SOCIAL CHANGE: PROBLEMS OF TECHNOLOGY AND PLANNING

Tracing the Social Consequences of Transport Technologies

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FOREWORD

It is a pleasure to offer a few words of introduction to John Forester's essay on the social contexts of technology. While mainly programmatic in emphasis, it is enormously helpful in detailing the definitive reasons why oversimple theories of the "impact of technology" ought finally to be discarded and in sketching a sociological "map" through which the highly diverse consequences of technology may be traced. It remains for me to supplement Forester's analysis with some remarks on the conceptualization of causality in assessing the genesis and impact of technology.

Technology might best be regarded as an opportunity -- based on empirical knowledge of varying degrees of verification and validity -- to exploit resources and produce goods or services. Technological knowledge may be assessed as superior or inferior as it results in a greater or less difference between the cost of inputs and the value of the product. But as Forester correctly insists, such a definition is from the outset too abstracted from social context. Whether or not technological knowledge is even regarded as an opportunity, for example, depends in part on the values and expectations of the social unit that might potentially adopt it. Furthermore to take advantage of the opportunity calls for the mobilization of a variety of resources -- energy, human skills, motivation, and the like -- and their combinations in accordance with the technological knowledge. How these combinations work out, however, depends in part on other than technological factors. Machine-tenders may be supervised under

a wide variety of styles of authority, and the choice of style surely rests on the society's cultural heritage of values and norms regarding authority much more than any technological dictates. With respect to impact, Forester more than adequately indicates the socio-cultural linkages of technological knowledge, and the variability in technological effects conditioned by these linkages.

On the subject of impact, Forester identifies three lines of improving our understanding: first, refining our way of assessing the different types of causal processes associated with technological change (e.g., manifest and latent functions -- see his summary list, p. 19); second, identifying various potential targets (values, norms, resources, etc.) of technological impact; third, by selecting a few principal types of change that these targets experience, viz., differentiation and integration of various sorts. Implicit in his analysis are two further points regarding impact that merit mentioning.

First, impact is always a function of both the "demands" of technological knowledge relating to the combination of non-human and human resources and the condition of those resources at the time of introduction. With respect to the technological demands -- e.g., for social organization -- Forester's analysis reminds us that these should be regarded not as fixed dictates but rather as limits, within which quite a range of variability might be expected. To revert to the machine-tending example, some kind of supervision of machine-tenders is called for by the rhythm of the productive process, so that different flows of materials can be coordinated, but not a specific kind of supervision. Furthermore, different technological arrangements vary according to the specificity of their "demands" and thus in the severity of their "impact."

Furthermore, if cultural expectations regarding authority are congenial to the type of supervision instituted around a machine technology, that technology need have scarcely any "impact" on such expectations at all; if the target population has expectations antipathetic to the mode chosen by the managers, then we would have a case of "impact" with probable worker dissatisfaction or alienation. Or to put the point simply, impact depends as much upon the target as it does the thrust.

Second, using Forester's list of kinds of targets, we should expect varying degrees of indeterminacy of impact, depending on the kind of target. It might be suggested, for example, that in general technological arrangements pose fairly definite restrictions on the type of non-human resource inputs required for producing a good or service (though considerable substitutability could be envisioned here, too) and in its space requirements. I would doubt, however, that it would be at all fruitful to think in terms of any direct impact of technology on cultural values; rather that impact should be considered as mediated through a variety of contingent processes. Technological change usually leads in the first instance to some kind of revision in the type and scheduling of life's rounds of activities; certainly the pace of work is affected by different machine technologies, and the pattern of family activities is much affected by the introduction of products like automobiles and kitchen appliances. These revisions may not be welcomed, however, on all counts, for they might conflict with or lead individuals to neglect other activities that are valued and normatively sanctioned. The changes in values and norms would ultimately arise from the dynamics of deviance and conflict, and the modification of expectations arising from these dyanmics. In this case the impact of technology is quite indirect, and

the intervening processes between technological change and change in cultural values could scarcely be predicted by knowing the nature of the technological change alone.

Such are a few of the lines of variability in the genesis and impact of technological and social change generated by Forester's suggestive essay. Hopefully some of his insights can be translated into concrete research problems. If they can, I would predict that the research based on them would add substantially to our now-lamentable store of knowledge about the impact of technology.

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I. INTRODUCTION

The consequences of learning to love the bomb may be among the easier ones to trace, for sociologists and planners at least, if not for ecologists. But searching for the social consequences of more mundane large-scale technologies is a task at which social science is strangely inept. The dynamics of social change are poorly understood, and these seem to be only slightly better understood than the phenomena of technological change. Technologies are strangely animated, or progressive social change is somehow mysteriously assured, bomb and all. This is not a happy state of affairs. This essay attempts to move beyond rather than contribute to the confusion. The agenda of the essay is simple, logical, and traditional.

To begin, the essay sketches briefly and then soundly criticizes two common views concerning technology and social change. Rather than serving as material of intellectual history, the perspectives serve as benchmarks for the larger project of the essay. The perspectives represent earlier attempts of theorists to understand problems of technologies and change; their ideas are illuminating not simply because of their descriptive power, but moreso because of their shortcomings. This review is intended less to do justice to specific authors than to represent in broad outline several commonplace, pervasive, but inadequate conceptions of these problems. This critique is launched not at past schools of thought, but at contemporary poorly specified, overly simple

and misleading ways of thinking about the relations of technology and social change. Understanding these relations of social change is, of course, fundamental to planning and decision-making analysis.

The previously discussed inadequacies still fresh at hand, the essay then suggests a more refined set of ideas concerning 'technology.' Rather than settle quickly for a simple definition of technology and jump to the analysis of its effects -- whatever it is -- the analysis steps back to suggest an understanding of several aspects of what the "it" of a technology may be. Technology has usually been employed as an abstract concept without a clear, concrete referent. That a technology is inseparable from a social technological system that embodies it has not been much appreciated; yet the implications of this simple idea are profound.

Following the discussion of technologies manifest in concrete social technological systems, the analysis turns to the understanding of social action systems. Continuities are apparent with recent American sociology concerning macroscopic social systems and collective behavior, and fundamental convergences with Marxist sociology are suggested in an appendix. At this point, the analysis has developed the preliminary foundations for the following discussion of the dynamics of social change.

Two independent but complementary dynamics of social change are elaborated. These are logical-deductive dynamics and thus are theoretical and empirically significant and testable in precisely the same sense that economic theory is. The first dynamic rests on the understanding of the previously discussed domains of social action; the second dynamic is that of differentiation and subsequent integrative responses in each of those domains.

A little simple engineering puts these pieces together and explores the relations of technologies and these dynamics, and the relations of spatial changes to social changes. Non-technological sources of change are discussed to complement the lesser primacy given to technologies as dominant sources of change. A general summary proposition then summarizes these arguments and leads to the brief exploration of several implications for further theoretical study.

Finally, the essay discusses specifie implications for planning theory and practice. These concern the understanding of the contexts of systems, the problem of system redundancy, the problems of diversity and growing spill-over problems, and dilemmas of planning as an integrative activity.

This essay is distinctly different from most concerned with technology and change. The level of analysis is simultaneously more abstract but more refined than the more common discussions of historical tendencies and trends. The discussion of technology as embodied in social technological systems distinctly sets this discussion apart from the usual discussions of technological "forces" and technologies as 'things in themselves.' Sacrificing specificity, abstraction allows simplicity, coherence, and synthetic power; given the confusion of much of the existing literature, the latter goals guide this analysis. Unless some semi-automatic screening of bits of the language used here prevents comprehension, the reader's everyday experience ought amply to provide a source for the concrete specification of the abstract arguments.

Finally, the essay quite necessarily leaves a number of loose ends. The review of common perspectives of technology and change ought properly to be a careful intellectual history. Interesting and fundamental ideas about our understanding of technological social systems

are left as suggestions, but are undeveloped. The dynamics of change, space permitting, ought to be vividly illustrated and further grounded conceptually. The specific improvements lent by these dynamics relative to the earlier perspectives ought to be clearly stated, but are not. The planning implications of all this work, for example regarding 'single factor' planning, likewise ought to be far more fully developed. These are all elaborations lacking due to considerations of length.

Still, the analysis provides a skeletal understanding of the relations of technologies and social change. The attempt has been deliberately to trade elaboration and full documentation for the strength and power of more abstract argument. Working from the initial review, the essay suggests a reinterpretation of technology and social change by refining notions not only of technological systems, but of the dynamics of change as well. That a systematic analysis of the relations of technology, social change, and planning problems is central to planning hardly needs to be argued. This essay is a preliminary attempt to provide such an analysis.

II. FALLACIES OF TECHNOLOGY AND CHANGE

"The automobile has profoundly changed the structure of American cities." "The automobile technology has, for better or worse, strongly impacted all of our lives; the impacts are many, varied, and diffuse." These statements ring true enough, but they betray themselves. They reflect our misguided usage of ordinary language to describe the relations of the auto technology and urban processes. Such statements obscure the complexity of these relations behind simplistic philosophies of history. How technologies and social life, including social changes, are related is more significantly at issue. The assertion that technology is the motor-force of history is not enlightening. Our questions are not what ultimately lies behind all change in social life, but rather how the processes of such changes may be better understood. Understanding the metaphysics of causation is less crucial than understanding how our decisions and situations come to affect one another.

Many of the problems connected with common ways of thinking about technology can be discussed under the broad headings of two older schools of thought: the evolutionist and the determinist. Each appeals to common sense and everyday language; yet each obscures an understanding of the dynamics of technologies and change.

Evolutionism

The evolutionist perspective presents a view of the unfolding of history as a branching process of progressive differentiation and

increasing complexity. Knowledge and know-how accumulate; the progressive development of technology is at once the product and the motor-force of the evolutionary process. The classical evolutionists of the nineteenth century, e.g. Comte and Spencer, argued for the linear succession of stages of development. Central to Spencer's work was the analogy of the growth of society to the growth of the organism. More recent diluted evolutionary perspectives have become multilinear, allowing for a greater heterogeneity along the growth path.[1] These ideas are simple and appealing enough. Yet they mask several fundamental problems that theories of social changes must address. Several widely accepted criticisms help to illuminate some of the inadequacies of evolutionist approaches.

Are the stages of social development universal? Is the progression, linear or multilinear, either necessary or irreversible? Are there any laws of history or laws of evolution? Are these ideas helpful for specific analyses of social change? Much sociological evidence suggests that the answers to these queries are negative. In some parts of the world, technological progress is virtually non-existent.[1a] Major social movements of political and religious natures have at times led to institutional stagnation and the breakdown of growth and development.[2] As Karl Popper has foreefully argued, "the evolution of human society is a unique historical process."[3] Thus, he continues, "its description, however, is not a law but only a singular historical statement...Trends are not laws..."[4]

Furthermore, there are other equally fundamental weaknesses in the evolutionary approaches. The question of just what was evolving has been curiously ignored. Kenneth Bock has noted:

> The specific question of what constitutes a social order or what are the requisites of social life tended to become lost in the difficult enterprise of reconstructing the evolutionary series.[5]

As significantly, the question of how evolution occurred has not been satisfactorily dealt with. As Bock notes: "...the mechanisms -- i.e. the historical processes of variation and selection -- were never specified."[6] Even survival is not an unambiguous notion, as Hawley demonstrated by showing the relativity of the concept of maladaptation.[7] Taking a slightly different tack, Moore has argued that even the "natural selection" of population changes is closely related to social structure and thus may be understood as "social selection."[8]

Evolutionary perspectives avoid pointing to the selection processes which govern why a particular technology may or may not be adopted, or why, similarly, a particular social group may or may not change. Without the careful specification of such mechanisms, there are only broad descriptive generalizations of before and after states of society. This does not provide an understanding of the relationships between the development of a particular technology and associated social changes.

