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in partial fulfillment of the requirements for
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January 20, 1978

SOCIAL INDICATORS AND
THE GENERAL DESIGN PROCESS

by

Francis Louis Graves

An Essay submitted to the Faculty of
Arts and Social Sciences in partial fulfillment
of the requirements for the degree of
Master of Arts Sociology

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ABSTRACT

The aims of this thesis are essentially ternary.

- (1) The author wishes to explicate and articulate the concept 'design'. Particular attention is paid to the social and cultural basis of the design process. An evolutionary model of the design process is proposed culminating in the echelon labelled 'total systems design'.
- (2) The thesis discusses social indicators in the context of a technocratic-rational social movement aimed at involving the sociologist in the general design process. The socio-political nature of the movement is emphasized.
- (3) Finally, the thesis examines and analyses a particular expression of social indicator research as somewhat representative of some of the applied problems of the general approach. Attention is given to the epistemological and methodological problems involved in the design and application of these social indicators.

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TABLE OF CONTENTS

	Page
1. INTRODUCTION AND STATEMENT OF THE PROBLEM	1
2. SOCIAL INDICATORS AND THE GENERAL DESIGN PROCESS	18
3. RESEARCH STRATEGY -- POPULATION, MEASURES, ANALYSIS	49
4. SUMMARY AND CONCLUSIONS	94
APPENDIX A - DATA SOURCES	
APPENDIX B - DESCRIPTIVE STATISTICS	
APPENDIX C - VARIMAX ROTATED FACTOR MATRIX TRANSFORMATION MATRIX	

CHAPTER 1

INTRODUCTION AND STATEMENT OF THE PROBLEM

In this thesis, we argue that the applied processes of policy, planning and management, as they pertain to the public environment, can be considered as variations of the 'general design process'. This process is fundamentally concerned with the conscious, purposeful manipulation of the environment. The design process is evident at differing levels, ranging from the micro level of individual products and buildings (e.g., industrial design and architecture), to the national and transnational level of public policy and management. At all of these echelons of the design process, there is an important social and cultural element which has often been ignored. This thesis examines the socio-cultural basis of the general design process and considers the potential contribution of sociology to that process via social indicators.

The current lack of dialogue between the applied-design sciences and the pure social sciences has been noted by several sociologists (e.g., cf. R. Boguslaw, 1965; W. Michelson, 1971; R. Gutman, 1972). Although both are concerned with the problem of human adaptation to the natural and man-made environment, they have pursued these issues in relative isolation. What are some of the consequences of this bifurcation? For the social sciences,

this has resulted in a rather impotent role in the applied fields of policy, management, planning and design (economics has been a notable exception to this rule). For the designer and policy-maker, this has often meant poor policy/design as the designer/policy-maker is generally not cognizant of the profound psychological, cultural and social impact of his physical design or policy. This condition is not to the advantage of the often-forgotten participant-user of the designed milieu (viz., the people living in the mess). Designers, planners and policy-makers must be sensitive to the needs of the participant-user, as well as the total environmental context, in defining quality of life¹ and contributing to its enhancement.

The author suggests the social indicators² research can be viewed as a social movement arising as a response to these problems from social science.

This thesis will examine the social and cultural basis of design and the role of the social indicators movement in the contemporary general design process. A

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¹ Quality of life refers to the degree of fit between actual and ideal conditions.

² Social indicators - in its most general usage, any measure of social conditions. The major distinction is between subjective (i.e., perceptual) and objective indicators (see Chapter 2).

reasonable starting point for this exercise could be an examination of the concept design, which in its most general sense, subsumes the processes of planning, policy and management. The shared organizing principle which unites these processes under the rubric 'general design' is that they all are concerned with the conscious human ordering of the environment.

The balance of the thesis will be concerned with:

(1) explicating the concept 'general design'; (2) examining the social indicators movement as a response from social science to the perceived design-impotence of that discipline; (3) conceptually mapping the functional position of social indicators qua social intelligence in the process of systems design; and (4) presenting and analyzing a set of social indicators of quality of life for medium-sized Canadian cities. Thus, the thesis is concerned with the interrelationship of sociology and design via the social indicators movement.

Given the multi-disciplinary nature of our universe of discourse, the discussion will be cast in the language of general systems theory where it is appropriate. The systems approach is well suited for our requirements as both designers/planners and sociologists employ it³. Theorists

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³ See W. Buckley, 1967, Sociology and Modern Systems Theory; and Francis Ferguson, Architecture, Cities, and the Systems Approach, 1975.

have already realized the necessity for incorporating social indicators in the general design process (cf. J.P. van Gigh, Applied General Systems Theory, 1974: 179-208). A further strategic advantage of employing a general systems approach is that it provides a formal language for the exchange of models, theories and concepts across disciplinary and professional boundaries. This will permit the development and articulation of various perspectives outside of sociology when they are germane to our inquiry.

In a recent discussion of the professional relations between architects and sociologists, the sociologist Robert Gutman underlines the need for improved dialogue between the design and social sciences regarding problems of the built environment:

"....in what ways should we restructure the context in which architects now make use of sociologists? How can we ensure that research on buildings conducted by sociologists will make maximum use of the experience, knowledge and wisdom of the architect? In other words, how are we to produce a true social architecture and a genuine architectural sociology? These are the questions that architects and sociologists should ask. (emphasis mine)."

Robert Gutman (1972), p. 368

W.H. Michelson (1976), address this same problem of feeble sociological input to the design process at the higher level of the total urban environment (ibid: 214-216). He suggests that social science should provide information concerning the social consequences of planning and designing. In this thesis, we argue that social indicators may

provide this type of social intelligence.

Sociologists are not terribly concerned with the concept design (except in a rather specific sense, e.g., research 'design'). Traditionally, the design sciences have employed a rather limited notion of design as an exclusively physical process (e.g., C. Alexander, 1964: 1). In its most extreme form, this position results in the vulgar theory of architectural determinism which posits that the physical environment (e.g., buildings) determines human behaviour. For a cogent critique of this position, consult Maurice Broady, "Social Theory in Architectural Design", 1966). As Michelson argues (Michelson, 1976: 217):

We must not exaggerate the importance of physical environment by itself to quality of life. Yet, it is by now evident that the nature of physical environment is by no means irrelevant to people, their characteristics and their activities. Cities can only gain by minimizing 'planned incongruences' in future designs. And social science can only gain through the heightened understanding of social phenomena afforded by the additional perspective of physical setting.

By rethinking and generalizing the concept design, one might provide a common arena for trans-paradigmatic dialogue between the social and design sciences. One particularly promising strategy for involving sociologists in the design process is the social indicators approach which provides information on the quality of the total environment from a social perspective. Lest our discussion be sacrificed on the alter of rhetoric, an in-depth

empirical example of social indicators research is provided.

Let us suggest a superior environment is not only possible but an exigency. Let us further suggest this improved environment could be architected or designed. Like other complex systems within the environment, the social system could be improved through judicious design. What are the possible parameters of such a system? Who will define and implement the plans and purposes of this system? Can we measure the performance and progress toward such social goals? How can the people most aware of the complexities and counter-intuitive behaviour of socio-cultural systems (i.e., social scientists) become involved in the design process? Finally, can social indicators provide the vehicle for involving the sociologist in the design process? These are some of the issues to be broached in this thesis.

In 1965, Robert Boguslaw argued that the design process was pre-occupied with computer based systems and automation. This has "...left the contemporary social scientist, together with the vast majority of our population occupying the role of bystander." (R. Boguslaw, 1965, p.v.). But, as we pointed out, the bystander is also the participant-user of the designed milieu. Thus, a novel and insidious form of alienation occurs, alienation from the design process. If anything, the situation has become exacerbated in the last decade. The engineers, planners and architects that Boguslaw calls the "new utopians"

must include the bystanders in the design process or these new utopians will continue to resurrect ever more spectacular examples of their past errors. It is further suggested that they recover some of the esprit of humanism demonstrated by the "old utopians".

The formerly condemned computer-based systems have played an integral role in the development of the art in sociological methodology. Certainly the types of social indicators analysis conducted in the latter part of this thesis would have been impossible to do 15 years ago. It is possible that the ability to manipulate tremendous amounts of complex information with a computer has permitted a redesign of the scope, objectives and methods of sociology, endowing it with a much stronger capability of informing the general design process. Let us now consider some of the current theoretical statements on the concept 'design' before examining the potential role of the social indicator movement in that process.

What is Design?

Let us begin this explication of the concept design by considering the Oxford Dictionary's definition:

Design 1 - Mental plan; scheme of attack; purpose; end in view; adaptation of means to ends; preliminary sketch for picture, etc.; delineation, pattern; artistic or literary groundwork, general idea; construction, plot, faculty of evolving these; intervention.

- 2 - Set apart for person; destine
(person or thing) for a service;
contrive plan; purpose; intend.

These definitions are clearly too flexible and vernacular for our uses but they all seem to emphasize the notion of intentional and meaningful behaviour. It also is helpful to note that the meaning of design is inextricably tied to the notion of a plan. How does the architect's notion of design compare to these usages?

The architect, while retaining the essential goal-directed meaning of design, chooses to focus on the physical aspects of the process. It is important to note that the architect emphasizes the processual nature of design. Christopher Alexander, in a ground breaking and influential essay (Notes on the Synthesis of Form, 1964), suggests that we consider the "...process of design; (as) the process of inventing physical things which display new physical order, organization, form in response to function." (emphasis mine, C. Alexander, 1964, p. 1). This seminal work continues to demonstrate how design is an ensemble, or an attempt to reconcile the level of context (problem) with that of form (physical solution), Alexander's inclusion of 'physical' in his definition of the design process is suspect. It does nothing but needlessly restrict an otherwise accurate definition of the design process. This preoccupation with the physical aspects of design has often been at the expense of the non-physical aspects (viz., the

psychological, the social and the cultural).

A more contemporary discussion of design by Francis Ferguson substitutes the term "procedural coherence" for the older term "design". Although Ferguson does stress the systemic aspect of the design process, he is also culpable for over-emphasizing the material component of procedural coherence:

...models of procedural coherence (are) specifically directed at determining the configuration of physical systems -- that which we traditionally know as planning and design. (emphasis mine)

Francis Ferguson (1975), p. 20

The architect, Geoffrey Broadbent, extricates himself from the problem of excluding the non-physical aspects of the design process by including human systems in his discussion of the architectural design process:

...architectural design could be reduced to a matter of reconciling three systems, the human system, the environment system (that is everything in the external environment), and the building system itself, subsuming all the interactions which take place between the controlled, internal ambience and the building fabric in terms of structure servicing and so on.

Broadbent (1975), p. 387

In a discussion of designing within the planning disciplines, Edmund Bacon (1974), examines the evolution of city form and urban design. He posits that 'simultaneous movement systems' (i.e., pedestrian paths, vehicular paths, public and private transportation) are the salient

organizing principles which determine urban design. Speaking on design, he suggests that "the basic ingredient of architectural design consists of two elements, mass and space. The essence of design is the interrelation of the two." (Bacon, 1974, p. 15). Instead of the reconciliation of form and context which Alexander sees as the essence of design, Bacon views design as the dialogue of mass and space. Once again, the physical aspect of design is viewed as the "essence" of design.

It appears that many architects and planners perceive the design process as a material manipulation of the physical environment in order to achieve balance between the interrelated parts (be they environmental, contextual, formist, mass, space, etc.). Apart from Broadbent, this fitting process has not been concerned with the impact of human systems per se.

One of the most interesting comments on the design process is provided by industrial designer Victor Papanek in his book Design for a Real World. He suggests that design is the "...conscious effort to impose meaningful order". As Charles Gordon points out, this definition approximates the sociological definition of social action (Personal Communication, 1976). The Dictionary of Sociology and Related Sciences (1970) defines social action as "any conscious or unconscious concerted or collective effort" (p. 275). The sociological definition of social

action includes both conscious and unconscious effort. (The unconscious aspects of primitive design will be discussed later.)

Finally, let us examine a general systems theorist's definition of the design process. Eric Jantsch suggests that design may be viewed:

...as the ensemble of interactive processes between consciousness, a malleable "appreciated world" in our mind, and reality ----and in three human spaces: physical, social and spiritual (cultural) space. Such a ternary system of processes is capable of conceiving and implementing positive creative action... (emphasis mine).

Jantsch (1975), p. 79

Once again, note the parallel between Jantsch's definition and that of social action.

At this point, our general definition of design is offered:

General Design: Design is that process whereby humans individually or collectively systematize their world by means of conscious, purposive action.

The world is also systematized in a variety of non-purposive, non-conscious and non-human ways; however, these phenomena are not properly design process, although they are intimately related to design.

Varieties of Design

In order to organize this part of the discussion, an evolutionary perspective will be adopted. This is not to

suggest that the order of the model as described is invariant. Four fundamental stages can be distinguished in the evolution of design: primitive design, specialized design, formal design and systemic design.

Primitive Design

Primitive design reflects the structure of primitive society as well as the ecological exigencies of the particular area in which it occurs. Several factors distinguish this most pristine form of design.

Designers or architects per se are non-existent. Occupational specialization is minimal in primitive society and what division of labour exists is distinguished on the basis of age and sex. Design knowledge is part of the primitive society's adaptive strategy and this technological information is transmitted in the same fashion as other adaptive information (viz., through oral tradition, myth, borrowing, diffusion, imitation of pre-existing forms, etc.).

Primitive design is pragmatic design according to Geoffrey Broadbent (1973, pp 25-29). He maintains that primitive design was highly practical and that the primitive designer made the best of what limited materials and technology were available to him. Trial and error was the process by which design was established. The goal of primitive design was essentially similar to that of contemporary design, that is modification of the environment. For the primitive designer, this concern was primarily with the

physical environment. Safety and climate regulations were of primary concern.

Christopher Alexander suggests that primitive design was unselfconscious (Alexander, 1964, pp 46-55). This notion views primitive design within the context of a slow-moving, firmly set tradition. While these observations are correct, Alexander emphasizes the lack of creativity and consciousness with which the primitive designs. This is problematic. If the primitive designer makes beautiful and functional forms not by "any special ability" but by merely "standing in a long tradition", what was the genesis of these designs? If one argues that they spring from legend, myth, and oral tradition, one must still explain the creative origins of these sources.

Specialized Design

The next step in the evolution of the design process the author calls specialized design. Specialized design is distinguished from primitive design by the separation of the role of designing from the collective consciousness of society at large. The act of designing now becomes the task of select individuals within the society. The evolution of specialized design probably reflects the shift in orientation from a collectively patterned social order to a differentiated and specialized modern society. Designing now becomes a marketable service which is manifest in the evolution of craft.

Craft evolution also occurs through a gradual process of trial and error in an unselfconscious tradition (Alexander, 1964). The plans or designs are not formalized but held in a relatively fixed mental image by select members of the society. This information is transmitted in what Broadbent calls an iconic fashion. In an iconic design system, each member of the design tradition possesses mental plans (in the sense that Gallanter, Pribram and Miller (1962), Plans and the Structure of Human Behaviour, employ the term), of what a house, vehicle, etc., should be like.

