context of social action. The specification is not simply a logical inference from the general to the specific. Rather, the cultural paradigm is a frame of reference for interpreting problems of social action. To use Ruth Benedict's imagery, Appollonian socieities arrive at different social institutional arrangements than do Dionysian, even when facing the same physical environment.

Rules for social action are clustered around ways of dealing with typical social problems, the functional exigencies of a society. Clusters of rules define social institutions. Some principal clusters of norms form around economic, political, familial and religious problems.[23] These are formal considerations for establishing an institution. All actual institutions have substantive content. The institution of the family, for example, involves rules of exogamy and endogamy, and these

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physical needs. The last is a synthesis of the first two cultural emphases.

Max Weber (1964) divided cultures into the ascetic--the active and striving, rationally selecting means to attain ends of action--and the mystic--the contemplative and non-rational.

Talcott Parsons (1951) contrasts the unversalistic-achievement cultures--guided by abstract ideals and general rules and stressing activity or performance as a basis of status--with the particularistic-ascriptive cultures--guided by the ideal of relationships, attending to the unique concrete instance and evaluating actors more in the light of their belongingness than of their performance.

[23] The term "social institutions" generally refers to specific clusters within each of these broad classes. Economic institutions, forming around the distribution and exchange of resources, include the institutions of property and contact. Political institutions, clustering around the allocation of power and authority and the implementation of a society's goals in the outside world, include the institutions of war and governance.

may differ according to the social setting of the family.

The meaning of physical environmental objects (really, the meaning of the relation between actors oriented to the objects) is controlled by their institutional location. In a capitalist economy, a material resource is treated as a commodity for exchange. For instance, land is a commodity to be exchanged in the market without attention to other significances of the land. Under feudalism, land was not alienable in a purely economic way. It could be transferred by political coercion or by sale arrangements between kin groups. Political institutions treat things as weapons. Religious institutions orient to material things as symbols of sacrament and covenant. Kinship groups turn them into "use values"--consumption items and symbols of kin solidarity.

Relational Organizations

Man-environment units are assembled in relational organizations. These are not visible arrangements of people and things for the attainment of a goal. Rather, they are typical clusters of social rules describing how social ecological organizations might be put together. These organizations form around the attainment of specific social tasks within the larger economic, political or religious institutional orders--or cross-cutting them. Relational organizations are *sui generis* socio-cultural systems for meeting societal needs. The type of institutional order influences the likely relational organization. A feudal economy is likely to be associated with bureaucratic organizations. The specific social relations constituting the patrimonial or bureaucratic organizations gives rise to norms specific to them. Relational organizations primarily oriented to economic goals such as production include

labor employment facilities, unions, banks, industries, retail sales firms and commercial organizations,[24] In these organizations, specialized norms emerge to govern relations; for instance, of counselors to directors in employment facilities. Physical objects in these economic settings are a focus of negotiation for rights in them. In a capitalist market, the rate of transfer of these rights is governed by price.

Political relational organizations form around the problem of acquiring power and behavioral concession to power. They include parties and social movements, police and courts as well as an administrative and executive apparatus of government. Political organizations are not only norm oriented but are also norm creating, even formally legislating law regulating administrative activities of the government and those subject to government. Physical objects, in this setting, become weapons, means of gaining and exerting control. Government, for instance, symbolizes itself through its weapons. Not only arms but food and transportation, among other things, may be treated as weapons by governmental organizations.

Religious relational organizations include churches, religious orders, seminaries and healing shrines. They organize around the sacramental activity of priests, pastoral healing and prophetic urging of commitment to values, educating the young or developing doctrine and

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[24] In addition to their primary institutional location, relational organizations also draw on the norms of other institutions in meeting their operational exigencies. Banks are tied to political organizations such as the government. Industry contributes material support to the polity. Political organizations, for their part, maintain social stability necessary for the pursuit of commerce and for the capitalization of production.

ideology through oracle and revelation. Specific organizational norms govern the prerogatives of a priesthood and criteria for admission to religious leadership. Physical objects in this setting evoke attitudes, have expressive significance. Chalice and wine express the communion of man and cosmos. Idols and holy places specify occasions and place for worship. A physical object set apart becomes sacred, as holy land over which the faithful war, or a sacred cow neither available for work nor for food. An inordinate amount of labor may be mixed with nature to qualify the object for veneration, as in the mosaics of a mosque or the hand lettering of a scroll of the Torah. This labor may be acquired through the economy, as in the purchase of a burial ground, or outside the economic market as religious activity, such as a monk illuminating a manuscript.

Relational organizations which define non-coercive bases of social order include the stratification systems, and their accompanying symbols of deference. These define the placement of individuals, roles or groups relative to one another. Kinship systems are particularistic solidarities established by contract between families and confirmed by fertility. They order activities around consumption, the socialization of the young and reproduction and become foci of community organization. Specific organizational norms define authority as patriarchal or matriarchal and express rules for accounting lineage. A primary meaning of a physical object in a kinship structure is as a consumption item, a variant of "use value."

Ecological Organizations

The "fallacy of misplaced concreteness" was a phrase used by Alfred North Whitehead to refer to the problem of evaluating an apparently "concrete" event without reference to its context. An observable ecological organization viewed in abstraction from the systems of norms and values suffusing it offers but a shallow grasp of the behaviaor of collectives of individuals. The same could be said about relational organizations considered as abstractions from the actual world.

Ecological collectives consist of people bargaining, government offices, sitting parliaments, courts with jurisdiction over particular territories, particular churches and shrines, residential households and palpable kinship networks, all organized with respect to the exigencies of time and place. The results of social policy are assessed in terms of observable changes in ecological collective activities.

Thought about ecological organizations conjures up pictorial representations and the tendency has been to describe them in terms of classificatory concepts referring to their attributes. Populations of individuals are enumerated and rates of fertility and mortality estimated. The press of this population on resources appears as a pictured ratio of people to cosumables. The spatial arrangement of work or recreational activities and the spatial patterns of residential communities may be mapped literally.[25]

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[25] Measures of ecological organizational activity include rates of consumption of material resources and of energy, the size of a store inventory and the factor efficiency of a productive system. Labor may be measured in hours worked and recreation in terms of visits to state parks. Some of these attributes, such as labor hours or consumption rates,

The visible shape moving through time is an abstraction. Successful prediction of development requires an assessment of ecological organizations in the context of relational organizations, and of the actors' choices in the context of culture and internal needs.

The Articulation of the Systems

Whitehead's approach is designed to develop a model of the actual social world as we experience it. The several levels of generality are components of that actuality--not abstractions from it. The notion of a nested system is intended to convey the fact that each level enters into the constitution of each of the other levels. These systems are not related one to the other as a case to a universal, a sample to a universe, nor as observable indicators and abstract concept. All of them are "observable" by inference from behavior.

Each level--the paradigmatic, institutional, relational and ecological is a social or cultural system. That is, each refers to a different type of component of reality having its own characteristics, its own internal rules of formation. They are bounded subsystems. An understanding of any one, and indeed, the empirical substance of any one, depends on an understanding, and indeed, the substance of the others as context.

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are abstractions from actual life. Others refer to integral components. Thus, we say that rate of growth of a population is given by the difference between fertility and mortality, balanced by migration rates. These are not correlates of growth but arithmetical components of the growth rate. An observable image seems to remain--of even the abstracted attribute. We can visualize production. A firm's profits are understandable by themselves.

Each system is articulated with each of the others by means of transformation mechanisms or boundary exchange processes. They are the prehensions and feelings and modes of relationships of Whitehead's schema. Substantively, these mechanisms are social, psychological and cultural processes.

Here, we will attempt to specify a few characteristic mechanisms articulating, mainly, adjoining levels of generality. The terms to be used initially are those current in the social sciences--logical specification, institutionalization, internalization and objectification. These are short-hand for a wide set of processes relating actual entities and eternal objects.

A process of specification, an interpretive act, articulates the cultural paradigm with institutional rules. The paradigm sets ways of looking at the problems presented at the level of social action, defining social facts and proposing criteria for the selection of norms for behavior in the light of those facts. The interpretive process is socio-cultural, not individual. Most social activity takes place within a single paradigm, as the notion is used here. The range of variation within a single society tends not to involve significant conceptual leaps. Actors are constrained towards consistency by one another's definitions of reality. This consistency decreases in the contemporary world with its contact between civilizations and its culturally pluralistic societies.

The paradigm does not appear as an autonomous cultural symbol toward which the actor orients in deciding on his action. The paradigmatic definition is implicit in the intellectual, emotional and evaluative aspects

of ongoing activity. At any time, the paradigmatic is culturally received, having been produced in countless historical acts.

A process of institutionalization articulates institutional rules and entities on the relation level, man-environment units and relational organizations. Institutionalization means that certain rules are selected by society and become more or less habitual guides to action under the circumstances specified by, in this case, relational organizations. The rules become constitutive of, and so internal to, the social relations in those organizations. Sanctions are attached to their performance. In Durkheim's (1938) terms, they are "exterior" to and "constraining" of behavior. They exist as institutional culture outside of the specific system of action. In becoming constitutive of action, however, the rules become internal to action. Social activity is implicitly ordered around such behavioral principles. The order is accepted as legitimate. Ordinarily, coercion is unneessary to assure behavioral conformity to legitimate order.[26]

Rules are clustered in institutions. The clustering can be considered from the top down if interest is in the problem of control; from the bottom up, if the interest is in the way ideas and systems of action arise from experience; and from the middle, beginning with man-environment units, outward if interest is in describing the structure

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[26] Social selection from among the available institutional norms underlies differentiation of political, economic, religious and other institutions. Selection also implies exclusion of norms on the grounds of incompatibility. Thus, to follow Weber (1964), a religion of contemplative mysticism, such as Buddhism, expresses values incompatible with an active ascetic orientation in the economy. Within the economy, rules fixing testamentary succession with a kinship line would be incompatible with a system stressing ties of class as the basis for the allocation of resources.

of the nested systems. Reasoning from the top down, the emergence of a commercial contract for labor services, for example, is an expression of more general social arrangements for getting work done and social conepts of property. Similarly, the way man-environment units are clustered in typical organizational patterns is controlled paradigmatically and institutionally. The emergence of the factory in a society, for example, depends upon the society having developed interethnic relations as a basis for a market and upon the separation of production from the household. Behavior grounded in institutional rules is manifested in ecological organizations.[27]

The relating of "capacities" and lawfulness of the behavior of physical objects within the relational man-environment unit is not a matter of articulating different levels of generality but of relating two quite different orders of things--an element in the natural with an element in the social order. Here, a transformation concept is needed. The transformation here is a social rule connecting laws of nature with social rules. For example, a law of nature associates pressure and the malleability of metal. A social rule, oriented to this knowledge, may direct an actor to pound heated metal with a hammer until it achieves a desired appearance. At one remove, a second actor engages the first, for a fee, to pound the metal with a hammer. The social mechanism

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[27] Rules may become institutionalized as regular ways of organizing relationships because mechanisms of social control, negative sanctions, place a premium on adherence. This is a loose or weak sense of the term. Rules also may be considered institutionalized in a weak sense when established on the basis of interests of the parties. Perhaps the term institutionalization should not be used for the cases of enforced conformity and agreed compliance but should be restricted to the case in which rules become constitutive of relations.

joining competencies and physical attributes in the man-environment unit includes perceptions of the self as competent to engage the physical attributes, a psychological rule, and justified in doing so, a moral rule.[28]

The mechanisms of learning join the capacity to the behavior of the attribute. The skill for using a hammer is internalized in the personality. That skill is elicited in the presence of the metal and under defined social circumstances. Learning to allow a symbol to evoke feeling or learning a symbolic reference is the ground for esthetic appreciation of the physical object. The feelings evoked in the presence of physical attributes may, in fact, be a response to a human relation for which the physical is a sign.

The requirements of some particular social function delineate the forms of relational organizations. Economic organizations are integrated around problems of exchange--the physical objects becoming commodities and the actors establishing a price. Political organizations are integrated around the problem of dominance, the physical object being a value needed for survival and the actors using it as a weapon. Relational organizations are also integrated around socially divided labor, certain actors and objects are clustered in executive roles and others in pro-

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[28] This is a well worn field in experimental psychology. Tests assess the dyadic relation between capacity and physical attribute--motor ability, response time, color discrimination, musical talent tests and so on. This psychological underpining has been extended to man-machine systems in attempts to establish boundaires for machine design and for training capacity. Work on the psychology of intelligence has added an interpretive element here. What a society will "try" with respect to environmental mastery or appreciation is given in its ethno-philosophy of nature, and in its ethno-science--as described by Levi-Strauss (1962) among others.

duction roles.

Technical rules and the technical division of labor are yet another integrative basis for relational organizations. For instance, the technically based social rule about heating metal and then pounding it occasions a relation betwen a smith and a coal supplier. Man-environment units are joined sequentially as dictated by the design of the productive process. A press operator is joined to a metal molder in turn, is joined to a painter. At higher levels of organization, the production brings together industries not otherwise in contact--around automobiles a body plant relating to an engine plant and both to an assembly plant which, in turn, relates to a marketing organization. Specialized organizational rules emerge for the conduct of these relations. These include a vested interest in that mode of production and its associated social system.

Norms established at the relational level are adjusted around space and time exigencies to articulate relational and ecological organizations. Location theory was developed by Alfred Weber (1957) to account for the spatial distribution of economic activities. Architecture and city planning handle the location of activities artistically. Community studies deal wth spatial patterns of residence and industry in cities, with the relation of farm and city, and so forth.

Were no ecological organization formed, there would be no relational organizations. Relational norms participate in the very fibre of ecological organization--the actual factories, banks, and households of the society. Being organizationally subject to space-time exigencies means that the personnel for interaction must be territorially co-resident

and that activities must be coordinated according to the array of other demands in the participants' schedules. Time and space constraints may be reduced by transportation.

This model of a nested system, including its mechanisms of articulation, is filled with content when related to a particular environmental object--such as energy--and with respect to some particular social institution--such as the economy--or group--such as a labor union.

From here, the road to social policy, to the utilization of knowledge, does not lead only to the laying down of rules, of governmental regulation from its own island on the Potomac. The policy maker is a social actor, engaging in the use of ideological symbols and moving onto the field of social action.

SOCIAL MANAGEMENT BY ENGAGEMENT

Public opinion "pollsters," social researchers all, may jealously admire the political "pro's" ability to set a strategy and "call" an election. Strategists and ideologists of social movements may project the acts of their constituencies to the front page and become a power in the legislative halls. The political "pro" may draw only peripherally on social science knowledge. The major social changes which occur, even in so rational an age as ours have less the character of rationally planned action, informed by scientific knowledge, than the character of traditional prophecy. Chinese revolutionaries and the leadership of the Third World have little use for our prattlings. Of course, for every victorious political "pro," ideologist or prophet, untold aspirants stumble.

The weakness of the political "pro" and ideological leader is in their restricted vision. They are acute at grasping the significance of a situation but because of ideological blinders or a parochial social location, some key forces may escape their notice. It is, though, to the social manager and the social researcher who informs the social manager, that the present paper is directed. This paper has not a prescription for prophecy or ideologically based strategy, but rather a language for talking about social bricolage.

Social bricoleurs work in bureaucratic settings as well as personally charismatic ones. The professions and the academy and government agencies are the sources of social policy and social management. The beginning of social management is in the way in which an organization manages itself, organizing its information and arriving at decisions.

The methods for developing knowledge, and associated action plans, have been called action research, demonstration projects and community self-study.

We have taken some steps toward laying the philosophical basis for social bricolage. We have set forth a schema which names some processes the social manager must think about. This schema comes to life when its categories are filled with substantive material. We engage social actuality when instead of a category of relational organizations, we deal with the steel industry or American ship building, and instead of the category or ecological organizations, we deal with the strike action at Jones and Laughlin or the reorganizing of the merchant fleet in the light of containerization.

The philosophy of science, in general, and the philosophy of the social sciences, in particular have over the past few decades concentrated on a philosophical basis for positivistic social science. They have dealt with the logical status of isolating abstractions and the justifications of analytic propositions, among many other things.