Technological Determinism

This muddled state of affairs is only slightly better than that which the technological determinist perspective provides. The technological determinists rejected the simple growth theories of the evolutionists, but made and asserted greater primacy for technology and science as the driving forces of social change. This style of thought is pervasive and implicit in much of our ordinary language.

To say that "technology strongly impacts urban systems," for example, is not only to use a short-hand that glosses over specific modes of change. It is also but one short step to a fundamental dilemma of explanation in the social sciences: Are we to look for the causes of change in structural conditions or in the minds and desires of human populations? The latter position is Weber's; the former, both pessimistic and rationalistic, is Durkheim's.[9] Depending upon one's sympathies, Marxists either synthesize or straddle the horns of this dilemma.

The technological determinists, of course, take the position with Durkheim. The perspective has been adopted at several levels of argument which we can illustrate with selected quotes. The American sociologist, William Fielding Ogburn, is perhaps most responsible for a school of thought known as "technologism." Ogburn's most famous contribution was his hypothesis of cultural-lag. Dismissing the definitive evolutionist idea of stages, Ogburn was nevertheless impressed with the apparent accumulation of material culture. Noting that parts of society seemed to change faster than others, Ogburn suggested that the dynamics of change could be understood as the lag of non-material culture adapting to changes in the material culture.

> When the material conditions change, changes are occasioned in the adaptive culture. But these changes in the adaptive culture do not synchronize with the changes in the material culture. There is a lag...[10]

This statement is innocent enough and indeed leans upon, as Ogburn himself notes,[11] the possibility of change which is not technologically induced. Just as Gideon Sjoberg has pointed out in his review of studies of urbanization, technology is often granted an undeserved primacy.[12] The aspects of material culture must be specified, and

systematic analysis conducted of how changes in these lead to or generate adaptive changes. The antithesis of Ogburn's position ought also to be explored. How do culture and the non-technological realms of life affect the development of technology? The mechanistic language of stimulus-response, diffusion, and "impacts" obscures these issues. In another context, these problems emerge as criticisms of the overly simple materialism of "vulgar Marxism." In the analysis of technology and social change, these criticisms are directly pertinent; they apply to a large part of our ordinary conception of the "technological driving force."

At a more sophisticated level are the technological determinists who argue that "technology is out of control" or that technology has an irresistable logic to its development. Clark Kerr and his associates are representative of the position that views technological development as fundamentally and irreversibly changing human civilization.

> The empire of industrialism will enhance the whole world; and such similarities as [NB] it decrees will penetrate the outermost points of its sphere of influence, and its sphere comes to be universal...several roads lead into this new and ultimate empire.[13]

> It is the great transformation -- successful, all-embracing, irreversible.[14]

Also a student of modernization, Walter Rostow gives us a blend of Kerr and Ogburn.

> Psychologically, man must transform or adapt the old culture in ways which make it compatible with modern activities and institutions.[15]

Evidence exists that contradicts the implications of both positions. Students of change have been careful to point out the coexistence of tradition and modernity, old ways and new.[16] The utility and applicability of such mechanistic arguments are questionable.

Do they help one understand specific relations of technology in social life? No. They rather confuse us with metaphysical "ultimate" empires and musts.

Jacques Ellul argues a still more subtle and persuasive determinism. Rather than focusing upon particular technologies, Ellul points to the rise and domination of the flood-tide of "technique."[17] At best, Ellul shows dilemmas of human freedom, morality, and rationality as posed in an increasing rationalistic and technical world. At worst, he seduces with a romantic pessimism that has affinities with simplistic materialisms. For example,

> Technique integrates the machine into society. It constructs the kind of world the machine needs and introduces order where the incoherent banging of machinery heaped up ruins. It clarifies, amazes, and rationalizes...[18]

Where are human actors?

> At the present time, technique has arrived at such a point in its evolution that it is being transformed and is progressing almost without decisive intervention by man.[19]

And for the Marxists, "Capitalism did not create our world; the machine did."[20]

Such a perspective begs the questions of inevitabilities, proof, and the role of deliberate action. Ellul's analysis is sophisticated and elaborate; a semblance of his argument here simply illuminates the problem of simple technological determinists. Specific dynamics of change are easily swept from sight by the overriding, more general forces of history. The possibilities of specific decisions, action, and organization, are easily kept lacking the attention given rather to the global forces of the machine. Whether or not technique could be considered the driving force of history is

not a question that science can address. Nor is it a helpful question in the specific analysis of social change unless processes of change can be detailed. The task is to clarify the relations of technologies in social change better to understand social relations rather than obscure them behind metaphysical determinisms. How the very basis of problems is understood provides the basis for seeking "solutions." Ogburn gives a nice example of the conceptual confusions of the determinists:

> We may say that the automobile creates motels, though actually it is the human beings who do the creating, because the variable is the automobile and not the human beings.[21]

The message should be clear; how and why human beings actually do the creating deserves careful analysis -- for determinists will continually confront the causal mysteries of the machine.[22]

There are several paths away from these obscuring notions of hidden forces and inevitabilities. The first may be to narrow the scope somewhat from the sweep of history to the particular dynamics associated with the use of a large scale technological system and the multiple decisions which underlie it. Another is to pose the question of the success and failure, acceptance and rejection of various technologies. What social structural conditions are responsible? Perhaps the most basic break that can be made with the evolutionists and determinists comes with the recognition that little is understood of human causation. Attention is warranted not only to fundamental assumptions about man, e.g. rational economic behavior, but also to the social, structural[23] and cultural conditions that allow and shape human behavior.

Such steps have been taken in the modernization and industrialization fields by C. E. Black and Wilbert C. Moore, for example. Both argue an appealing response to the determinists.[24] In his critique of technological inevitability, Robert Lauer points out Black's suggestion of a possible "universalization of functions, but not of institutions." Lauer says

> Modernization, that is, confronts a society with certain basic problems, but the answers that are given to those problems may vary considerably.[24]

This is significant, for while certain ends may be adopted across societies, the means employed may radically differ. Similarly, Moore notes that "many changes involve ranges of structural substitutability for constant ends and functions."

Most simply, a tool may serve a given end in a variety of ways. Thus, how it is used, and the import which the form of its use has in a specific society cannot be given in or dictated by the tool, the technology. The grand historical ideas of necessity must give way to the analysis of the structural conditions and variabilities that shape and are shaped by technological systems. This will lead to a fundamentally different understanding of technology itself. Sjoberg has pointed to the inadequate conceptualization of "technology" in the dynamics of change in the urban context. Nevertheless, his refined position in the same 1965 article is still far too simple, and still prone to the "stark materialism" he seeks to avoid. His notion of technology serves both as a representative of contemporary thought as well as a position that we shall attempt fundamentally to improve.

> As we define technology, it involves the tools, the sources of energy, and the know-how connected with the use of both tools and energy that a social system employs. Industrialization is that kind of technology that relies on inanimate energy sources, largely complex tools, and the specialized know-how required to tap these power sources and utilize these advanced tools.[25]

The notion here has a cognitive component (know-how) added to the materialistic, but where are human beings as actors in structural, historical conditions? In a 1957 essay following Ogburn's, Hornell Hart took one short step in answering this question by arguing,

> It is the function of the structure that gives it importance, and the function of the products of technology is use by human beings. Technology is therefore essentially social.[26]

This conclusion is as fundamental as it is transparent, yet its basis given above is still woefully narrow. Before articulating a model of the relations of large scale technology and social change, there must be a richer, more suggestive, and more useful understanding of technology as it exists in social life.

III. THE SOCIAL NATURE OF TECHNOLOGY: TECHNOLOGY IN TECHNOLOGICAL SYSTEMS

The materialistic notions of instruments and tools are narrow and inadequate, as are their cognitive counterparts of capacity and know-how. These are hardly wrong; they are partial and reflect just one small part of the story of the relations to social change. Technology is fundamentally social in genesis, implementation, and organization. A technology is conceivable only as an integral, inseparable component of social, technological systems of persons who use and carry out the technology. Technologies are effective only as they are socially real, embodied in concrete social systems and social organizations. Only as it is used and carried out in social life, may a technology as an abstracted aspect of a real social, technological system induce social change. Thus, for the analysis of social change, if our first thought about technology is "technological system" or "social organization" rather than "tool" or "know-how", we are going in the right direction. A technology is not a metaphysical force; a technology is human as well as material, characterized as fundamentally by persons, their possibilities, and social relations as by matter and physical laws.

Now, what the technological system does when mobilized defines its functions. In a classic essay Robert Merton noted that functions are both manifest and latent, the former being intended and recognized, the latter not. This is an important distinction. How these functions

are organized, that is, the patterns of interactions associated with these functions, constitutes the social structure of the technological system. As noted above by Moore and Lauer, Sjoberg too has stressed that cultural variabilities, different value systems, can shape correspondingly different structures.[27] Political power may similarly shape the concrete structures of technological systems. Nevertheless, a particular structure may well have both recognized and intended consequences, as well as unrecognized and unintended ones. These shall be analyzed below.

Causal language must be more carefully used. As social organization, as it is embodied in a technological system, a technology can be understood both to cause and to permit change. Insofar as people can understand and use a technology at a certain time, for certain ends, and in certain ways, it allows, facilitates, or enables social change.[28] Insofar as the technological system itself is a structuring of some people's behavior and is in effect a certain imposition in our social world, it causes change. The rationalizing effect of technologies, for example, can be due in large part to the fact that our use and operation of the technologies are rationalized. Sjoberg has suggested that "the structural arrangements of the industrial city are functionally related to the nature of modern technology..."[29] The use of a new technology not only accomplishes certain ends, but also reflects by its very presence a change from the pre-existing social structure. The fact that a technological system exists as a social system in and with other social systems is as fundamental as the fact that it accomplishes anything.

This simple notion can be extended with the recognition of the interconnectedness of socio-technological systems in and with other social systems.

The connections are manifold. The most difficult to grasp may be emotive, affectual, or cultural in nature; the most basic are physical input-output flows of energy, matter, and information. Ecologists pay attention to the latter; many others are familiar with the economic questions of resource flows associated with technologies. Where the technology starts and stops along these connections is anything but a simple question. As Kurt Back has somewhat ironically noted, "...the definition of the system and its boundary is a difficult problem for systems analysis." (p. 664; see footnote #62) The recognition and understanding of this problem, as opposed to its arbitrary "solution" and neglect, is basic to our understanding of technology and change. The character of the systemic understanding of a technological system will fundamentally determine the subsequent analysis of its relations to social change.

The analysis of such interconnectedness is substantially furthered by attention to the prerequisites of technological systems. As a technology is inseparable from its technological system, the notions of prerequisites include not only those of resources, space, and energy, but also those of skills, laws, and values. The phenomenon of increasing occupational specialization associated with particular technological systems can be understood as a social prerequisite for their operation and as a "structuring effect" of the technologies as well. In this case technology "causes," i.e., requires, change.

Although the analysis of the functional prerequisites of social systems has not been without difficulties, the work is suggestive for pointing to social and technical prerequisites as avenues of social change. To draw from the work of Talcott Parsons, perhaps the most influential of modern American sociologists, technologies require accompanying

changes or accomodatations in several domains. Some cultural compatibility is required, as well as legal and moral compatibility. There must also be some minimal degree of mobilization and organization of persons; the equally problematic, concomitant question of the availability of resources also arises. How these requirements are met, again, may vary structurally. This basic notion will be carefully expanded and articulated below; here it only suggests a more refined notion of technology integral with social organization.