Formal Design

The next level in the evolution of the design process involves the coding of these plans in a non-ambiguous, symbolic fashion. Design in which rigorous symbolic codes are employed antecedent to the actualization or synthesis of form the author refers to as formal design. Formal design involves the use of prepared drawings, which corresponds to Broadbent's rule-governed 'canonic design'.

Systems Design

This author specifies one further echelon in the development of the design process. This stage (which is yet to be fully realized) is called system design. Systems design is the formal attempt to design for all possible interrelations and interactions of the components of the designed system and its environment. In its full

florescence, this entails consideration of the inorganic (physical), organic (biological) and superorganic (psychological, social and cultural) worlds germane to human existence. Given the enormous complexity and the counter-intuitive nature of such a design process, a system or team of functionally differentiated but harmoniously integrated environmental designers may be exigent. (The computer is an invaluable aid, given the tremendous amount of information involved in such complex design decisions.) Each component of the design system would deal with a particular stratum or aspect of the context, while retaining an image of the design-plan as a whole.

To summarize this chapter, let us suggest that 'design' in a general sense, can be considered as the human process of ordering the environment with consciousness. This design process should entail the important non-physical worlds (i.e., social, cultural and psychological) which influence the quality of life but in practice rarely does. This is because the design and policy sciences have over-emphasized the impact of the physical design in a modified form of what might be called the physical-environmental-determinism school. The sociologist has been of little assistance in defining the social context of design or influencing the overall design/policy environment.

This thesis argues that the sociologist must become involved in the general design process if social quality of

life is to be enhanced in urban society. The thesis proposes that the provision of design-pertinent socio-cultural information may be the sociologists salient role in the design-policy structure of post-industrializing urban society. There are a variety of potential sources for this social intelligence within sociology. This information may be generated both deductively (from theory) and inductively (from observations), however, we argue that due to the general paucity of true theory in sociology, the use of deductive social information may be premature. Rather, 'general social theory' may provide a conceptual framework for guiding the selection and interpretation of empirical indicators. The single most promising strategy for this type of approach involves the development of social indicators.

The next chapter argues that the social indicators movement can be considered from the perspective of a social reform movement aimed at meeting many of the problems raised in this thesis (viz., lack of sociological input to design, policy and planning processes; desire to develop a more applied sociology capable of improving the 'real world', etc.). We hope to show how the movement can be meaningfully located within a systems model of the general design process. To summarize, we can say that the thesis will attempt to explicate the general design process from a sociological perspective and to show the utility of viewing

the social indicators movement as a possible sociological contribution to that process.

CHAPTER 2

SOCIAL INDICATORS AND THE GENERAL DESIGN PROCESS

Having articulated the general design process as the act of teleological interaction with the human environment, we commented upon the sociologists feeble role in that process in contemporary society. In this chapter, we critically evaluate the hypothesis that the social indicators approach may be conceived of as an elite social reform movement fostered by the social scientists' shared perception of feeble impact upon the design and policy networks of the modern technocratic political system. We will also attempt to formalize the functional position of social indicators within a model of the general design process.

Social Indicators as Social Movement

In this section, the thesis examines the social indicators approach qua social movement. The label 'social indicator movement' has been widely accepted by those scholars and professionals working in the area in a somewhat casual fashion. In this paper we explore the utility of viewing social indicators research from the perspective of a social movement in a more critical and formal sense. Hopefully, this will provide a technique for organizing our discussion of the movement in terms which are not purely historical. As a consequence of this we hope to

enhance our understanding of the structure and purpose of the movement within the context of more general social change labelled 'postindustrialism'. This exercise should also improve our understanding of the relationship of the movement to the design process.

The label 'social indicators movement' can be traced to a 1969 statement by Otis D. Duncan. In Toward Social Reporting: Next Steps, Duncan opens his monograph by noting:

It may be helpful to think of the swelling chorus of proposals concerning social reporting (or its virtual synonyms: social indicators, social accounting, social intelligence) as a social movement. We might then see our present situation as one of transition from the early stage of excitement and incubation to the intermediate stage of rational debate undertaken to sort out and test alternatives. The latter hopefully, would be followed by a stage of routine, continuous activity.

Apart from the possible prognostic value, the social movement paradigm is useful in forestalling the disappointment that might otherwise ensue if the subsequent issue in the field of social reporting seems meagre by comparison with the present anticipation. In the initial stage of a social movement the recognition of a need for change is better developed than the definition of what change would alleviate the condition giving rise to the unrest....Although we must recognize enthusiasm as essential to the growth of the movement, it is vital not to confuse the rhetoric used to propogate this enthusiasm with the wording of a contract between social science and the public.

(ibid: 1-2)

Having stated the advantages of considering social indicator approaches as a social movement, Duncan drops the topic. A more critical examination of the applicability of the social movement paradigm is in order.

Let us consider some of the salient defining characteristics of a social movement. H. Blumer suggests that social movements are "...collective enterprise to establish a new order of life." It is not too difficult to establish that social indicators can be considered in the context of group behaviour directed in a purposeful fashion towards social change. Consider Stuart Rice's description of the ultimate goals of the social indicators enterprise (1967: 173):

Social indicators, the tools, are needed to find pathways through the maze of society's interconnections. They delineate social states, define social problems and trace social trends, which by social engineering may hopefully be guided toward social goals formulated by social planning.

King (1956: 27) suggests that social movements should be considered as:

...a group effort extending beyond a local community or a single event and involving a systematic effort to inaugurate changes in thought, behaviour and social relationships.

We will demonstrate the cross-temporal and trans-spatial nature of the movement later in the paper. Suffice to note at this point that significant social indicator activity is evident through time (particularly from the

mid 1960s to the present) and through space (the movement is evident in almost all Western, post-industrializing nations).

Toch (1965: 5) labels social movement as "...an attempt by a large number of people to solve collectively a problem they feel they have in common". We hope to demonstrate that those individuals involved in the movement satisfy this criteria on several grounds. Some of the common perceived problems delineated by the movement include: the problem of the so called 'economic philistinism'; the increasing evidence of rising social pathology in the western urban environment; the political impotence of the sociologist; and the lack of a social intelligence necessary for architecting an improved 'quality of life'.

To summarize, let us note that the social movement paradigm applies to a diffuse range of apparently disparate activities thus making a single formal definition problematic. Despite these explicative problems, it seems that we can specify the characteristics central to the concept of a social movement (McLaughlin 1964: 4). Furthermore, we posit that these qualities are evident in the social indicators movement. These characteristics include:

- 1) A shared value system
- 2) A sense of community

- 3) Norms for action
- 4) An organizational structure
- 5) Attempt to influence the social order
- 6) An orientation toward definite goals.

Making one final distinction between reform and revolutionary movements, we are prepared to argue for the suitability of viewing the social indicators approach as a social reform movement within the context of more general technocratic-rational social and cultural change typifying the emergence of post-industrial society. According to Bell (1973: 14), 'post-industrialism' may be defined by the following traits:

- 1) Economic sector-change from goods to service emphasis
- 2) Occupations-preeminence of the professional and the technocrat
- 3) Axial principle-centrality of theoretical knowledge
- 4) Future orientation-control of technology
- 5) Decision making-growth of the new 'intellectual technology'.

The role of the social indicators movement as a basis for a new 'intellectual technology' for decision making is noted by several writers (including Bell). For a particularly succinct statement of the social indicators program in this capacity, the reader is referred to the

Economic Council of Canada's Eighth Annual Review,
Design for Decision Making: An Application to Human
Resources Policies, 1971.

Having established the social movement paradigm as our conceptual framework for organizing this discussion, let us now critically overview the movement within that context.

(i) Origins and History of the Movement

One can trace the origins of the social indicators movement to the origin of 'statistics' themselves. Initially the term 'statistics' referred to 'matters of state'. The most pristine measures of this sort are evident in the Political Arithmetic of the 17th century. These early statistics were measures of the outputs of government record systems and were particularly evident in France.

The present movement is more specifically concerned with measuring the progress and quality of society. A precedent for the current movement is seen in the work of W.F. Ogburn in the early thirties. Ogburn's seminal Recent Social Trends (1933) represents the first systematic attempt to establish an objective system of social indicators of quality of life. It is important to note that Ogburn's research was conducted under the auspices of the President's Research Committee on Social Trends (established 1929). Even at this incipient stage in the development of the movement, there is an intimate association between the

movement and the office of the President in the American political system. Although this early research was not conducted under the rubric 'social indicators', it did show the essential politically-potent role of the approach as a technique for monitoring the state of society vis-à-vis the goals of society.

Clearly, one of the outstanding 'shared perceived problems' which characterized the early stages of this social movement was the issue of the low political efficacy of the sociologist. While envying the political potency of the economists in the American political system, other social scientists underlined some of the serious problems attached to defining quality of life and national goals strictly in economic terms. While such economic indicators as the sacred Gross National Product had been demonstrated to be somewhat successful in coping with some of the severe problems associated with the economic malaise of the 1930s, it was becoming increasingly obvious that a more comprehensive measure of well-being was necessary to meet the acute social and cultural pathology of the 1960s (e.g., urban crime, riots, civil disobedience, racial problems, student unrest, etc.). As an alternative to this 'economic philistinism', the social indicators movement offered a variety of non-economic measures of social health.

The rubric 'social indicators' was such a protean

concept (in much the same fashion as was 'quality of life') that it provided a unifying concept for a variety of seemingly disparate research and political enterprise. The movement has grown exponentially since the label was coined in the highly influential Social Indicators (1966). This collection of essays edited by Raymond Bauer was originally concerned with evaluating the second order (i.e., unintended) consequences of the American space program. The authors argued that the realization of this goal required a more fundamental knowledge of the state of society. This sort of social intelligence would be provided by social indicators. As a function of this attempt to measure social response to a large scale government program, many of the fundamental epistemological and methodological problems of the entire approach were delineated. The authors of Social Indicators emphasized the pressing need for indicators measuring the multidimensional aspects of society and the longer term requirement for a social accounting system. Two of the key points stressed by these authors were: (a) the role of indicators as feedback; and (b) the exigency of this sort of social knowledge for anticipating (in contradistinction to predicting) alternate futures.

Further impetus was added to the movement by the work of the National Commission on Technology, Automation and Economic Progress. This American commission was

organized in 1964 and summarized its findings in a report entitled Technology and the American Economy (1966). The commission was designed to investigate the rate of technological innovation and its effects on such aspects of society as the economy (particularly employment and production) and community and human needs. Furthermore, the commission was asked to propose actions that might cushion the impact of these changes. Again, this commission pointed to the lack of a system for monitoring the state and progress of society as a confounding factor in achieving the commission's goals. As a function of the group's disenchantment with its power to determine goals and evaluate performance, the commission (Daniel Bell claims principal authorship of these proposals) made the following recommendations (1966: 96-97):

In an effort to improve the means of public decision-making, we propose the creation of a 'system of social accounts' which would indicate the social benefits and social costs of investment and services and thus reflect the true cost of a product...

A system of social accounts, if it could be established, would give us a broader and more balanced reckoning of the meaning of social and economic progress and would move us toward the measurement of the utilization of human resources in our society in four areas:

1. The measurement of social costs and net returns of economic innovations;
2. The measurement of social ills (e.g., crime, family disruption);

3. The 'creation of 'performance budgets' in areas of defined social needs (e.g., housing, education);
4. Indicators of economic opportunity and mobility.

Perhaps as a response to this early work a bill was filed in the United States Senate by Walter Mondale and ten other Senators (Bill S.843: Full Opportunity and Social Accounting Act). This bill was a system of social accounts in 1967. A year earlier, President Johnson had established a group at the Department of Health, Education and Welfare (H.E.W.) to develop "...the necessary social statistics and indicators".

It is important to note the intimate relationship between the early movement and the Johnson administration. A clear influence of the American political structure and the ideals of the 1960s is manifest in the movement. Indicators were considered as a potential strategy for achieving the ambitious 'Great Society'. As Gross and Straussman observe, "...the social indicators movement is a prime example of an elite movement in the present period of technocratic politics in the service of concentrated corporate and presidential power" (1974:46). Support for this contention is evident in the content of the seminal Toward a Social Report. This report was the final output of the Johnson administration and H.E.W. Part of the report was composed of the working papers of

a panel of 41 social scientists co-chaired by Daniel Bell and William Gorham. The volume dealt with a broad range of issues germane to the quality of the total environment. It dealt with some areas of social concern as: social mobility; health; the physical environment; poverty; income; education; public safety and order; arts and science; and finally, participation and alienation. The report recommended continued effort and funds be allocated to the task of developing a comprehensive social report (similar to the existing economic report) capable of measuring social change and establishing social goals. It also cited the potential application of indicators as tools for assessing the worth of public programs and their impact on social well-being. We can see the emergence of the movement's operating norms and values stressing societal guidance and rational management. As K. Land points out (1975), these claims are almost identical to those presented three years earlier in the Report of the National Commission on Technology, Automation and Economic Progress.

Despite a slight shift in the types of social concerns emphasized, the movement continued to provide social intelligence in the service of elite technocratic politics for the Nixon administration. This administration's National Goals Research Staff produced Toward Balanced Growth: Quality and Quantity. In addition to many of the concerns dealt with in the Johnson report,

this document included sections on population growth, consumerism, technology assessment and economic growth.

According to the political scientist Michael Springer (1971), the idea of a social report was initially proposed by Bertram Gross (1965, a; 1965, b), who perceived the problem of defining social well-being within the narrow context of economic health. Gross argued for the establishment of a system of social accounts modelled after the established systems of economic accounts. Although Gross can be criticized for not dealing specifically with the logistics of implementing such a system, he does provide a promising conceptual framework for the movement -- General Systems Theory. A detailed discussion of the advantages of utilizing a systems approach for indicators research is beyond the scope of this paper. Suffice to note that the systems perspective is particularly commensurate with the movement's need for examining interrelationships and interdependencies among indicators within an overall analytical framework. This polemic is presented convincingly by Land (1975) who suggests that this type of indicator approach, which he labels a social indicator model approach, should be distinguished from its analytically weaker sister, the descriptive approach. The bulk of work in the early movement was descriptive in nature.

Gross' general system model demonstrates the

applicability of systems theory to a general framework for social accounting. The model specifies linkages between seven structural variables (people, non-human resources, sub-systems, external relations, internal relations, values and guidance) and seven performance variables (satisfying interests, producing outputs, investing in systems, using inputs efficiently, acquiring resources, observing codes and behaving rationally).

Social accounting is perhaps the most ambitious aim of the indicators movement. It is viewed as a long range goal which probably will only be achieved through what deNeufville calls the "interactive processes of design and application". In discussing the rationale for this approach, Gross and Straussman argue:

Social accounting has gone beyond the more limited view of social indicators as a set of performance indicators. The discussion of system structure alluded to such questions as the concentration of power, hierarchy, the dynamics of conflict and the requisites of rule as typified by the analysis of any so-called central guidance system.

These authors further suggest that the selection of the conservative term 'accounting' was a tactical move to attenuate the radical overtones that necessarily flow from investigation of these structural components of the model. The authors do not propose data sources for this approach.