Where does the knowledge generated by positivistic social science fit here? The generalizations and analytic propositions of positivistic social science suggest to the social manager the possible ingressions among actual entities. The accidental universals regarding the relationship between occupations, industries, and lengths of strikes, or between various kinds of shipping technology and economic competition, tell us what kind of substantive system of action is possible.

It is the responsibility of the social scientist to discourage the direct utilization of these accidental universals. Utilization based on

positivistic knowledge always involves reification, surplus meaning. The rule for this reification is that of "joker's wild."

There is a division of labor. Some social scientists develop abstract propositions. This knowledge is always important as a contribution to culture. Others will shepherd those abstract propositions through their reification into ideology within the social engagement which is social management. The social manager is a bricoleur, thinking through a social strategy and a social ideology. The Whiteheadian framework presented in this paper offers one philosophical grounding for the activity of the bricoleur. This report, with its focus on energy, concentrates on the man-environment unit. The meaning of the environmental element, the physical object, is a function of the institutional contexts, the relational organizations, in which it is embedded. The following chapters offer a framework for interpreting the meaning of energy-society relations in religious, political, and economic settings.

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CHAPTER III

THE RELIGIOUS INTERPRETATION OF NATURAL OBJECTS

The Incarnational Relation

To interpret the meaning of a man-environment act which is implicated in a specific religious activity, assess the manifest function of that activity in the wider religious system.[1] Is the "ultimate concern" of the act, to borrow Tillich's phrase, with fertility, purification, or soteriological hope?[2] Religious ritual dramatically expresses these meanings. Ritual and its symbolism, unless it is mystic or contemplative, evokes social action in support of norms grounded in these meanings.[3] Religious meanings are posturings--expressing the sentiments of actors and their tendency to act upon those sentiments. Religious action affirms or disaffirms the legitimacy of all other social institutions. The religious

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[1]The manifest function relates to the interpretation of the activity as it appears to the actor and so is necessary for the analysis of the actor's conscious motivation. The sociological analyst conducting a "causal" analysis of the rise and decline of various religious activities in connection with changes in other variables will be concerned with latent functions.

[2]Religious concerns revolve around the social philosophical problems mentioned above. They are oriented to the persistence of life or fertility, the cosmological problem; the grounds for solidarity among humankind, the anthropological problem; the contingencies of action and the character of evil, the problem of theodicy; and eschatological problems and, especially, in its religious setting, the roots of value and the legitimation of social rules, the axiological problem.

[3]Each particular religion proposes some particular meanings and norms in each of these four areas. Various religious organizations or churches may stress one or more of them as central. Weber's classification of religious orientation along two dimensions, aceticism/mysticism and inner-worldly/other-worldly is a good place to begin a sociological analysis of religious differences.

theory of legitimation is given in its theology. This is an activity of religious intellectuals who contemplate the criteria of legitimation of the social order. Theology also evaluates the content of social norms and so prescribes and proscribes social behaviors.

The attribution of a religious significance to a physical object is to announce an interpenetration of the natural and social orders. The meaning of the physical object involves a symbolic reference between the physical laws governing the object and the social rules of the religious situation in which it participates. The physical object is often a vehicle for evoking social action. Thus, wine in an act of communion lends its character to the affirmation of solidarity among the communicants. The characteristics which it lends are selected by the religious system. Its physical appearance may evoke the thought of blood, and its attendant meanings of atonement and, thus the nullifying of estrangement. Its pharmacological character, its ability to overcome the control and individuality of an ego, and to loosen the anxieties of dread, guilt and conscience, may evoke the symbolism of healing. Wine, in its role as a secular potion for conviviality, may betoken the common participation of communicants in an animating spirit, a matter of commitment to action or to a meditative search for truth.

Religious ritual may also be oriented more directly to physical objects. A prayer for rain and an agricultural fertility rite are examples. These rituals, by sacralizing the physical, define its place in human society. Human action respecting nature is thereby controlled. The concept in the Massachusetts Bible Commonwealth that

untamed forces could be the devil's abode, so justifying the preparation of the land for agriculture as a religious act, is an example. Religious definitions of the meaning of the physical and biological world influence the behavior toward those worlds in other social institutional contexts--from hunting rituals among Eskimos to the protection of endangered species in western societies. Religious symbolism is evocative in its means and incarnational in its aim. The presentation of the physical objects arouses and materializes the sentiments of fertility, community, certitude or awe. Religious symbolism is expressive rather than instrumental. The means are assimilated to the aim. Evocation, the means, becomes incarnation, the aim.

The prototypical example of religious action, binding the natural and social orders, is totemism. Emile Durkheim (1954) appropriately describes totemism as the "elementary" or better, the fundamental form of religious life. Totemic institutions govern the role of physical objects in religious institutions--and then in society as a whole. Totemic rites are vehicles for evoking action oriented to the social order, such as defining the rules of exogamy and endogamy. Totemic rites also evoke meanings constraining social action directed to the natural order, defining planting times, the selection of animals for food and the sense as to what is appropriate and what is a profligate consumption of natural resources.

The interpenetration of the natural and social orders in totemism was explained by Durkheim as a duality in the classification of things. Totemic categories group botanical and zoological species, as well as physical elements, in relation to the groupings of societies, clans or

tribes. The meanings attributed to the physical rest on the relations among their associated social groups. The rules relating clans, their duties of mutual aid, vengeance, mourning,or the obligation of marriage are adumbrated in the classificatory rules for natural objects. These two sets of rules mesh in the rules for the social use of natural objects.

The object is called holy but the holiness is manifest in the social act with respect to the object--the attitude which Durkheim calls the sacred. The sacredness, since it is assigned by the group, expresses the cultural definition as internalized by the individual. The totemic bond between the orders of nature and the social order implies parallel principles of grouping on both sides. An attraction for objects classifies them within the clan. Feelings of repulsion classify them as strangers. The men of the clan and the things classified in it form, by their union, says Durkheim, a solid system all of whose parts are united and vibrate empathically. Men, plants, animals and physical things are several forms of the totemic being. The totemic principle animates these forms and unites them in a moral organization.

The totemic principle is functionally specified as society develops. Gods are set over special categories of natural phenomena, over the sea, over the air, or over tasks, such as healing and divining. As the functional problems of society define the foci of social institutions, the religious principle is woven through each of them. The mundane activities of life may be sanctified and the objects implied in them receive a "surplus" meaning. The doctor's scalpel is treated ritually and so especially protected while the wild forest, harboring demons, is razed.

In the following chapter, we will find that natural objects in economic and political contexts have an instrumental role. The religious relation to the natural world does not become instrumental in virtue of its association with economic and political activities. In fact, it adds an expressive component to those instrumental meanings. The religious relation is governed by a mechanism which Durkheim terms "respect." The attitude of respect is such that man submits to rules of conduct and thought which he has neither made nor desired and which may even be contrary to his inclinations and instincts.

As economic and political activities and their objects become implicated in a religious relation, they share the "mana" of the object as totem. Fertility rituals express the intergenerational solidarity of the community, its commitment to survival and, perhaps, to growth. Economic and political growth can, in the way, become a passionately supported ideology. Most religions celebrate the fertility of nature, and thus, of growth. It sometimes happens that the celebration is displaced by rites intended to coerce nature toward fertility. The expressive symbolism becomes instrumental. Magic has displaced religion. Rituals oriented to inducing fertility are magical in character. Symbolically appropriate human acts are conducted to evoke a fertile response from nature. Human and natural fertility are symbolically parallel and human fertility, itself, may become the aim of magic. The wise for human fecundity is expressed through rites involving ovarian fruits or bird eggs.

Meanings cannot be imposed on natural objects in some random way. The meaning must be appropriate to the characteristics of the natural

object. Appropriateness is culturally determined in the light of the array of social situations in which the object may be implicated. The religious meanings of environmental objects are conditioned by their practical role in the culture. The religious meanings of water are associated with its role in maintaining life, as a source of fertility, and as a defense against death. Water is also associated with purgation and, therefore with moral purification. The two meanings are associated. Purification is a rebirth, a repeatable fertility rite. Rain ceremonies are fertility rites and defenses against the anxiety of death, the fear lest the rains not come or the river become dry.[4]

Territories may be sanctified. Robertson Smith (1956) finds the totemic principle not only in plant and animal species but resident in holy places. Ancient worship in general is materially embodied in appliances of worship. Myths about metamorphosis between gods and rocks and animals indicate to Smith that the kinship of worshippers and the deity is both physical and moral. Metamorphosis is the essence of incarnational symbolism. Contemporary territorial nationalism rests on this sacred association between a people and its land. To the extent that the land is sacred, there is resistance to allowing it to enter

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[4]The specific meaning of water in relation to fertility in a particular culture varies with its physical disposition in that setting, whether its source is rain, a spring, or a river. The Talmudic treatise Taanit associates the prayer for rain with the divine attribute of power (givurot). Water, in ancient traditions, is associated with the sky god--with thunder and clouds. Meanings are expressed in ritual. The ritual behavior which accompanies uncertainty about whether rains will come and in sufficient quantity tends to be ecstatic. Where the agriculture is dependent on rivers and irrigation the river flow is likely to be more regular. Ritual takes the form of more cadenced water rites.

the market as a commodity and the deeper the commitment to maintain political control over it.

From Ambivalence of the Holy to Cultural Differentiation

Holiness restricts license to natural things.[5] Semitic religion recognizes two kinds of holy places. One kind is the haunt of the "jinn." Semitic relations incarnate evil in the jinn. The jinn are evil incarnate. They are like wild beasts and have no human kinfolk, as totems do. They appear and disappear mysteriously. The haunts of the jinn are waste and desert places, wild, untamed.

Thomas Merton (1970) describes what he calls a Manichean hostility toward creative nature in frontier mythology. The pioneers destroy the wilderness by fighting and reduce it to a farm, a village, a road, a canal, a railway, a mine, a factory, a city. The wilderness, the domain of moral wickedness, favored spontaneity and therefore, sin. Puritain immigrants in the New World tamed the wilderness to impose divine order. Neat parallel furrows and fenced areas became a metaphor of God's care as opposed to the evil of the wilds.

The sacred is ambivalent, having the power to help and to harm. The natural objects which are sacred are not always as territory of the jinn and of the gods. James Frazer (1926) describes the

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[5]Smith (1956) suggests that the words for holy convey this--the northern Semitic root QDS originally referring to separation and withdrawal, the Arabic root HRM, conveying the notion of prohibition and the Polynesian term taboo indicating that which is set apart.

mystic view of natural phenomena as "animated conscience" endowed with both the power and the will to benefit or to injure mankind. Nature independently animated, as the power of the storm or of the wind, particularly of the east wind, is an evil force.

The interpenetration of person and nature may be sundered. The symbolism is that of sin, perhaps a challenge to God's authority. An individual may be excommunicated, his soul cut off from his people and his land. A people may be denied the former rains and latter rains and exiled from its land. This is the symbolism of catastrophe in the man-nature relation. The damage is to the human partner.

Religious thought may be secularized as social ideology. Physical objects in ideological action may assume cultural significances similar to those here termed religious. They may be foci of passion around the growth and decline of the society, around the taking of social risks as in decisions of war and peace, around the legitimation of social norms and values such as judgement of equity in the use and distribution of resources or around the very solidarity or disintegration of the society itself. Such secularization is common in political social movements. An example may be taken from literature, an expressive cultural form which functions in secular culture much as do certain religious texts. Leo Marx (1970) in his study of the American writers Cooper, Emerson, Thoreau, Melville, Whitman and Mark Twain says that each took for granted a thorough and delicate interpenetration of consciousness and of environment. The early conservation movement, which these writers inspired, expressed this interpenetration. Nature was treated as a world existing apart from but for the benefit of mankind.

The relationship between man and nature may be sundered by man's misappropriation of parts of nature without attention to other parts. In this secularized version of sin, the damage is to nature rather than to a human partner. Human institutions are undermined as a secondary consequence of their dependence on nature. In either the religious or the secularized symbolism a disengagement of man and nature, a reversal of the incarnational act, is catastrophic.

Conflicted engagement, rather than disengagement between nature and society is a common image associated with the more "advanced" religious and ideologized systems. Lynn White (1967) points out that Jewish and Christian religious traditions instruct man to conquer and dominate nature, an aggressive attitude leading to the destruction of nature, the over-exploitation of animal and physical resources. The dominion of man, however, in these "advanced" systems tends to be subject to religious law. The license to use holy things is restricted, following the general principle cited above. Man is a responsible steward. Eric Freudenstein (1970) cites the Deuteronomic prohibition of the destruction of trees in a conquered land. As the text has it, the tree of the field is man's life. The symbolism again has the double reference to the material and the cultural bond with nature.[6]

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[6]A concept of stewardship can arise in those religious systems which have differentiated the statuses of man and nature. In the nature religions, as in the totemic case, the fate of nature and society is one because they are one. In one example of the current reawakening of interest in theological cosmology, William Pollard (1970) offers a Christian theology of nature designed to deal with the sundered relation between man and nature. Its aim is to reawaken in man a sense of sacredness and holiness of the earth and her creatures. Dominion is a responsibility exercised in love.

Healing the sundered relation is a traditional soteriological problem. Sacrificial rituals, and their proxies, may be symbolic acts of healing. In sacrificial commensality, worshippers are reunited with one another as they unite in the totemic, or other emblematic, principle. burnt offerings, ascending as smoke, evoke the unity of people through their commitment to an ethereally symbolized deity. Guilt offerings erase the transgressions of man, obstacles to unity. Thank offerings celebrate the harvest, expressing and reaffirming the unity of man and nature.

Sacralization and the Reinterpretation of Natural Objects

Religiously and primordially, in the evolution of culture, nature and society interpenetrate. Ritual action oriented to physical objects is incarnational in aim. What is incarnated is the social commitment to the ritual aim. At the same time, the implicated natural object shares in the passion and commitment of the social goal. Thus, the passion around a sacralized resource escalates far above the demand for that resource on economic or other utilitarian grounds. In the development of culture, the incarnational, interpenetrating relation synthesizes the economic, political and other aspects of the relation of man and nature within a transcendal religious meaning. One may think of a series of stages of social development in which these different aspects of meaning become independent of one anotehr. Religion itself evolves through these successive differentiations and, as Weber (1963) would conceive of it, increasingly rationalized stages. Within the specifically re-

ligious domain, the substantive tie between man and nature remains as context--the ground for healing any estrangement between man and nature which may arise from the economic and political relations. As the differentiation proceeds, the significances of physical objects in the action implicity changes. Historically, successive differentiations have occurred following a particular sequence.

The ambivalent orientation to the sacred, as both beneficent and dangerous, provides the first axis of differentiation. The sanctuary of the god and the haunt of the jinn are discriminated--not as moral categories, for that notion does not yet exist, but simply as a there and a here. The controlllable is separated from the not controllable. The latter becomes the "wholly other," the mysterium, the object of worship. The former become an extension of the mundane self, an object of labor in the world. This is not to say, as nineteenth century "scientism" would, that religion becomes responsible for a residual category of the unknown, only to be progressively reduced as the area of the known extends. Rather, the differentiation separates, on the one hand, those relations in which man and nature are treated as two aspects of a continuous cosmic whole, a unity of shared substance. On the other hand are those relations in which the social and natural orders are treated independently, but related by law. The religious orientation, as the legitimating ground, remains as the foundation of an integrated cosmological view. It is the backdrop against which differentiation in other respects becomes culturally supportable.

Structural differentiation between social groups and, parallel to this,

between the species of nature, follows. God is transcendent and man builds sanctuaries to invoke the presence of the Deity, to recreate the symbiosis. Man and God, man and nature, are not related directly, but through rules regulating their respective roles. Gods must be persuaded to care for society. Society develops its own guardians--priests, magicians.

Man, instead of discovering the lairs of the gods, builds sanctuaries and invites their presence. Smith (1956) dwells on an enormous difference between worshipping a god in its natural embodiments, such as a tree or rock, and persuading it to enter a building or a grove which worshippers established as their embodiment for it. The latter implies intimacy and permanency in the relationship between man and a being he adores. A god no longer bound to a unique location may be worshipped in a strange land. A god may also choose not to inhabit a sanctuary, abandoning a community to a heresy or an idolatry.