Still, technology seems to do more than accomplish some people's ends and require some accommodations. For as technology is shaped by context, it significantly seems to shape contexts as well. The development of a new technology often leads to new definitions of the accessibility and availability of resources.[30] As Schnore has noted, technology can alter the effective environment. Transport improvements, for example, translate into lower distance costs and lead to redefinition of the spatial environment. In a fundamental sense, changes in technology alter not only the possibilities and requirements of action, but the very structure of the public world (cf. Heidegger, Being and Time). This dilemma of action changing its own basis is pointed out by Schneider, noting that actions may lead to changes in ends for the actor.[30a]

Transport technologies are demand generating as well as demand-filling. As it recontextuates, or changes contexts, changes in technology, in a technological system, can change the very conditions for rational action of both its users and others.

Another aspect of this structuring or contextuating role is the problem of substitution. Where a new technology is an improvement upon an existing one, the rise of the new social structure may by substitution

obliterate the older structures. This is a source of change not only for the members of the previous social organization but also for those persons associated with them. For example, "traditional arrangements most closely associated with the economic technological order seem to buckle first under the impact of industrial urbanization."[31]

But how is it that technology "contextuates" or "requires"? As embodied in a technological system, a technology is also an object of attention for those who neither use nor operate it. The notion of contextuation leads to questions of fields of values and concerns of others. Whose contexts of action are being manifestly changed? A technology "makes a difference" to others, both because of its functional capacities and because of its substance, its social structure. How the technology makes these differences to people is fundamentally a problem of the basic integration of societies, i.e., how social systems manage, however partially, to sustain working arrangements and to stay together. These problems will be dealt with at length in a following section.

Consider again the problem of how technologies require change. There are several interesting areas to explore here. If a particular technology seems to demand but meets resistance to specific change, the question of power emerges. But when requirements are rather readily met, two explanations remain. First, the requirements may be physical, implying material or energy inputs. The second mode of requirement, however, leads to a fresh insight. Requirements are met because of prior, dictating commitments and subsequent obligations; a technology can thus be understood as a <u>social investment</u>. Such an understanding can make causal sense for us of the widespread notions of social behavior adapting to new technologies. Such, for example, is the underlying dynamic in John Kenneth Galbraith's argument concerning corporate behavior. Galbraith argues that modern corporations

attempt to mold consumer demand to available supply potential, rather than vice versa. This idea of technology as social investment may be an important consideration in the relations of technology and social change. A technological system is not only a social system with technical capacities, it also represents social investments which will be maintained and protected. The idea raises questions of the social nature of investments and commitments, and their associated behavioral consequences as the investment in a technology changes the fabric of existing investments and commitments. These questions lead to the rethinking of the very bases of participation and social identification that accompany social investment and commitment. Who invests, for whom, and the nature of participation in such decisions related to technological systems are extremely problematic and politically significant.

To sum up: the following concepts are central to a clarified understanding of technology: a) manifest and latent functions; b) social structure; c) basic input/output flows and connections; d) basic prerequisite functions and associated structures; e) the notion of social investment; f) contextuation -- changing the conditions of rational behavior of others and redefining the "effective environment" of others.

Fundamental to the analysis is the understanding of technology as an aspect of concrete technological systems, as integrally, inseparably, and substantively social. A technology is no abstract, cosmic force; it is essentially embodied in social organization, persons and their relations.[32]

IV. TECHNOLOGY IN SOCIAL CHANGE

Prologue

The following pages develop a theoretical perspective that may help order the complex interactions of technologies and social systems. The perspective has affinities not only with modern functionalist thought but with Marxist thought as well.[33] Instead of closely knit and operationally testable propositions, the analysis provides a framework or a skeletal structure within which such propositions can be deduced and tested.[34] However partially successful, the attempt in these pages is to articulate a relatively simple, elegant conceptual scheme with which to understand the dynamics of urban social change and the integral roles technologies may play in them. The following comment of Daniel Bell regarding the role of theory in the analysis of social change is helpful:

> The function of theory is to guide us to sources of strain; the power of theory is to offer an explanatory framework on a higher level of generality. (Bell, Russel Sage Seminar)

Theory cannot be prescriptive, but it should inform future expectations. The theoretical argument developed here is not simply descriptive; it shows how the development and use of large scale technologies may lead to various orders of urban social, economic, and political problems. The exposition demonstrates not only the connections of technological systems in the larger urban fabric, but also the inseparabilities of the traditional disciplinary social, political, and economic problems. Significantly the perspective

neither ignores cultural factors nor bows to cultural determinism. Were the all too-prevalent latter perspective true, we would have nothing to learn from any culture other than our own. Still, this perspective does not solve any of the classic problems of social causation. Since such solutions seem nowhere imminent, the analysis is rather one of the theoretical structural and cultural conditions of social action and change.

Taking the increasing complexity and diversity of metropolitan systems as a touchstone, the argument draws upon theoretical work concerning social differentiation.[35] The argument here walks a theoretical tightrope that has plagued modern sociology; continuities are maintained with perspectives giving primacy to social actors and, alternatively, to social structure. Rather than pull grand theoretic formulations out of the air, the analysis leans heavily on threads drawn from Marx, Weber, and Durkheim.[36]

In particular, the model here does not rest upon inductively constructed trends, but rather is a logico-deductive analytic framework applied to the analysis of social change. The presentation here is 'middle-range'; neither theory without empirical referents nor data presented without organizing principles. Discussing the dynamics of modernization, Smelser has set the tone for the task at hand:

> Because of these sources of variation, it is virtually impossible to discover hard and fast empirical generalizations concerning the evolution of social structures during economic and social development. My purpose, therefore,...is not to search for such generalizations, but rather to outline certain ideal-type directions of structural change... (Smelser, TTM 260, see footnote #36)

A. Action Systems

1. Action, Differentiation, and Assumptions

This theoretical analysis rests upon two fundamental ideas. The first is that social action systems can be systematically analyzed in terms of a hierarchy of four basic components or dimensions of social action.[37] The second is that of the systemic dynamic of differentiation and subsequent action to provide some degree of social integration or coordination. Criticisms of the differentiation-integration dynamic have pointed out the indeterminate degree of subsequent integration. Yet it is precisely this uncertain and problematic degree of integration that makes it interesting to the analyst of technological development and subsequent social problems and changes. The close affinity between the theoretical idea of minimal integration and actual social disturbances, stresses, and problems makes the dynamics of differentiation of great interest. The integrative problem accompanying differentiation can be thought of as the pervasive challenge to all social units to maintain some workable degree of coherence and stability in their lives in the face of growing diversity, pluralism, and interdependence. The implications of this challenge are profound. No witness of recent population growth and technological change will dispute the manifold problems of complexity, diversity, and general social 'coordination' and governance. The model of the differentiation-integration dynamic presented here is an attempt systematically to unravel and understand these problems.

2. Dimensions of Action and Domains of Social Relations

Social action systems consist of a hierarchy of dimensions. In his Theory of Collective Behavior, Smelser extends the Parsonian theory

of action from the single actor to include action systems constituted by the interaction of two or more actors. Smelser develops his notion of 'the basic components of social action' by systematically elaborating the understanding of action as normatively regulated mobilization for ends in situations. Smelser states:

> The four basic components of social action, then, are: (1) the generalized ends, or VALUES, which provide the broadest guides to purposive social behavior; (2) the regulatory rules governing the pursuit of these goals, rules which are to be found in NORMS; (3) the mobilization of individual energy to achieve the defined ends within the normative framework...if we move to the social system level, [two or more actors] we ask how motivated individuals are ORGANIZED into roles and organizations; (4) the available SITUATIONAL FACILITIES which the actor utilizes as means; these include knowledge of the environment,...tools, and skills.
>
> Smelser CB 24

The application of these components as dimensions to social systems rather than simply to single actors provides the conceptual power to develop a detailed analysis of social structures as actors find themselves within them. Not only do persons and organizations share and participate together along these dimensions, but they also find bases for conflict within them as well. If one notes their correspondence with the four 'functional prerequisites' developed several years earlier in the functionalist literature, it becomes apparent that each dimension may also be understood as a potential constraint, or alternatively, determinant, of social action.

The concept of dimensions implies neither social homogeneity nor lack of conflict, nor any oft-criticized functionalist 'tendencies to equilibrium.' Instead, the dimensions give a systematic framework with which to organize characteristics of the diversity of conflicting and cooperating social organizations present in any society. In addition, the dimensions provide a tool with which to explore more

abstract analyses of social structures and their interrelationships. The distinction between the function of a technology and its social structure was noted above. These dimensions not only help one to understand better these aspects of a technology, but also they suggest avenues of interdependence, support, and, significantly, conflict with other social systems.

The components or dimensions of values, norms, organizations and resources define particular 'action systems.' Since all action systems share these dimensions, then the relationships between persons or organizations are not simply 'dimensions' but, loosely, 'fields' or shared domains. The domain of agreements and conflicts about values may be defined as the cultural. The domain in which norms and patterns of action are followed and challenged may be defined as the political, or alternatively, the social structural.[38] The domain in which actors share and fight one another for resources is commonly called the economic. The domain in which our behaviors interact with varying degrees of stability and deviance is also ordinarily defined as that of organization, taken among action systems as well as within them. The dimensions of action and the corresponding social domains may be extended. One aspect crucial to our understanding of cities, that of space, may be separated from the resource domain. This provides a framework with which to study the interactions of changes in location with cultural, political and moral, organizational, and economic changes. Thus, 'action systems' of two or more persons share a five-dimensional structure of action. Each shared dimension is referred to as a domain. The various actors in a society, then, coexist, not without conflict, in the five domains of values, norms, organization, resources, and space.

3. The Hierarchy of Dimensions and Domains

Action theory, stemming largely from the work of Weber, stands materialistic dynamics on end. Values and worldviews and solidarity are usually given primacy; law, organization, and the use of resources follow. Thus, after elaborating the components of social action systems, Smelser argues that they stand in a dynamic, logical-deductive, hierarchical relationship to one another. He states:

> Changes in the basic values entail changes in the definition of norms, organization and facilities. Changes in norms entail changes in the definition of organization and facilities, but not values. Changes in organization entail changes in the definition of facilities, but not norms or values. Changes in facilities, finally, do not necessarily impose any changes on the other components. (CB 33-34 , see footnote #36)

This hierarchy, with values at the top level and resources below, still refers to the dynamic relationships of the domains of action within one organization or action system.[39] But since the domains are common to all action systems, they provide, with the idea of the hierarchy, a conceptual means to trace changes both between and within social systems. This further develops action theory by dealing with relations of systems as well as those in systems. Now, certainly, change in a lower level domain in one organization may lead to change in a higher level domain of another group. Noting this possibility without exploring it further, Smelser continues:

> This is not to say that EMPIRICAL modifications at the lower levels do not ever constitute conditions of structural strain which initiate higher level changes.