To summarize the incipient stages of the movement

(i.e., 1960-1970), we suggest that it was characterized by four major concerns:

1. Developing social goals
2. Evaluating public policy
3. Assessing the state of the social system
4. Evaluating the change and direction of the social system.

Furthermore, it is helpful to note that the movement demonstrated a structure somewhat isomorphic to the general structure of social movements. It shared common values such as efficiency and technocratic rationalism; common operating norms of empiricism and quantification are evident; and ideology strongly influenced by the American political system and the ideals of the 1960s. It is also clear that this social movement is only one facet of the more general social and cultural change accompanying the emergence of post-industrial society with its emphasis on central guidance and rational management.

State of the Art-Indicator Research in the Seventies

Although some of the initial fervour attached to the initial stages of any social movement generally abates as the movement routinizes, the use of social indicators seems to be increasing and moving beyond its initial symbiotic relationship with the office of the President in the United States. As evidence of the growth of the movement consider a recent bibliography (Wilcox, 1972)

which found over 1,000 books and articles on the subject. We would guess that this number may have increased by that figure since 1972.

In the United States, the leading edge has been provided by the universities and private foundations such as the University of Michigan, the Russel Sage Foundation, the Urban Institute, Iowa State University, the Private Planning Association and Wayne State University (D.W. Henderson, 1974: 6).

Let us now consider the social indicators movement outside of the United States. Indicator research is manifest in most Western industrialized and post-industrializing nations. Research on indicators is also being conducted by international organizations such as the United Nations (U.N. Research Institute for Social Development) and the Organization for Economic Cooperation and Development (O.E.C.D.). This latter agency (which is strongly influenced by the U.S. presence) has been particularly concerned with developing internationally comparable social indicators of quality of the environment capable of assessing the relative state and performance of different countries. The construction of these cross-national social indicators should assist the fields of macrosociology and comparative studies however serious problems of equivalence (both conceptual and phenomenal) must first be resolved. For example, O.E.C.D.'s

Environment Committee (Paris, Dec., 1976) proposes that an indicator of Indoor Space be included in any set of urban environmental indicators. Certainly an indicator of crowding is in order, however, the report recommends that the measure be operationalized in terms of a minimum floor area per individual. Although the proposed measure would make adjustments for differences in age and sex of the inhabitants, it makes no such adjustment for cultural differences. This is a serious problem as anthropologists have demonstrated that the perception and use of space is a cultural phenomena (cf. E.T. Hall, 1959). Thus, any valid cross-cultural measure of crowding must account for this fact.

Other similar work is being conducted by the United Nations. Under the direction of Richard Stone, an ambitious indicators project has been launched: "Towards a System of Social and Demographic Statistics" (1973).

At the national level, indicator research is evident in most technologically advanced western nations. In France, the Institute Nationale de la Statistique (IMSEE), is well known for work on social indicators of aging and education. In Britain, the Central Statistical Office publishes Social Trends quarterly, a social indicators periodical. Japan has also been active in attempts to develop an overall quality of life index. The Japanese Economic Planning Agency has recently published its

White Paper on National Life: The Life and Its Quality, (Ministry of State, Japan, 1973). Similar indicator research is found in Sweden, Germany and Italy as well as Canada (we will discuss the Canadian scene separately). A common general method underlies most of this work in that it relies on the use of objective social indicators, or what might be called the physical-empirical approach, in which secondary data were gathered, organized, manipulated, computerized and statistically analyzed.

Perceptual Indicators

The other major type of indicator strategy seen in the contemporary movement falls under the rubric 'subjective' or 'perceptual' indicators of quality of life. For a state of the art discussion of the methods and disciplines involved in developing perceptual indices of environmental quality, the reader is advised to consult Craik and Zube (1976). Attempts to quantify subjective perceptions of quality of life have relied heavily on survey and questionnaire techniques. Norman Dalkey (1972) conducted a Delphi study of quality of life which attempts to weigh the various components of the environment germane to quality of life (social, psychological, economic, geographic, environmental and political). The results of this exercise indicate a relatively even weighing of each sector. Further examples of the perceptual/subjective approach to social indicators are seen in the University

of Michigan's survey project on the quality of working life, (Social Indicator Research, Vol. 1, No. 2, Sept., 1970, pp 135-169, Quinn and Shephard The 1972-73 Quality of Employment Survey). Similar approaches to perceptual indicators are evident in the same journal. The reader might also consult Campbell and Converse, The Human Meaning of Social Change (1972).

The Canadian Scene

In Canada, there is considerable interest in social indicators although there are some distinct differences from the parent American movement. The Canadian movement is less of a vigorous social movement and more of a policy tool in the service of the various levels of Canadian government. As a crude indicator of the Canadian presence in the movement, it is noteworthy that the movement's chief international journal, Social Indicator Research, is produced in Canada. The editor and managing editor are Alex and Barbara Michalos of Guelph University and in total, there are six Canadian contributors to the editorial board (vs. ten American contributing editors).

Statistics Canada, in conjunction with O.E.C.D., is developing an inventory of social indicators. They have published Perspectives Canada (Volumes 1 and 2), a compendium of time series social indicators of a descriptive nature. The Economic Council of Canada (ECC), seems particularly active in the area, having a sizeable group

called the Social Indicators Group; however, this is almost exclusively a group of economists doing economic analyses under the misnomer of social indicator research. This is further evidence of the stranglehold on policy research exerted by the economists in Canada. Judging from the trivial and fatuous nature of the research conducted by this group in Canada, it is clear that 'economic philistinism' is stubbornly installed in the Canadian decision and policy environment.

Indicator research is also being conducted by the Science Council of Canada, the Department of Labour and the Department of the Environment. The author has been involved with the Ministry of State for Urban Affairs' quality of life study for Canadian urban communities. This project includes both perceptual and objective social indicators of quality of life for Canadian cities (greater than 1,000 population). At the provincial level, work on social indicators has been conducted by both the Ontario and Alberta governments.

To summarize, we argue that it is suitable to consider the social indicators approach as a social movement with a somewhat distinguishable structure and function. A core set of shared values stressing efficiency, managerialism, technocratic rationalism, and, at times, humanism, is evident. A sense of community and identity has been instilled into the movement primarily through the common

literature and journals. A series of significant conferences has also been instrumental in this respect. A sense of community is also fostered in that this movement has occurred almost exclusively in the advanced post-industrializing nation/states which have demonstrated an ubiquitous rationality in their policy-decision environments. As discussed, the organizational framework has been provided by the trans-national organizations such as O.E.C.D. and the U.N. at the cross-national level. A similar functional role has been played by governments and private foundations at the national level. An attempt to influence the social order and an orientation toward definite goals is clearly seen in the American movement and to a lesser extent in other western nations. Primary concern has been with the development of a new definition of well-being and national goals which is sensitive to the broad range of social, cultural and psychological factors germane to individual and collective quality of life. Consequently, there has been a concomittant move to elevate the sociologists position in the design and decision hierarchy (while attenuating the previous 'economic philistinism').

It appears that the movement will continue to serve the needs of decision-makers in government circles. This orientation has increased emphasis on operating norms of conservatism and elitism, however, the movement initially

demonstrated elements of humanism and radicalism in that it challenged many of the side-effects of capitalism in pointing out the need for considering social costs of the industrialist system as well as a new global definition of well-being which transcended the narrow economic definition prevailing in government circles. This new definition of quality of life emphasizes a novel post-materialistic, total-systems orientation to public policy and social measurement.

As Wolfgang Zapf (1972) notes, the official government reports have usually omitted indicators of politically embarrassing conditions such as elite recruitment, social conflicts, armaments, interest representation, etc. As the original movement served the interests of the 'New Frontier', it is exigent to balance this potential bias with critical social indicators. The most likely source for this potential source of critical social intelligence would be the university (with the possible aid of the media).

Finally, we note two main trends or alternate futures for the movement. First, the movement could continue to crystallize as an elite technocratic movement in the service of the status quo. As an alternative to this 'managerism' scenario, we have the 'humanist' scenario. This vision sees the movement as a component of large scale social transformation toward a 'human

oriented' post-industrial society which emphasizes architecting improved quality of life for the individual and group within the total world system.

Having considered the sociologist's contribution to the movement, we should note that the movement is trans-disciplinary and important contributions are evident outside of sociology. We will briefly consider these other models of social indicators and then return to the more important task of mapping the role of sociology (via social indicators) in the general design process.

Other Models of Social Indicators

In examining social indicator approaches outside of sociology, we note that the particular value context and operating norms of that discipline will influence the design and applications of social indicator models in that discipline. Thus, a variety of specific models adapted to the particular concerns of individual disciplines are evident within economics, psychology and related disciplines.

A cursory review of these perspectives will aid in grasping a more global understanding of the varieties of the social indicators movement.

(i) Economic Models

Much of the interest in social indicators has been stimulated by the success of indicators of economic health within economics (such as the Gross National Product). Economics presents other contributions to the movement as well.

The economic perspective has traditionally been concerned with quantifying the economic principle of the greatest good for the greatest numbers (this corresponds to the 'desired environment' of our model - Figure 1). Throughout the development of economic models, economists have been concerned with models of interpersonal utility measurable in cardinal and ordinal terms. All of these models assume transitivity and consistency (of the decider, homo economicus). Recently (i.e. during the last 4 decades), concern with measures of aggregate performance of economic systems such as GNP (S. Kuznets, 1946) and real income per capita, have been paramount with near catholic support (Ben-Chieuh-Liu, 1976: 13).

The depression was instrumental in fostering the development of economic indicators as instruments for predicting and controlling the economy. Recently, economic indicators have placed emphasis on positivistic

rather than normative models (viz., distinguishing scientific goals from social goals). This has resulted in a heavy emphasis on technical analyses such as input-output studies, linear programming, econometric simultaneous equation models, game theory and operations research. Despite this, the thorny problems of human action and values are still highly evident in a contemporary measure of economic welfare (cf. Nordhans and Tobin, Measure of Economic Welfare).

In conclusion, economic indicators have traditionally been the most politically potent indicators of collective prosperity and social well-being. Recent concern with social costs and a more diversified measure of social quality of life demand a rethinking of economic indicators; however, attempts to develop a comprehensive social welfare measure are ill advised as they will attenuate the usefulness of such existing measures as GNP, which have proven valuable for long and short term economic analysis (E. Dennison, 1971).

Psychological Models

The psychological perspective in social indicators features a concern with the personal or individual perspective. It is a truism to suggest that individual psychological satisfaction is a necessary condition for Quality of

Life. Work in psychology has centred on measuring perceived Quality of Life as well as identifying the salient components of well-being.

In a recent Sage publication, which is a companion volume to Sheldon and Moore's seminal Indicators of Social Change (1968), Campbell and Converse and Rodgers discuss quality of life within the context of personal experience. They are concerned with such qualities as disappointment, aspiration, satisfaction, etc., and conclude that verbal reports of these experiences can be valid and reliable. Similar positive conclusions concerning the reliability and validity of measures of self-reported well-being are reported by Andrew and Candall (Social Indicators Research 3 (1976), 1-19), using Joreskog's LISREL algorithm to estimate construct validity.

Other contributions of psychology to indicators research include schemes such as Abraham Maslow's hierarchy of human needs (in ascending order: physiological, safety, belongingness and love, esteem and self-actualisation). Much subsequent work in indicators has been influenced by such psychological schemes which prioritize individual needs.

Penelope and Shelly (1973), in the Sources of Satisfaction, argue that the evolution of satisfaction

follows an invariant progression through three sectors: the genetic, the personal and the social.

Other examples of psychological research germane to the indicators movement include: Cantril's investigation of patterns of human concerns cross-nationally (1965); Bradburn posits a functional model of well-being as a product of two independent dimensions, positive and negative effects - both linked to quality of life by a set of independent variables (N. Bradburn, The Structure of Psychological Well-Being).

Recapitulating, psychological contributions to the indicators movement are primarily subjective in nature and focus heavily on the problem of individual well-being. One problem with these approaches is that they are often guilty of ethnocentrism and a potential contribution of anthropology to the movement could lie in testing and developing cross-culturally meaningful indicators of both psychological and social well-being. To our knowledge, this has not been attempted to date. As even our society possesses a plural ethnic subsystem the question of conceptual equivalence is germane. For cross-nationally comparable indicators such as OECD is proposing, this is even more important.

GST Model of the Position of Indicators in the General Design Process

Let us now examine a systems model hypothesising the relationship of indicators to the general design process. The model is clearly not testable and is intended to be of heuristic rather than rigorous analytical significance.

The model is a hypothetical representation of the interrelationships of the various concepts and processes involved in an indicators-based design system. Grossly simplified, the processes of designing, planning, policy, etc., may be viewed as an attempt to maximize the degree of fit between the desired and actual environments.

In order to implement creative, purposive, social action (be it corrective, reinforcing, or laissez-faire), the decision process requires information concerning the discrepancy between these two environments. Although there are a variety of methods possible for evaluating this difference, the method proposed here (i.e., indicators) relies on rigorous quantitative measures of an objective and subjective nature. This distinction is manifest in the use of surrogate objective indicators of well-being as well as perceptual indicators based on self-assessed verbal reports of quality of life.

Dynamics are introduced into the system as responses to disturbances (perturbations). Systems may respond to disturbances in a variety of ways. The system may respond morphostatically - i.e., it will attempt to eliminate the disturbing factor by negative feedback. Alternately, the system may respond morphogenetically - i.e., it will reinforce the initial disturbance or 'kick' through a process of mutual reinforcement (positive feedback). This is the source of system change in which the system will create new disturbances in response to older ones thus elaborating the structure of the system (hence morphogenesis). For a seminal discussion of this distinction by a sociologist, the reader is advised to consult W. Buckley (1967).

The utility of indicators in the general design process is most evident when design/policy is user-oriented and sensitive to the complex socio-cultural matrix within which designs unfold. Although social information must be tapered to the needs of the particular discipline or profession exploiting it, in general, the rationale is to provide valid and reliable social information which will inform and assist the designer in defining the goals and impacts of their products. Gutman (1966:49-82), addressing himself to architects, summarises this need for expert guidance:

The current rage for sociology is not fully explained, however, by recognizing the natural ambition of the architect to substitute professional, scientific expertise

for the informal, casual interpretation of human purposes and motives which has always been intrinsic to the architectural tradition. It also reflects the emphasis now current in the profession on making buildings that are responsive to the specific and unique needs of their users.

This same desire for professional expertise is increasingly evident at other levels of the design process such as public policy and national goals. Social indicators, judiciously selected and interpreted by sociologists can fulfill this role.

To summarize, we suggest that social indicators research can be viewed as an attempt to provide quantified social knowledge to the applied processes of policy, planning, and architecting we have called systems design. Indicators may permit us to define design-pertinent aspects of the total environment and social structure. Properly designed indicators permit statements about the social-cultural context; relative performance of various sectors of the environment; highlighting deficiencies and social costs; delincating design constraints (eg. economic, climatic, etc.); etc.

In the next chapter we will examine a research program conducted by MSUA using a set of quality of life indicators for medium sized Canadian cities.