The mode of production, the means of subsistence, involves a correlation between natural objects and social organization. Thus, in an elementary sense one speaks of desert peoples, sea-faring peoples or plains cultures. A change in the mode of production implies a change in the meaning of the natural objects and, concomitantly, in social relations. More will be said about this in the later discussion of the economic meaning of natural objects. Within a society, individual and groups change statuses. These changes of status are definitions of the relation to natural objects. Commonly, the change is ritualized using the symbolism of territorial migration.

Arnold Van Gennep (1960), for instance, borrows the images for the ritualization of status change from practices accompanying territorial

change. Frontiers, says Van Gennep, not only have a political, legal and economic aspect, but a magical and religious nature as well. Objects are installed as boundary markers to the accompaniment of rites of consecration. The significances of the territories is ritualized to express the stages of separation, transition and incorporation into the new.[7]

The religious relation with respect to the physical is created in the social act of sacralization in those religious settings in which the natural and the social have been differentiated. The possibilities of sacralization are limited by attributes of the physical object; that is, by other social meanings it may bear. These may be utilitarian as well as other religious expressive meanings. The tokens of mammon are not subject to sanctification but the jewels contributed to the sactuary become adorable. Simulated rites of passage may occur between male and female, as in reversal ceremonies. Such simulations support empathy between the sexes. The reality of physical attributes prevents a rite of passage to affirm a permanent shift from one gender identity to another--unless, as in the limiting case, the physical attributes change.

Individuation, the emergence of the individual in the midst of the collective, is an extension of the status differentiation with social

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[7]Rites of separation mark the departure from previous surroundings. The transition from one territory or one status to another occurs in a neutral zone. Transition rites may include purification, washing, cleansing. The interdiction of entry into a territory may be enforced through the mediation of frontier divinities. Hermes and Priapus had this function for the Greeks. The passage is secured with rites of incorporation and perhaps the presentation of salt or a shared meal.

groups. Individual physical objects derive their basic meaning from the class of objects to which they belong. The collective totem, according to Durkheim (1954), identifies a civil status. An individual totem is a specialized form of the collective. It expresses a special status for an individual within the general social status.

Economic and Political Significance Emerges from the Religious

The differentiation of society from nature must precede the economic notion of property as separable from an owner. The notion of sanctuary, as the residence of a god, is older than the notion of property. The idea of property implies a social exclusionary principle. The sanctuary evidences such a principle in its exclusion of the profane from the sacred or, and this is closer to the present point, the exclusion of other gods from sanctuary. This exclusionary principle differentiates communities. The idea of property requires an exclusionary principle within a community, not between communities. A principle based on kinship has this character. Any society must have, at least, two kinship groups lest mating be incestuous. A concept of private property emerges along with that of domestic sanctuaries from which non-kin are excluded.

The idea of property also requires easy detachment of the thing from personality, the denial of a substantial connection between man and nature. The possibility of alienating a thing from a person or group must be established before the concept of property is viable. This possibility, too, must succeed the substantial differentiation of man from nature. Real property is a natural object which is bound to the individual

by rights rather than by substance. Various modes of assigning those rights, links between persons and things, then become conceivable. It seems that the most extreme development of this process is that of the capitalist economic market. Property becomes a bundle of rights to be priced for sale as a commodity which, in theory, is totally independent of the person in whom the sale may invest these rights.

The history of testamentary succession illustrates the changing understanding of the links between persons and things within a religious context. Testamentary succession, originally a matter within religion and kinship, would become a matter of economic relations within civil society. Henry Maine (1963) describes how the varied properties to be transferred are united by the single circumstance of their having belonged at one time to one person. More precisely, the circumstance is that of having belonged to and continuing to belong to a particular collective. The family brotherhood is commemorated through family rights around the pledge or the inheritance. The heir prolongs a man's legal existence. It is really the existence of the family which is prolonged and transferred, by fiction, to the individual. The specification of the individual delegate, to whom rights are transferred, is ritualized. Traditionally, the religious organization has been the agent maintining the fiction and adjudicating successor rights. The ecclesiastical power in Rome, for instance, controlled the registration of testaments. Among the Hindus, the right to inherit a dead man's property is coextensive with the right of performing his obsequies.

A testamentary right, linking society and material objects, is

less concrete and substantive than the intrinsic and self justifying right based on blood. It is more concrete and substantive than the notion of right in property as a commodity in which a thing adheres to a person only in virtue of market entitlement. Economic exchange based on contract is not concerned with the perpetuation of the group--or of the group's link to property.

The rules of property assignment may be ethical and political as well as economic. Aldo Leopold (1970) warned of the decline of the ethical relation of man to the land as property becomes an economic commodity. Indeed, as he feared, the relation involves privileges but not obligations. This may lead to excessive exploitation. A substantive connection with nature maintains a symmetry of man-environment relations. An economical legal connection would not unless market conditions constrained exploitation or political policy intervened to protect property for the general welfare, that is, assumed the obligation of stewardship.

The physical environment may become alien to man even when not, as well as when it is inhabited by "jinn," evel. The anthropocentric concept of the uniqueness of man may relegate the environment to the status of a neutral thing. Man forgets, as McHarg (1970) says, that he is the world's steward. The relation becomes instrumental or utilitarian and, thus, breaks away from religious significances. This occurs when the utilitarian orientation is manifest. A latent social utilitarianism may remain hidden within a religious relation. Roy Rappoport (1967) demonstrates the way the ritual cycles of the Tsembaga regulate the

relationship of the group with the non-human, in this case, biotic, components of their immediate environment. The same ritual cycle promotes the redistribution of land among people and of people to land, and it limits the fighting among people over land. The ritual cycle further enables people in New Guinea who share a territory to maintain the eco-system of that territory. These utilitarian outcomes are not a direct consequence of the ritual. They result from the sacralization of the economic relationship through its absorption within religious ritual. The expressive meaning of the religious relation is joined to the instrumental meaning of the economic relation. In a sense, religion limits economic license--or grants it under special circumstances.

Similarly, religious and political significances of things may be meshed. Religious attitudes of identity between man and nature underpin acts in defense of land. A protection of the land is a protection of society. Insult to a totemic species is an insult to society itself.

This dicussion has revolved around the development of religious institutional rules in the formation of the man-environment unit. The sundering and binding of relationships within the man-environment "molecule" is a problem of alienation and salvation. The assembling of religious man-environment units in relational organizations is the formation of churches. The binding and sundering within relational organizations is the familiar growth and schism of relgious organizations. Non-religious institutions are morally supported by the religious--but that is material for another chapter.

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Chapter IV

THE ROLE OF PHYSICAL OBJECTS IN POLITICAL INSTITUTIONS

The Object as Weapon

In a power relation, an actor, individuallor collective may exercise coercive control over the acts of another. In an authority relation, conformity follows acceptance of the legitimacy of the content of demands or of their source. Control of a physical object may be a means of exerting power in a social relationship.[1]

"Combat" and "siege" characterize two types of coercion which implicate physical objects. In combat, the physical object is part of the means of coercing, a weapon. In "seige," access to a physical resource is controlled. The resource has consummatory significance for at least one of the actors. Its denial or acquisition is part of the goal of coercion. The beseiged consummatory object may be needed for individual survival, such as food, or be a strategic element in the survival of the collective, such as a partner for sexual reproduction or a matter of religious significance, such as the sacraments. The distinction between "siege" and "combat" is, of course, not inherent in the object but inheres in the role the object plays in the relationship, either as a means or as a goal. Nevertheless, some objects, because of their attributes, lend themselves more to one than the other significance. In both cases

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[1]Behavioral control may also be exerted psychologically--as in blackmail, or religiously--as by a threat of excommunication. These need not involve direct orientation to a physical object. Power, however grounded, may be exerted through administrative arrangements or by direct executive action. These mechanisms are treated in the general sociology of power and will not be covered here.

one may speak of the significance of the physical object as a weapon. In combat it is actively wielded. In seige, it is passive and sought after. The coercion is in its denial.

The physicalist abstraction which considers the "weapon" a single object--a sword for instance, misses the full social meaning. The weapon is an event including flesh impaled on the sword in a struggle between actors for dominance. A sword on the wall of a home is no weapon. It may be a symbol of a weapon--a part representing a whole potential event. The flaming sword at the gate of Eden is a weapon in conjunction with the forbidden entrance, the denied return to a primordial utopia. In this sense, a weapon is such when it is functioning as such--and the function is inconceivable without all of its parts.[2]

Authority involving legitimacy, not sheer force, also involves an "understanding," contractual or informal, between the parties regarding the rights to use a physical object as a means of control, its use as a weapon. The relations of power ask no consent and claim no rights. The decision to apply power, however, is controlled by social norms and may appeal to legitimacy as in the case of police power. Aside from

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[2]Richard Adams' (1975) work in Energy and Structure is one of the most sophisticated social scientific theories of energy and society. He defines power as that aspect of social relations that marks the relative equality of the actors. This definition is based on the outcome of a power relation, establishing social rank. The definition in this paper of exercising coercive control focuses on the process. Adams' actors are termed "operating units" or minimal social systems. These would be obtained by assembling the man-environment molecules described in this work. The power relation between Adams' operating units depends upon the relative control by each actor over the elements of concern to the participants. Among those elements of concern are environmental resources--and, thus, the Adams' analysis converges with the one presented in this paper.

situational conditions, social norms may govern the circumstances in which power is applied. Once those circumstances arise, the relation is resolved through power--no longer by appeal to rules.

On a day to day basis, power exists more in potency than in action. No society could persist as a prison society. Even slavery appears as a social institution, that is, in conformity with social rules. Force may be the resort of members of everyday society when legitimate authority fails to maintain a social consensus, particularly a consensus on the equity of the distribution of resources or when legitimate means of redress are not available. The potential for this implementation of power is presented symbolically on occasions when it is not implemented. The symbols of power coordinate social action and designate the roles of physical objects with respect to power. Ranking systems, for instance, implicate physical objects in symbolic roles such as that of special clothing, titles, or, if language may be included as physical, the right of speaking in the imperative mood. They also include access to weapons--as in the case of the mounted knight or baton carrying officer.

The Particularistic Form of the Power Relation

Legitimacy of authority may, as Weber suggests, be based on a rational legal contract, on tradition, or on affective elements such as charisma. Rational legal and traditional bases of legitimacy tend to involve universalistic norms. Under universalistic norms actors evaluate another and the significance of the physical object by reference to general rules or standards. The charismatic relation is particularistic. The

actors judge one another and judge the meaning of physical objects with reference to the way in which the actors are otherwise related--as father and son, as king and subjects. The power relation is always particularistic. What is resolved in the exercise of power is the dominance of one of the parties. External standards are irrelevant.

Power relations share this particularistic orientation with the religious relation. However, a holy place is unique and one may not be exchanged for another. Political particularism does not invovlve a unique relation to a particular class of objects. Rather, objects with political share an abstracted characteristic, the property permitting their use as a weapon. Functionally equivalent weapons may be substituted one for the other. Attachment is not to the "magic" of the personal sword but to classes of weapons that can strike down an enemy.

The social organization of political actors varies with the attributes of their weapon systems. Eighteenth century musketeers ranged themselves in close order to concentrate firepower. Modern infantrymen with automatic rifles scatter over a wide terrain engaging in more mobile tactics.

The institutional rules of the religious relation involve the symbolic interpenetration of the human and the natural, animating and humanizing the physical objects. Political institutional rules relate the actor to the function of an object. They are technical instructions for its employment. To use the object man orients to himself as part of nature--behaving as a lever as he swings a sword and as a force delivering momentum as he cuts into his victim.

The result is that man is a simulated physical object. Some moral theorists

see this as dehumanization. It is, however, only simulated dehumanization. The control of the human operator remains free and independent. The dominated actor tends to be dehumanized, treated as a physical thing, coerced as if by a mechanical force. Such dehumanization is conditional. Its aim is to coerce and control, to obtain a human response, not to destroy the subject.

The Means of Control of Values

Control over a resource base make an actor more powerful. Control of an energy resource has an amplifying or potentiating effect because it at once extends the range of control over physical objects and concentrates their effect. Energy in the form of food, for instance, supports population growth, enhances the biological and psychological quality of the population and, if plentiful, releases the population from subsistance activities to further power.

By intensifying social action, these factors increase the complexity of the society. Durkheim's rule that moral density produces a division of labor may be extended to the notion that moral intensity also produces a division of labor. The denial of food to another society retards the differentiation processes in that other society. This increases the probability of its continual subjection to a controlling society, all other things being equal.

The energizing of technical systems through oil or coal allows increasingly complex relations to form around production and its products. The energizing of transportation permits the same population

to extend its powers by engaging in more social activities at dispersed locations within the same space of time. The more complex a dominated society is, the more complex must the machinery of domination become. Complexity is not in itself power. It is the raw material of power. The power of a complex society is realized to the extent that its complexity is organized with respect to social purposes. The ability of a society to realize this potential rests upon cultural characteristics, especially its moral consensus and moral commitment--that is, upon the support provided by the religious to the political orientations.

Power is effected through the control of whatever is of value, that is, whatever is needed for the society to meet its latent requirements and pursue its manifest aims. The requirements of biological survival of the members of the unit are crucial and so are the requirements for the survival of the society's systems of action and systems of culture. Wilheim Reich (1970) describes how, in the early days of the party, the Nazis controlled their membership by controlling their sexual expression. Control of the knowledge and skills with which the physical object is managed, control of technology, or control over the other actors, such as control over the labor force, are ways of expanding power. Control over a relationship between actors is a source of power. By denying family members the right to visit one another, a government is using a weapon. By denying access to customers to a firm, the very existence of relationships of exchange and the survival of the firm are threatened.

Control of the means of production is, basically, control over the human relations around the processes of production. As Adams (1975)

points out, in addition to control of the means of production, control over conversion processes, including consumption and destruction of resources, are a basis of power. Adams refers to Lotka's principle that in evolution natural selection favors those populations that convert the greater amount of energy, that is, bring energy under their control.

Relative geographic location of actors with respect to physical resources conditions their ability to use those resources as weapons. The geopolitical hypothesis, either that of Mahan, holding that control of the seas is the key, or taht of MacKinder holding that control of the heartland is strategic, exemplified the significances of geographic position for the application of power. The physical metaphor in the term power is apt since it is bound to distances--to the level of ecological organization in a way that authority is not. Orientation to authority can be internalized and carried as culture--and thus freed of place. Control through culture may displace direct coercive control.

Transportation technologies permit the spatial extension of direct coercion by permitting the rapid movement of force across territory. Actors participate in activities spread further and further over the landscape--extending the scope of power. The concentration of political actors from a wide area to a compact space is facilitated by transportation. Transportation also organizes the application of power by coordinating social with spatial complexity. Transportation coordinates activities oriented to the relational order with activities oriented to the spatial order. It draws activities in the various institutional spheres into the political order, exposing them to control. Transportation, through its

role in the economy, for instance, creates vulnerabilities. Global market interdependencies, a product of transportation, become exposed to a variety of interventions at strategic points. Control of routes between georgraphically specialized regions is one form of political intervention in economic relationships.

A decrease in the degree of order in social arrangements offers an opportunity for the exertion of power. Following the definition of Levi-Strauss, Adams (1975) defines structure as referring to properties of the system that remain unvarying under a given group of transformations. That is, the structured parts of a system are beyond the actor's control. However, the aspects of a system that are structured for an actor varies with the social location of that actor. What is order for one operating unit, and thus beyond control, may be disorder for another, and thus, subject to control. The conversion of a sector of the environment or of human relations into structure for some people, while it remains non-structured for others, makes the latter, those who can still manipulate it, the dominant group.

Structuring for others is a means of controlling others and thus a means of exerting power. The worker alienated from the means of po-duction has no control of those means. They are structure for him. For the owner they are a factor of production, a means which may be varied and so, non-structure for him. As he varies these means, he controls the worker.

The same argument holds for symbolic as well as for physical structures. To control the meaning of environmental situations is to have power over those meanings. Those in control of the interpretations of physical resources

control the viable options for those oriented to those interpretations. The power of the press, as of the prophet and of the priest, is in that it interprets reality for society.

Power is not an end in itself. The coerced behavior is behavior in various institutional settings. Thus, the political cross-cuts the economic and the religious among other institutional relations.