This is the direction of change central to Marxist analysis. To anticipate discussion below, this 'upward' direction of dynamics can be explained by arguing that differentiation in a lower domain by one organization may lead to adaptive or integrative changes in higher domains in other organizations.[40]

Still, Smelser's presentation of the downward deductive direction of the hierarchy is powerful. This thesis indeed underlay Weber's extensive analyses of world religions. More in accord with contemporary social and political analyses, the spread of political ideologies and subsequent social changes provide evidence for the hierarchy notion. The values of modernization and nationalization in economically developing countries have led to major changes in government legislation, regulation, and activity. These changes in turn have led to accompanying changes in patterns of activity and have stressed traditional customs and norms. Both new norms and declining older ones have given rise to changes in social relations and lifestyles. That these changes in activity have significantly changed the use and allocation of resources hardly needs argument. Based on ideological values of economic development, these countries have implemented new norms, laws, and codes, which have reordered and guided social, economic, and political behavior. This new behavior in turn has changed the definition, distribution, use, and allocation of resources available to these societies. In capsule form, the hierarchy argument suggests that values legitimate rules which guide organized action, using resources -- all of which, for the purpose of this essay, occur in space.[41] The argument is that a change in values can change rules and customs, that a change in these will alter the shape of organization, and that this in turn will alter the allocation and use of resources in space. To anticipate later discussion again, when technology is considered not simply as a tool but rather as concretely inseparable from full-fledged (five-dimensional) social organization, the hierarchic relationships lead to the analysis of change and stress in each of the social dimensions or domains.[42] How

a technology might lead to upward changes in the hierarchy of domains can be understood once the second basic idea,tthat of the dynamics of differentiation and integration, is introduced and understood. First, however, one additional feature of the structuring of action should be understood.

4. Constraints and Context

Just as social action inherently involves each domain and thus takes place in each, the components and domains can represent constraints, conditions, or crucial aspects of the context of action. The domains define compatibilities to bring into question in the evaluation of the possibilities of actions and changes. Thus cultural, political, organizational, economic, and spatial incompatibilities can critically shape social actions, whether those actions occur within the technological system, or those of others. This is no random or arbitrary checklist of 'important factors'; these contextual influences represent a logical corollary derived from the dimensional understanding of action and the corresponding domains of social action.

This argument explains why one-dimensional determinisms are destined to fail. Since action necessarily impinges upon and occurs in five domains, where each domain can constrain action, no single domain or subset of the five can be solely determining.[43] This analysis suggests, then, basic prerequisites for the study and causal explanation of action -- for the domains of action constitute a structure of the context in which all social action occurs. What becomes important is not to say that a certain value led to a certain action under 'favorable' conditions; rather it is important that the combination of conditions that give rise to one action here and another there may be understood.[44]

Furthermore, a refined notion of the structure of context could significantly influence our use and analysis of cross-cultural data. Conditions of data comparability may be better specified. Finally, the discussion of dimensions should make abundantly clear that statistical analyses that attempt to correlate particular actions with just one or a subset of variables in the domains are doomed to failure -- unless social life can be frozen so that the remaining realms are effectively held constant. The structure of action provides a systematic understanding of why single (or several) factor explanations will not work. Given these ideas of the action components, the domains, and their hierarchic relations, the dynamics of differentiation and integration can now be explained.

B. The Dynamics of Differentiation and Integration

1. Background

The pioneers of the sociological ideas of differentiation and integration were Herbert Spencer and Emile Durkheim. Asserting an inherent tendency towardincreasing complexity and differentiation, Spencer pointed to the importance of contract as the integrative device that kept social systems from chaos and disintegration. Refining Spencer's idea of differentiation with his analysis of the division of labor, Durkheim more fundamentally challenged the primacy of attention given to contract. He argued that more basic integrative mechanisms were at work: formal and informal laws and customs that indeed also governed contract. Indeed, the concern with social integration, the enduring relationship of the individual or group to the larger social organization, is fundamental to Durkheim's work. Integration figures prominently in his doctoral dissertation, The Division of Labor in Society, as well as

in Suicide in the concept of anomie, and in The Elementary Forms of the Religious Life in his analysis of the totem and the very idea of God.

Perhaps the major criticism of Durkheim's work on differentiation has been that the sources of differentiation were inadequately explored. Partially in response to this criticism, Parsons and Smelser further elaborated the ideas of differentiation and integration in the 1950's and 1960's.[45]

Modern "functionalist" theory stressed the systems idea of functional prerequisites which appeared no longer as abstract requisites but as fundamental components of social action in Smelser's Collective Behavior. The systemic prerequisite of integration was thus 'transformed' into the integrative dimension of social action, the domain of norms. Therefore whether or not or how a society is static, self-maintaining, or conflict-ridden and changing is precisely at issue in the dyanmics of differentiation and integration, as developed here. Indeed, integration may also be understood as conflict management. Action inherently involves norms and occurs in a normative domain, some degree of integration is thus necessary. It is just this uncertain and problematic degree of conflict-management, coordination and integration that is central to the analysis of change. The important questions, then, are not those of integration or no, but rather of how much and why. These questions and their relationships to technological systems shall be explored after the dynamics of differentiation and integration are elaborated. Smelser's consideration of social disturbances stemming from lags in these dynamics will be particularly interesting.

2. The Basic Concepts

Perhaps above all else, it is interdependence that makes the argument for the dynamics of differentiation and integration convincing. In a loose but very real sense, persona need to get along with one another; if we are to be slightly more formal, we might call this a basic concern with 'maintaining the smooth interaction' of social action systems. This, simply, is the problem of integration (see fn. 36, Smelser, '59, p So integration is used here not in the sense of spatial proximity, for example, or of connectedness, but rather in the qualitative sense of stability and workability of social interactions. Where social interactions exist without such stability and manageability, social problems, disturbances, and the 'disintegration' of social relations emerge. These problems of integrative failures arise at many levels of analysis in the face of technological change. Discussing modernization, Smelser has pointed to:

> the following ideal-type structural changes which ramify throughout society: (1) Structural differentiation, or the establishment of more specialized and more autonomous social units...(2) Integration,...(3) Social disturbances...which reflect the uneven march of differentiation and integration.
> (see fn. 36, Smelser, '64, p. 259)

Shmuel Eisenstadt notes in regard to structural change:

> Recognition of the integrative problems that are attendant on new levels of differentiation constitutes the main theoretical implication of the concept of differentiation.
> (see fn. 5, Eisenstadt)

and in the same place,

> ...at each more "advanced" level or stage of differentiation, the increased autonomy of each sphere creates more complex problems of integrating these specialized activities into one systemic framework.

Eisenstadt goes on to make the point alluded to above: the solutions to the integrative problems raised by processes of differentiation are by no means guaranteed. (see fn. 5, Eisenstadt)

This presents the following ideas. The creation or development of new social units inherently raises questions of the coexistence of those units in their host societies.[46] Peaceful and troublefree co-existence cannot be expected automatically; therefore, further, perhaps continual, social changes may be expected to follow the original developments. Such a further change, for example, might be the creation of a special agency to regulate troublesome new relations. Where successful integration is lacking or slow in coming, social stress and problems can be expected. Ironically but far more significantly, the very creation of an integrative agency arising as a response to problems of differentiation represents in itself still further social change and differentiation.[47] Not only are the connections of technological systems changes to the process of differentiation and integration important, but so are non-technological sources of such change as well. The dynamics of differentiation and integration provide theoretically possible directions of social change and lead to many possible social problems accompanying such change. Since social change and social systems can be understood at five levels or in five domains, the processes of differentiation and integration in each domain should be examined. Then, with the consideration of technological systems, the relations between the domains can be elaborated.

3. Differentiation/Integration in the Domains

a. Values: the cultural domain. Cultural differentiation occurs by the development of new values, religions, beliefs, and dogmas. The attempt at the enduring articulation of new cultural forms and essentially new and diverse symbolisms represents cultural differentiation. The social integrative mechanisms usually considered in this

domain are the church and family. Today, however, the growth of service agencies -- of counselors, streetworkers, social workers -- has been important to the 'handling' of problems of maintaining stability in the face of growing cultural pluralism and diversity.[48]

Various racial and ethnic group conflicts have been the most blatant of recent problems of cultural differences. In a neat discussion of such problems, Bennet Berger has pointed to the American ambivalence concerning cultural pluralism on the one hand and the 'melting pot' on the other. He says, "...to be truly tenable, a pluralist ideology must accord intrinsic honor and value to a diversity of lifestyles, and this it has never completely done."[48a] Thus the ideas here lead to the very nature of the integrative problems of cultural differentiation: intolerance, bigotry, racism, the breakdown of the bases of solidarity among and within peoples.

b. Norms: the political, moral domain. Differentiation in the political or integrative domain, that of norms, is still more clear. This differentiation occurs primarily by changes in law, custom, and regulations -- both formal and informal. The classic integrative device is the law, applied by the judiciary and implemented through government. Differentiation in this domain consists, for example, of the proliferation of government agencies and jurisdictions, and the spread and specification of regulations. The proliferation of submetropolitan governments in metropolitan areas is a recent example. Also, the development of new moral norms among particular groups represents such differentiation.

The concomitant integrative problems are clear; they are those of coordination, delegation of authority and the accompanying problems

of autonomy, the decreasing viability of atomistic planning, and the co-existence of different customs and moralities. The spinal issue here is legitimacy; given the differentiation of norms and integrative mechanisms, the problems of keeping peace among different social units and of keeping them somewhat from working against one another are essentially problems of legitimacy. When integration is not smooth, processes of differentiation in this domain can lead to crime, challenges to the bases of moral systems, and challenges to formal systems of authority.[49]

c. Organization. Differentiation in the domain of organization occurs with the creation of new roles and organizations and so raises problems of their subsequent smooth operation and interaction. Unsuccessful integration shows up as incoherence, deviance, instability and inadequacy of role performance, difficulties of mobilization for action, disorder, and problems of access to new roles and organizations. Louis Wirth, for example, may be understood as having suggested a model linking changes in roles accompanying structural differentiation to the impersonality of formal integrative responses and then to anomie, alienation, and deviance.[49a] A great deal of attention has been paid to the changing integrative responses to organizational and role differentiation.[50] The proliferation of mediating, service-sector institutions in modern societies reflects an integrative response, for example, to vast differentiation in the organizational domain.

d. Resources: the economic domain. Differentiation in the domain of resources can take many forms. The following are examples: the discovery or redefinition of natural resources, increased stratification of skilled or educated classes, changes in tax bases, increased stratification of income, market differentiation. Major resource

allocations produce differentiation in the resource domain. The immediate integrative questions and problems are those of scarcity, equity of distribution and allocation, and relative deprivation.

e. The spatial domain. New uses of space or processes of spatial separation or isolation are effective processes of spatial differentiation. Spatial differentiation becomes both the changes in distribution of territorial uses and in the social redefinition of space, e.g., the meaning of proximity. Integrative responses and problems in this domain concern access and transgression. Here, communications and transportation technologies, the social systems of transport and communications, are vital.

Perhaps the most significant example of such spatial differentiation has occurred in the phenomena of suburbanization, i.e. suburban land and space uses. Bennet Berger has pointed out nicely the distinctiveness of the spatial domain. Noting the self-segregating tendencies of suburbs, that 'suburbs seem to be new homes for old values,' Berger argues that the causal connection between the physical characteristics of suburbia and alleged changes in lifestyles has never been established. Indeed, the analysis here suggests that suburbanization can be usefully understood as a phenomenon of differentiation in all the domains, with all of the attendant problems of integrative failures in these domains.

4. The Spatial and the Social

A much deeper understanding is needed of the common knowledge that the transport technology of the automobile made suburbanization possible. Used as a commute vehicle the auto may allow localized spatial differentiation, e.g., shifts in residential and industrial

locations. But perhaps more significantly the auto serves to reintegrate spatial differentiation on the metropolitan level. Fundamentally, the process of spatial integration represents a process of effective social differentiation in the other domains.