FIGURE 1

SIMPLIFIED MODEL OF THE ROLE OF INDICATORS
IN THE GENERAL DESIGN PROCESS

Definition of Parameters

Perturbations - disturbances in the most general sense. This includes any innovative factors introduced into the system. This would generate conflict and socio-cultural change although linear causality is inapplicable as the system is not 'well ordered' (viz. has no 'first' element). The products of the design system are perturbations in as much as they represent modifications in the tracking of the system by virtue of their novel presence.

Actual Environment - essentially, the total operational environment in itself. Environment refers to a reciprocal phenomena; a set of characteristics of the material universe acting upon the individual and an accumulation of successful strategies (culture) to the problem of selecting successful conditions.

Desired Environment - this rather nebulous term subsumes the notion of the goals and collective aims/purpose of society. It is clearly not a unitary concept but rather a surrogate term for the broad range of concepts such as quality of life, maximum welfare, etc.

Values - values here refers to those shared, collective standards employed by societies as criterion for selection of goals. These cultural phenomena are also instrumental in the process of perceiving and

selecting problems and are integral in modifying the desired and actual environments.

Indicators - we employ the term in a general sense to refer to any empirical proxy measures of the state of the system. In the theory of measurement, indicators are considered as surrogate barometers of underlying concepts, theoretical variables or constructs. In this instance, the underlying constructs to be measured are the actual environment and desired environments. Again, values will influence the selection of indicators. We distinguish between objective and perceptual indicators, the former being direct measures of objective conditions, whereas the latter are individual, subjective perceptions of things themselves.

Information - this is the output of the indicator process.

$\Delta E_A - E_D$
Comparator - this is the process of evaluating the degree of fit between the actual and desired environments.

Control Mechanism - this is the systems control mechanism which discriminates the threshold values for distinguishing a positive, negative or neutral response to the output of the comparator. Positive response results in positive or mutually (morphogenesis) reinforcing feedback; negative response (morphostasis) entails negative feedback, is status quo or system maintenance. The establishment of thresholds is

variable through time and space and a complex function of values and sociological perception. This is analogous to the policy formation process.

CHAPTER 3

RESEARCH STRATEGY

Over 75% of Canadians live in urban areas and evidence suggests that this condition will continue to accelerate towards the year 2000 (Ray, 1975: 1). If the problems of rapid urban growth are to be managed effectively and humanely, designers, decision-makers and laymen must have access to the rigorous type of social information that indicators can provide.

In the previous chapter, we discussed the role of social indicators in the general design process. It was fairly clear how this relationship would operate at the level of public policy, however, the relationship between social indicators and the design of buildings and cities was somewhat fuzzier. This connection is lucidly developed by the architect and urban planner Edmund Bacon in his Design of Cities (1969: 258-59). Speaking about his cyclical feedback model of the design process Bacon observes:

Just how the reality of the impact of concepts, ideas, institutions, processes, proposals, and built environment on people's lives can best be communicated to the persons and institutions responsible for formulating new proposals for city building is very much undetermined. The social sciences and particularly the behavioral

sciences should be engaged. Unfortunately, these sciences have, in the past, visualized their role as that of observers of social phenomena, and therefore of studying the social acts of the past. To be effective in terms of city building, the social sciences will have to recast their thinking to recognize the general speeding up of the pace of development, the phenomenon of simultaneity, and develop methods of measurement of social change in terms of people's states of mind, of the fundamentals of the quality of life, through social indicators which are sufficiently sensitive to respond to change quickly. These should be designed to provide the administrator with a continuous flow of insights so he may reformulate the hypothesis in the light of the reality of the impact of the program on people's lives. This may well be the major thrust of the innovative effort of the social sciences over the next several decades. (emphasis mine)

In this chapter, we will consider a research program being conducted by the Ministry of State for Urban Affairs which attempts to meet this need for social information. This author does not intend to present all of the results of the Ministry's project in detail (this is forthcoming in two large volumes). Instead, we will restrict discussion to the salient objectives and methods of the study. The analytical framework which we impose on the data is somewhat different from that employed by M.S.U.A. It is only the data which is identical.* The data are presented to illustrate some of the theoretical and methodological issues involved in doing applied social indicators research.

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* Although M.S.U.A. has kindly granted permission to the author to utilise the data, it should be made clear that the views expressed here are those of the author.

It is not this specific project per se that we are primarily interested in but this project as a particular expression of a more general technique (viz., social indicators research). It is felt that in many ways, this work is representative of some of the strengths and weaknesses of the entire indicators approach.

Description of the Project

The project (in which the author participated intensively from February to September 1977) was an attempt to develop a set of valid and accurate social indicators which measured the primary aspects of urban quality of life for non-metropolitan urban areas in Canada and provided information on policy impact. The project was modest in terms of time and money invested and was related to a system of ongoing research being conducted by the Human Environment Group of M.S.U.A. The other research included: (i) an earlier study of objective indicators of quality of life for the 22 CMAs; (ii) a future indicators study for satellite communities in Canada; and, (iii) finally, a perceptual survey of public urban concerns.

The Population

The aim of the project was to provide comparative measures of quality of life for medium and smaller sized Canadian cities. This is intended to complement earlier

work by M.S.U.A. which had used the 22 CMAs (Census Metropolitan Areas) as its target population (Urban Indicators, 1975). Using, as an operational definition, "all cities greater than 10,000 population that were not CMAs in the 1971 Census", we generated a list of 115 places. Of these initial 115 cities, 2 were dropped (Ste. Scholastique and Whitehorse) because of severe problems in data availability. The remaining 113 cities were organized by economic region. This was incorporated into the computerized system file's substructure and greatly facilitated the ability to disaggregate the data by region. This generated the following list of non-metropolitan urban areas.

NON-METROPOLITAN URBAN AREAS

<u>Subfile</u>	<u>Province</u>	<u>Places</u>
Atlantic	Newfoundland	Cornerbrook Grand Falls Labrador City
	Nova Scotia	Kentville New Glasgow Sydney Sydney Mines Truro
	P.E.I.	Charlottetown Summerside
	New Brunswick	Bathurst Campbellton Edmunston Fredericton
Quebec	Quebec	Moncton New Castle Oromocto
		Rouyn St. Georges St. Hyacinthe St. Jean St. Jerome Sept-Isles Shawinigan Sherbrooke Sorel Thetford Mines Trois Rivieres Val d'Or Valleyfield Victoriaville
Quebec	Quebec	Alma Asbestos Baie Comeau Cowansville Dolbeau Drummondville Gaspé Granby Joliette Lachute La Tuque Magog Matane Montmagny Rimouski Riviere du Loup
Ontario	Ontario	Arnprior Barrie Belleville Brantford Brockville Chatham Cobourg Cornwall Geulph
		Haileybury Hawkesbury Kapuskasing Kenora Kingston Kirkland Lake Leamington Lincoln Lindsay

<u>Subfile</u>	<u>Province</u>	<u>Places</u>
		Midland New Hamburg North Bay Orillia Oshawa Owen Sound Pembroke Petawawa Peterborough
		Sarnia Sault-Ste-Marie Simcoe Smith Falls Stratford Timmins Trenton Wallaceburg Woodstock
Prairies	Manitoba	Brandon Flin-Flon Portage la Prairie Thompson
	Saskatchewan	Moose Jaw North Battleford Prince Albert Swift Current Yorkton
	Alberta	Grand Prairie Lethbridge Medicine-Hat Red Deer
British Columbia	British Columbia	Chilliwack Courtenay Cranbrook Dawson Creek Kamloops Kelowna Kitimat Nanaimo Renticton
		Port Alberni Powell River Prince George Prince Rupert Terrace Trail Vernon Williams Lake

NON-METROPOLITAN INDICATORS PROJECT

LIST OF PLACES BY MAJOR GROUPS

Totals:	1. Census Agglomerations 25,000 and over	38
	2. Census Agglomerations 10,000 to 25,000	31
	3. Other Urban Municipalities 10,000 and over	44

N =113

1. Census Agglomerations: 25,000 and over

Baie Comeau	Kamloops	Rimouski	Sydney
Barrie	Kelowna	Rouyn	Sydney Mines
Brantford	Kingston	St. Hyacinthe	Thetford Mines
Charlottetown	Medicine Hat	St. Jean	Timmins
Chilliwack	Moncton	St. Jerome	Trenton
Drummondville	Nanaimo	Sarnia	Trois Rivieres
Fredericton	Oshawa	Sault Ste Marie	Valleyfield
Granby	Peterborough	Shawinigan	Victoriaville
Guelph	Port Alberni	Sherbrooke	
Joliette	Prince George	Sorel	

2. Census Agglomerations: 10,000 to 25,000

Arnprior	Haileybury	Newcastle	Smith Falls
Asbestos	Hawkesbury	New Galsgow	Summerside
Campbellton	Kenora	New Hamburg	Terrace
Cobourg	Kentville	North Battleford	Trail
Courtenay	Labrador City	Pembroke	Truro
Dolbeau	Lachute	Petawawa	Val d'Or
Flin Flon	Magog	Prince Rupert	Williams Lake
Grand Falls	Midland	St. Georges	

3. Other Urban Municipalities: 10,000 and over

Alma	Gaspe	Moose Jaw	Sept-Isles
Bathurst	Grande Prairie	North Bay	Simcoe
Belleville	Kapuskasing	Orillia	Stratford
Brandon	Kirkland Lake	Oromocto	Swift Current
Brockville	Kitimat	Owen Sound	Thompson
Chatham	La Tuque	Penticton	Vernon
Corner Brook	Leamington	Portage la Prairie	Wallaceburg
Cornwall	Lethbridge	Powell River	Woodstock
Cowansville	Lincoln	Prince Albert	Yorkton
Cranbrook	Lindsay	Red Deer	
Dawson Creek	Matane	Riviere du Loup	
Edmunston	Montmagny		

Measures: Selection Criteria

Many concerns influenced the selection and design of the measures employed in this study. Rather than discussing the selection process for each of the final 63 measures individually, let us consider the general criteria applied in the decision process. The social indicators literature provides some guidance in specifying the major areas to be covered in this type of social report, although there is certainly no precise consensus as to what should or should not be measured. We will direct the reader to some superior examples of this type of guidance. Bertram Gross (1965a; 1965b) offers a general systems model of structural and performance variables, (see Chapter 2 of this paper). Sheldon and Land (1972: 146) suggest attention be paid to the following list of content areas:

I Socio-economic Welfare

1. Population
2. Labour force and employment
3. Income
4. Knowledge and technology
5. Education
6. Health
7. Leisure
8. Public safety and legal justice
9. Housing
10. Transportation
11. Physical environment
12. Social mobility and stratification

II Social Participation and Alienation

1. Family
2. Religion
3. Politics
4. Voluntary Association
5. Alienation

III Use of Time

IV Consumption Behavior

V Aspiration, Satisfaction, Acceptance, Morale, etc.

Nestor Terleckyj, (1970) suggests the use of "input-output tables" to tabularly represent the relationships between activities and goals. He cites as areas of major concern:

1. Freedom, justice and harmony
2. Health and public safety
3. Education (basic and advanced learning) skills
Adequacy and continuity of Income
4. Human Habitat
Homes, Neighborhoods, Access, Quality of Environment,
Recreation
5. Finer things
Beauty, Sciences, Arts, Leisure
6. Economic Base

Guidance in the design of specific indicators was gained from examining earlier similar studies (e.g. B.C. Liu,

1971). OECD's Environment Committee has also recently published a list of specific social indicators for assessing the quality of urban environments (OECD, 1976) and many of these suggestions were followed.

Following is a list of the theoretical, semantic, pragmatic, and empirical considerations employed:

A. Theoretical

- (i) Validity - Is there a reasonable match between the indicator and the construct - does the variable measure what it purports to measure?
  - (ii) Reliability - Are the results intersubjectively replicable? Can another researcher obtain similar results using these measures?
  - (iii) Stability - Is the time period long enough to attenuate artifactually high or low values as a function of an atypical reporting period?
-

B. Semantic

- (iv) Comprehensiveness - Is the measure a general proxy indicator of conditions for the sector of quality of life it is measuring?
- (v) Uniqueness - Does the variable measure a discrete construct within a sector?
- (vi) Meaningfulness - Is the measure meaningful to a layman or a policy-maker (i.e., easily interpretable)?

C. Pragmatic

- (vii) Availability - Is it possible to collect data for this measure for a reasonable proportion of the observations?
- (viii) Cost - Is the measure feasible in terms of the temporal, financial constraints of the project? Is the information return justified by the cost in terms of manpower and money?
- (ix) Computation - Are there major difficulties in computation which cloud interpretation or throw the utility of the measure into doubt?

D. Empirical

- (x) Number of Relationships - After examining the correlation matrix, how many significant ($\alpha = .05$) relationships are associated with each measure?
- (xi) Number of Meaningful Relationships - How many plausible/important associations are demonstrated by the measure?

- (xii) Redundancy/Multicollinearity - Number of significant (.05) relationships greater than .5 within the same sector.

Applying these criteria to the selection process, we arrived at a final inventory of 62 variables. The variables were then normalized using Z-score transformations (all but 1 of the variables were full metric).

The Measures: • Description

Rather than discuss in detail the 62 indicators, we will restrict discussion to a brief description of the measures. A technical appendix summarizing the data is included. This includes the following information: (i) summary descriptive statistics (means, standard deviations, minimum value, maximum value, for the entire aggregated data set and also broken down by the five economic regions); and (ii) sources - where is the data from?

Figure 2 is the analytical model specifying the structure of the contextual and normative measures and their relationships to the various sources, domains, sectors, and concepts related to the master construct - quality of life. The following pages briefly describe the various indicators and contextual variables. This discussion is organized by the analytical model.

Figure 2 - Analytical Framework

I. Contextual Variables - (a) Social-Demographic Domain -
Population Structure

(i) SIZE

1. Pop71 - This is simply the population in the 1971 Census of Canada (Cat. No. 92-708).
2. P76 - This is the estimated 1976 population using 1971 Census boundaries. It was necessary to estimate the '76 population on the basis of 1971 boundaries as they change from census to census. Similarly, inter-census population interpolations were estimated to provide population bases for generating per capita figures for data from non-census years. The logarithmic interpolation process required knowledge of the 1971 and 1976 census figures.
3. HHSZ - Average household size. This measures the mean number of persons residing in a common household in each community.

(ii) CHANGE

4. VSRC - Population change 1971-1976. This is one of the key contextual variables measuring the population growth or

decline in a community from the 1971-1976 Census.

(iii) TURNOVER

5. GMR - The gross migration ratio. This measures the level of population circulation in an urban system. A population may remain constant in size while changing all its parts thus a measure of turnover as well as size is necessary. This data was generated by special tabulation contract by Statistics Canada.

(iv) AGE STRUCTURE

6. OADR - The old age dependency ratio. This gives information as to the relative presence of older people in a community. This information is pertinent to quality of life as older people require specific design-policy-needs, thus knowledge of their relative presence is necessary. It also gives an indication of the pressure put on the working segment of the population by this non-working segment.
7. YDR - Youth dependency ratio. Similar to the OADR for those aged less than 14 years.