Centralization and Expansion of Power

Physical objects play a key role in two further power processes: its tending to become centralized and the expansion of its scope application. The tendency to societal concentration is expressed in Michels' (1960) observation that democracies become oligarchies. Religiously infused polities, such as Islam in its first centuries, with missionary zeal, struggled to maintain its center, first in Damascus of the Umayyad and then in Baghdad of the Abbasid Caliphate in a period of political expansion.

The inability to centralize power can threaten the holder of power. Kinship groups, because of their relatively small size, says Adams, are generally not suited to the centralization of power. They become still less suited when a society taps large energy resources, expands and creates a need for more machinery of power. Dynasties and royal marriages are attempts to structure power through kinship loyalties. The dynastic family can rule only insofar as it enjoys the support of other kin groups. It must trade on legitimacy.

Physical objects, as elements in weapons, extend the arm of the power holder and so abet centralization. Energy, especially, is a social potentia-

tor. Energized weapons become increasingly potent relative to the human effort needed to exercise them. That a trigger releases a lethal shot offers an order of magnitude increase in the concentration of power. Power is neutralized as weapons are distributed among contestants. Therefore, the tendency is for government that, by the political scientist's definition, seeks a monopoly over the use of force in a territory, to concentrate control of weapons. The concept of a balance of power, not accidently, also a physical metaphor, is associated with such decentralization or diffusion of power. Slight departures from "balance" lead to a polarizing of resources which first flow in two and, ultimately, in one direction.

The emergence of specialized systems for the development and management of power is an expression of centralization. Such headquarters groups support other societal institutions to the extent that power is not absolutely centralized. This occurs when the holders of power do not or can not, by themselves, meet the needs of a society. As political systems develop, with personnel committed full-time to the exercise of the tools of power, a process of self-growth is generated. This expansion of power is the second important process of political power systems. Group specialized in power management tend toward functional independence, committed to the end of increasing power for its own sake.

Power systems expand as they obtain more resources. Energy is strategic. It potentiates the contribution of whatever material resources are already available as well as increasing the access to resources. Contrariwise, the system contracts as fewer resources are available. This

simple statement, however, begs the question of the manner of and accompaniments to the contraction. Power is its own reward, or better, its own reinforcement. Power begets power by feeding on resources significant to other institutional systems. Just as economic systems turn physical things into commodities, power systems turn them into weapons or instruments of power and this may be the fate of physical objects which are initially religiously or economically significant.

Growth in magnitude of a society increases complexity. The growth of power is limited by the ability of the power holders to structure that complexity. If unable to structure the complexity, a system of power may fall of its own weight. Centralization is the "natural" mode of such structuring. However, the political system may also accomplish this end by ceding some control based on authority to subordinate regimes. The ability to structure a society politically depends, in part, on the ability of the economic system to supply resources to the political system. Budgetary economies, such as households, are limited in their growth because they have little drive to accumulation in excess of their short-term consumption requirements. By hoarding tender for control of future commodities, in the manner of a Maharajah collecting gold beyond his current need, the limit may be extended. This hoard may be used to obtain further political power.

The limit practically disappears with the emergence of profit-making as an economic goal. Profit-making cross-cuts political and economic action. It is not oriented solely to the consumption of economic goods but to their application in controlling wider ranges of economic activity. The growth of profit-making systems, however, is controlled by the level

of demand for what is being produced. Systems of power promote the internal growth of economic systems by extending the markets for production, labor, and for the distribution of products.

When power becomes a direct means of acquiring resources, it does not contribute to the expansion of the economy but displaces it by brigandage, piracy, conquest and spoilage. Power contributes to the expansion of economic activities by creating the conditions of political stability needed for peaceable exchange.

Power systems voraciously consume resources. A weapons system is always expensive. Power systems are limited by the economic availability of resources. A consideration in the expansion of power is whether the control of a subordinate consumes more resources than becomes available through the exploitation of that subordinate.

Power systems are limited by the physical availability of resources under a given technological regime. A technological advance which increases the resources available at a given cost, such as the technology of deep pit mining, contributes to the growth of power.

Competing systems of power limit one another. An equilibrium among such competing centers is achieved through strategic balances of power. Power systems may balance one another by varied mixes in the elements of the system. A superiority of natural resources may be balanced by a distant, secluded and easily defensible lair. The existence of competing power centers is assured by the distribution of resources in space. Resources available at a given moment and in a given place depend on location and knowledge and requirements for conversion and transport.

Since power is never fully centralized and certainly never absolute, systems of control cannot be soley systems of power; that is, solely directly coercive systems. Further, economic and other institutional activities cross the boundaries of power systems as in international trade. This further compromises sole reliance on coercion. Systems of control must, therefore, achieve legitimacy, a commitment of loyalty and social discipline. The degree of loyalty is measured by the extent of its maintenance under stress and the willingness to sacrifice for the group. Social control must eventually come to rely on authority with coercion as a limiting case. The physical resources that were weapons become memorials of power or symbols of latent threat. Negotiation for rights in resources ultimately becomes the chief means of resource allocation.

Power in Various Institutional Settings

Power is always instrumental, the physical object being part of the tool. The political significance of a resource is an abstraction from its full character, a judgment based on a selection from among its attributes. That physical objects may function as weapons depends upon their association with values defined in other institutions. The use of the sword is potent because of the significance of life among other threatened values. One way of conceiving of types of power is in terms of the other institutional significances of resources coupled with the political act.

The general means for exerting power belong to the political context but the manner and occasions of its realization are specialized for each

institution. Physical objects become elements in hierocratic power in a religious institutional setting. A sin offering to absolve guilt, a communion wine to promise salvation, a language giving access to religious knowledge or fire as an element in oracles and revelations are examples of objects with religious signficance and as such are objects of value. A priest or a temple guard controlling the distribution of these values is exercising hierocratic power. The willingness to heal, curse, or to excommunicate may become weapons. The power relation may be that between the subject and the priest or the priest may act to support the domination of certain subjects over others. Indeed, deeper level responses of a sick person to a healer or of a cursed victim dying a voodoo death are not voluntary. Those relations are by their nature psychologically coercive. Taboos operate in this way. A person subject to a taboo is subject to hierocratic power.

Kinship organization may also resort to power to enforce its norms. Marriage rules may be enforced by the coercive provision or denial of mates and even lethal force, as in the traditional penalty for adultery. The incest taboo, and its derivative, rules of exogamy and endogamy, is the archtype of family control and is enforced by psychological pressures and sometimes by communal application of material force. Other examples of the link between political power and kinship are: sterilization programs, controlling the right to have children; conscription into military or religious service, controlling the right to retain children once they are born; the use of power, including capital punishment, to punish infringements on family authority.

Economic relations revolve about exchange of rights to use and consume

resources. Economic power involves the use of political means to control the process of exchange and, thus, to control access to resources. The use of economic means alone to control behavior, such as a fine to deter an act or a payment to encourage an act is not, in the sense of the theme in this paper, a power relationship, unless those means are used to create a situation in which the only choices left to a subject actor are ultimate ones. Power used to acquire resources for their own sake, such as a war to capture brides, is simply political action--not joint political-economic action. The major types of economically relevant resources subjected to political influence include capital creation, the regulation of investment, controls on land rent, the regulation of conditions permitting the transferability of land or other goods and control of the purposes for which goods may be used. Economic power may be exercise through police power which supports monetary levies, such as taxation, tribute and fines, the enforcement of zoning regulations, the designation of appropriate parties to a sale, as in a boycott or blockade, or sumptuary legislation designating the types or quantities of goods that may be consumed as in a food or energy rationing program. Economic power may also be exercised through psychological means, as in control of food consumption through taboos and canons of taste.

These examples refer to the exertion of power to control economic relations. Contrariwise, economically significant physical resources may be used as an element in exerting power over other activities--the use of economic relations as a means of power. This, as suggested above, is not to be confused with the ordinary use of economic incentives to gain compliance. That refers to a negotiated exchange relationship. The

engagement of mercenaries is a way of exerting power on the basis of an economic relation. The power relation is not that between the mercenary and his employer, but between the master of the mercenary and the subject against which he is used.

An economic relation between two actors may be guaranteed by a power relation between them and a third actor. The government in this way enforces the terms of the contract. Rules govern the occasions for the application of such power. However, once that occasion arises, conformity on the part of the subordinated actor does not depend on his recognition of the legitimacy of the demands of the power wielder. The next section sets aside this issue of the cross-cutting of the political and economic significance of the physical objects to discuss the purely economic significance of physical objects in exchange relations.

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CHAPTER V

ECONOMIC SIGNIFICANCES OF PHYSICAL OBJECTS

The Definition of Economic Action

Utilities as Social Functions

So important have historians considered economic action that they classify the stages in social evolution in accord with the manner of acquiring material resources: hunting and gathering, agricultural and industrial societies. Economic action is directed to the acquisition of resources by society for its subsistence, among other needs, and the allocation of those resources among sectors of the society.

Resources have, throughout history also been obtained by political means, as the booty of conquest, in response to religious norms such as the distribution of alms, and the tithing of produce, and on the basis of obligations of solidary groups, such as kinship groups, as in the case of gift exchange, or the division of the hunt among the family. In these cases, the resources have political, religious and kinship, not economic significance.

Traditionally, subsistence, directly contributing to biological maintenance indirectly to societal maintenance, has been the principal focus of economic attention. Parsons and Smelser (1964) define the goal of the economy as production of utilities. Utility is, in their terms, a facility for solving an adaptive problem of a social system, of relating the system to its environment. The acquisition of utilities is the complement to, and the reason for, their production. Processes of economic exchange mediate between the production and acquisition of utilities.

Social producers generate a supply and consumers exert a demand for utilities. Utility refers to a contribution of a resource to the adaptation of some social system to its environment. Supply is the available production

of utilities and demand the disposition of the actor to pay for those utilities. The interaction between supply and of demand occurs in a "market" where their balance is expressed in a "price"--a measure of the rate at which rights in utilities change hands. The exchange, the changing of hands, the passage of rights in the utilities from producer to consumer or between consumers is the hub of economic action. Utility, a significance based on the social relevance of attributes of the physical objects, and price are a significance of the object for market activity, and the fundamental dimension of economic classification. Together, they define the position of the object in a matrix of exchange relations. The object classified as a source of utility with a price is termed a "commodity." The basic man-environment unit of economic action consists of the producer, consumer, commodity triad.

The social evaluation of physical properties as utilities rests on their relation to both short and long term action systems. In general, short term significances control the specific allocations of an available item. Changing prices, wages and interest rates are measures of short term changes in the evaluation of commodities, or better, of the action oriented to the commodities. Price controls are set for instance, at which a supply of labor is elicited from a labor potential. The short term evaluation takes place in the context of long term, institutionally based, commitments. Laborers' commitment to labor is not responsive to short term price fluctuations. The specific terms of contract are agreed between the parties. The permissible terms of contracts entered upon by members of the society are guaranteed by the stability of government and its support of contract law. The society's stock of knowledge about the character of its resources and technology for transforming them for a variety of purposes is a long term meaning of these resources.

Income, wealth and capital are some specific economic significances of commodities. Income is a rate of flow of command over utilities. Wealth is

an aggregate form of economic utility. Capital, a special case of economic wealth, is that proportion of the resources committed to production. The decision as to the proportion of resources a society commits to production is decided through the capital market. Capital facilitates the production of utilities through its monitering of the use of labor and resources as factors in production.

Wealth, or capital, is itself a commodity which is produced by labor in concert with laws of nature. As Mill (1862) said, objects of nature are transformed by human exertion, by placing the object in the right position so that the natural laws can act. Marx (1936) defines labor by its function as "productive activity that appropriates particular nature given material to particular human wants". Labor constructs the significance of physical objects by embedding them in human action systems.

Marx observed that the laborer who, all his life, performs the same simple operation converts his whole body into the automatic specialized implement of that operation. This is part of the meaning of labor becoming a commodity. Hence, labor becomes an extension of the physical world in the process of transforming that world. As Bukharin (1969) put it, in labor man opposes himself to nature as one of its own forces.

A resource as technology in production also acquires economic significance. Technology in production is a way of harnessing force, White (1959). Society grows by appropriating to itself more energy from nature and it is through technology that this appropriation occurs. According to Bukharin, the introduction of new tools completes the revolution which was begun in changing relations of production.

The utility, or economic significance of physical objects, is expressed as social rules which govern the activity in which objects are implicated. Linguistically, these rules are able to reference a physical attribute such as a

standard for the thickness of metal for an automobile body. The physical standard is a euphemism--taking the part for the whole. The intended utility is the degree of danger or safety the metal affords an occupant in the event of a crash.

The Universalistic Character of Economic Significance

Price is a collective determination, a result of many choices. Commodities are priced with reference to a collecting standard which is external to the relation between any given action and the object. The commodity's significance is universalistic rather than particularistic. Objects with the same technical characteristics, utility and price are substitutable one for the other. A common standard for expressing price, such as money, facilitates the assessment of substitutability. This contrasts with the particularistic bases of significance of objects in a religious, political and familiar context. Sacred things are not detachable from those to whom they are sacred. The transfer of a "sacred" object requires a rite of desacrilization and resacrilization of the object. The transfer of a church is a case in point. An initiation rite changes the status of an actor and, thereby, his relation to sacred objects. The notion of substitutability is foreign to religious meanings.

In a political context, objects may be substituted on the basis of functional equivalence. The meaning of fundamental equivalence, however, is particularistic, defined in terms of the function of the weapon in resolving a social relation. In religious and political contexts, interest is in the actors and their orientations. The object is an aspect of the relationship between actors. In economic contexts, the emphasis is on the object. The relationships between people are interpreted in terms of their respective rights in the in the object. They are owners or renters. A relationship, entered into in order to acquire an economic utility, does not persist beyond the occasion of exchange.

Relations of commodity exchange are the closest to "pure" economic relations found in an advanced society. The record of the exchanges is represented in account ledgers. In this sense, economic action is rational action, and as Max Weber (1947) says, it is peaceable action.[1]

Consumption and Production as Economically Relevant Activities

The emergence of economic relations, in this "pure" sense is a rather recent historical development and is not yet fully realized. The freeing of physical objects from particularistic significances has gone further in commercial and industrial than in other settings. The very notion of utility offers resistance to a "pure" economic relation. Utility, except in the purely commercial transaction, is in the "use value" of the object. Use values are precisely the religious, political, familial and other substantive significances of objects. Consumer demand is rooted in this non-economic circumstance. For this discussion, consumption will be treated as an economically relevant activity but not as an economic activity *per se*.

Economic action is also closely associated with productive activity. The transformation of raw materials by industry as a technical process and as such, not part of the economy. Industrial production tends to be analyzed as part of the economy because in a capitalistic economy it is

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[1]Economic action is rational action. Its means are selected in terms of a standard of efficiency for realizing profit for the individual actor and for allocating resources within the collective. Economic action has no monopoly on rationality. Technological, scientific and legal, among other activities, also tends toward rationality. Political action may also be rational in selection of means but tends to accept goals as defined by other institutions. Religious action tends not to be rational--though ritual and magical activities may be extensively rationalized. Allocative decisions in a budgetary or household "economy" are made in terms of consumption needs, rather than a national orientation to the market.

accomplished by rational profit making enterprise oriented to a market.[2] Industrial activity is never simply profit oriented and never completely technically and economically rational. The industrial labor force and management resolve their relation and the division of profits, in part, by political means, such as the strike. Further, human labor is never completely abstracted from the other characteristics of the laborer including biological limitations and other social institutional memberships of the laborer.

Production is economically relevant if it is for a market. Social production which is not market oriented includes a household producing for its own use, a farm family making its own clothes, or monks tending a garden to produce food for the monastery. Respectively, these are houshold and religious communal activities. Max Weber offers the example of "demiurgic" labor in a feudal system. Dependents of the lord worked the land and received a share of its products. The production of these tenant farmers was not for a market but for the wider houshold of the lord.