This is a basic relationship of transport and communications technologies to problems in and between social systems. Two previously isolated communities, for example, now joined by communication or transport technologies, can be expected to face the host of integrative problems of the four non-spatial domains: tolerance and solidarity, legitimacy, instability and disorder, and inequity and relative deprivation. This is one of the most significant relationships of these technological systems to changes and stresses in social structure. Where technologies integrate space, they effectively differentiate social systems in the four domains of culture, social structure, organization, and resources -- and thus give rise to subsequent integrative problems and stresses.[50a]

For example, the integration of space that represents effective social differentiation also means that while new spatial relations are created, the old political decision-making structures and agencies remain. Abstractly, a problem space is growing and shifting without corresponding shifts in decision spaces. Problems and the capacity to solve them are further out of kilter. This of course is all part of the problems in the political or integrative domain. Spatial integration effectively includes more integrative agencies within the same system; how in fact these are integrated and coordinated is a substantial problem of planning and governance.[51]

The hierarchy of domains and the dynamics of differentiation and integration have been elaborated. The relations of technological systems

to these processes must be systematically explored. The question for this essay becomes: how do technological systems, as social systems, serve both to integrate and differentiate, as well as 'cause' (hierarchic) changes in their own right?

5. Technology and These Dynamics

The simple function/structure distinction is useful because it points immediately to separate paths of change. Functionally, for example, the technological system of the auto integrates space. Structurally, it differentiates: first by partially substituting for other modes serving the same function (public transport); and secondly, by itself constituting new organizations, jobs, and institutions, e.g., particular changes in occupational specialization. The very implemented structure and use of a technological system constitute effective social differentiation. This idea is fundamental.

Frequently overlooked are the changes in the latent, unrecognized and unintended, consequences of the structures -- the previous form of the technologies -- that are being improved upon or substituted for. These changes complement structural differentiation, for differentiation represents not only the creation of new structures, but also may mean the discontinuation of diverse functional significances of pre-existing structures. For example the old integrative functions of neighborhood shopping patterns may be lost in the structural change to predominant supermarket shopping. The old may give way to the new because the same manifest, overt functions can be better served, yet other latent functions may be lost altogether, or changed, and so become sources of new social change or stress.[52]

Thus as social organization itself, the very development of a technological system represents structural differentiation on five levels, in the five domains we have discussed (see Figure 1, p. 51). Similarly, but logically independently, the functions that a technology serves may lead to further structural differentiation. The social structure of a technological system and the social structures whose existence it permits (e.g., suburban industries) are not identical. The technological system of the automobile, for example, has an elaborate social structure of labor and leisure uses, supporting services and regulatory agencies, as well as socially allocated resources of fuel and space. Nevertheless, in its capacity to integrate space, not only does it allow the option of territorial differentiation, but it also poses the integrative problems that follow any social structural differentiation in space. Where integration is not automatic within the confines of existing values, norms, modes of organization and resources, the development of stress and the creation of social mechanisms to manage the integrative problems -- whether by services, negotiation, persuasion, or by coercion -- can be expected.[53]

Though vast literatures are concerned with the changing nature of social relations in a highly technological society, several additional relations of technological systems to processes of integration may be noted here. First with investment in and commitment to a technology, there is a concomitant social structuring. There is an integration not only between users and operators, but within each of these groups as well. The one-hour, one-person-to-a-car commute is a different form of integration, a different social structuring of activities, than the sharing of more crowded public transit facilities. A more important consideration may be the form of integration of a technological

system with either its prerequisite supporting services or with other social organizations. The central question is the degree to which a particular technological system may prescribe or demand a particular form of integration, usually, of course, a highly rationalized one.

Considering technology in a technological system not only as fundamentally social, but as representing social investment and commitment as well, allows a better understanding of the extent and success of the 'rationalizing demands' that a particular technology makes. Persons make the demands to rationalize through their commitments to and investments in particular social structures having functional capacities -- what are usually simply called technolcgical systems. This simply says that investments for efficiency may have rationalizing social costs. The political and moral significance of this is that the rationalizing demands are thus rooted in persons responsible for making particular social commitments and investments, and not in any technological motor force of history. These considerations, then, beg the questions of which forces in a society have the political power or autonomy to make such investments. The costs of rationalization may be extreme, as Weber warned, and yet it is equally clear, if equally hard to measure, that significant 'de-rationalization' of modern technologies -- often meaning their elimination -- might have extreme costs as well.[54]

6. Non-Technological Structural Sources of These Dynamics

'Non-technological' sources of change are also sources of social differentiation. Technological sources cannot be'the motor forces of history'; non-technological sources of change abound. These independent roots of change are important not only because their effects may be

understood in terms of the dynamics presented here, but also because they may influence the use and development of particular technological systems. As technological systems influence larger social systems, so are they influenced as well.[55]

The idea of structural sources of change is a central one, for just as the above dynamics lead to re-structuring, structural change, so do initial structures foster the conditions of change. Prime examples of such social structural sources are social and economic stratification and relative deprivation. While the Marxist class notion is problematic in advanced industrial societies, it has been argued alternatively, for example, that by their very nature authority structures are sources of conflict.[56] Alternatively, there is little lack of consensus among sociologists of action that social systems often contain value conflicts, unattained aspirations, particular role performance problems, and 'imperfect' socialization -- any of which can be regarded as sources of change.[57] The very criticism of functionalism -- in particular that the degree to which functional prerequisites are met is always problematic -- immediately suggests a number of avenues along which to explore structural sources of change in a given society. Similarly, social systems may always be struggling with insolubles, e.g., scarcity of time, loyalties, as well as goods and services.[58] The institutionalization of new political empires, for example, has never been homogeneous and has always led to the development of structural conflicts and new problems of maintenance. The very process of structural change "usually creates new collectivities and organizations... These necessarily develop needs, interests, and orientations of their own which may impinge on various other groups and institutional spheres."[59]

That changes in technologies and technological systems create such structural sources of change should be apparent. Thus, the idea that highly technological social systems are predominantly homeostatic in the structure-maintaining sense is untenable. Wilbert Moore has summarized these ideas about ubiquitous sources of structural change simply enough: "An industrial system institutionalizes conflicts and tensions; it does not eliminate them."[60]

Still another source of structural change might be called 'one-dimensional rationality.' In economic terms this appears as the inherent motor of change that capitalistic competition and innovation represent.[61] Referring to the cultural domain against a backdrop of traditional values, Wilbert Moore has noted the equivalent process: "...a rational, technical orientation to the natural or social order is an essentially irreversible intellectual revolution."[62] These are not only generalized sources of social structural change and differentiation, but are also in specific situations related to the development, use, and integration of technological systems. Non-technological sources of change are abundant; these may, though, converge with and influence technological systems as well.[63]

Relations of technological systems as social systems to other social structures have been discussed. Now the above dynamics and the problems and stresses these lead to should be clarified.

C. Summation and Implications for Further Study

In their concrete substance and by their capacities, technological systems exist in the social world in the five domains of culture, social structure, organization, resources, and space. The thesis of the hierarchic relations between these domains points immediately to avenues of

change, given a particular new technology. Furthermore, technological systems change can actually be differentiation in each of these domains; here the analyst of change is led immediately to consider the adequacy and concrete forms of integration that will follow in each domain. Where interactions are not smooth, where integration is minimal or poor, social stress and problems may be expected.

The two dynamics converge when the change in one process is simultaneously change in the other. Legislation concerning environmental quality, to take a very simple example, will not only lead, down the hierarchy, to budget allocations for new agencies, but will also pose integrative problems of coordination with other federal, state, and regional policies. The growing problems of coordination reflected in the widespread discussions concerning regional government are significant. They demonstrate that integrative responses to particular problems represent a differentiation of the integrative or political domain itself, and so lead in turn to still higher level problems of integration and coordination. This is the crucial irony of the implications of the differentiation-integration dynamics for planning and governance.

The proliferation of governmental units leads to changing labor and resource allocations, while simultaneously posing integrative problems. Similarly, the increasing cultural pluralism so often noted in metropolitan areas leads to these same avenues of change. The hierarchy notion implies that cultural pluralism means far more than a pluralism of ideals and abstract values; changes in moral codes and legal norms, changes in lifestyle, behavior and organization, and changing resource demands and uses all can be expected. At the same time, cultural pluralism leads to integrative problems first along the value

dimension, and then to those corresponding to each of the subsequent domain changes just noted. That transport and communications technologies, for example, can lead to such cultural pluralism or differentiation via its function of spatial integration has already been argued. (pp. 34 ff.)

Therefore, a general proposition capturing these dynamics in terms of the domains of social action can be presented. If the characteristics of a newly implemented technology, and so technological system, are such functionally and structurally that it represents change in any of the five social domains, then social stress and change will occur 1) in each domain below the one(s) changed, and 2) in the form of integrative responses, of varying degrees of adequacy, and subsequent problems, in each domain where change has occurred. This proposition can generate a large number of derivative corollaries. One interesting example is that from a significant change in one domain of the hierarchy, we can expect to find subsequent lower level integrative problems.[64] This is the interrelationship of technology in technological systems as social organization, the domains of social action, their hierarchic relationship, and the dynamics of differentiation and integration.[65] Both dynamics lead to sites of possible social problems; but which of these problems are probable can be known only given the data of the particular situation. Such data would include the particular cultural influences upon the structure of the technological system, the strength of regulatory agencies, the availability of local resources, and the like. This theoretical analysis can thus be used in various cultural settings, allowing for and providing a means to incorporate their differences, without either ignoring cultural factors or yielding to cultural determinism.[66] This analysis, again, leads systematically

and rapidly to questions of stress and possible change.[67]

The questions of integration lead quickly to those of jurisdictions and participation; for as long as action and change occur within given jurisdictions -- considered in each of the domains we have discussed -- minimal integrative problems may be expected. Thus the ways in which technological systems redefine the jurisdictions in which actors participate is important; for here they stretch and stress moral codes, accepted values, lifestyles, and equitable distributions of resources. A delicate balance may exist between the legitimacy granted an action prescribed by the social and political investment in a technology, and that of established and conflicting values and norms.

Technologies redefine the social systems in which persons participate; jurisdictions and memberships and the bases of legitimacy and solidarity may shift.[68] One visual way to pose these sets of problems may be to imagine them as aspects within each of five maps, one for each domain, lying transparently on top of one another. Given then that technological systems change the boundaries in one or more of these maps, the subsequent changes in boundaries in the other maps can be traced as well. That the maps are inseparable components or layers of social action systems has been demonstrated above. These are maps too that include corresponding potential problems: access, equity, order, legitimacy, and solidarity.[68a]

V. IMPLICATIONS FOR POLICY AND PLANNING THEORY

A conceptual scheme and a theory of technology and social change have been developed here -- in the sense of providing a systematic set of connections along which change may occur and problems may develop. The analysis has implications for planning and policy; four ideas are particularly worth noting here. These have to do with redundancy, externalities, contextuation, and planning as an integrative activity.

A. Redundancy

Organizations face a tradeoff between the stability that redundancy of function offers and the potential savings in operating costs that could accrue to streamlining, i.e., the elimination of duplication and overlap of functions.[69] Thus, if stability is highly valued, the promises of planning-programming and budgeting specialists to 'trim the fat' may be dangerous. Granted that too much redundancy will indeed be wasteful, minimal redundancy is likely to result in fragile organizations, i.e., organizations with high probabilities of disruption, crisis, and failure. The implications for large scale technological systems are profound. First, if all the previous technologies serving the same function are made virtually obsolescent, the single new technology -- by virtue of its lower cost of use, for example -- may by substitution eliminate whatever existing redundancy of that function existed previously. Alternatively, if a new technological system allows radically new behavior,

or enables the creation of new social structures, but by virtue of its innovative character has no redundant 'support,' the very existence of those social structures and behaviors may be not well assured.