(v) ETHNIC COMPOSITION

8...CBRN - Percentage of the population

Canadian born. This is a measure of the relative presence of the dominant cultures in a given community.

9. ETHD - Index of ethnic diversity. This is a measure of the level of cultural heterogeneity in an urban centre.

I. Contextual Variables - (b) Economic Domain - Industrial Structure/Community Economic Health

(i) FUNCTION

10. DF - Dominant function. This is a measure of the economic activity in which an urban area has the highest excess employment. The measure uses 11 functional categories (e.g., extraction, manufacturing, etc.).

(ii) SPECIALIZATION

11. SI - Specialization index. This is a measure of the distribution of the urban labour force among the various economic activities. The higher the value the higher the degree of specialization.

(iii) COMMUNITY ECONOMIC HEALTH

12. BV - Average annual value of new building permits issued per 1,000 population.

Calculated for a 3-year period,

1974-76.

I. (c) Contextual Variables - Physical Environment Domain -
Climatic Context

(i) SUNSHINE

13. SUN - Mean annual hours of bright sunshine, 1955-70. Like the other climatic variables, sunshine modifies the types of outdoor activities permissible in a community, influence subjective perceptions of well-being. It also provides pertinent design information (e.g., is solar heating feasible in this community?).

(ii) PRECIPITATION

14. DWPRECIP - Average number of days annually with measurable precipitation (1941-70).

15. DWSC - Mean number of days annually with snow cover greater than one inch. (1941-70).

(iii) TEMPERATURE

16. WCHLC - Mean January windchill index in centigrade. The windchill is more closely related to perceived temperature than actual temperature. (1941-1970).

17. JANTC - Mean January temperature
(centigrade) (1941-1970).

18. JULTC - Mean July temperature (centigrade) (1941-1970).

I. (d) Physical Domain - Position in Urban System

(i) DISTANCE

19. TOCMA - Distance to nearest CMA (Census Metropolitan Area).

II. Indicator Variables - (a) Social-Demographic Domain -
Security/Order

(i) LEVEL OF RISK/EXTENT OF CRIMINALITY

20. CINDEX - Crime index. Index of violent and serious property crimes. Mean number of offences per 1,000 population per year (1973-75). Crime data is extremely interesting but problematic to interpret. A low crime rate can be a function of poor enforcement, low crime or poor reporting by citizens. Also because of the politically potent nature of crime statistics, they are often subject to manipulation.

21. VINDEX - Violent crime index. A sub-index of CINDEX focussing only on violent crimes - robberies, homicides, assaults, sexual offences. Reported as a per 1,000, per year figure (1973-

75).

- 22. RINDX - Robberies per 1,000 population per year (1973-75).
- 23. PROPC - Serious property crimes per 1,000 population per year (1973-75). Includes break and enter, theft over \$200 and theft of motor vehicles.

(ii) SAFETY/LEVEL OF RISK

- 24. INJRY - Average number of persons injured in car accidents per 1,000 population per year (1973-75). Measure of level of risk to life and limb on roads of a given city.
- 25. ACDNT - Average number of car accidents with damage over \$200 per 1,000 population per year (1973-75). Measure of level of risk to property.
- 26. TRAFR - Dangerous and drunken driving offences per 1,000 population per year (1973-75).
- 27. AFLPC - Average fire losses per capita per year (1966-1975). Measure of risk to life and property from fire.
- 28. MF001 - Community fire insurance rating. Complex measure of risk of fire loss in a community constructed by insurance companies.

29. POLMP - Policy manpower per 1,000 population (1973-75). Although ubiquitous policy presence may attenuate quality of life, this is a critical component of the delivery of urban services..

II. (b) Indicators - Social-Demographic Domain - Health Sector

(i) CARE

30. RBC - Hospitals: Rated bed capacity in General and Allied Special Hospitals per 1,000 population (1976). Measures the quality of the delivery of health services.
31. GP - General Practitioners per 1,000 population (1975). Good indicator of the general level of health services in a community.
32. SPCF - Special care facilities: Beds per 1,000 population (1975). Primarily a measure of level of health service to chronically ill and aged in a community.

(ii) CONDITION

33. IMR - Infant mortality rate. Infant deaths per 10,000 per year (1973-75). An important, internationally recog-

nized indicator of individual health conditions.

II. Indicators - (c) Cultural Environment - Education Sector

(i) ACHIEVEMENT

34. G10 - Percentage of the population aged 20-34 with grade 10 or less (1971).

Measure of the degree to which a community meets minimal educational requirements.

(ii) PARTICIPATION

35. ATT - Percentage of the population aged 15-19 attending school full-time (1971).

(iii) INPUTS

36. PTR - Pupil/Teacher ratio. This is one crude proxy of the quality of educational inputs. Obviously there are other equally important and unrelated inputs to the educational process unmeasured here (e.g., professional quality of instructors, budget, class size, home environment, etc.) (1975).

II. Indicators - (d) Cultural Environment - Services

(i) CULTURAL/RECREATIONAL FACILITIES

37. SCS - Guttman scale of provision of socio-cultural facilities (1972).

Global measure of the quality and quantity of socio-cultural facilities in a given community.

38. SOCMEET - Area (floorspace) per 1,000 population of commercial meeting establishments (1972). A proxy indicator of opportunity to develop new social relations and participate in collective leisure activities.
39. MUSE - Exhibit area per 1,000 population of exhibition halls, museums and art galleries, 1972.
40. MOVIE - Auditorium, theatre and cinema seats per 1,000 population (1972).
41. BOOK - Public library usage - books loaned per 1,000 population (1972). Measure of the level of consumption of one of the key sources of western culture (books).
42. REC - Guttman scale of the provision of recreational and leisure facilities (1974). This measure is a useful summary measure of the general level of recreational and leisure facilities in a community.
43. BBPARKS - Baseball fields per 1,000 population (1974). Indicator of the

provision of facilities for outdoor group activity.

44. POOLS - Swimming pools per 1,000 population (1974). The measure is a useful indicator of the provision of facilities for individual activity.

45. ALLEYS - Bowling lanes per 1,000 population (1974). Indicator of the provision of indoor leisure facilities.

46. PLAY - Supervised playgrounds - area per 1,000 population. Indicator of provision of recreational facilities for children.

47. NEWS - Weekly circulation of local newspapers per 1,000 population (1975). Indicator of the quality of local communications network which is integral to creating and maintaining community self-image.

48. CT004 - Cable TV stations - number of channels received (1975). This is a measure of the range of information presented to a community through the television media.

II. Indicators - (e) Economic Domain - Income

(i) LEVEL

49. AFI - Average total family income as a percentage of the Canadian mean for urban areas (1971). Measure of the relative level of family income in the community vis-a-vis the national level.

50. DINC - Average disposable income after federal and provincial taxes for all tax filers (1974). Measure of the individual income level in a community.

(ii) DISTRIBUTION

51. UND5 - Percentage of families with incomes under \$5,000 (1971). This is an indicator of the proportion of households below the poverty level in a community.

II. Indicators - (f) Economic Domain - Labour Force

(i) PARTICIPATION

52. UNEMP - The unemployment rate among the active labour force (1971).

53. FLPR - Female labour force participation rate for women aged 20-64 (1971). Measure of female participation in economic system as well as surrogate indicator of other aspects of social structure (e.g., attitudes and values

towards women working).

(ii) STRUCTURE

54. OCCUP - Occupational status index based on the education and vocational experience scale of the Canadian Classification Dictionary of Occupations (1971). This measure is also inextricably connected to the social domain as it is one of the chief indicators of the collective SES in a community.

II. Indicators - (g) Physical Environment - Natural Environment

(i) AIR QUALITY

55. HAZE - Index of haze. Measure of air quality based on sightings of visible pollutants (1960-1976).

II. Indicators - (h) Physical Environment - Housing Sector

(i) PRIVACY/DENSITY

56. DENS - Percentage of occupied dwellings with more than 1.1 persons per room (1971). There is a diverse literature on the relationship of density and crowding to environmental quality (cf. Shulman, 1977).

57. CU18 - Percentage of children under 18 years living in apartments (1971). This information should be policy-relevant as the apartment is a far more restrictive social environment for children than is private detached housing.

(ii) COST

58. HOUSEV - Average cost of new single detached dwellings (estimated for 1976 from 1971 data). This is a measure of the accessibility of this type of housing to a community.

(iii) CHOICE/TENURE

59. APTP - Apartment units as a percentage of total housing stock (1971). The environment of the apartment and the apartments impact on the total urban environment demand specific policy and design considerations. This measure provides information as to the magnitude of apartment presence in the total built environment.
60. OWN - Owner occupied dwelling units as a percentage of the total housing stock. Private owner occupied dwellings are germane to quality of life in a variety

of positive ways (e.g., increased attachment to place enhances commitment to community and privacy).

II. Indicators - (i) Physical Domain - Transportation Sector

(i) DEMAND/USE

61. FARE - Public transit - annual fare passengers carried (1974). Public transit with its positive returns in terms of energy conservation, user-convenience and air pollution is a meaningful social goal. This measures the demand upon this service in communities where it is present.
62. RVM - Public transit - annual revenue vehicle miles (1974). This is an indicator of the level of service provided by public transit in a community.

ANALYSIS

The entire system of indicators and contextual variables should present a variety of potential uses to the researcher, designer, layman and policy-maker. As we have suggested earlier, these uses will primarily be in terms of evaluating differences between desired and actual conditions so as to minimize that discrepancy. Let us now consider some examples of the sorts of meaningful functions these data can provide and the steps necessary to ensure the merit of these applications. This discussion is not intended to be exhaustive but to point out some of the salient possibilities presented by a system of social indicators.

Preliminary Steps

Apart from the meticulous task of checking and cleaning the data, the research should take a series of preliminary steps in the analysis and presentation of the indicators.

(i) Standardizing the Data

In order to ensure the comparability of the data, the measures should be standardized. The statement that there were ten times as many crimes in Oshawa as there were in Lincoln is not terribly meaningful in itself, however, the statement that the crime rate in Oshawa is ten times that in Lincoln would be informative (although empirically

inaccurate). The point is that the data should be expressed in terms of rates or per capita figures (when necessary) in order to permit comparison of places with different population bases. The selection of an appropriate population base (e.g., per 100; per 1,000; per 10,000) should be decided on the basis of consideration of established figures (e.g., the OECD proposes per 1,000 figures in its guidelines for indicators research) as well as the meaningfulness and interpretability of the figures (e.g., avoid bases which will consistently generate .0054 rapes per 100 population). It is also necessary that the data be standardized in order to do any correlational analysis.

(ii) Normalizing the Data

As well as standardizing the data, it is helpful to normalize the data through Z-score transformations, (this is in fact a specific type of standardization). The returns for normalizing these data are significant for at least four reasons. First, it translates all of the measures to common metrics with mean = zero and standard deviation = one. This permits comparison of measures which previously existed in totally different units of measurement (e.g., crime rate and pollution index). The utility of this feature is evident in our ability to now rank order and graphically display rankings of communities on a particular indicator and express their scores in terms of Z-scores. This allows us to see the performance of a particular city on a certain indicator of

quality of life in terms of its position vis-a-vis all other communities and the magnitude of its departure from the norm for that indicator. This information could be pertinent to the design process in that it allows us to examine the relative performance of certain components of the urban environment. We will present an example of this type of graphic display in the appendix later in this chapter. Secondly, normalized scores can be combined into composite scales by simply adding Z-scores for the appropriate variables to be included in the scale. Thus, if one were interested in examining any one of the theoretical sectors as a whole, one would simply add the Z-scores of the variables in the scale. This is particularly useful when working with a large data set with many measures (such as this one). Again, the rankings of communities on composite scales (e.g., how does a community perform on a general socio-cultural service scale?) can be graphically displayed. Thirdly, Z-scores are necessary to perform the factor analytic techniques we considered appropriate for the data. Finally, this particular strategy for aiding the presentation and analysis of quality of life indicators is employed convincingly in earlier studies (cf. Liu 1971, 1976). The generating and merging of Z-scores into our system file was handled routinely through the SPSS condscriptive option.

The formula for Z-score transformation is:

$$Z = \frac{(X_i - \bar{X})^2}{S}$$

It is useful to also retain the variables in their original metrics (e.g., percentages, degrees fahrenheit, dollars) as the information concerning the magnitude of differences is often clearer. For example, saying community A has a Z-score of -2.58 on an income indicator vs. -0.58 for community B does not contain the same information concerning the magnitude of differences as does saying community A averages \$10,000 per individual per annum vs. \$5,000 income for an individual in community B.

(iii) Preparation of Correlation Matrix and a Note on the Problems of Ecological Correlation

Having completed these operations, it is useful to prepare a correlation matrix for the variables. This will allow us to examine the strength of interrelationships amongst the various measures. Interestingly, the question of statistical significance is not pertinent here as we are working with population parameters rather than inferential statistics (estimates of parameters based on sample data). Unfortunately, there is a concomittant analytical cost for this benefit. Although our data is completely generalizable to our universe of medium sized Canadian cities (unless one considers a universe as something which unfolds through time, thus, we would again have only a sample of the total universe), we make tremendous sacrifices in terms of our ability to control for various factors. In the terms of Campbell and Stanley (1963), we have very high external validity but

very low internal validity.

This problem is intimately related to the thorny problem of 'ecological fallacy' - viz., imputing systemic generalizations to the individual level. Given the tremendous within-variance of our units of observation (cities), one is hard pressed to defend any inferences to the individual level. Although methodologists have suggested techniques for attenuating ecological fallacy (for example Blalock, 1965; Goodman, 1959), these remain largely ignored and are themselves statistical manipulations rather than real experimental control. We avoid the problem in two ways. First, our units of analysis are cities not individuals, thus our inferences about urban behaviour are valid. Secondly, we have consciously designated the problem of individual analysis as specific to the domain of subjective/perceptual indicators (this complementary research is in the process of being conducted now by M.S.U.A.).

The presentation of the entire correlation matrix is unreasonable because of its size (1,422 non-redundant cells). In fact, the computer hardware limitations of available core work space forced us to generate the matrix by dividing our vectors of variables into 3 sectors from which we reassembled the entire matrix. A summary of the results of this analysis (excluding implausible and highly spurious associations) is included in the technical appendix. Interesting relationships were examined in

more detail by generating scattergrams which allowed us to examine the functional form of the distribution.

These results were further analysed by using partial correlations to test for the stability of the relationships when controlling for possible spurious linkages. Relationships were further tested by running them for individual regions to see if the relationship was localised in one area or stable from place to place. For example; the relationship between the crime index and disposable income is moderately positive for the aggregated data set ($r = .41$). However, this summary measure masks the fact that this relationship may be centred in one region or that the relationship may differ in direction from region to region. Running the correlation again for each subfile separately, we see this is in fact the case.