The tendency to compare these activities with production for a differentiated economic market is anachronistic. The produce of the manor had a personal or particularistic significance, expressing the solidarity of the lord and his feudal fiefs. Parsons and Smelser point out in Economy and Society (1956), that this produce is not a "commodity". A claim on labor service based on kinship solidarity was common in primitive "economies". The claim is joined to the right of residence and possession of land as

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[2] The term industry is used loosely to refer to any organized activity for producing goods or services whether or not a transformation in the attributes of the material is involved. Thus, we speak for an education industry and a health industry. Mining is productive but not industrial since it is primarily a system of collection and distribution of resources. Transportation, also called an industry is better considered as an interstitial system mediating the various stages of production and consumption sectors. It is allied with systems of exchange. Agriculture is preindustrial production. All of these activities are economically relevant but not part of the economy as such.

physical capital. These are economically relevant activities only in the negative sense that they may compete with production through a market.

The management of a factory producing for a market may attempt to make its operating decisions in economic terms--viewing its labor, material and capital as resources exchanged in the respective markets. However, since a factory is a social system with many other rational forms existing among its members the market model tends to be "imperfect." To analyze it solely from an economic perspective would be a partial analysis.

John Stuart Mill observed that the activities of production are never as fully rationalized as economic exchange. He argued that whereas production is dependent on the inherent properties of things, exchange and distribution of wealth become matters solely of human institutions. Mill's "inherent properties" are defined in terms of use and their role in social activities. Institutions for Mill are a function of intellectual and moral culture as well as the fundamental laws of human nature.

Industrial production does not free objects of particularistic significances. A product may be alienated from the individual worker, or from workers as a group, but a factory is still an actual social system in which non-economic considerations play a significant part. [3]

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[3] Organizations for production and consumption have subsystems linking them with the economy. An industry may have a marketing department for selling its products as well as a department for purchasing raw materials, recruiting labor and attracting capital. An internal economic system allocates labor, capital and material among its subdivisions. The family, as consumer, also has an economically oriented subsystem--sometimes termed the "household". The houshold markets its labor services and purchases its consumer goods, its food, housing, as well as services such as health and education. Internally, the household has mechanisms for allocating resources among its members. These include transfer payments from the breadwinner to dependent members of the family. Once a physical object crosses the boundary from economy to household, has passed through the appropriate subsystem, and enters the net of family relations, it ceases to be an economic commodity and takes on a significance from the particularistic activities in which the family uses it.

Max Weber distinguished between economically oriented action concerned with the satisfaction of this desire for utilities, and economic action which refers to the peaceful use of actors' control over resources. The key economic activity is the shifting of control or the shifting of rights in resources. Economic activity is therefore principally the activity of exchange.

For this analysis, activities of production, on the one side, and consumption, on the other, will be considered as economically relevant activities--not part of the core of the economy. They constitute action systems salient for the economy and dependent on it.

Economic Action as Exchange: Mediating Consumption and Production

Limiting the definition of the economic system proper to relations of commerce and exchange is not usual. There is, however, some precedent for it. Parsons and Smelser (1956), who do not fully accept this limitation, conceive of an economy as a system of relations coordinating a system of production and a system of consumption. The system of consumption, on the one side, controls the direction of economic action. It defines the nature and quantity of utilities desired and, indirectly, the physical objects to be pre-empted for consumption. The levels of consumption, however, are affected by conditions of production, the supply. The system of exchange, including informational activities of exchange, mediates, and so coordinates, consumption and production. As trade and commerce goes, these activities assume a functionally independent character. This functional independence is evidenced by the emergence of retailing as a specialty, and, in more recent centuries, the establishment of the stock exchange. The commercial market eventually stamps both consumption and production with its character. Then, the economic orientation to the significance of objects as commodities

and exchange as the controlling process becomes a more pervasive influence on both consumption and production.

Economic exchange is a transfer of rights in goods and services.[4] As such, the economic is closely tied to the legal system, the norms according to which rights are transferred. In the move toward autonomy, economic exchange promotes the development of a body of law specifically oriented to its activities. This includes commercial law, the law of torts and damages and of crimes related to property.

As a physical entity moves through these consumption, exchange and production systems, three different meanings of it are emphasized. Production activities are technologically oriented to selected physical attributes. In the economic system, it becomes a commodity, a focus of bargaining about rights in it. Finally, within a budgetary unit of consumption, the object assumes a use value. The primary significance at each of these points is conditioned by the other two as they react in the actuality of the physical object. The language of the economic system often is used to express the meanings of the object in production and consumption. This, however, should not cloud the distinction which becomes apparent as soon as we attend to what actors in the three settings are doing with the object.

Any actual material object has clusters of attributes which enter variously into the several producing, exchanging, and consuming systems.

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[4] Not every exchange is economic. Exchange may be religiously traditional, as in the bringing of the first fruits to the Temple, or to take Weber's example, enforced by convention as in the exchange of gifts among friends. The significance of the exchange relation, as well as of the exchanged object, must, in all cases, be understood with reference to other than economic institutions. The economy is, after all, a means for satisfying wants. These wants are established in non-economic relations. Economic exchange as a differentiated system emerges from the rest of the social system under special conditions. Only in an analytic sense are economic meanings independent of other institutional significances.

Action systems are brought into relations with one another through their interest in attributes of the same physical object. Those who want iron for automobiles and those who want it for kitchen utensils meet in a competitive market. Exchange brings various groups into competition for the product and the competitors differ in other than economic characteristics--such as political power. This introduces a non-rational factor into exchange.

Market differentiation is the attempt by producers to design a product for a limited set of users for some narrow use. This marketing technique limits competition at the point of sale. However, competition at the earlier stages of production, perhaps that for the common raw materials used for specialized products, remains.

An economy of exchange links producers and consumers in the same and different social institutions. The economy, in this way, may link the political and the industrial systems. Exchange facilitates the movement of products to the polity and the movement of capital, created by the polity, to industry. Exchange mediates between the household and industry. The producer, by paying an employee, provides income for the household and the household provides labor to the producer. [5]

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[5] These boundary exchange situations were recognized by Bukharin, who introduced an example from outside of the capitalist system. He argues that a change in the condition of the productive forces leads to a conflict between social technique and social economy. This, in turn, leads to a regrouping of men in the economic apparatus and subsequently in the social and political structure. This is expressed through a different combination of parties and, ultimately, through a change in legal, moral and other standards. Bukharin identifies the economy and the relations of production. He says that the class that is dominant in the economy will be dominant in politics. One might add that political power influences the economy as it influences the control processes of exchange.

The Conditions for the Emergence of an Economy

Economic significances of physical objects stand between the meanings of those objects in the context of craft and technology and their "use value" in various contexts of consumption. The social differentiation of production from consumption activities is a condition for the mergence of an economy. When production and consumption are in different social groupings, or there is a division of labor in the production which cuts across groups, the need for exchange arises. No group alone is self sufficient. Exchange emerges between ethnic or caste groupings, each of which is producing more than is needed of some particular item for its own provision.

Thinking more in terms of individual characteristics, Adam Smith accounted for the emergence of exchange in terms of "a propensity in human nature to truck and barter". Such motivational components contribute to recruitment to socially created trading roles.

Consuming and producing units have differentiated historically as a sexual division of labor. House and field work center around women, hunting and fighting around men. In production, women work the field and men hunt. In consumption, women tend to the household and men fight. The same physical object appears in the context of production and then in the context of consumption activities. The economic market stands between them.

An independent exchange system does not emerge when production and consumption are conducted by the same family. The formal relation between producer and consumer guarantees the exchange as a gift. The economic significance is then buried in other aspects of the relationship. Marriage laws, such as the law of exogamy, govern such a direct exchange between social groups. This law of exchange, governs the substantive relations between patriarchal family governments. The act of exchange of women affirms or re-

affirms a continuing tie between the kinship groups. This contrasts with economic exchange which, when completed, terminates the relationship--except insofar as other exchanges are in the offing.

Social differentiation is the process which reveals an independent economy. What drives the process? Why does society differentiate with respect to economic functions?

Leslie White (1959) in his work on energy and culture, attributes the social differentiation leading to an independent economy to the harnessing of increasing levels of physical energy. By freeing society from the demands of subsistence and in extending the range and scope of social activities, kinship based society gives way to civil society. A civil society orders itself on the basis of property relations. The characterization of economic relations are implicit in the concept of property, especially the possibility of alientation of the thing from the person. Physical objects may then enjoy a status independent of their attachment to particular persons and groups and, therefore, are transferable from one actor to another.

Residential distinctions precede the notion of property. Relations between groups involve reference to real property when land, detached from a substantive connection to persons, comes to be treated as physical capital. White maintains, two classes, one subordinate and the other superordinate, come into being. Economic and social class relations, an exchange economy and social stratification, appear together. These political and economic relations separate when resources are used as an element in exerting power.

The hunter and gatherer does not literally harness energy. He merely avails himself of what nature has presented and little surplus remains. The agricultural revolution, implying the planned collection of solar energy through plants and the domestication of animals, signifies an intentional

harnessing of energy and a significant leap in the amount available, and available on schedule, to the society. That expansion of power with land as the weapon initiates the division of classes, basically a political organization of society. With the transition to civil society, resources are allocated through the political system. The economy is still nascent. As societies industrialize, a market emerges. Initially, it is not a free market. The state controls the economic processes, supervises the market, as, for instance, through its control of weights and measures.

The emergence of economic meanings of physical objects may be analyzed from a cultural perspective. As objects are manufactured or gathered in quantities beyond immediate needs, they become depositories of human labor, and, thus, acquire a new meaning less bound to their use value. Labor itself becomes a commodity, with an exchange value as physical objects become candidates for evaluation in terms of market exchange value. Certain physical objects become mediums of exchange, money appears as tokens for use in the economy, as distinct from the intrinsic use of more objects in production and consumption. The appearance of money signals the presence of economic activities proper.

Exchange activities occur before commerce becomes a specialized action. The full emergence of an exchange market awaits the differentiation of an occupational group committed to this activity as a source of income and as a focus for organizing their lives, individually and collectively. In Europe, commerce begins as an auxiliary occupation of peasants and of persons engaged in house industry. The seasonal character of their occupations releases them to engage in what Weber called "peddling and hukstering"--the kernel of eventual independent occupations. In addition, interstitial groups, such as those not owning land and those excluded by guilds from

occupations, entered commerce. Jews became commercial mediators between Christian Europe and Moslem East, partly because of trading traditions, of family connections in the two settings providing a stable basis for contract, and of their exclusion from other occupations in Europe.

Commerce did not disengage itself from religion as long as religious requirements for residence and court standing remained in effect. Also, as long as the religiously grounded law of usury controlled business finance the tie remained. Commerce was slow to break its ties to the political system. The polity provided security for traders. Commerce by sea was allied with piracy. Weber points to the difficulty in distinguishing a warship from a private ship or a merchant ship. Governments protected the economic activities by providing secure sea lanes. Protection of merchants conducting commerce in alien lands was problematic. An alien, for instance, could not appear before a court to contest an alleged contract violation. Their personal security had to be guaranteed as well as the enforceability of their contracts. Merchants sought protection of local citizens before they sought the direct protection of the authorities. This established a basis for local trading corporations.

The right to property is expressed as a norm linking things to persons but, more exactly, is a norm linking persons' activities with respect to uses of things. Even more exactly, the norm links persons to one another with respect to things. Durkheim (1933) calls this link between persons "negative solidarity" since one person's property right excludes another's. The negative relation, however, takes place in the context of a wider positive solidarity, society's guarantee of rights in real property.

The detachment of material objects from the situation in which they were produced has seemed to Marxists and some humanists to be a deformation,

not of the object but of the personality of the producer alienated from his product. This problem is sharpened as land becomes a commodity. The ancestral farm or the land of the tribal gods can be alientated only at a price to personality and society. Carl Polanyi (1957) says that to form a market out of land is the wierdest of all undertakings. Detaching man from soil means the dissolution of an economic unit into its elements in order to fit the separate elements into the system where each is most useful. Land is interwoven with institutions. The relationships around an object give it its meaning. The market consists of its own set of relations. They, however, are universalistic not particularistic. The market significance of an object, and of the relations around an object, are defined with respect to an external standard--the coordination of the object in the matrix of exchange. As an element in the economy, an object becomes a focus of another set of social relationships. The alienation of worker from product or homesteader from land is a metaphor for the dislocation of the non-economic institutional relationships. The detaching of a commodity from relations of production is, in Marx' term, fetishism. The market, operating between production and consumption, mediates this change in the act of relations defining the object. The price which the economy expects from these other institutions is the dominance of market relations.

A commodity does not have "utility" to the market participants. It has an exchange value because it has utility to consumers--satisfies some human want. Production, says Marx (1936), is the production of use values for others. The "for others" is a social use value, a utility to consumers. Marx agrees with other economists that the commodity becomes a depository of exchange value when inserted in the market. Marx would not, however, establish exchange value as a function of supply and demand. Value is the

congelation of homogeneous human labor. The value of a commodity varies directly as the quantity and inversely as the productiveness of the labor incorporated in it. That value is then set quantitatively by the amount of time worked to produce an object--all worker time being essentially equivalent. Marx' labor theory of value is a device to assessing exchange values, establishing a ground rule for the substitutability of one object for another.

The Rationalization Process

Systems of exchange, production and consumption are completely rationalized because they are never mutually independent.[6]

The extent of rationalization of the economy depends on the extent to which persons and non-economic meanings, are detached from material objects. Actors are concerned only with economic appropriation of the object. The economic meaning of appropriation varies with the social role of the appropriators. Technology may be appropriated by the workers, by the owners or by a regulating group, Weber (1947) notes, and its meaning will differ accordingly. The craftsmen traditionally owned his tools and materials as well as his product. In a factory, ownership is in the hands of management. Sometimes a governmental group, which actually holds title, places the material on loan or lease to workers or to owners. In the United States, for instance, some public lands may be leased for mining or timber harvesting.

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[6] Max Weber (1927) illustrates the economic conditioning of production by institutional constrains on the use and allocation of agricultural land. In Germany, equal shares were allocated to peasant members of economically independent villages. The plots were cut into strips in line with the technology of the plow. Independent production was the rule. In Switzerland, alpine husbandry depended on common pasture. Economic regulation derived from the necessity of sharing the pasture. In the Russian mir, the strips of land were assigned according to the number of mouths to feed or the number of laborers to work the land and, thus, assignments were temporary.

The disengagement of a commodity from particularistic meanings is more likely when it is not possessed by the worker-producer. The conditions of economic exchange press toward expropriation of the worker as a class. Technical factors press toward the expropriation of the individual worker, as well as the workers as a group. The requirement that many workers cooperate in the productive system is one such technical factor. When technical efficiency requires managerial control over the selection of the modes of work and of workers or where a management, with control over the goods and equipment, is in a superior credit position or, finally, where there is orientation to market situations for which the technical superiority of autocratic management has its competitive edge, workers may be expropriated in general. Technical requirements and the orientation to large markets, rather than the acquisitiveness of some owners, sets the stage for expropriation of workers and rationalization of production and of exchange. Products, then, are no longer the extension of the personality of the producer but are commodities in the economic exchange system or facilities controlled by management in the rational pursuit of economic goals. Particularistic meanings give way to universalistic.

Rationalization of production and of consumption activities differ from rationalization of exchange. The system of exchange is subject to formal rationality when it maximizes quantitative calculation or accounting, in Weber's (1947) terms, to the extent technically feasible. Consumption and production move toward what Weber called substantive rationality. The substantive rationality of consumption is measured by the degree to which the person can be provided with the goods by means of economically oriented social action. Savings, for example, the systematic distribution between present and future utilities, is a measure of rational economic action on

the part of consumers. The rule of marginal utility, meausuring the distribution of utilities between various uses, is another measure. Rationality in production is measured by the quantity of product in relation to the quantity of input. Production may be rationalized, as Weber notes, when the productive process uses free labor, free capital, and capital accounting.

Technology contributes to the rationalizing of all three action systems. In the productive system, technology provides rules for organizing the productivity of labor according to a principle of efficiency. In exchange, technologically based information systems contribute to the functional independence of the economy. In consumer systems, technology makes the home, at times, a small production unit. At times home technology is a condition for accessing a commodity, as a can opener is needed to obtain prepared food.

The process of exchange is more likely to be rationalized under conditions of political peace. Peace guarantees the credibility of buyers and sellers and guarantees the enforcement of law in commercial relations. This requirement of peace has a volatile element, as Polanyi (1957) has noted, under a market economy. Interferences with public order and trading habits, which might otherwise be harmless, can constitute a lethal threat. The economic relation on which society depends for its daily bread may break down.