With large scale transportation technologies, for example, these problems have been evidenced by the nineteenth century dependence of American farmers on the railroads, and recently in the decline of public transit services in the face of growing automobile technology. An increasing note is being made today concerning the relative deprivation of the carless. What is significant here is not that autos are necessarily beneficial, but rather that the social and economic costs of the lack of redundancy of transport facilities are being felt.

Since relatively minor changes in technology will not usually drive pre-existing and competitive technologies out of existence, redundancy should be less of a problem here than in cases where a large scale technology represents a radical break from existing ones serving the same function. Thus the better a new technology is in terms of significant changes in capacity and cost, the more likely it is that redundancy and stability problems will arise. This higher probability can be neutralized, though, by a greater social investment and commitment to act quickly should breakdown occur. Still, where compensation to those like the carless does not accompany the new technology, as usually it does not, these social inequities and problems of redundancy may still be expected to arise. As the carless indicate, part of the redundancy problem of a new technology will be shifts in user populations.

An interesting problem arises here. The redundancy arguments suggest, as indeed classical evolutionists did, that increasing structural differentiation ought to lead to more adaptive, stable social systems. The implicit question is this: Given differentiation, does

the following need for coordination and re-integration 1) create a redundancy of integrative mechanisms and so lead to stability, or 2) create one more semi-autonomous integrative mechanism leading to co-ordination problems of its own? One might expect that to the degree that common goals are well articulated and consensus is relatively highly achieved, the general redundancy in the political or integrative domain will lead to greater social stability, rather than conflict and the impossibility of planning.

To sum up, there are two possible problems of technological systems in relation to the lack of redundancy in serving their ends. The first is a problem of efficiency. The lack of redundancy may create functional fragility. A system may develop which is highly -- and dangerously -- dependent upon the single link of the technology, so that its failure could be highly damaging. The second problem is one of equity, that of the redundancy of user alternatives. The function of a new technological system may remain the same but user populations may shift. Some persons previously served may have no access to the services of the new technologies and may have no alternative services available to them. The carless in an auto dominated society, for example, may be a new deprived class.[69a]

B. Context

The above analysis raises a particular set of problems concerning the contexts of technological systems. It was suggested that the domains of social action may be roughly taken as a structuring of context -- to be filled out empirically in particular situations. It was also argued that as technological systems change social contexts, they can be understood only as inseparable components of social contexts. But which context is chosen or assumed in the design of technological systems will

radically affect that design. Considerations, for example, of cost, beneficiaries, and time scale all are vital to design decisions. John Seeley has pointed to the underlying problem of cultural values and political philosophies by suggesting the theorem, "accepted context equals alliance."[70]

Taking a slightly different tack, Martin Krieger has suggested that one approach to working with planning and policy problems may be to 're-contextuate,' perhaps to reformulate, understand, and 'solve' problems by changing the contexts we see them in.[70a] Given an apparently technical transport problem, one might ask not what technical transport system changes might be made, but rather what legal or environmental actions might be taken to resolve the problem. Contextual policies might effectively deal with many of the problems related to automobile growth. The establishment of minimum residential density requirements in suburbs, for example, could radically alter the shape of local transportation systems and thus also land uses. Given a tentative statement and understanding of a problem, then, one approach to 'solution' ought to include a set of questions concerning possible contextual changes which might be made to eliminate or alter the problem. The analysis above provides a systematic framework within which to detail such questions.[71]

C. Convergences and Constraints

The ideas of the context of technological systems lead to questions of compatibilities and convergences. The dimensions of context show possible constraints and their origin. A detailed analysis of context would show sources of acceptance and rejection and warn of possible conflicts and stresses. With knowledge, then, of how contextual elements might change, problems and potentials of

convergence can be explored. The context of a policy or problem is not static. Thus, new technologies, new laws, and changing resource availabilities may all be external, contextual sources of change affecting policy issues at hand or a particular technological system.

D. Externalities and Stresses on Fundamental Values

This analysis suggests a final set of problems. Reviewing planning styles and related issues, Richard Bolan noted that the increasing specialization and fragmentation of decision-making systems decreases the capacity to plan but increases the need to plan. What is the underlying problem here? With increasing differentiation and specialization, not only do the problems of integration of these new structures arise, but the exploding numbers of externalities pose problems as well.[72] These externalities may be positive and negative, but will nevertheless lead to the integrative problems of equity, order, solidarity, and legitimacy as they have been discussed above. Thus, interdependence comes about not only through the necessary integration of specialized structures, but also through the necessary managing of the externalities of these structures.

Emphasis has been given to integrative dilemmas in the political domain, where there is the tension between the specialization of regulatory bodies and their own coordination. As significantly, similar dilemmas of integration exist in the other domains. In the cultural domain, for example, there is a tension between adherence to one's own value system and tolerance of conflicting systems. In the economic domain the tension occurs between internal and external costs, between classical economic rationality and the managing of externalities. In the organizational domain there is the tension between aspects of

the highly formal and the less formal, between strong rationalization of relations and less well specified and controlled relations.

These dilemmas point to the possible integrative solutions to problems of increasing differentiation and technological change. In a highly technical society in which technological change is the norm, higher level integrative crises will be frequent. Differentiation of structures inevitably leads to higher level problems of coordination or morality. When higher level integration is lacking the 'prisoners dilemma' or the 'tragedy of the commons' may occur. Small system rational behavior may lead to large system catastrophe. Given a constrained view of systems, it is rational for subsystems to optimize, i.e., suboptimize. Not only do they do so functionally, but their externalities may be addressed by proliferating governmental agencies in the same manner.[73] Technological change means structural differentiation and concomitant integrative problems. These can be expected to lead increasingly to the dangers of large system catastrophe, and thus to still higher level integrative problems. Beginning at the metropolitan level, these problems quickly become regional and national, and these, for example, problems of resource availability, may quickly become international issues.

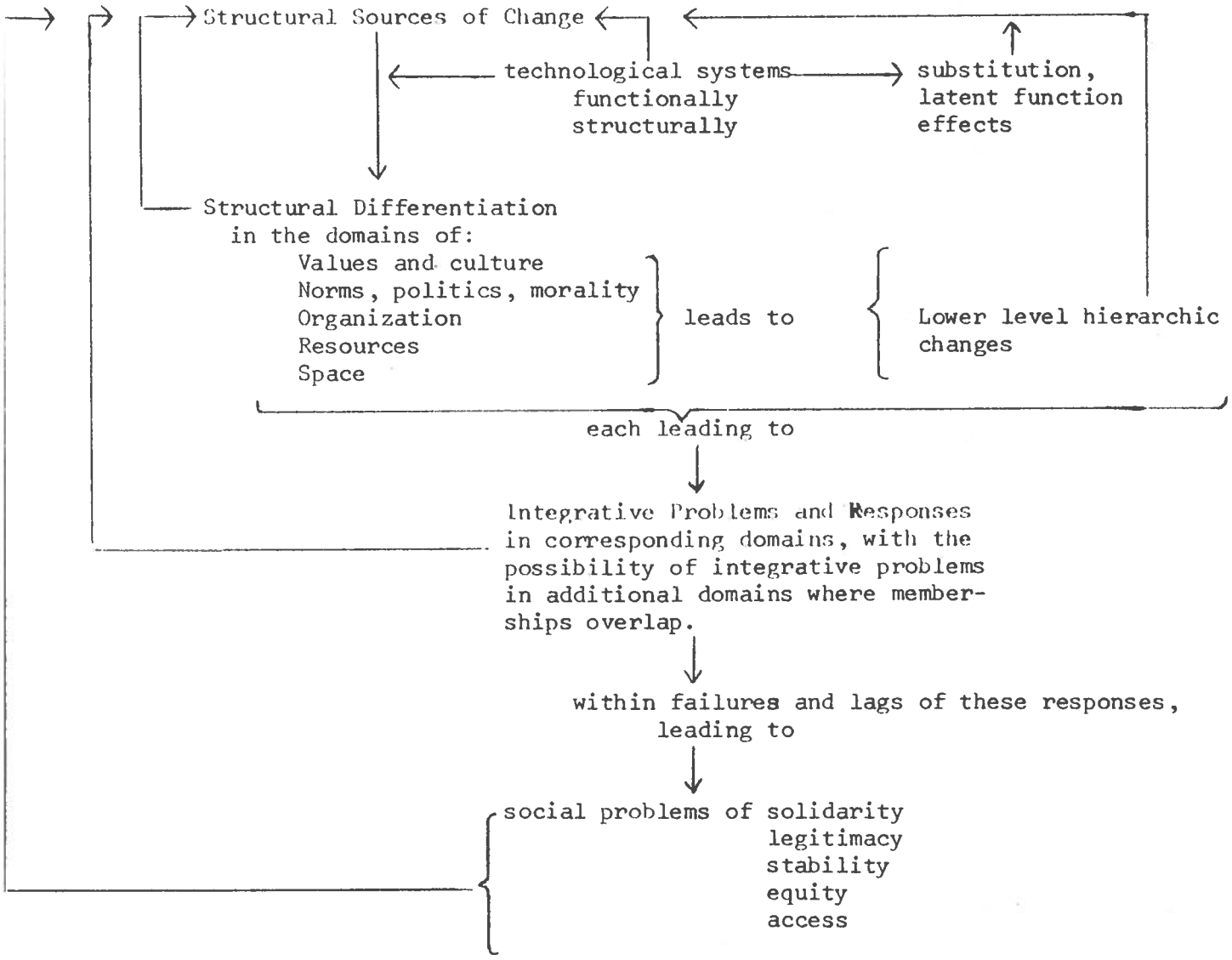
At an almost evolutionary scale, technological systems changes may lead to integrative problems of the most fundamental sort. For when the problems of harmful externalities become national and international in scope, the integrative solutions proposed and implemented to meet them will spring from and challenge justifications rooted in our most fundamental values, beliefs, and philosophies of man. Indeed, if technological change will mean increasing interdependence and

stresses at these highest levels of coordination and integration, a necessary revival of political ideology and religions of man might well be expected.

Relations of technology and social change

Dynamics: 1. the hierarchical relations of values, norms, organization, resources, space.

2. differentiation leads to integrative problems and possible stress.



FOOTNOTES

1. J. Steward, Theory of Culture Change: Methodology of Multilinear Evolution, Univ. of Illinois Press, 1963. Cited in N. J. Smelser, Sociology, Wiley, 1967.

1a. C. E. Ayres, Theory of Economic Progress, North Carolina Press, 1944, p. 21.

2. S. N. Eisenstadt, "Social Change, Differentiation, and Evolution," American Sociological Review, 29, 1964, pp. 381-2.

3. E. Dunn, Economic and Social Development, Johns Hopkins Press, 1971, p. 126.

4. Ibid.; Karl Popper, The Poverty of Historicism, Harper Torchbooks, 1964.

5. Eisenstadt, op. cit., p. 375; K. Bock, "Evolution, Function and Change," American Sociological Review 28, 1963, p. 231.

6. Bock, op. cit., p. 230.

7. A. Hawley, Human Ecology, Ronald Press, 1950, p. 29.

8. W. E. Moore, "A Reconsideration of Theories of Social Change," American Sociological Review 25, 1960, p. 812.

9. Cf. E. Durkheim, The Rules of the Sociological Method, Free Press, 1938; M. Weber, The Methodology of the Social Sciences, Free Press, 1949.