Pearson Product Moment Correlation
Coefficients Between Income and Crime Rate

	r_{CI}
Atlantic	.10
Quebec	.36
Ontario	-.02
Prairies	-.10
British Columbia	-.19
Aggregated Set	.41

$$I_{ik} = (\sum_{j=1}^n W_j Z_{ij}) / n \rightarrow I_{ik} = (\sum_{j=1}^n Z_{ij}) / n \text{ with } W_j = 1.0$$

where: I_{ik} = magnitude (index value) for the k th component

N_j = weight assigned to variable j

n = number of variables measuring the criterion in question

Naturally, adjustment for the normative direction of the indicator must be made (simply by making N_j either + or - depending on the direction of the indicator). Thus, the summary scale should have a unidirectionally unambiguous interpretation (i.e., a high value is 'good' and a low value is 'bad'). This is the rationale for excluding the contextual variables which do not allow this type of interpretation.

In a similar manner, the indices for the four domains of objective quality of life could be treated as weighted averages of the indicator values:

$$Q_{ip} = (\sum_{k=1}^m W_k I_{ik}) / m \rightarrow Q_{ip} = (\sum_{k=1}^m I_{ik}) / m$$

where: Q_{ip} = quality of life index value for component p for city i

m = number of indicators included in the component.

The equal weighting scheme is justified as there is essentially no theoretical guidance as to how these components (domains) should be weighted. What little

evidence there is suggests that the equal weighting scheme* is justified (cf. N. Dalkey, 1971). We found the use of these types of summary indices useful for collapsing variables, however, some hesitancy was noted due to the 'apples and oranges' nature of the indicators added. Also, Liu's weighting scheme and rejection of the principal components analysis is unjustified (empirically). For this reason, the author explored an alternate strategy of data reduction - factor analysis and factor scaling (Armor, 1974).

Factor analysis is not a unitary method but a collection of related techniques designed to reduce a set of variables to more condensed factor(s) or dimension(s). It accomplishes this through a series of linear transformations of the data. In fact, to factor analyze in its most general sense means to express a set of variables in a data matrix as a linear combination of the variables (Nunnally, 1967: 291). In this sense, any factor analysis can be viewed as a particular expression of a family of related techniques organized under the rubric of general linear model analysis. It is closely related to such techniques as regression and canonical correlation.

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* For an example of this approach to quality of life indices, the reader is advised to consult Ben-Chien Liu's (1967) study of the Quality of Life in U.S. Metropolitan Areas (a scathing criticism by D. Seidman and reply by Liu is found in the February 1977 issue of Social Indicators Research).

For this reason, it is exigent that the data can be easily disaggregated by economic-geographic region (minimally). This is best accomplished by incorporating a subfile structure into the system file.

Given the number of correlations in the correlation matrix, it appears necessary to reduce the complexity of the matrix by reducing the number of variables (recall that the variable list has already been reduced according to the criteria posited in Chapter 3 from an original 153 variables). We have explored two major techniques for distilling our data; (a) a factor analysis of the data, and, (b) creation of composite indices. In fact, these strategies overlap as one solution for building composite scales, involves the use of eigen values and factor loadings as weighting schemes.

Creation of Composite Indices

As we mentioned in our discussion of Z-score transformation, it is permissible to create composite indices from the linear addition of standard scores. This method, which we refer to as the standardized additive method, allows us to generate quality of life indices for the indicators connected to the 4 major environments (theoretical domains) germane to objective quality of life. Specifically, the construction of quality of life composite indicator "k" is given by:

$$I_{ik} = \left(\sum_{j=1}^n W_j Z_{ij} \right) / n \longrightarrow I_{ik} = \left(\sum_{j=1}^n Z_{ij} \right) / n \text{ with } W_j = 1.0$$

where I_{ik} = magnitude (index value) for the k^{th} component

N_j = weight assigned to variable

n = number of variables measuring the criterion in question.

The salient function of a factor analysis is its data reduction capacity (Nie, 1975). However, others view factor analysis as a theoretical technique for examining constructs rather than their empirical referents (Nunnally, 1967: 290-311; Harman, 1965). Within the field of urban studies, some factorial ecologists have argued that factor analysis is the best technique for distilling 'meaning' from a set of indicants (D. Timms, 1973). Our aims in using a factor analysis are less ambitious. We are primarily interested in the data reduction capability of factor analysis and also interested in using the factor output to assist the construction and weighting of composite summary quality of life indicators.

Multiple factor analyses were performed as a tacit reliability test (parallel forms). Let us briefly review the steps involved in the factor analyses:

- (i) preparation of the correlation matrix (R-type);
- (ii) extraction of initial factors (principal components);
- (iii) rotation to terminal factors (oblique and orthogonal).

The selection of R-type (relations between variables) as opposed to Q-type (relations between observations) was guided by convention and pragmatics. SPSS does not routinely handle Q-type matrices and there is nothing in the literature to suggest that a Q-type analysis will drastically affect the success of a factor analysis.

The option of a defined, or principal component type, extraction of factors is justified as we were not prepared to make any a priori assumptions concerning some underlying regularities in the data. Also, the principal components solution (without iterations) permits precise computation of factor scores. These may only be estimated using other extraction strategies.

We decided to use both oblique and orthogonal rotation of factors to terminal factors. The oblique solution is empirically more realistic (as it does not demand statistical independence of the second factor) but mathematically more complex (not too severe a constraint as the machine does the mathematics any way). In any case, comparison of the results of the oblique and orthogonal solutions suggests little difference apart from a shift in the order of the factors (i.e., factor 3 became factor 4 in the oblique solution).

We prepared alternate variable lists to see if the removal of different variables influenced the factor solutions. Two major different lists were employed. The first list contained our entire 62 normalised variables whereas our second list removed the 19 contextual variables (leaving only the 41 indicators). Although some information is lost in using the indicators only, we decided in favour of this latter option as the author wished to construct summary indicators through factor scaling

(Armor, 1974) and the inclusion of variables which did not have a clear worse-better interpretation clouded the ability to normatively interpret these composite scales. Rather than clutter the discussion with all of the output of the factor analysis, let us consider only the salient aspects of the analysis as they are germane to our goal of constructing meaningful factor scales.

The principal component technique can be summarized mathematically as

$$Z_j = a_{j1}F_1 + a_{j2}F_2 + \dots + a_{jn}F_n$$

where the n individual variables are expressed linearly in terms of n novel uncorrelated (orthogonal) components (i.e., factors) $F_1, F_2, \dots, F_n$, each of which is an exact linear transformation (combination) of the original variables. Recall that our data set has already been rigorously filtered in terms of redundant measures,* thus the communality is relatively lower and hence, the proportion of the variance accounted for by our first few factors should be considerably less than that encountered in a typical factor analysis (e.g., a psychometrician may factor analyse a data matrix generated by a 20-item instrument with all questions designed to measure some general trait such as introversion. Clearly, he will have much higher communality and a much greater proportion of the variance explained with a few factors than we will, given that our measures were intended to be relatively orthogonal).

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* See p. 41; Uniqueness.

UNROTATED FACTORS

<u>Factor</u>	<u>Eigenvalue</u>	<u>Percentage of Variance</u>	<u>Cumulative Percentage</u>
1	6.022	15.1	15.1
2	4.027	10.1	25.1
3	3.395	8.5	33.6
4	2.521	6.3	39.9
5	2.453	6.1	46.0
6	2.248	5.6	51.7
7	2.005	5.0	56.7
8	1.618	4.0	60.7
9	1.403	3.5	64.2
10	1.368	3.4	67.7

The question of how many factors to retain is not simple. Rummel (1967) suggests that one retain all factors that explain an 'interesting' amount of the total variation. However, this is too informal. Conventional wisdom suggests retaining all factors with an eigenvalue (i.e., the 'root' or sum of the squared factor loadings of less than 1). Because factor analysis works on standardized items, the variance of any item is 1; thus, a factor whose root is near to 1 explains no more variance than a single item. Given our large number of variables, this will probably bring uninterpretable factors into the analysis. Thus, we also employ Armor's (1974) criteria that a large drop from one root to another followed by slightly decreasing roots usually marks the end of meaningful factors. Our most important criteria suggests we include only those factors which appear interpretable for rotation and further analysis. Using these criteria, we retain our initial 8 factors which cumulatively explain about 61% of the total variance.

2 2

OF/DE

This process was also assisted by rotating successive numbers of factors until a meaningful solution is found.

Although there is some merit to examining the unrotated factor matrix, we put more faith in the meaning of the rotated (varimax) factor matrix which is considerably more stable than the unrotated factor matrix.

Examining the rotated factor matrix, a relatively clearly defined meaning is evident in the eight dimensions. Let us discuss this in terms of factor scaling. Using David Armor's definition, we understand a factor scale to be "a composite formed to measure a factor by using only the highest loading items on a factor" (Armor, 1974: 33). Armor defends this by arguing with empirical support that in the case of a multiple factor solution, reliability will be enhanced by using only the highest loading items on a factor, rather than a factor score (which accounts for all the loadings). He also argues that returns in terms of validity and conceptual clarity will be realised.

As illustrated in the single-factor case, even better reliabilities can be obtained by forming scales using only the items that load highly on a given factor. This method is even more important in the multiple-factor case since the existence of two or more rotated factors guarantees that each factor will have many items with loadings close to zero. The set of items that loads highly on each factor (say, above 0.40 or so with no higher loadings on other factors)

NOTE: See Appendix C for Varimax Rotated Factor Matrix and Transformation Matrix.

is taken to form a scale. Since this approach guarantees relatively equal factor loadings (i.e., equal item weights), simple unweighted summed scales can be constructed; alpha reliability can then be computed as a close approximation to theta. Alternatively each subset of items can be refactored for a single-factor solution; both factor scores and theta can then be obtained. Items that load high on two or more factors should be excluded if one desires to maintain scale independence.

(ibid: 36)

Employing Armor's factor scaling criteria, we can generate the following summary factor scales. We label the dimension of objective quality of life these scales measure. We can further assess the quality of the scales in terms of their reliability (i.e., intersubjective replicability). In order to do this, we use θ^* , a reliability statistic for composite factor scales created from principal component solutions. The statistic can be interpreted in a similar fashion to the more traditional Cronbach's alpha (1951) which is only suitable for covariance scaling. The general formula for θ^* in the multiple factor solution is:

$$\theta^*_k = [p/(p-1)] [1 - \sum \phi_{nk}^2 / \lambda_n]$$

where p = number of items

$\sum \phi_{nk}^2$ = sum of squared elements in n^{th} row and k^{th} column of transformation matrix that maps the original factor (n) loadings into the rotated (k) loadings

λ_n = eigenvalue (root) of the unrotated factor.

Thus, our first scale would be composed of the following standardized variables from factor 1.

Economic Health Scale = $(Z_{DINC} + Z_{AFI} + Z_{UNDS} + Z_{UNEMP})/4$

Without too bold a logical jump, we might label this scale the economic vitality dimension, which becomes our first general factor. It appears that material well-being, reflected by economic health, is a salient dimension of our objective indicators. Employing θ^* , we can assess the reliability of this scale:

$$\theta^*_K = [(p/p-1)] [1 - \sum \phi_{nk}^2 / \lambda_k]$$

where P = 40

$$\lambda_1 = 6.022$$

$$\sum \phi_{nk}^2 = .9908$$

$$\theta^*_1 = (.9756) (.8355)$$

$$= .815$$

Strictly speaking, this is the reliability coefficient for the factor scores. However, as Armor demonstrates empirically using 'real data' (Armor, 1975: 29-40), the reliability of the factor scale composed only of the higher loading items must be at least as good as the reliability of the factor scores and generally is a few points higher. Thus, the reliability of our security factor scale is .815. Theta, as well as maximizing Gronbach's alpha is invariant regardless of the metric of the data. This desirable statistical property is unlike alpha which will yield

two different values for the same data in standardized and raw format (cf. Vernon Green, 1977).

A second scale composed of measures relating to the information/education level in the community is evident.

It is not surprising to see that the information level in a city is a fundamental dimension underlying objective quality of life. The information composite is constructed from the following standardized items:

$$\text{Information Scale} = (Z_{\text{NEWS}} + Z_{\text{BOOK}} + Z_{\text{G10}})/3$$

$$\text{calculating } \theta^*_{\text{INFO}} = .849.$$

The third scale is unambiguously the public transit dimension with high loadings on our Z transit measures exclusively.

$$\text{Transit Scale} = (Z_{\text{FARE}} + Z_{\text{RVM}})/2$$

$$\theta^*_{\text{TRANS}} = .731$$

Our fourth scale we label the apartment-complex dimension. Again, the interpretation is straightforward given the items involved in the scale.

$$\text{Apartment Scale} = (Z_{\text{APTP}} + Z_{\text{CU18}} + Z_{\text{OWN}})/3$$

$$\theta^*_{\text{APT}} = .600$$

Our fifth scale is clearly the public risk dimension. It is composed of the violent and property crime indeces as well as the traffic accident and injury measures.

$$\text{Risk Scale} = (Z_{\text{VINDX}} + Z_{\text{PROPC}} + Z_{\text{INJRY}} + Z_{\text{ACDNT}})/4$$

$$\theta^*_{\text{RISK}} = .594$$

Our sixth scale is more problematic to interpret. It is composed of the air quality and cable television reception. We suggest that both increased range of information available and decreased air quality (i.e., increased haze) are concomittants of increased urbanization of these smaller communities. Thus, we suspect this composite to be an indicator of progressive urbanization and it should be associated with contextual growth measures.

$$\text{Urbanization Scale} = -(Z_{\text{HAZE}} + Z_{\text{CT004}})/2$$

$$\theta_{\text{URB}} = .618$$

Our seventh scale appears to be organized around a social services dimension. This factor is largely composed of the three health quality measures (i.e., doctors, hospital beds, and special care facilities per 1,000 population). Social meeting places also load highly on this factor.

$$\text{Social Services Scale} = (Z_{\text{GP}} + Z_{\text{SPCF}} + Z_{\text{RBC}} + Z_{\text{SOCMEET}})/4$$

$$\theta^*_{\text{SOC SERV}} = .622$$

Finally, our eighth scale is formed from two labour force measures and the socio-cultural services scale. As the measures all relate to modernization, a diversification^{ed} of the labour force and social/cultural facilities we might label this the cosmopolitan dimension.

$$\text{Social Diversification} = (Z_{\text{FLPR}} + Z_{\text{OCCUP}} + Z_{\text{SCS}})/3$$

$$\theta^*_{\text{DIVERS}} = .694.$$

CHAPTER 4

SUMMARY AND CONCLUSIONS

Let us now attempt to summarize and integrate the threads evident in the thesis. The thesis began by examining the process of conscious ordering of the human environment. Many acts of purposeful environmental manipulation such as policy, planning, architecture, etc., can be considered as general design processes in the systemic sense we define the term. 'Design' in this general sense transcends disciplinary and professional boundaries, however, progress towards solving design problems in a total systems sense is attenuated by the lack of flow of design-pertinent information across these boundaries. We argue that this problem may be reduced by employing a systems approach which permits the free flow of trans-disciplinary information concerning shared systems-design problems.