The social and technical division of labor are products of and contribute toward rationalization--that is, the detachment of significances of objects from persons. Specialized labor enters the productive relation with fewer significances extraneous to production. As Adam Smith (1817) already perceived, there are fields, such as agriculture, in which it is difficult to separate the different branches of labor and so difficult to

rationalize. This was before modern agricultural technology. The attempt to rationalize production is accomplished by bureacratic organizations of production.

Consumption is rationalized either through ascetic discipline, which controls the consumer's behavior according to some overriding principle, or rationalized bureaucratically through institutional control, such as the feeding of personnel in the military.

The Contract

A major feature of rational exchange is the institution of contract--a formal set of definitions of the meaning of things. A sales contract deals with the rights to goods and a labor contract with rights to services. A contract sets forth settled terms for the exchange. In that some things are subject to this exchange and others are not, these terms become constitutive of the meanings of objects. Under American law, national preserves are not subject to transfer by contract between individuals and an individual is proscribed from selling himself into slavery--that is, a contract to this effect is not enforceable. Terms of contract may be established in a non-rational, and thus, non-economic way. Agreement may be attained because of substantive needs or pressure not related to the things to be exchanged.

A contract provides an institutional framework for exchange. In regulating exchange, it links two systems of action through the institutional framework of a third. A contract, for example, links the household, as provider of labor, with the producing sector. It spells out the workers expected commitments to the firm, legitimates the firm's authority and specifies the firm's obligations to the household. A trade union may

emerge as an interstitial group between the household and production units and negotiate contracts for groups of workers.

The labor contract limits the expectation of services in the light of the inseparability of services from the performer's person. A physical commodity can be transferred completely--not only rights to the commodity referred to in the contract but the entire object in which the relevant attributes inhere. Thus, commodity contracts are more rationalizable than labor contracts.

All contracts are supported by a wider net of instituional arrangements. Various political and philosophical regimes differ in the rules they establish for the transfer of objects. John Stuart Mill, writing on property, rejects the notion of primal ownership of land. Ownership, he says, must be negotiated by contract. This takes land out of the particularistic context and places it in the domain of the universalistic. He continues that property is not directly a right to things but a right of each to his or her own faculties and what he can produce by them and whatever he can get for them in a fair market. By this principle, a functional performance is a basis of the meaning of things.

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Chapter VI

ENERGY AS AN ENVIRONMENTAL ISSUE

Environment and Culture: The General Connection

An environmental issue is a manifestation of a conflict between social actors with respect to the physical environment. Energy, as an environmental resource, is a focus of conflict when actors compete for it and when its conversion or extraction produces disamenities for at least one of the actors. Disamenities are interferences with the course of social actions. They tend to be named according to their physical components rather than in terms of the social activities which are frustrated. The terms nuclear radiation, thermal pollution, air-borne particulates, sulfur dioxide and oxides of nitrogen, or strip mining become foci of social conflicts. Environmental issues and the conflict which they express are social engagements at the level of ecological organization.

Typically, since society is organizaed with respect to its physical environmnet, a change or threatened change in that environment implies a social organizational change. Often, even when the environmental change is planned, its organizational sequalae may not have been bargained for. This is the case, a fortiori, when the environmental change is uninvited. The environmental issue is fueled by the strain engendered by incipient social change. A change perceived as an "act of God," such as a "natural" disaster would not in itself create an environmental issue but can be the occasion for a conflict. When families live in a flood plain despite warnings to the contrary and then claim

disaster relief, the stage is set for a conflict between the public agencies and the elements of the community. When earthquake damage is related to faulty construction, the basis for a conflict between builders and householders exists.

Paradoxically, society is vulnerable to environmental issues because physical environmental objects, such as energy and its attendant technologies, are an integrative focus for society. Social activities organize themselves around physical resources and are bound together in that shared orientation. The social conflict is society's effort to reintegrate on some new basis when the physical environmental attribute has changed. Its social function is to restructure the axis of conflict in a society.

An analysis of environmental social conflict begins with an examination of environment as an integrative focus for society. This is the backdrop for a discussion of the vulnerabilities of society to change in its physical environment. Then the case of an environmental issue that arises from conflicting orientations to the same and unchanging resource will be examined.

Environment as a Socially Integrative Focus

Social Vulnerabilities from Energy Dependency

Aristotle lent his prestige to a naive statement of the impact of physical environmental conditions on social institutions which has survived to the present day. It refers to a direct impact of climate and geographical conditions on the physiological organism and, through that,

on personality and society. Of course, since Aristotle conceived of the physical and humorous worlds as being formed of the same material, his empirical error is, in part, redeemed by a theoretical consistency. The anthropogeography of Ritter (1866) and Ratzel (1896-98), following in the footsteps of often misinterpreted Montesquieu (1964), set the tone for a more flexible analysis. Social institutions and culture are adaptations to varying environmental conditions.

The aspects of the environment regarded as a resource (that is, as a focus of social organization) are a function of culture. For example, fossil fuel was available and being used in a small way before cultures knew how to exploit it for major social change. The Burmese had oil wells in the tenth century. About the same time, the Chinese were passing gas through bamboo pipelines (Ayres, 1956). A physical object becomes a resource when an attribute of it is perceived as relevant to a social purpose. Shelter, subsistence, and social intercourse are the most basic of such purposes. Erich Zimmermann, in the 1933 Encyclopedia of the Social Sciences (1963), offers a definition of the social meaning of a resource as "those aspects of man's environment which render possible or facilitate the satisfaction of human wants and the attainment of social objects." We may also think of negative resources as those aspects of environment which hinder satisfaction of human wants. Positive and negative resources share the distinction that they are selected from the entire physical environment for social attention.

The relation between environment and society is, practically and in this two-valued sense, between resources and social institutions. Karl

Wittfogel's (1957) description of the dependence of political institutions upon forms of water supply is a good example of a constraining though not determining influence of the physical on the social. Hydraulic civilizations, those organized around large scale water works for irrigation and flood control, are likely to have centralized political power, to develop mass organization, a rational approach to nature based on algebra, astronomy and geometry as well as an elaborate administrative form. Hydroagricultural civilizatons,which depend on rainfall, are more likely to develop a multi-centered polity. Thus, river and rainfall dependent agriculture predisposes to two types of political and economic arrangements. Those arrangements treat water as a weapon, an element in the maintenance of power, and as a commodity, a good to be allocated in exchange for fealty and material support.

Clifford Geerz' (1963) contrast of the effects of swidden as opposed to wet rice culture is an excellent illustration of a dynamic relationship between society and the environment. Swidden, a system of slash and burn, integrates an agricultural population into the natural ecosystem. The slashing and burning refertilizes the ground and the productivity of the earth remains the same. As more and more people come to depend on the same subsistence product, the habitat deteriorates. In wet rice culture, as each new worker applies himself, productivity is intensified. The same plots are worked more densely as population grows. This more tightly packed population evolves complex and elaborated social forms, a process that Geertz called agricultural involution.[1]

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[1]Teilhard de Chardin (1959) describes cultural involution at the most generalized level. Hominization, he says, reverses the evolutionary process

Meggars (1954) provides an example of the relation of technology and cultural change. The replacement of the hoe by the plow in Europe in the Danubian periods VI and VII increased the intensity of production and thus the resource base. The consequence was a population increase and cultural development.

Environmental attributes control the possibilities of development of culture, including the likelihood of certain technological innovations. Different climates and landscapes, for example, impose different limits on the cultures subsisting in them. Meggars (1954), for instance, objecting to classifying landscapes in physical terms, proposes a classification in terms of suitability for food production, of agricultural potential. Culture in areas of low agricultural potential subsists only by hunting and gathering. A high agricultural potential, as in the Andean culture area, permits a culture to evolve with textiles, casting of alloys and plating gold, silver and copper. Such a culture may also have a hierarchical political system and a hierarchical religious system with a priesthood.

The greater the agricultural potential, the more raw material is available for cultural elaboration. An elaborationed culture will go further in developing technology and at the same time become more dependent on that technology for environmental management. Social integration around physical attributes means that society is vulnerable to

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by separating individuals and species and by introducing inner communication among them. Subsequently, the continuing cultural evolution produces relations which are compressional and converging. The cultural noosphere emerges through this implosive concentration.

any changes in the values of these attributes. A social group may change the value of the attribute of the physical environment toward which another group is oriented. This occurs, for example, when petroleum development affects a primitive hunting area. Such an intervention is the basis for an environmental social conflict. When the "same" environment is a focus of more than one social system, a potential for the classic competition for scarce resources is present.

Social Conflict Arising from the Indivisibility of the Resource

The Restructuring of Social Conflict. Organizing around an environmental object brings actors together into unique social formations. In simpler societies, typical social conflict are restructured around such objects, such as a territory. More complex societies experience social conflict around differences in the relative social positions of groups. Groups at different levels of social authority struggle over political domination. Groups proposing different life styles or religious ideologies clash over culture. The staffs of organizations in disparate institutional systems, of religion as against the polity or of economy as against the family, compete for their share of societal commitment. These are class, ethnic, religious or ideological conflicts. The axis of such conflicts follows social structural lines as determined by the social division of labor and by cultural orientation. Such social conflicts may implicate physical resources. Those resources, however, may not be at the heart of these conflicts. The social relational and cultural issues may exist prior to concern with a physical resource. For instance, an ethnic group in conflict with another may complain about the

noise of members of the other group. Were the noise problem resolved, the conflict could turn around another issue, perhaps around smells or air pollution. The environmental object becomes an occasion for externalizing a pre-existing ethnic or class conflict.

When an environmental issue is the "true" basis of conflict, the conflicting groups will usually differ from those involved in the conflicts of class or ethnicity. Airport noise is an environmental issue which becomes a basis of conflict. The airport management and the surrounding population bear no animus toward one another before low flying aircraft follow a flight path over homes. Were this physical event to be eliminated, or the noise eliminated, the conflict between the groups would subside. The environmental event brings together groups that otherwise might not be related at all, and certainly not related conflictually. Groups in social conflict may ally in an environmental fight while groups socially friendly may find themselves opposed. The environmental issue restructures social conflict, defining new group alignments.

Groups coalescing around an environmental issue constitute a new social entity with its own institutional culture.[2] At the center of this culture are standards regarding the existing and proper states of the environment and norms about actions to be taken to achieve that state.

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[2]The French human georgrapher, Vidal de la Blache (1926), described a bio-ecologically natural entity as an expression of terrestrial unity. This entity is not to be discovered by looking at a single species but at the entire plant life of a region, at the environment as a composite. The environment is capable of grouping and holding together heterogeneous things in mutual vital relationships. Those mutual relationships are ordered, cooperatively or conflictually.

These norms derive, in part, from prior religious, political, or economic norms of the participants. Since the new social entity recruits from across standing social groups, these norms may not be shared. Welding together the protagonists and ordering their conflictural engagement with the antagonists is an internal integrative problem of the new entity.

Ecological organizations develop with respect to the space/time material world. They draw norms from several institutional spheres. Organizational divisions concerned with labor commitment differ from those concerned with marketing in their attitude toward materials being processed by the organization. They are, nevertheless, bound together by a common interest in that process. Another example of such group formation is that of the "organic" solidarity of technically divided labor. Performers at various stages of the productive process are integrated into an organization. In building construction a crane operator prepares a site, a carpenter sets up foundation forms, a steel worker implants structural members and a cement mixer pours cement in the forms holding the basic members, etc. The incumbents of these specialties, tied together the process, may even conflict with one another around the process.

Competing for the Same Resource. Actors in different social organizations may become competitors for the same material or physical resource used in a variety of social activities. Coal is used for heating homes and for the reduction process in steel manufacture. Householders and the steel industry compete in the market for coal and thus order their activities mutually. Conflict over territory locks the destinies of groups together. Two peoples competing for one land may each seek an exclusive claim. Perhaps the land is strategic for the achievement of imperial hegemony.

The geographer Sauer (1956) reminds us that conflict around the same scarce resource is the traditional economic conflict. The conflict of Cain and Abel, between sowing and herding, has long been with us.

Conflicts may emerge from incompatible ways of relating to the same resource. Herdsmen on the plains of America used fire to burn grassland and drive game while fighting with their more sedentary neighbors who also used fire, but to prepare pastures. Hydropolitical rivalries around the Nile, the Jordan, the Indus, the Helmand and the Tigris-Euphrates have had a similar result (Hirsch, 1961). People jockey for position with respect to water resources, around factors of water supply, topography, the quality of water, the silting, the flooding, the accessibility to markets. Each group tries to acquire the economic center of gravity. The downstream society tends to have a better food base and so has a sounder and more progressive economy.

Nowadays the conflict between agricultural and residential or industrial land use emerges in zoning discussions. Historically, the city became possible because of the contributions of neolithic agriculture, especially the production of hard grains that could be kept and transported. The traditional city has depended symbiotically on its hinterland. The current city, spreading over its immediate hinterland, competes with agricultural production. The relative locations of food production and of manufacturing are now bieng reordered.

Cultural attitudes may promote incompatible ways of relating to the same resource on the part of several groups. Ward H. Goodenough (1964) offers a contemporary example. Professionals engaged in environmental health programs see health as the prime consideration, while for the clients

health advantages are weighed against the price of the environmental adjustments required.[3] Attitude, of course, is but one manifestation of a system of social action. The conflict is between two cooperating action systems which, in a wider framework, have divergent interests.[4]

Transportation enables two populations to exploit the same resource without being residentially competitive. While ordering the physical relation between groups, transportation shapes the competition among them for resources. A transportation net increases regional specialization in production. This may permit interdependent cooperation. On the other hand, connecting more groups with a resource may increase the level of conflict. More powerful transportation may expand the markets which depend on the same local resources.

Transportation routes themselves may be foci of cooperation or of conflict. A road system may define a "zone of attraction" bringing diverse regions and activities together, as long as security is guaranteed and police stabilize the relation. When military control breaks down and security is lost, the very same road becomes a war path, a "zone of repulsion" in which people meet in conflict (Vidal de la Blache, 1926). The organization around a route rather than, say, a mountain height, gives

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[3] Walter Heller (1971) describes the conflict between the ecologists who, following the environmental imperative, seek to stop economic growth as the price of biological survival, and the economists who, following a socio-economic imperative, aim to promote growth as the price of social survival.

[4] A single individual may occupy conflicting roles. Lewis M. Killian (1952) describes a flood situation in which police or firemen are caught between their family roles, requiring them to save their families first, and their responsibilities to the community.

its peculiar character to the conduct of commerce or to the conduct of war.[5]

The Disparity of Social and Physical Boundaries. The focus to this point has been on the formation of social groups around a physical object. The emphasis has been on the cooperative and conflictual relations between the groups. Often, the aim of such social jockeying is to allow an equilibrium between the resource, the rate of consumption of the resource, and other group activities. A more general case is that of the match between the boundaries of related physical and social systems. A social system's geographic boundaries may extend beyond those of the physical system of orientation. Boundaires of the economic market, say for corn, are international. To meet its demand, an area of farmland may be simplified and specialized. A number of natural but smaller ecosystems may be overridden producing the bioecologically difficult problem of monoculture. The ecosystem boundaires may be extended, for instance, by bringing in fertilizer resources from elsewhere. The operators, and perhaps the residents of the monocultural farmland, enjoy the income from the market as they struggle to stem the deterioration of their land. The buyers in the wider market have an interest in the lower prices attendant on monoculture--and, if they are politically powerful, may be cast in the role of exploiters of the land.

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[5]Herfindahl and Kneese (1965) discuss the effects of highways on rural areas. Building highway exits in certain places have positive and negative economic effects. They recommend that conflicts be handled by established jurisdictions. Ullman (1956) notes the cross grain alignments of railroads in America, the mountains going north and south while the trains run east and west connecting groups that would otherwise be geographically separated--again engendering a new interdependence that may become a source of conflict.

On the other hand, the physical system may be territorially more extensive than the social. The problem of environmental noise arises when physical noise spills over the boundaries of the social system producing it--to a social system disturbed by it. To resolve this the social system boundary may be extended by joining the noise maker and noise reciver communities in a common juridical relation.