10. W. F. Ogburn, Social Change, Delta, 1966, p. 203.

11. Ibid., p. 211.

12. G. Sjoberg, "Theory and Research in Urban Sociology," in P. M. Hauser, The Study of Urbanization, Wiley, 1965, p. 170.

13. C. Kerr, Industrialism and Industrial Man, Cambridge: Harvard Univ. Press, 1960, p. 46.

14. Ibid., p. 267. It is ironic that the same development has given us the very real capacity to extinguish most life on earth. What then would the successful "ultimate empire" look like?

15. Z. Winner, Autonomous Technology and Political Thought, University of California, Berkeley, Political Science Department, unpublished Ph.D. dissertation, 1973; W. Rostow, Politics and the Stages of Growth, Cambridge Univ. Press, 1971, quoted in Winner above.

16. R. Lauer, "The Scientific Legitimation of Fallacy: Neutralizing Social Change Theory," American Sociological Review 36, 1971, pp. 881-9; S. N. Eisenstadt, "Institutionalization and Change," American Sociological Review 29, 1964, pp. 49-59.

17. J. Ellul, The Technological Society, Vintage, 1964. Ellul's thesis is provocative, challenging, and powerfully articulated. This review can do little justice to the force of his arguments. The utility of his position for particular policy analysis should be distinguished from that for reformulating classical philosophical problems of social relations.

18. Ibid., p. 5.

19. Ibid., p. 85.

20. Ibid., p. 5.

21. W. F. Ogburn, "How Technology Causes Social Change," in F. Allen, Technology and Social Change, Appleton-Century-Crofts, 1957, p. 15.

22. Where in recent years has the deterministic position led? McIver pointed out in 1942 that, statistically, technological determinism is rather difficult to prove. More recent versions of his point fall under the rubric of the "identification problem" in econometrics. Nevertheless, strong traces of mechanistic ideas persist in the analysis of change. R. M. McIver, Social Causation, Giran and Co. 1964; G. Carlsson, "Change, Growth, and Irreversibility," American Journal of Sociology, 73:6, May 1968.

23. Althusser takes the challenge of Marx to be the understanding of structural causality. L. Althusser, For Marx, Vintage, 1970.

24. C. E. Black, The Dynamics of Modernization, Harper, 1966; W. E. Moore, Impact of Industry, Prentice-Hall, 1965.

24a. Lauer, op. cit., p. 886.

25. G. Sjoberg, "Cities in Developing and in Industrial Societies: A Cross Cultural Analysis" in P. Hauser and L. Schnore, (eds.), Study of Urbanization, Wiley, 1965, p. 214.

26. H. Hart, "Acceleration in Social Change" in F. Allen, Technology and Social Change, Appleton-Century-Crofts, 1957.

27. Sjoberg, "Cities in Developing and in Industrial Societies: A Cross Cultural Analysis," op. cit., p. 215.

28. Sjoberg, "Theory and Research in Urban Sociology," op. cit., p. 164. As Sjoberg, among others, states, for example, "...it is technology that makes urbanization possible."

29. Sjoberg, "Cities in Developing and in Industrial Societies: A Cross Cultural Analysis," op. cit., p. 252.

30. E. Ullman, "Regional Development and the Geography of Concentration," in J. Friedmann and W. Alonso, Regional Development and Planning, M.I.T. Press, 1964, p. 154.

30a. L. Schneider, "Dialectic in Sociology," American Sociological Review 36, 1971, p. 671.

31. Sjoberg, "Cities in Developing and in Industrial Societies: A Cross Cultural Analysis," op. cit., p. 224. We will return later to an interesting problem in organization theory that arises here: if substitution leads to a lack of redundancy of means to the particular ends at hand, the new technology may lead to significant problems of effectiveness. Witness, for example, the decline of rapid transit in the face of auto growth and the resultant "car-less." Cf. M. M. Webber and S. Angel, "The Social Context for Transport Policy," Science and Technology and the Cities: A Compilation of Papers Prepared for the Tenth Meeting of the Panel on Science and Technology [Committee on Science and Astronautics, U.S. House of Representatives], 1969 (also available as U.C.-Berkeley, Institute of Urban and Regional Development Reprint No. 48.

32. Though the thought may be tangential, the logical dialectic of parts/whole leads to the same conclusions. A technology is contextually defined as it defines context; part and whole inform each other.

33. Stinchcombe has demonstrated nicely, by using cybernetic ideas, that the functionalist and Marxist perspectives are not incompatible. A. Stinchcombe, Constructing Social Theories, Harcourt Brace, 1968.

34. Taking a theoretical exposition as a device allowing one to learn from and understand varied empirical and cultural settings, the analytic structure here can be used to organize specific and diverse cross-cultural urban data.

35. This body of analysis represents a thread joining Adam Smith, Herbert Spencer, Emile Durkheim, and more recently, Talcott Parsons and Neil Smelser. Drawing especially from recent work of Smelser, the analysis should clearly demonstrate that concepts central to functionalist perspectives are applicable to the understanding of social change as well as of social equilibrium. To say that social systems are self-equilibrating is neither to say that they are static, nor to say that they are homogeneous and without internal and external conflicts. See, W. E. Moore, Social Change, Prentice-Hall, 1963; N. J. Smelser, "Toward a General Theory of Social Change" in his Essays in Sociological Explanation, Prentice-Hall, 1968; N. J. Smelser, "Growth, Structural Change, and Conflict in California Public Higher Education: 1950-1970," in N. J. Smelser, G. Almond, Public Higher Education in California, U.C. Press, 1974.

36. That such movement toward synthesis may not be without hope is evidenced by Gouldner's characterization of Wilbert Moore and Smelser's recent work as 'left-functionalist.' We draw from both these sources. W. E. Moore, Social Change, op. cit.; W. E. Moore, The Impact of Industry, Prentice-Hall, 1965; W. E. Moore, "A Reconsideration of Theories of Social Change," American Sociological

Review 25, 1960; N. J. Smelser, Social Change in the Industrial Revolution, Univ. of Chicago Press, 1959; N. J. Smelser, Essays in Sociological Explanation, op. cit.; N. J. Smelser, Collective Behavior, Free Press, 1962; N. J. Smelser, "Toward a Theory of Modernization," in Social Change, Etzioni and Etzioni (eds.), Basic Books, 1964; A. Gouldner, The Coming Crisis of Western Sociology, Avon, 1970.

37. The seminal works here are those of the modern functionalist tradition, particularly the work of Talcott Parsons in the 1950s, and, for our purposes here, the more recent work of Neil Smelser. Contrast the structure of action systems in Smelser's Collective Behavior with that of the earlier -- e.g., T. Parsons and N. Smelser, Economy and Society, Free Press, 1956.

38. Recall the definition of social structure as patterns of interaction; these may be formal or informal. The political in ordinary language is commonly taken to refer only to the former. Morality begins to cover the informal. The use of the word political, then, is in the broader sense, here.

39. The hierarchy begs the question of how values may change or come to be articulated as the basis for new action. Value change is hardly well understood in social science. Still, for the purposes of this exposition, the discussion of non-technological sources of change, pp. 38 ff, points to possible systemic sources of value stress and change.

40. See Appendix, p. 63ff.

41. Here is 'land-use' in its most abstract clothes.

42. It is important to note that social organizations overlap and are not completely isolated and distinct. Thus, members of participants in the social structure of a particular technological system are simultaneously participants and members of other organizations. The resource component of a technological system is not separable from the broader resource realm of the host society. Similarly the value and norm components of a technological system cannot be isolated from the corresponding domains shared by other social organizations. This suggests an important avenue of research: the systematic analysis of the overlapping memberships of technological systems and the encompassing social systems. As a first step, memberships may be characterized by each of the action domains, i.e., memberships in organizations devoted or oriented to these.

43. These domains are no abstract, empty, formal constructs; concrete organizations are devoted to each, e.g., church and family, the state, service agencies, businesses. It is interesting to note that in his review of schools of thought in urban sociology, Sjoberg found distinct schools devoted predominantly to each of the realms we have discussed.

44. Cf. R. M. McIver's use of conjuncture in Social Causation, op. cit.

45. Smelser, Essays in Sociological Explanation, op. cit., pp. 251-254. While Marx, Durkheim, Parsons, and Smelser might disagree in whose interests integration takes place, all would fundamentally agree that integration is essential to all social systems. What is problematic is the form of integration, how integration takes shape.

46. See section 6.

47. When and if this progression stops is not clear. Consider the proliferation of government agencies and jurisdictions in highly industrialized societies.

48. Cf. Sjoberg's discussion of mediators. G. Sjoberg, "Cities in Developing and in Industrial Societies: A Cross Cultural Analysis," op. cit., p. 232, p. 253.

48a. B. Berger, "Suburbia and the American Dream," in S. Fava, Urbanism in World Perspective, Crowell, 1968, p. 438.

49. We should note an interesting insight taken from game theory. The increasing spread of integrative agencies of a semi-autonomous nature can lead to the rationally self-defeating 'prisoners dilemma.' Without coordinated action from other agencies, there is little incentive for particular agencies to pay attention to negative external, spillover effects of their actions. Since everyone does this, everyone suffers. See, for example, this dilemma applied to ecological problems in Garret Hardin's "The Tragedy of the Commons," Science 162, December 13, 1968, and to problems of urban renewal in Davis and Whinston's classic, "The Economics of Urban Renewal." (O. Davis and A. Whinston, "Economics of Urban Renewal," Law and Contemporary Problems 26, W 1961.) These problems are elaborated in a following section. For one analysis of the re-integrative problems following differentiation in the integrative or political domain, see Lowi's discussion of the impossibility of planning in T. Lowi, The End of Liberalism, Norton, 1969.

49a. Claude Fischer, "Urbanism as a Way of Life: A Review and an Agenda," Sociological Methods and Research 11/72, vi:2.

50. Perhaps the classic expositions here are Toennies' theses regarding the shifts from communal-based to contract-based social systems, and Weber's work on the processes of rationalization in society. The modern refinement of these ideas is found in the many works and criticisms of Talcott Parsons. Especially significant here is Parsons' idea of the pattern-variables. He argues that modern industrial societies reflect the latter end of the transition from diffuse, particularistic, affective, and ascriptive characters to specific, universalized, affectively regulated, achievement-based ones. F. Toennies, Community and Society (Gemeinschaft und Gesellschaft), Michigan State University Press, 1957.

50a. Durkheim argued that by diminishing the gape separating social segments, transport and communications technologies would cause the density of society to increase, causing increased division of labor through the dynamics of competition. The analysis here is alternative explanation relating these technologies to social differentiation. E. Durkheim, The Division of Labor, Free Press, 1964, Book Two, Chapter Two, p. 259; L. Schnore, "Social Morphology and Human Ecology" American Journal of Sociology 5/63, 1958, p. 631. This should clarify fallacies of physical determinisms which would have one believe that changes in physical arrangements will cause particular social changes.

51. Note the discussion of regional governments, and the possibilities of planning discussed by Lowi in The End of Liberalism, op. cit., Part II.

52. Thus ideally one would like to understand a 'structure of latent functions' that might be disrupted in the process of structural differentiation. Without elaboration here, we can suggest that the ideas of dimensions and domains of action may be the skeleton of such a structure of latent functions, and so provide suggestions for study, given a specific technological system change. In his outline of a discussion of social change, Daniel Bell also noted the lack of attention paid to changed latent functions taken as a source of social change. Bell, Russel Sage Seminar, 1968.