Having articulated a systems model of the design process, the thesis considered the potential functional role of sociology in that design system. The salient contribution of sociology to total systems design may be the provision of design/policy-pertinent, socio-cultural information. Although this social intelligence could be provided by many techniques within sociology (e.g., participant observation, theory, survey research, etc.), in

this thesis we considered the social indicators movement as a response to this need by sociology. In discussing the structure of the movement, we underlined the importance of the shared perception of anemic sociological input in the design/policy systems of contemporary Western society. In conjunction with the economists' stronghold on policy advice, this has produced a narrow definition of public goods and policy tied to material well-being at the national level. At the more micro level of building design and regional planning, the sociologists' absence has resulted in over-emphasis on physical material concerns of design problems and an inability to contextualize designs and plans within the larger social milieu. Can social indicators provide the type of social intelligence necessary for an improved design system in contemporary society?

Recalling the sort of objective indicators presented in this thesis, we make the following observations. Social indicators can provide a tool for assessing the quality of life in urban environments. Assuming improved quality of life is at least a tacit goal of any design system, indicators should permit an improved 'fit' between form and context through an improved specification of the social component of context.

For instance, Rainwater (1966) suggests that, different SES groups perceive housing differently. Lower-

class groups emphasize safety, shelter and comfort needs whereas middle and upper-class groups consider housing as private domains for expressive self-fulfillment and display of affluence. Different social groups assign different meanings to designs and a hierarchy of needs is evident underlying these differing meanings. What are the design implications of this and how do indicators relate? We suggest that design and policy should match the design to the needs of the potential users and not to the values of the designer or policy maker who is typically recruited from middle and upper-class groups. Thus, rather than imposing middle-class goals, design must search to satisfy first priorities of the users.

Social indicators can define the user in a multi-dimensional sense. Social indicators of income and educational level of a community will define the dominant social class (numerically at least). Age dependency ratios will tell of the structure of the population from a different perspective with different design/policy implications. Clearly, a community with a huge youth population will have differing social needs than a city with more senior residents. Similar considerations apply to other indicators of social context such as ethnicity measures. Recall that the use and perception of space is a culturally-specific phenomena (E.T. Hall, 1959).

Gutman (1966), argues that sociological knowledge is necessary "to articulate the specific user needs of various social groups". Social indicators permit the definition of the dominant social groups as well as the relative distribution of social services and facilities in a community.

Social and environmental indicators can establish pragmatic boundaries for design. Indicators of the physical environment (e.g., days with snow cover, temperature and sunshine measures) should assist the process of fitting a physical design to its physical environment.

Such design decisions as building insulation, site selection, use of alternate (e.g., solar) energy sources can be made on the basis of this information. These decisions can be further assisted by information concerning other objective environmental domains (e.g., does the income level in the community mitigate against certain expensive design solutions).

The impact and social costs of design and public policy decisions may be monitored via social indicators such as unemployment level, air quality, etc. A well developed system of crime indicators may permit monitoring of the level of public safety and social pathology in a community. Examination of the relationship between such normative indicators as crime rates and other policy-manipulable indicators will permit improved understanding

(and perhaps control) of the dynamics of urban crime. In the data presented here, it is interesting to note a complete lack of relationship between police manpower and the crime index. Thus, traditional wisdom concerning the relationship between police and crime rates may have to be rethought. Similarly, we can examine the performance of other crucial indicators such as the infant mortality rate, age index, female labour participation rate, education levels, etc., in relation to other variables which may be manipulated by designers and policy makers. Clearly, a more complete set of objective and perceptual indicators would permit the design of an improved society. Whereas administrators and politicians previously paid lip service to such concerns as equality and social justice, social indicators of the relative distribution and delivery of urban services as well as measures of social mobility may permit a just distribution of society's resources. It would be naive to expect policy-makers to create an egalitarian distributive system simply because there was data available to do so. Rather, it is hoped that knowledge of this sort will enter the public consciousness (e.g., through the media) and thus encourage more equitable distribution of social resources.

Indicators permit assessment of the impact of designs and the specification of sources of urban residential satisfaction. With quantitative knowledge

of quality of life, we can begin to evaluate the relative contribution of various sectors of the environment to well-being.

Design standards can be established through the development of performance indicators. Indicators of air, water and sonic environments can establish the standards necessary to ensure that disturbances from these environments do not unreasonably impinge on residential quality of life. Similar standards could be established through the use of perceptual indicators of scenic, recreational, residential and institutional environments (cf. Craik and Zube, 1976).

Indicators can assist the forecasting of social events (cf. Spilerman, 1975: 381-403). Given the tremendous complexity of contemporary urban society, this knowledge is necessary for making enlightened policy/design decisions. As the authors of Social Indicators (Bauer, 1966) point out, indicators as social feedback provide the sort of social knowledge necessary for anticipating alternate features.

Social indicators in a more general sense provide us with a tool for developing a foundation for social design. This social intelligence should be applicable at all levels of the general design process; from the micro-level of the individual product and building to the meso-level of regional and urban design to the national and

global level of national and international goals and policy. The sociologist's role would be to strategically produce and interpret social intelligence pertinent to these design processes. In short, a fully developed information base of objective and perceptual social indicators will permit the realization of total systems design in which design is a "formal attempt to design for all possible interrelations and interactions of the components of the designed system and its environment" (Chapter 1).

With the social knowledge indicators provide, it is possible to chart the progress and performance of societies as well as monitor and evaluate the impact of social action. It is hoped that this may involve the sociologist meaningfully in the development of a just and humanistic socio-cultural architecture. For any or all of these reasons, social indicators should become the leading edge of a future oriented sociology.

APPENDIX A

DATA SOURCES

<u>Variable</u>	<u>Data Source</u>
POP71	<u>S.C. Cat. 92-714</u> (Census of Canada, 1971)
P76	<u>S.C. Preliminary Counts</u> (Census of Canada, 1976)
V5RC	<u>S.C. Cat. 92-714</u>
OADR	<u>S.C. Cat. 92-715</u>
YDR	<u>S.C. Cat. 92-715</u>
GMR	Special tabulation (Statistics Canada)
CBRN	<u>S.C. Cat. 92-727</u>
ETHD	<u>Canadian Urban Trends</u>
SUN	<u>Canadian Climatic Normals:</u> <u>Hours Bright Sun</u> (Environment Canada)
DWPRECIP	<u>Canadian Normals - Precipitation</u> <u>Environment Canada - Atmospheric</u>
DWSC	ibid
WCHLC	<u>Canadian Normals - Temperature</u> <u>Canadian Normals - Wind</u>
JANTC JULTC	<u>Canadian Normals - Temperature</u> <u>Environment Canada</u>
DF	<u>Canadian Urban Trends</u>
SI	<u>Canadian Urban Trends I</u>
BV	<u>S.C. Cat. 64-001</u>
HOUSEV	<u>S.C. Cat. 64-002</u>
APTP OWN	<u>S.C. Cat. 93-732</u>
DENS	S.C. Special tabulation
CU18	S.C. Special tabulation

RVM

Transportation Group - M.S.U.A.

HAZE

Department of Environment -
H. Inhaber

G10
ATT

Special tabulation (S.C.)

PTR

DREE Community Data Files -
Department of Regional Economic
Expansion

RBC

S.C. Cat. 83-201

IMR

S.C. Cat. 84-206

SPCF

S.C. Cat. 83-221

SOCMEET
MUSE
BOOK
MOVIE
POOLS
ALLEYS
PLAY
BBPARKS

ANSSR (Department of Health and
Welfare) 1974 Survey

REC
SCS
F001
CT004
NEWS

Community Data Files - Department
of Regional Economic Expansion

AFLPC

Dominion Fire Commissioners Annual
Reports: Fire Losses, 1966-1975

DINC

Urban Economy Group - M.S.U.A.

AFI
UND5

Canadian Urban Trends

FLPR
OCCUP
UNEMP

Special tabulation (S.C.)

APPENDIX B

APPENDIX

DESCRIPTIVE STATISTICS: QUALITY OF LIFE FOR URBAN PLACES 10,000 - 100,000 POPULATION IN FIVE MAJ

VARIABLE	ATLANTIC REGION		QUEBEC REGION	
	MEAN	STD DEV	MEAN	STD DEV
<u>A. CONTEXTUAL VARIABLES</u>				
<u>Demographic Context</u>				
- % Population Change, 1971-1976	2.0	13.7	2.7	7.1
- Average Household Size, 1971	4.0	0.4	3.9	0.3
- Youth Dependency Ratio	53.8	8.4	47.0	5.8
- Old Age Dependency Ratio	11.9	4.9	9.3	3.4
- Gross Migration Ratio, 1956-71	43.7	17.5	26.5	15.2
- % Canadian Born, 1971	95.7	2.1	97.9	1.3
- Index of Ethnic Diversity	0.3	0.1	0.2	0.1
<u>Climatic Context</u>				
- Mean Hours of Bright Sun (Ann.)	1784.1	104.9	1868.3	134.4
- Mean Days of Measurable Precipitation (Ann)	154.8	25.4	147.4	17.7
- Mean Days with Snow Cover (Ann)	120.6	24.2	134.0	17.9
- Mean Windchill Index, January (C°)	-26.7	5.3	-30.2	7.1
- Mean January Temperature (C°)	-8.3	4.2	-12.2	2.7
- Mean July Temperature (C°)	18.2	1.6	18.9	1.7
<u>Economic/Geographic Context</u>				
- Index of Industrial Specialization	7.6	17.2	5.6	8.4
- Average Value of Building Permits Issued per 1,000 Pop., (\$000)	385.1	348.9	422.7	184.7

14

APPENDIX

TIVE STATISTICS: QUALITY OF LIFE INDICATORS - 100,000 POPULATION IN FIVE MAJOR REGIONS THROUGHOUT CANADA

ATLANTIC REGION		QUEBEC REGION		ONTARIO REGION		PRAIRIE REGION		BRITISH COLUMBIA REGION	
STD DEV		MEAN	STD DEV	MEAN	STD DEV	MEAN	STD DEV	MEAN	STD DEV
0	13.7	2.7	7.1	3.8	7.3	5.7	13.4	10.0	14.0
0	0.4	3.9	0.3	3.4	0.3	3.3	0.3	3.4	0.3
8	8.4	47.0	5.8	47.3	5.8	47.4	4.9	50.7	6.9
9	4.9	9.3	3.4	15.2	4.3	16.0	6.3	11.6	7.4
7	17.5	26.5	15.2	47.6	37.1	50.1	10.7	49.7	10.3
7	2.1	97.9	1.3	86.9	5.9	85.9	3.5	80.8	4.6
3	0.1	0.2	0.1	49.7	14.3	69.3	6.2	65.7	7.0
1	104.9	1868.3	134.4	1964.5	120.0	2165.2	131.1	1763.7	256.7
8	25.4	147.4	17.7	134.1	18.0	100.6	16.4	142.1	40.5
6	24.2	134.0	17.9	100.7	33.2	133.5	31.2	61.1	59.4
7	5.3	-30.2	7.1	-24.53	5.2	-36.3	6.8	-12.8	9.2
3	4.2	-12.2	2.7	-9.1	4.1	-16.7	3.6	-3.9	5.7
2	1.6	18.9	1.7	50.0	1.4	18.5	1.3	17.8	2.2
6	17.2	5.6	8.4	3.1	3.8	7.6	14.7	2.4	1.1
1	348.9	422.7	184.7	494.5	198.1	833.7	547.4	844.0	414.7

VARIABLE	ATLANTIC REGION		QUEBEC REGION		ON
	MEAN	STD DEV	MEAN	STD DEV	ME
<u>B. QUALITY OF LIFE INDICATORS</u>					
<u>Physical Development</u>					
Housing:					
- Avg. Cost, New Single Detached Dwellings (1976)	23384.0	6911.0	24038.0	3360.0	2978
- Apt. Units as % of Housing Stock (1971)	22.8	9.0	39.3	9.4	2
- Dwellings Owned as % of Housing Stock (1971)	59.9	15.9	51.5	8.7	6
- % Occupied Dwellings with 1.1 or More Persons Per Room	14.0	4.8	14.1	2.9	
- % Children Living in Apts., 1971	8.9	4.0	11.2	5.4	
Transportation:					
- Public Transit: Fare Passengers Carried (1974)	25.5	23.0	28.7	2.3	2
- Public Transit: Annual Revenue Miles (1974)	7.7	3.7	8.3	4.1	
Natural Environment:					
- Air Quality: Haze Index	0.014	0.006	0.016	0.015	
<u>Social Development</u>					
Education:					
- Education Level: % Aged 20-34 with Grade 10 or Less School, 1971	46.7	6.2	54.4	5.7	
- % Aged 15-19 Attending School, 1971	74.2	5.1	70.7	5.0	
- Pupils/Teacher Ratio, 1975	20.3	2.3	-	-	

- 2 -

ATLANTIC REGION		QUEBEC REGION		ONTARIO REGION		PRAIRIE REGION		BRITISH COLUMBIA REGION	
MEAN	STD DEV	MEAN	STD DEV	MEAN	STD DEV	MEAN	STD DEV	MEAN	STD DEV
14.0	6911.0	24038.0	3360.0	29789.1	5614.8	24951.0	5749.0	31034.0	4173.0
12.8	9.0	39.3	9.4	24.3	7.5	24.1	6.6	18.0	6.3
9.9	15.9	51.5	8.7	64.7	7.9	61.8	7.8	67.0	5.6
4.0	4.8	14.1	2.9	7.2	3.1	8.1	4.2	8.9	4.1
8.9	4.0	11.2	5.4	8.8	3.5	7.0	5.2	5.0	2.4
5.5	23.0	28.7	2.3	29.7	15.8	40.8	5.1	14.6	3.5
7.7	3.7	8.3	4.1	9.3	3.4	12.5	3.4	7.7	4.9
0.014	0.006	0.016	0.015	0.055	0.041	0.002	0.002	0.017	0.031
5.7	6.2	54.4	5.7	45.4	7.2	35.9	6.0	36.5	6.0
4.2	5.1	70.7	5.0	75.2	5.5	68.5	8.7	71.9	4.1
0.3	2.3	-	-	19.1	1.5	9.8	0.6	19.9	1.0

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VARIABLE	ATLANTIC REGION		QUEBEC REGION		O M
	MEAN	STD DEV	MEAN	STD DEV	
Health:					
- Hospitals: Rated Bed Capacity per 1,000 Pop., 1976	12.0	5.0	11.0	6.0	
- Physicians: General Practitioners per 10000 Pop., 1975	1.3	0.6	0.7	0.2	
- Special Care Facilities: Beds per 1,000 Pop., 1975	8.8	6.0	8.8	4.9	
- Infant Mortality per 1,000 Pop., 1973-75	3.2	1.3	2.7	1.0	
Social & Cultural:					
- Index of Socio-Cultural Facilities, 1972	4.8	1.9	5.3	2.5	
- Area per 1,000 Pop. of Commercial Meeting Establishments, 1972	1106.5	915.1	-	-	13
- Exhibition Halls, Museums & Art Galleries Area per 1,000 Pop., 1972	406.3	475.9	329.8	690.3	5
- Seats per 1,000 Pop., of Cineams	30.9	18.9	43.4	27.5	
- Public Libraries: Books Loaned per 1,000 Pop., 1972	6340.3	5252.0	3489.9	5013.9	78
Recreation & Leisure:					
- Recreation & Leisure Facilities, 1974	8.4	4.0	7.9	3.0	
- Baseball Fields per 10,000 Pop., 1974	0.3	0.2	0.4	0.2	
- Swimming Pools per 10,000 Pop., 1974	0.3	0.4	0.5	0.3	
- Bowling Lanes per 10,000 Pop., 1974	6.9	5.5	6.5	4.0	
- Supervised Playgrounds per 10,000 Pop., 1974.	2.9	2.0	1.2	0.9	