Both situations create a new social entity around the environmental occasion. The fertilizer puchasing system in the first case is a new market arrangement. In the second case, a new social juristication is established which includes both the noise makers and the noise receivers. Russell and Landsberg (1971) describe the creation of a new social entity in terms of physical and social linkage effects. Issues, denoted by their physical names of pesticides, of carbon dioxide balance in the atmosphere or of mercury pollution, establish linkages between social systems. Societies, previously strange to one another, intersect by virtue of their newly shared physical events.[6]

In the limiting case, a population may be in conflict with itself around an environmental object, trading off an advantage at one point for a disadvantage at another. Paul Sears (1970) describes forests as points of coaction for populations because they have water and fuel. The vegetative cover retards the run-off of water to the sea maintaining stability of forest water resources. The technological culture that

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[6]Russell and Landsberg (1971) are concerned with social decisions which generate such linkages. A government policy may create conditions which affect the environmental situation of another government. The building of the Aswan Dam, for instance, affected the fishery in the eastern Mediterranean from which North African and Eastern Mediterranean countries, as well as Egypt, harvest fish.

clears the forest accelerates that run-off and so destroys its own resource base, just when its demand for water is rising.[7]

The Resolution of Environmental Conflicts

Environmental conflicts are resolved in two basic ways--by intervening in the physical environment to bound the environmental impacts or by adjusting the boundaries of the social action system so that it comes into balance with the resource. In both events, the relation between the physical and social systems is adjusted. Rule making is at the heart of the matter. Rules regarding mufflers on automobile exhausts, catalytic converters to reduce noxious fumes, scrubbers on smoke-stacks or zoning regulations are phrased in physical terms but are, in fact, instructions to act to bring these physical results about. They are social reules which adjust physical events to fit social events.

Rules referring directly to social activities, usually economic and political, are intended to adjust the boundaries of the social system to fit the physical. Economic interventions include the payment of effluent fees which socialize a part of the cost of production. Walter Heller (1971) suggests charging both producer, and ultimately the consumer, for externalities and allowing self interest to work in slowing or reversing the march toward a degraded or exhausted environment.

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[7]The problem of congestion is a variant of internalized environmental conflict. Individual behavior becomes deleterious only in the aggregate. Congestion, as defined by Rothenberg (1970), results when users attempt to share a service not furnished in separable units earmarked for each user. Abusers and victims are not distinguishable in congestion as they are in the case of pollution.

Krutilla and Ekstein's (1958) recommendation of "multiple purpose" river development is a way of regulating the relation between groups by adjusting their activities to maximize use of the physical system. Cooperation may then replace conflict in orientation to the resource. Economic mechanisms are effective where conflicting groups participate in the same market. Economic policies of government are designed, primarily, to adjust relations among those under the same political jurisdictions.

Political action, including the political imposition of economic means, and judicial action, are common forms of social intervention. Private parties may litigate over an environmental question; in essence, over some injury suffered by one of the parties under the law of damages. In a conflict between public and private interests, public agencies or private citizens acting through public agencies, may bring action for violations of environmental laws.[8]

Governmental planning and policies may adjust relationships within a unified political entity. The institution of property, declaring certain resources owned by certain groups, has this as an effect, but lacks the flexibility of multiple use planning.[9] It is especially ineffective

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[8]Grad and Rockett (1970) describe the new legal readiness of courts to find constitutional power to enforce and make environmental regulations. In the case of the Scenic Hudson River Preservation Corporation vs. Federal Power Commission, 1966, the conservation organization obtained standing to petition the FPC to review Consolidated Edison's license to construct a pump storage plant on Storm King Mountain over the Hudson River. The potential loss of tax revenue to communties through loss of recreational facilities became an appropriate consideration for the courts.

[9]Gilliam (1967) criticizes single purpose planning, thinking that power plants only produce power. Nuclear plants, as in the Diablo Canyon project, compete with park usage. This is a matter of regional planning since the problem crosses local jurisdictions.

where conflict is over the same resource.

In sum, many environmental social conflicts emerge when different activities compete for the same resource, perhaps using different aspects of the "same" indivisible resource, when the externalities in resource use by one group affect the use of the resource by another or when incompatible uses of the resource exclude some actor from that resource. As groups reorder themselves around environmental resources, new social entities emerge. The axes of social conflict are restructured, from that along class, ethnic, religious or ideological line to that of the group formed around the resource. The resolution of the conflict involves the institutionalization of new social relationships, a new social entity. An environmental issue begins and ends as a focus of social integration.[10] Environmental issues signal a restructuring of social conflict and ultimately a restructuring of social cooperation.

Environmental conflicts may be resolved through political, economic and legal mechanisms for regulating the realtionships between the conflicting groups, for channeling the conflict or reordering their relation so that they become coordinate groups. New group entities are brought together, perhaps conflictually, around an environmental issue. The nature of their continuing relationship is established by the mode of conflict resolution.

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[10]An environmental conflict may be reduced with little change in the structure of relationships by conservation programs to reduce the consumption of a resource on the part of one or both of the parties. This generally means a reduction in average per capita consumption. Coale (1970), concerned with population control and per capita energy use, proposes the use of contraceptives or abortion to influence the level of fertility and, in consequence, the level of energy consumption--without affecting the per capita consumption.

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CHAPTER VII

ENERGY IN SOCIETY

The previous chapter dealt with energy as an environmental object. The formation of groups around an orientation to a resource was described. By and large, the environmental object was treated as passive in the encounters between groups involved with it. Groups cooperate or compete for a resource, however, because that resource has some more direct and active role in society. This was alluded to with reference to environmental pollutants causing a disamenity for certain groups and with reference to the problem of disequilibrium between physical resources and the societies oriented to them in the cases in which geographic boundaries of resource and social systems did not match.

Why is energy sought? What is the active role of energy in society? What is the direct relation of energy and society, the basis of its value and role in environmental conflict? National growth, as measured by GNP, is commonly correlated with the level of per capita energy consumption (Starr, 1972). Not only growth, a change in social magnitudes, but development, increasing social complexity, is a function of the level of energy consumption. Leslie A. White's (1959) well-known formulation is that, "As the amount of energy harnessed by socio-cultural systems increases per capita per year, the systems not only increase in size but become more highly evolved, i.e., they become more differentiated structurally and more specialized functionally."

Richard Adams (1975) argues, and we agree with him, that the negentropic implication of White's term "harnessed," that biological and social structures bind energy, is an unnecessary postulate. Energy

potentiates social processes and, as a consequence, increases social complexity. Potentiated social processes imply an increased rate of social interaction and command more social and physical space. Energy availability promotes structural differentiation but it alone does not determine the axes of differentiation. Social and cultural mechanisms order the complexity and thus, influence the direction of development, of social evolution.

Theorizing about energy and social evolution is inspired by an image of persistently increasing energy availability. What happens when energy supplies decrease? A decline in energy availability restricts the functioning of the previously differentiated units. Society does not then quietly regress to an earlier evolutionary level, a less differentiated stage. Existing social units, striving to sustain themselves, engage in a "struggle for survival." This, after all, is the scenario which Malthus offered.

White's concerns were macrosocial and macrocultural. The society's economic base shifts from gathering, to hunting, to agriculture and to an industrial form as it organizes itself about successively greater energy resources. The period of change is exceedingly great. The mechanisms by which energy, social complexity and the structuring of that complexity interact are not apparent at this "grand" level. The problems of societal adaptation which ensue when energy is disproportionately available to different institutional sectors may elude the analyst of the total societal level.

Three Formal Propositions

Energy, through some technology, "potentiates" the effects of social acts. This is the case, particularly, for the instrumental institutions, the polity and the economy. Three formal propositions (formal because they seem to apply in all organizational settings) may be stated about the role of energy in society.

The more energy available to a social organization, (1) the more it tends to grow in size, (2) the greater the degree of its structural differentiation and (3) the more intense its social activity becomes. Reciprocally, intensity of activity, increasing size and structural differentiation of a social organization lead to an increase in the level of energy consumption.

"Structural differentiation," refers to the extent of specialization of activities within a larger organization. These specialized activities constitute a sub-system, and so are relatively "boundary maintaining." Generally, but not always, each of these specialized sub-systems performs some specific function for the larger organization.

Greater structural differentiation means greater complexity. Complexity implies a larger population of social units, particularly social units of different types, interacting within the given social space. The social relations among these units are the energy consumers. Therefore, a more complex system means more energy consumption. This complexity may itself be structured, as when rules are introduced controlling interactions. Such structuring reduces the entropy and, thus, the amount of interaction. As a consequence, the per capita (or per social

unit) level of energy consumption declines. Social authority, and its associated norms, is another way of structuring social complexity.

Transportation is a mechnaism for coordinating the social institutional and the social ecological orders. Transportation is, ordinarily, looked upon simply as an energy consuming activity and, indeed, it is. It permits roles to emerge more rapidly than population. People can do more things with their time and thus, more connections between activities mediated by transportation. However, insofar as a transporation system structures socialactivities, it may reduce the energy consumption through those activities.

The terms "level of intensity of social activities" refers to the rate of interaction among the units of the system. Intensity in the economy, for instance, is measured by the employment rate or by GNP, the latter being a proxy for aggregate economic activity.

"Size of organization," is, of course, a commonly used measure in the sociology of organizations. Often it is measured by the number in the work force. Population growth projections used to predict future energy consumption, given knowledge of a per capita consumption, follow this logic. The units of consumption need not, hwoever, be individuals. They may be social organizations or social roles. Thus, an increase in the number of manufacturing firms or in the number of households in the society ("operating units," in Richard Adams' terms) makes society larger and more energy consuming. Further, energy consumption within a household will vary with the number of roles more than with the number of people in the household.

Ten Orienting Propositions

The Institutional Significance of Energy

Energy, like money, appears to be culturally neutral. It promotes social development but does not determine the direction of that development--the axes of structural differentiation. The direction of development is determined by the underlying institutional culture, even by a civilizational ethos, to use the "grand" theoretical terms of Sorokin or Spengler. These factors are "exogenous" to our immediate modelling exercise. However, certain characteristics of a high energy industrial regime lead to some typical organizational and institutional adaptations.

The previous formal statements, relating energy to size, intensity of social activity and structural differentiation or organizations apply to any social system, any society and any institution and organization within that society. Following are ten substantive propositions which relate energy consumption to characteristics of institutional and organizational culture. These still rather broad propositions set the stage for more specific, empirically testable statements. The ten orienting propositions refer to social control, cultural change and political change. A final one stands alone--positing a decrease in energy availability. The underlying notion of these substantive propositions is that a high energy society, drawing energy from mineral resources, becomes an increasingly "rationalized" society.

Social Control

First, a high energy regime experiences a "depopulation of the productive unit." The increasing ratio of material energy to human labor

in the units of production means fewer people in view. The growing quiet of the battlefield, as fewer soldiers with increasing fire power dominate areas of battle, is characteristic. Each person's activity controls more space and consumes more space.

Second, the increasing reach of human acts and of cultural complexity impose a new requirement upon the agencies of social control. Power evolves ahead of the ability to control it. Psychological "instincts" must be restrained when human behavior has such powerful consequences. Transportation, increasingly significant as a way of integrating the spatial and relational orders of social activity, increases its significance as a tool of social control. While polities expand, political centralization remains as an important way of structuring social complexity. Government, industry and labor organizations pyramid control to higher levels. Giant nations, themselves federated units, become commonplace. Administrator and manager emerge as new specializations.

Cultural Change

Third, spatial centrifugality, as suggested in the first proposition, is accompanied by social centrifugality. A society using mineral-based energy in place of human and animal energy will, partly because of the dispersal of its activities, become increasingly free of traditional cultural groups and ties. In the early stages of the age of steam, labor concentrated in cities around the industrial work site. The concentration meant a dispersal of traditional kinship systems. Occupational groups increasingly became central, free of kin and caste, with their

own occupational culture.

Fourth, greater physical distance between human actors means less personal interaction. The significance of norms controlling face-to-face relations decreases relative to those for managing formal organizational relations and the relations of people to the material products of activity. Thus, in industrial society, traffic regulations, pollution controls, zoning and land use regulations, rights of the sea, etc., become increasingly significant bodies of law alongside newly formulated rules of personal status.

Fifth, the collection, conversion and distribution of energy resources gives rise to characteristic occupations and organizations. The occupations associated with the conversion and application of mineral based resources, the technological ones, develop their own form of culture, in particular,their own work culture. These emerging cultures influence the direction of development of the larger society.

Sixth, a shift in the relative power of social institutions takes place. Increasing energy availability means a relative shift of power toward those institutions that can most readily avail themselves of energy--specifically the economic and the political institutions. Institutions dealing in meanings and solidary social relationships, such as kinship and religion, suffer relative decline in high-energy societies. social relationships, in general, take on the shape of political and economic relations. Control and exchange become more significant motifs of society.

Political Change

Seventh, as new energy resources are accessed, the basis and locus of social power shifts. Power based on land holding declines as that based on industry becomes more salient. Military power is reshaped under different energy regimes. Weapons systems rely less on massed manpower and more on technical components. The occupation of territory, while still central, is not so exclusive a military objective when power can be exerted over a distance.

Eighth, at the heart of the political systems of high-energy societies are three types of organization: industry, transportation and warfare. These social activities are potentiated more than any other under a high-energy regime because they involve instrumental activities and because their power is more directly linked to physical resources--both of which benefit from technology.

Ninth, the nature of the working class and its place in society changes. For thousands of years, the contribution of labor to the preparation of materials for social use has been in collecting the material and then manually working on it. In the high-energy society, labor is engaged less in the collecting and processing of materials than in providing organizational intelligence. The working class splits into those who provide the knowledge for production, the technical manager, the labor administrator, and those who continue to shape the materials, the craftsmen, operatives and unskilled laborers. New social alignments reflect these divisions. The power of the traditional worker's movement diminishes.

An Energy Deficit

A tenth type of social change is associated with the reduction of energy availability--either in the society as a whole or in selected sectors of it. If energy is given, it can be taken away. Social expansion may be followed by social contraction. Contraction is not the reverse of expansion. The removal of energy leaves the complex of relationships created during social expansion strained. Actors involved in and benefiting from the relationships formed around energy join in the vanguard of struggle against energy reduction.

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CHAPTER VIII

AGGREGATE SOCIAL INDICATOR DATA

The Logic of This Method

Energy is socially relevant in three ways--as a level of energy consumed, in terms of its relative allocation among social acitivites and as implicated in environmental issues. What are the social effects of increasing or decreasing levels of energy availability on society and, reciprocally, what is the effect on energy consumption of changing social arrangements. The cognate questions are asked about the allocative and environmental questions. A crucial social question has to do with the social structural determinants of levels of usage and, reciprocally, the effect of levels of usage on social arrangements.

These questions, and others, may be answered through an exercise in empirical modelling--relating a complex set of variables by means of structural equations. The model may be used for subsequently monitoring the relation between energy and social institutions as availability and allocations change. So that others may continue the time-series for the purpose of monitoring and social reporting, we accept a serious constraint on our data gathering. Only measures available in published sources will be used.

Unobtrusive indicators may be used to measure societal, energy and transportation variables. Most of the observable indicators will be drawn from the level of ecological organization. Behavior at this level is a function of space-time exigencies as well as of other nested social, cultural and personality systems--and may be so interpreted.

Measures of energy consumption and allocation, depending on the degree of institutional differentiation and the intensity of social interaction, will be taken within each institutional sector.

The first set of indicators are measures of institutional differentiation and intensity of social interaction--primarily, "causes" of energy usage. A second set refers directly to energy consumption, as in transportation, for instance, in relation to consumption in other areas. Finally, indicators are presented to measure the social effects of changes in energy usage--the social structural effects and signs of social tension--in each institutional area. Almost all of the indicators are ratios--and, thus, presented in the form of fractions.

The Influence of Changes in Social Organization on Level of Energy Consumption

Institutional Differentiation. The first set of indicators assesses the degree of structural differentiation within the polity, economy, family and religion. All else constant, these would, according to the previous argument, be positively related to the level of energy consumption. Measures are ratios, the number of sub-units within larger units. The changing values of these ratios over time constitute the variables.