53. The relationship of transport and communications technologies to the redefinition of place and the increasing interrelatedness of previously isolated areas is common knowledge. What is powerful here is the translation of this spatial integration into the avenues of social differentiation in the domains discussed above. See, for example, Bernard and Pelto, Stover on the railroads, Moline on the small town, Webber noting, "...it is interaction, not place, that is the essence of the city and of city life." H. Bernard and P. Pelto (eds.), Technology and Social Change, McMillan, 1972; J. Stover, The American Railroad, Univ. of Chicago Press, 1961; N. Moline, Mobility and the Small Town, Univ. of Chicago Department of Geography, Report #132, 1971; M. M. Webber, "The Urban Place and The Non-Place Urban Realm," in Explorations into Urban Structure, University of Pennsylvania Press, 1964.

54. Without exploring it in depth, Toennies noted that the decline of the "common spirit," the dissolution of folkways and community, could be related to the freedom of people, "being aware of possible greater advantage, to conclude agreements and foster new ties." Toennies, op. cit., pp. 224-5. What this is saying, of course, as we have developed it, is that the use of new technologies will necessarily lead to changes in the existing forms of social integration. Thus we can expect commitments to new technological systems to lead to more formally integrated social structures and so to the dissolution of traditional forms of interaction. Whether or not such new forms of integration are characteristic of metropolitan life in general has been questioned by a review of existing data by Fischer. C. Fischer, op. cit.

55. In the references cited, Schnore, Eisenstadt, and Smelser all note the relative lack of attention that has been given to the sources of differentiation.

56. R. Dahrendorf, Class and Class Conflict in Industrial Society, Stanford Univ. Press, 1969.

57. W. E. Moore, for example: Social Change, and R. K. Merton, On Theoretical Sociology, Free Press, 1967, p. 144.

58. W. E. Moore, Social Change, op. cit.

59. Eisenstadt, "Institutionalization and Change," op. cit., p. 239; Eisenstadt, "Social Change, Differentiation and Evolution," op. cit., p. 381. In a recent discussion of The Peoples Republic of China, Schurman has similarly pointed to structural sources of change, social and economic contradictions. Among these are contradictions of values, roles, social and political stratification, economic goals, sector conflicts and questions of scale. (F. Schurman, Ideology and Organization in Communist China, U.C. Press, 1971, pp. 99-103.) Interestingly, Lewis Coser has argued to the effect that conflict between systems or groups can have positive integrative functions within them. (L. Coser, The Functions of Social Conflict, Free Press, 1966.)

60. The homeostatic thesis derives from a too quickly applied organismic analogy. Walter Buckley uses general systems notions to argue that in addition to displaying homeostatic behavior, social systems are 'morphogenic' or structure-changing as well. Here the simple organismic analogy breaks down and necessarily gives way to various strands of social Darwinism -- as long as biological metaphors are adhered to. The evolutionist fallacies have been discussed above, pp. 5-7. Walter Buckley, Sociology and Modern Systems Theory, Prentice-Hall, 1967.

61. One of the most brilliant recent expositions of these dynamics was Joseph Schumpeter's 'process of creative destruction,' (Schumpeter, Capitalism, Socialism, Democracy, Harper, 1962.) The same idea is developed in Robert Heilbroner's The Limits of American Capitalism, Harper, 1966, and John Kenneth Galbraith's New Industrial State, Houghton-Mifflin, 1969.

62. Moore, "A Reconsideration of Theories of Social Change," op. cit., p. 813. In general systems terms, Back has pointed to the importance of "cognitive learning" insofar as it leads to "general differentiation." K. Back, "Biological Models of Social Change," American Sociological Review 36, 1971.

63. Cf. Richard Meier on convergence, "Social Consequences of Scientific Discovery," American Journal of Physics, Vol. 25, No. 9, December 1957, pp. 602-613.

64. Consider, for example, integrative problems following federal policies effectively subsidizing suburbanization.

65. For change induced in upper levels of the hierarchy from lower level changes, see the discussion in the Appendix.

66. Cultural determinism taken to its logical conclusion becomes quickly ridiculous, for if culture truly determines everything, one could never learn from one situation with regard to another, and indeed, the cultural determinist thesis itself would be untenable.

67. It is interesting to note that Ogburn's thesis of cultural lag is a consistent, if overly simplistic version, of the differentiation-integration dynamics elaborated above. Both his notions of technology as an impetus to change as well as his notion of lag have been refined by illustrating the multiple domains in which lags may occur. 'Durkheim's problem' remains; while the relations of technological systems to processes of integration and differentiation may be more clear, whether or not increasing differentiation leads to increasing chaos or ordered interdependence remains a question. Cf. Sjoberg, "Cities in Developing and in Industrial Societies: A Cross Cultural Analysis," op. cit., p. 238.

68. Where indeed the individual participant finds himself in this balance ought to indicate whether or not the structuring effect of the technology, again, of social investments, is alienating or not. Cf. Seeman's discussion of "self-estrangement" as a form of alienation, and Marx's early writings. (M. Seeman, "On the Meaning of Alienation," American Sociological Review 24, 1959, pp. 783-91; K. Marx, Economic and Philosophical Manuscripts of 1844, International Publ., 1964.) In what sense may the character of personal participation, e.g., control, change as well? Adapting from Durkheim, might the bases of identification and morality shift with these changes in participation and membership? Further research regarding relations of technology, change, and personal experience ought to deal with these notions of investment, jurisdiction, membership, participation, and identification, in each of the domains of action.

68a. Cf. Marx, ibid., pp. 31-34.

69. M. Landau, "Redundancy, Rationality, and the Problem of Duplication and Overlap," Public Administration Review, July-August, 1969.

69a. Peter Willmott, "Car Ownership in the London Region," OECD, Paris, September, 1972.

70. J. Seeley, "Social Science? Some Probative Problems," in M. Stein and A. Vidich, Sociology on Trial, Prentice-Hall, 1963.

70a. M. Krieger, "Is it Worthwhile to do Public Policy Research?" University of California, Berkeley, Institute of Urban and Regional Development, Working Paper No. 167, 1972.

71. This can often be the fundamental hidden agenda for Marxists. The world is socially constructed; the most important contextual redefinition of problems, indeed of the whole social world, comes with correct praxis and class consciousness. See Lukacs History and Class Consciousness, M.I.T. Press, 1971, and a more recent continuity with it, Sartre, Search for a Method, Vintage, 1963, with the concept of totality and totalization.

72. R. Bolan, "Emerging Views of Planning," Journal of the American Institute of Planners, July 1967.

72a. Recall the above discussion of latent functions, their shifts and subsequent integrative problems, p. 36.

73. Cf. footnote 49.

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APPENDIX

CONVERGENCES WITH MARXIST SOCIOLOGY

There are interesting areas of possible congruence between action theory and Marxist sociology, which is often polemically regarded as incompatible with 'functionalist ideas.'[1] Fundamental to Marxist analysis is the distinction of structure and superstructure, the material basis of society and its idealistic and cultural reflections. What is often crudely referred to as economic determinism in Marx's thought is the primacy given to the predominant modes of production as determining forces of social change rather than to the forces of the superstructure. Though the terms are often ambiguously defined,[2] fundamental to the understanding of the structural basis of any society is the recognition and analysis of the means and instruments of production on the one hand, and the social relations of production on the other. Similarly, predominant in the analysis of superstructural forces is the recognition of two distinct entities, the state and church on one hand, and correspondingly ideology and religion on the other.[3] To begin to argue dynamics now puts one in the middle of a long history of debate in Marxist scholarship. 'Vulgar Marxists' would argue roughly that the source of all change lies in the material conditions of society. Others

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[1] NB. This refers to Marxist sociology in its structural and empirical aspects; no pretenses are made that the philosophical leanings of particular functionalist sociologists and certain Marxist sociologists may not differ radically.

[2] Cf. Saran.

[3] See, for example, Lefebrve, The Sociology of Marx, Vintage (1968).

grant an equally important role to 'class consciousness'[4] While these problems cannot be sorted out here, correspondences to the domains of action articulated above can be shown, and the differing implications for change explored.

There are clear connections between the notions of values and culture and that of ideology, and between those of the political and moral domain and that of the state and church. Similarly, there is correspondence between the notion of the organization of action systems and the social relations of production, and between the domain of resources and that of the means of production. There may be affinities between Marx's sociological sense of praxis in the broad and general sense and the modern (Weberian and Parsonian) concept of action.[5] But the analysis of social change brings out differences.

Central to the Marxist analysis is the notion of conflict and the dynamics of change. Yet there is hardly consensus in Marxist scholarship concerning the precise roles of the various structural forces in society. Nevertheless, the ideas of class conflict, the protecting and maintaining roles of the state, and the relations of means and social relations of production are not mutually exclusive with the ideas of differentiation and integration as developed here. That class conflicts are central to any analysis of change is to assert that there are specific, contradictory integrative forces in a society, and that the outcome of their struggle will be determined by relative power, strength of organization, and consciousness. That the state serves particular interests is

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[4] See, e.g., G. Lukacs, History and Class Consciousness, MIT, 1971.

[5] We suggest this as a radical but arguable position to consider. Referring to the parallels drawn above, compare Lefebvre, whose use here of politics includes ideology, "Economy, society, politics are thus aspects, levels, elements, or 'moments' of reality. These moments are distinct, though they are not separate entities. None of these levels lay claim to eternal truth." Lefebvre, Sociology of Marx, op. cit., p. 125.

not to say that it does not regulate interactions and so integrate components of the society; that many object to that 'successful' integration does not lead to the denial of the effectiveness of state agencies. That changes in the means of production may lead, up the hierarchy of domains as developed here, to changes in social relations, simply means that integration must occur in the social system of production encompassing those means. Similarly, such a change in social relations may often lead to changes in the behavior of the state; again, this is change in the direction up the hierarchy, but simply reflects an integrative problem in the political domain. Again, that such a change in the state may lead to changes in values articulated to rationalize such action, and that such values may spread or become socialized, is another case of the same phenomenon. How, then, more specifically, are changes that occur between domains in the direction up the hierarchy to be understood?

The problem is one of the potential constraints on action. For if all levels are inseparably present and so may limit action, change at any lower level of the hierarchy will lead to questions of the compatibility of existing states of the upper levels. Thus changes in the lower levels will lead to changes in the upper when values, norms, or forms of organization in those upper domains are inadequate to support or allow the lower level behavior to be sustained. The structure of action gives a logical path of change down the hierarchy, but also shows why changes in the other direction, in encompassing systems and jurisdictions, can occur as well. At any given time, the state may be perfectly adequate to regulate a small shift in the social relations of production; here integration within the given relations of power is assured. Yet there is little theoretical reason that 'Marxists' and

'functionalists' would disagree that large scale changes in the means of production will engender changes in the organization or social relations of production, and those changes in turn -- insofar as they represent a differentiation of roles and organization -- will call for integrative -- managerial and state -- responses. These in turn will be legitimated and rationalized with specific cultural values. Change in the direction up the hierarchy of domains, as Marxist analysis would suggest, can thus similarly be understood in terms of the differentiation-integration dynamics discussed here. Crucial concepts here are those of compatibility, encompassing systems or jurisdictions, and memberships in a broad sense. This simply suggests that 'Marxist' and 'functionalist' schools are not nearly as conceptually mutually exclusive as the common political polemics would have one believe. These parallels are illustrated here only to suggest that much further work in this direction needs to be done, and that such work ought to be highly rewarding as the dynamics and processes of each perspective inform the other.