- 3 -

ATLANTIC REGION		QUEBEC REGION		ONTARIO REGION		PRAIRIE REGION		BRITISH COLUMBIA REGION	
MEAN	STD DEV	MEAN	STD DEV	MEAN	STD DEV	MEAN	STD DEV	MEAN	STD DEV
2.0	5.0	11.0	6.0	10.0	4.0	13.0	4.0	10.0	4.0
1.3	0.6	0.7	0.2	1.2	0.4	1.6	0.5	1.3	0.3
8.8	6.0	8.8	4.9	10.5	6.5	13.0	7.4	6.1	4.1
3.2	1.3	2.7	1.0	2.5	0.8	3.3	1.2	4.4	2.5
4.8	1.9	5.3	2.5	6.5	2.1	7.1	1.3	6.6	1.1
6.5	915.1	-	-	1362.1	870.9	1640.4	725.1	1622.3	1137.5
6.3	475.9	329.8	690.3	505.5	1257.6	880.6	1501.0	154.1	131.3
0.9	18.9	43.4	27.5	37.6	23.1	34.8	25.5	37.3	38.5
0.3	5252.0	3489.9	5013.9	7866.1	5418.7	12273.9	10241.8	15293.9	19918.5
8.4	4.0	7.9	3.0	9.0	3.6	8.8	4.1	7.9	3.9
0.3	0.2	0.4	0.2	0.5	0.3	0.4	0.4	0.3	0.3
0.3	0.4	0.5	0.3	0.4	0.3	0.3	0.3	0.4	0.3
6.9	5.5	6.5	4.0	8.7	5.1	8.5	4.8	8.2	3.6
2.9	2.0	1.2	0.9	3.0	2.1	2.4	2.5	0.8	1.6

... 4

VARIABLE	ATLANTIC REGION		QUEBEC REGION	
	MEAN	STD DEV	MEAN	STD DEV
Safety/Physical Security:				
- Violent & Serious Property Crimes per 10,000 Pop., 1973-75	12.9	5.6	15.0	7.3
- Violent Crimes per 1,000 Pop., 1973-75	3.4	1.8	2.4	1.4
- Robberies per 1,000 Pop., 1973-75	0.2	0.1	0.5	0.4
- Serious Property Crimes per 1,000 Pop., 1973-75	9.4	4.4	12.4	6.4
- Motor Vehicle Theft per 1,000 Pop., 1973-75	2.0	1.4	2.3	1.3
- Avg. No. of Persons Injured in Car Accidents per 1,000 Pop., 1973-75	21.8	10.0	37.3	13.2
- Avg. No. of Car Accidents with Property Damage over \$200 per 1,000 Pop., 1973-75	3.6	2.8	6.9	3.1
- Dangerous & Drunken Driving Offences per 1,000 Pop., 1973-75	18.5	8.9	12.6	9.8
- Avg. Fire Losses (\$) per Capita, 1966-75	13.4	10.5	11.3	3.8
- Fire Insurance Rating, 1973-75	5.3	1.2	5.5	1.3
- Police Manpower per 1,000 Pop., 1974	1.5	0.6	1.4	0.4
Community Involvement:				
- Information Available: Cable TV: No. of Channels, 1975	3.5	3.0	6.7	4.9
- Weekly Newspaper Circulation per 1,000 Pop., 1975	1845.5	1535.1	773.5	829.8
<u>Economic Development</u>				
Income:				
- Avg. Disposable Income After Taxes, 1974	6206.0	734.0	6330.6	537.5
- Avg. Total Family Income: % of Mean for Urban Areas, 1974	81.8	11.5	83.8	7.9
- % Families with Income Under \$5,000, 1971	23.1	8.3	22.8	6.1

ATLANTIC REGION		QUEBEC REGION		ONTARIO REGION		PRAIRIE REGION		BRITISH COLUMBIA REGION	
MEAN	STD DEV	MEAN	STD DEV	MEAN	STD DEV	MEAN	STD DEV	MEAN	STD DEV
12.9	5.6	15.0	7.3	20.8	6.2	23.0	6.7	37.0	11.8
3.4	1.8	2.4	1.4	6.0	3.7	6.7	2.2	9.5	3.0
0.2	0.1	0.5	0.4	0.3	0.2	0.4	0.5	0.5	0.3
9.4	4.4	12.4	6.4	15.5	6.6	16.3	5.7	27.5	9.8
2.0	1.4	2.3	1.3	3.3	1.0	3.7	1.3	5.2	2.6
21.8	10.0	37.3	13.2	22.8	5.7	33.7	5.7	34.0	12.4
3.6	2.8	6.9	3.1	7.6	2.3	7.2	3.8	6.7	2.7
18.5	8.9	12.6	9.8	26.7	12.8	32.6	6.2	48.4	12.5
13.4	10.5	11.3	3.8	12.5	5.7	11.3	5.8	20.2	17.8
5.3	1.2	5.5	1.3	4.8	1.0	6.4	1.2	5.1	1.0
1.5	0.6	1.4	0.4	1.3	0.5	1.4	0.2	1.1	0.5
3.5	3.0	6.7	4.9	7.6	5.1	1.2	2.0	4.1	2.6
845.5	1535.1	773.5	829.8	1933.3	1588.1	2167.0	996.2	1244.3	963.8
206.0	734.0	6330.6	537.5	6276.3	518.2	6586.6	456.4	7353.6	536.2
81.8	11.5	83.8	7.9	92.6	7.3	86.8	8.9	94.3	7.7
23.1	8.3	22.8	6.1	17.8	3.9	22.1	6.4	18.0	6.1

VARIABLE	ATLANTIC REGION		QUEBEC REGION	
	MEAN	STD DEV	MEAN	STD DEV
Labour Force:				
- Unemployment Rate Among Active Labour Force, 1971	6.2	1.6	7.4	1.6
- Female Labour Force Participation Rate	41.1	7.7	37.6	4.5

ATLANTIC REGION		QUEBEC REGION		ONTARIO REGION		PRAIRIE REGION		BRITISH COLUMBIA REGION	
MEAN	STD DEV	MEAN	STD DEV	MEAN	STD DEV	MEAN	STD DEV	MEAN	STD DEV
1.2	1.6	7.4	1.6	5.8	1.2	6.5	4.8	6.8	1.6
.1	7.7	37.6	4.5	48.8	5.5	48.8	5.3	43.3	4.5

2042

APPENDIX C

FILE MONNETRO CREATION DATE 01/05/78
SUBFILE ALLC

BC

VARIANX ROTATED FACTOR MATRIX

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5	FACTOR 6	FACTOR 7	FACTOR 8
V2000TP	-0.105113	-0.174355	-0.03255	-0.91028	0.9079	0.9875	0.34110	-0.04332
V21000	-0.04433	-0.17705	-0.0293	-0.5757	0.9079	0.0168	0.0066	-0.33766
V22000	-0.03844	-0.18448	-0.0023	-0.5757	0.9079	0.0168	0.0066	-0.33766
V23000	-0.03844	-0.18448	-0.0023	-0.5757	0.9079	0.0168	0.0066	-0.33766
V24000	-0.03844	-0.18448	-0.0023	-0.5757	0.9079	0.0168	0.0066	-0.33766
V25000	-0.03844	-0.18448	-0.0023	-0.5757	0.9079	0.0168	0.0066	-0.33766
V26000	-0.03844	-0.18448	-0.0023	-0.5757	0.9079	0.0168	0.0066	-0.33766
V27000	-0.03844	-0.18448	-0.0023	-0.5757	0.9079	0.0168	0.0066	-0.33766
V28000	-0.03844	-0.18448	-0.0023	-0.5757	0.9079	0.0168	0.0066	-0.33766
V29000	-0.03844	-0.18448	-0.0023	-0.5757	0.9079	0.0168	0.0066	-0.33766
V30000	-0.03844	-0.18448	-0.0023	-0.5757	0.9079	0.0168	0.0066	-0.33766
V31000	-0.03844	-0.18448	-0.0023	-0.5757	0.9079	0.0168	0.0066	-0.33766
V32000	-0.03844	-0.18448	-0.0023	-0.5757	0.9079	0.0168	0.0066	-0.33766
V33000	-0.03844	-0.18448	-0.0023	-0.5757	0.9079	0.0168	0.0066	-0.33766
V34000	-0.03844	-0.18448	-0.0023	-0.5757	0.9079	0.0168	0.0066	-0.33766
V35000	-0.03844	-0.18448	-0.0023	-0.5757	0.9079	0.0168	0.0066	-0.33766
V36000	-0.03844	-0.18448	-0.0023	-0.5757	0.9079	0.0168	0.0066	-0.33766
V37000	-0.03844	-0.18448	-0.0023	-0.5757	0.9079	0.0168	0.0066	-0.33766
V38000	-0.03844	-0.18448	-0.0023	-0.5757	0.9079	0.0168	0.0066	-0.33766
V39000	-0.03844	-0.18448	-0.0023	-0.5757	0.9079	0.0168	0.0066	-0.33766
V40000	-0.03844	-0.18448	-0.0023	-0.5757	0.9079	0.0168	0.0066	-0.33766
V41000	-0.03844	-0.18448	-0.0023	-0.5757	0.9079	0.0168	0.0066	-0.33766
V42000	-0.03844	-0.18448	-0.0023	-0.5757	0.9079	0.0168	0.0066	-0.33766
V43000	-0.03844	-0.18448	-0.0023	-0.5757	0.9079	0.0168	0.0066	-0.33766
V44000	-0.03844	-0.18448	-0.0023	-0.5757	0.9079	0.0168	0.0066	-0.33766
V45000	-0.03844	-0.18448	-0.0023	-0.5757	0.9079	0.0168	0.0066	-0.33766
V46000	-0.03844	-0.18448	-0.0023	-0.5757	0.9079	0.0168	0.0066	-0.33766
V47000	-0.03844	-0.18448	-0.0023	-0.5757	0.9079	0.0168	0.0066	-0.33766
V48000	-0.03844	-0.18448	-0.0023	-0.5757	0.9079	0.0168	0.0066	-0.33766
V49000	-0.03844	-0.18448	-0.0023	-0.5757	0.9079	0.0168	0.0066	-0.33766
V50000	-0.03844	-0.18448	-0.0023	-0.5757	0.9079	0.0168	0.0066	-0.33766
V51000	-0.03844	-0.18448	-0.0023	-0.5757	0.9079	0.0168	0.0066	-0.33766
V52000	-0.03844	-0.18448	-0.0023	-0.5757	0.9079	0.0168	0.0066	-0.33766
V53000	-0.03844	-0.18448	-0.0023	-0.5757	0.9079	0.0168	0.0066	-0.33766
V54000	-0.03844	-0.18448	-0.0023	-0.5757	0.9079	0.0168	0.0066	-0.33766
V55000	-0.03844	-0.18448	-0.0023	-0.5757	0.9079	0.0168	0.0066	-0.33766
V56000	-0.03844	-0.18448	-0.0023	-0.5757	0.9079	0.0168	0.0066	-0.33766
V57000	-0.03844	-0.18448	-0.0023	-0.5757	0.9079	0.0168	0.0066	-0.33766
V58000	-0.03844	-0.18448	-0.0023	-0.5757	0.9079	0.0168	0.0066	-0.33766
V59000	-0.03844	-0.18448	-0.0023	-0.5757	0.9079	0.0168	0.0066	-0.33766
V60000	-0.03844	-0.18448	-0.0023	-0.5757	0.9079	0.0168	0.0066	-0.33766
V61000	-0.03844	-0.18448	-0.0023	-0.5757	0.9079	0.0168	0.0066	-0.33766
V62000	-0.03844	-0.18448	-0.0023	-0.5757	0.9079	0.0168	0.0066	-0.33766

Sub 8 (SCS+FLA)

Sub 6 (-CONS+HPP+CTH)

Sub 4 (APP-DIV+CON-SPR)

Sub 2 (-GID+HPP+HPP+HPP)

Sub 1 (-GAL+HPP+HPP+HPP)

Sub 7 (HCC+GAP+SPF+SPF+HCC)

Sub 5 (HCC+GAP+SPF+SPF+HCC)

Sub 3 (HCC+GAP+SPF+SPF+HCC)

Sub 2 (HCC+GAP+SPF+SPF+HCC)

Sub 1 (HCC+GAP+SPF+SPF+HCC)

ACTOR ANALYSES OF DATA SET

017

FILE NDNMETRO (CREATION DATE = 01/05/78)

UBFILE ALL PRS BC

TRANSFORMATION MATRIX

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5	FACTOR 6	FACTOR 7
ACTOR 1	0.55736	0.59152	0.04017	-0.55517	0.27029	0.23650	0
ACTOR 2	-0.50308	0.02231	0.24862	0.07227	-0.40981	0.18740	0
ACTOR 3	0.50007	-0.05752	-0.03485	0.65342	0.09201	0.49733	-0
ACTOR 4	-0.46285	0.04986	-0.75450	-0.02175	0.15785	0.22399	-0
ACTOR 5	-0.24821	0.11983	0.22636	0.59731	0.31878	-0.31563	0
ACTOR 6	-0.50496	-0.12060	0.33146	-0.25181	0.62691	-0.00385	-0
ACTOR 7	0.03237	0.14583	0.09279	-0.02319	-0.46949	-0.16517	-0
ACTOR 8	0.17655	-0.29067	-0.19637	0.00890	0.02964	-0.01789	0
ACTOR 9	0.14222	-0.73551	-0.05009	-0.12162	0.04064	-0.16741	-0
ACTOR 10	-0.07329	-0.25503	0.31557	-0.11024	-0.05576	0.67540	0

14

01/05/78

PAGE 12

FOR 4	FACTOR 5	FACTOR 6	FACTOR 7	FACTOR 8	FACTOR 9	FACTOR 10
55517	0.27424	0.23650	0.15163	0.58065	-0.06610	0.09788
00727	-0.40481	0.18740	0.23082	0.29979	-0.34928	0.15051
65344	0.09201	0.49733	-0.27622	0.04454	-0.57969	0.05860
02173	0.15785	0.22399	-0.18464	0.17891	0.13106	-0.00242
59731	0.31878	-0.31563	0.17758	0.37746	0.35754	-0.10950
25181	0.62691	-0.00385	-0.36097	-0.09208	-0.33169	-0.26745
02314	-0.46949	-0.16517	-0.57270	0.33487	0.05377	-0.52125
00397	0.02964	-0.01789	0.54994	0.09535	-0.28637	-0.07098
12162	0.04064	-0.16741	-0.14274	0.51641	0.02157	0.32302
11024	-0.05576	0.67540	0.06313	0.00966	0.55707	-0.20863

20/2

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