TABLE 1

DEGREE OF ROLE AND INSTITUTIONAL
DIFFERENTIATION BY INSTITUTIONAL SECTOR

Political

Number of local government employees/Number of state government employees

Number of local government employees/Number of federal government employees

$$\frac{\text{Number of federal government employees in regional offices}}{\text{Number of federal government employees}}$$

Occupational (based on Census Occupational Classification)

$$\frac{\text{Variance of number in third digit classes of 300 code}}{\text{Variance of number in second digit classes of 300 code}} \text{ (clerical)}$$

[parallel ratios for the 400 and 500 (crafts) and for the 600 and 700 (operatives) codes]

Work Institutions (based on Standard Industrial Classification)

$$\frac{\text{Variance of number of "firms" in third digit of codes 101-149}}{\text{Variance of number of "firms" in second digit of codes 101-149}} \text{ (mining)}$$

[parallel ratios for codes 221-239 (textiles), 401-478 (transportation) and 601-679 (finance)]

Households

Households/Population

Households with one child year t_1/Households with no child year t_0

Households with two children year t_1/Households with one child year t_0

Religion

$$\frac{\text{Difference in number of Protestant denominations (year } t_1 - \text{year } t_0)}{\text{Number of Protestant denominations (year } t_0)}$$

$$\frac{\text{Variance of number of Protestant churches (buildings)}}{\text{Variance of number of Protestant denominations}}$$

Intensity of Social Interaction. The second major grouping consists of indicators of the intensity of social activity in various institutions--the residential community, the polity, economy, family, education and religion. Transportation in each institutional sector is treated separately, so as to be able to differentiate those changes in consumption of energy due directly to changes in transportation usage and those to the change in other types of activities with energy consuming relevancies. The intensity of social interaction is positively correlated with trip-making and with the level of energy consumption--both in travel and through other means.

The amount of energy used is, itself, a measure of the intensity of social activity. Transportation use, as in indicator, is, then, ambiguous. It implicates directly an energy consuming technology and it is also an indicator of social complexity, arising, pari passu, where frequent and flexible interaction over distance is required. Thus, its use correlates with increased energy consumption in the roles it subserves. However, one of its functions is to structure that complexity, a result which reduces the intensity of interaction by ordering it and so reduces energy consumption. In the final analysis, the structuring seems but to provide the social respite needed to allow society to plunge further into intense activity and further structural differentiation. These aspects of the impact of transportation on energy should be disentangled. Analysis of historical data series should permit such disentangling.

The transportation indicators here are of two types: measures of conditions which establish a transportation need, and then, measures of actual transportation within each organizational setting.

TABLE 2

MEASURES OF INTENSITY OF ACTIVITY IN VARIOUS INSTITUTIONAL SECTORS

Community

Electricity for public places (private and government) lighting
Area of community

Political

Number of voters in presidential election/Number in electorate

Local, state and federal government employees
Non-government administrative work force

Occupational

Females 20-44 in the labor force/Total females 20-44

Workplaces/Households

Family Type

Female heads of household/All households (except single persons)

Single persons/All households

Education

Schools/Child population 6-18

Religion

Churches/Households
Non-public school enrollment/Total school enrollment

TABLE 2A

MEASURES OF INTENSITY OF (ENERGY RELEVANT) TRANSPORTATION ACTIVITY IN SELECTED SECTORS

Number of food wholesalers/Number of food retailers

Number of food retailers/Number of households

Number of households with more than one car/Car owning households

School and public transportation costs (school)/Number of pupils

Number of school busses/Number of pupils

Sunday traffic/Monday traffic

July Fourth traffic/July Eleventh traffic (if not weekend)

Energy Measures: Levels and Allocation. A conservation policy involves administrative regulations designed to reduce the amount of a commodity consumed. American government conservation policies have been oriented to the use and efficiency of energy consuming technology. Illustrative policies concern the increasing mileage efficiency of automobile engines, the attracting of people to outdoor recreation near their own home and the upgrading of the physical structure of the home to increase heating efficiency. The first energy consumption indicators are ratios in terms of these policy objectives.

TABLE 3

MEASURES OF GOVERNMENT CONSERVATION POLICY INTERVENTION

Amount of gasoline consumed/Number of miles driven

Visits to national parks by out-of-state vehicles
Number of total visits to national parks

Amount of home insulating material sold by supply industry
Total amount of home insulating material manufactured

The next group of measures goes to the heart of the social economy of energy. A central variable, at once the independent and dependent, is the level of transportation energy consumption. This variable may be entered in the aggregate of barrels or BTU or disaggregated by type of energy resource involved--gas, coal, nuclear, etc.--particularly when the question is that of the relative social allocation to transportation compared to the allocation for household heating, for example.

The allocation of energy consumption is functionally related to the level of consumption but has specific social effects not associated with the level alone. The theoretical introduction referred to the greater ability of the polity and the economy than the solidary groupings to use energy technology. As a consequence, the former develop more rapidly relative to the latter institutions. The point may be extended to the differential allocation of

energy among population groups--as, for instance, stratified by class or income or sectors of the economy.

The socially relevant measure of level of energy consumption--a per unit measure--extends the model of per capita consumption to various organizational settings.

TABLE 4

UNIT INTENSITY OF TRANSPORTATION AND OTHER ENERGY CONSUMPTION AND PROPORTIONATE CONSUMPTION BY SECTOR

Unit Intensity of Transportation and Other Energy Consumption

- Household energy/Number of households
- Commercial energy/Number of commercial establishments
- Manufacturing energy/Number of manufacturing establishments
- Private auto transportation/Number of households
- Public transit gross receipts/Number of households
- Business vehicle registration (trucks and cars)/Number of businesses
- Total societal energy consumption/Total population

Proportionate Energy Consumption by Sector[1]

- Household energy (heating, cooling, appliance and lighting)/Total energy
- Commercial energy (heating, cooling and lighting)/Total energy
- Manufacturing processes - work energy/Total energy
- Transportation (public and private)/Total energy

The Social Effects of Energy Consumption

Institutional Changes. The levels of energy consumption, as independent variables, influence aspects of institutional behavior, the dependent variables. These are the social effects of energy consumption. Changes are expected and are measured in social behavior in the polity, economy, family, religion, population and organizational ecology.

A change in energy costs will have impacts on population ecology, the distribution of households in space. As energy is cheaper or more available,

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[1]Total energy consumption--total patroleum, coal, nuclear in BTU.

the distance between home and work, suburbanization, will increase. As the allocation changes, the distribution of population among the regions of the United States will change. The regional effects may be assessed strategically in selected SMSA's each with particular energy and transportation situations. The change in each case is taken relative to the change in the country in general.

TABLE 5

THE SOCIAL EFFECTS OF ENERGY CONSUMPTION:
SHIFTS BY SECTOR

Polity

Number of meetings held by energy related Congressional committees / Total number of meetings of Congressional committees

Number of employees of state energy offices / Total number of state government employees

Licenses for nuclear generators (MW_e)

Employees of government energy agencies/Total government employees

Number of challenged EIS's/Number of EIS's filed

Number of EPA and health department directives raising environmental standards / Number of directives lowering standards or grantinf variances (or deferments)

Shifts of Economic Power

White collar employees per capita income/Blue collar employees per capita income

Number of managers/Number of proprietors

Transportation equipment hourly earnings/Manufactory earnings

Textiles hourly earnings/Manufactory earnings

Printing and publishing hourly earnings/Manufactory earnings

Petroleum and coal products hourly earnings/Manufactory earnings

Leather and leather products hourly earnings/Manufactory earnings

Black males 20-44 unemployment/White males 20-44 unemployment

Value of exports to oil countries/Value of imports from oil countries

Per capita school expenditures (non-instruction)

TABLE 5 (Cont.)

Quits/Layoffs

Wages and salaries/Total income

Transfer payments/Total income

$$\frac{\text{Number of passengers using airline terminals}}{\text{Number of passengers using intercity bus and train terminals}}$$

Number of hotel room rentals/Number of households

Shifts in Family

Age specific birth rates

Number of children ever born to women 45 years and older

Age at marriage - Females (by urban/rural, black/white)

Shifts in Religion

Civil marriages/All marriages

Pentecostal churches/All Protestant churches

Baptist churches/All Protestant churches

Population Ecology

Households in suburbs/Households in city

$$\frac{\text{Change in number of households in San Francisco } (t_1 - t_0)}{\text{U.S. change in number of households } (t_1 - t_0)}$$

Same ratio for Columbus, Tulsa, Miami, Philadelphia SMSA's

Organizational Ecology

Workplaces in suburbs/Workplaces in cities

$$\frac{\text{Change in number of workplaces in San Francisco } (t_1 - t_0)}{\text{Change in number of workplaces total U.S. } (t_1 - t_0)}$$

Same ratio for Columbus, Tulsa, Miami, Philadelphia SMSA's

Social Stress as a Social Effect of Energy Change. A variety of measures of social conflict suggest themselves. As a beginning, measures of social stress reflected in individual behavior will be used. Change in the level of energy and/or transportation availability will, following the earlier theoretical argument, lead to changes in social organization. The very process of constricting social activity will produce tensions. A variety of individual and social adaptations to those tensions may be expected.

TABLE 6

MEASURES OF ADAPTATION TO SOCIAL STRESS

Over-the-counter drug sales/Food sales

Alcohol sales/Food sales

Tobacco sales/Food sales

Millenarian churches (Jehovah's Witnesses, Seventh Day Adventists, etc.)
All Protestant churches

Work stoppages - transportation

Work stoppages - public sector

Work stoppages - manufactory

Number of arrests of Blacks for assault
Number of convictions of Blacks for assault

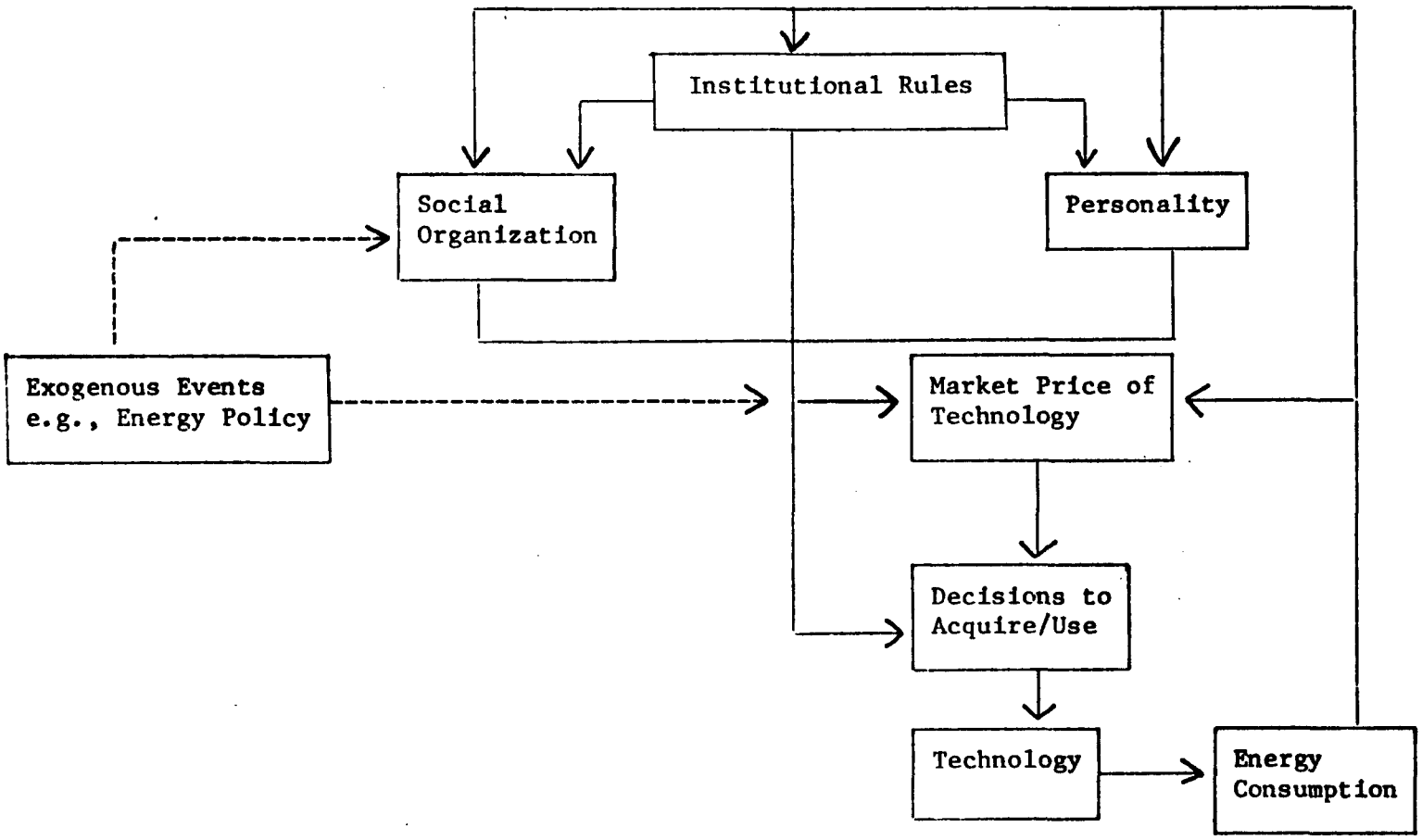
Number of arrests of whites for assault
Number of convictions of whites for assault

The Model: How the Variables Fit Together

Figure 1 represents the principal relationships among the classes (e.g., social organizational, personality, etc.) of variables. The box designated "social organization," at the upper left of the diagram, represents measures of the social relational net organized around physical

FIGURE I

THE CLASSES OF VARIABLES IN THE ENERGY/SOCIETY MODEL



objects. Since energy appears as a resource for conversion or bound to a technology (including transportation systems) that uses energy, it may be treated as a physical object for purposes of sociological analysis.

The elementary unit of analysis of social organization around a physical object is a triad. One actor, individual or collective, orients to another actor with respect to their mutual concern with the attributes, material or symbolic, of physical objects. Socially relevant attributes are a selection from all possible attributes of the object. The social meaning of the selected attributes is culturally defined. The situation of the action defines the significance for action of the physical object. An object may be a "commodity" in an economic relation, a means of "control" in a political relation or a vehicle for symbolic expression in a religious relation. The actor's grasp of the "laws of nature," as they govern the possible behaviors of the objects, enter the social definitions of those objects. Individual chapters have been devoted to the meaning of energy in each of these institutional settings.

Personality attributes relevant for energy consumption are represented by the box to the right in the figure. These social and personality factors are translated into energy consumption through decisions to acquire technology and decisions regarding the use of technology. The connections are depicted by lines in the center of Figure 1.

These decisions are made also with reference to the market price of the technology and the cost of its operation. The price, itself, is influenced by the aggregate demand, which, in turn, may be expressed as a "willingness to pay." This "willingness" and the "prices" are also dependent on the income of the consumers, the supply, production and distribution costs of

the technology, as well as the prices of substitutable items and the relation of operating cost to purchasing price.

The relation between technology and energy consumption, the bottom horizontal line in the diagram is one of "implication"--not of causation. The rate of energy consumption through a technology is known from its operating characteristics. The lion's share of current energy research is designed to document this implication.[2]

The "feedback" effects, social effects, of varying levels of energy usage are represented by the darker lines on the right side of the diagram. The evolutionary anthropoligist has traditionally framed the energy/society question from this direction. Energy "potentiates" social organization, extending their power or scope of action. Structural differentiation is one of the results.

This model is, of course, but a partial system--influenced by a number of variables defined as exogenous for the purpose of this exercise. Principal among these are aspects of the society not organized primarily with reference to physical objects--the religious, political, familial and certain aspects of economic institutional behavior, etc. Policy interest is in the way laws, intentionally formulated and promulgated behavorial rules, condition the society/energy relation. The broken line on the left side of the figure suggests that the factors mentioned above are exogenous for the immediate problem.

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[2]Such work assesses the stock and use of technology and technical factors, such as conversion efficiency, as controlling the level of energy consumed through that technology.

Engineering is concerned with this "technical" relation, the operating energy efficiency of machines or of an energy conversion process. Some "social research" is designed with this orientation, focussing on the final element of the behavioral chain, the "hand on the switch" or "foot on the pedal." That ultimate gesture is believed controllable by law (the fifty-five mile per hour speed limit), persuasion(sixty-five degree thermostat settings) or economic incentives (subventions for house insulation).

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