The Cybernetics of Socio-Economic Change and Development

Social Technology

The Organisation of the Change and Evolution of Socio-Economic Systems

H. ALAN RAYMOND B.A.(ECON)

Thesis submitted in fulfillment of requirements for admission to the Doctor of Philosophy

Department of Cybernetics

Brunel University

February 1979

If an individual or a people ceases to believe in itself, its aims, and ideals, others with firmer aims and beliefs will climb into the saddle. When a race or nation no longer desires place, power, position, influence, has no wish that its ways of thought should prevail, no desire to impress its seal upon future events, how can you suppose it will continue to stand in this hurly-burly world? Power in the world, the prizes of the world, must go to those who value them, and think them worth the effort to secure.

Civilizations arise, and continue to exist - and all history is the witness to the truth - when conditions are hard, only when they are continually threatened, only when they are determined to maintain and defend their rule. They decline and fall when the external pressure is removed, or the inner spirit decays. The surrender may disguise itself in many forms, of which humanitarian sentiment is one. 'If a country', wrote F.S. Oliver, 'will not stand up for its rights, it must surely lose them. The spirit of giving in is the most fatal disease to which nations are subject, and it is apt to attack them, like a cancer, when they have arrived at the meridan.'

The Human Situation,

W. Macneile Dixon,

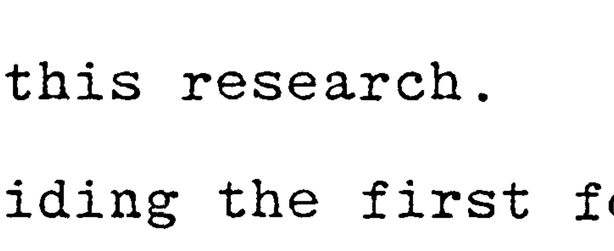
The Gifford lectures delivered in the University of Glasgow.

1935-1937.

Acknowledgements

I would like to thank the following people and institutions for their valuable help and assistance:

My thesis advisor Professor Frank George for his advice, patience, stimulation and encouragement; Brunel University, for providing the facilities; Professor Richard Salisbury of McGill University, Director of the Anthropology of Development Program for his invaluable encouragement, advice and assistance. I was fortunate enough to obtain the assistance of the Anthropology of Development Program in the organisation and financing of a research team to investigate the three Arctic communities. The Canadian Federal Department of Communities should also be thanked for providing the funds that led to this research. Carleton University, Ottawa, for providing the first forum for the ideas and principles developed here, a course in prospective international system dynamics, beginning May 1st, 1979 at the Graduate School of International Affairs. Finally, Deborah L. Green for typing a clean and professional copy.



H. Alan Raymond

February 1979.

CONTENTS

Contents Contd...

Contents Contd...

Charts & Diagrams contd... Page No.

PREFACE

This discussion is written in a descriptive manner, firstly because of the nature of the phenomenon investigated as the appropriate quantitative metric has yet to be invented, secondly because of the importance of the cybernetic-systems approach to some of the more critical questions facing man, the importance that the average layman understands this approach and the questions tackled in this investigation.

These critical questions concern the converging trends in socio-economic evolution that mankind is facing. Some of these trends are physical, some are socio-mental. The physical trends are more obvious: the accelerating cost of raw materials, the rapid decline in available raw materials on a per capita basis, the exploding population, the increasing disparity in the ability to generate wealth both within developed and developing countries as well as between them, new attitudes towards consumption and work, the increasing integration of the world into one socio-economic system, increasing life span and population bulges, technological advance, environmental deterioration, morale and moral degeneration and regeneration, cultural and social decay and expansion, deforestation, ideological resolution and conflict, economic waste and efficiency, and information and noise explosion.

This discussion focuses upon the flow of socio-economic

systems as directed and influenced by information flows and communication channels and how in consequence these converging trends are and can be optimally dealt with.

> "Extensive, concious attempts to direct a complex society in a viable, adaptive manner have only just begun in modern history, and much remains to be learned to avoid the mistakes of the past. An intimate understanding of the workings of the sociocultural level of complex adaptive system is essential."
>
> Walter Buckley.

I

Cybernetics

Cybernetics, the science of systems, of control and communication, is in its essence an old science, but is in its formulalization a new science.

Man has studied the principles and concepts of cybernetics since pre-history. Many primitive societies organized themselves around a cult or religion, where ideas or beliefs were used to control and organize. Such an example is the early Egyptian society which was organized around the Pharaoh as the descendent of the sun god. Similar ideologies organized other contemporary societies, indeed all societies.

In 1939 a group of dynamic scientists, clustered around the MIT mathematician Norbert Wiener, pursued a line of research which they decided was a new science, a new way of thinking about both physical and social phenomena. They named this new science Cybernetics, whose principles and concepts they realized ranged across every science, indeed across all that exists and all of man's endeavours.

Perhaps the moment of this realization took place, the realization that these principles crossed all branches of science, came when two members of Wiener's group were designing a machine to allow the blind to read. The principle being that a photocell be used to scan a line of print, producing variable audio tones representing the

words scanned. The blind could hear with their ears so to speak. The machine was designed with sufficient complexity in order to be able to scan different types and sizes of print. An anatomist who was also part of the group examined the schematic diagram with its banks of photocells and oscillators, asked "Is this a diagram of the fourth layer of the visual cortex of the brain?" This was the catalytic insight into the principles and problems of control which stimulated the group to further research into the problems of control and to name this line of research Cybernetics.

Cybernetics is the study of control in a system, a system being any cohesive collection of items that are dynamically related, items as points connected by a network of relationships. Control being a systems strategy for achieving a goal. Control is essentially achieved by feedback; that is a system is adjusted in terms of its progress (permutation) along an optimal path (permutation), towards its goal. The ability of a system to be adjusted towards an optimal path (permutation) is directly related to its complexity and its ability to generate variety (different forms of behaviour based on information). The study of control is essentially then, the study of the complexity of a system, of the relationships between the components of the system, and their ability to generate variety. Because the study of these relationships can be enormously complex, cybernetics has made use of the theory of the <u>black box</u>.

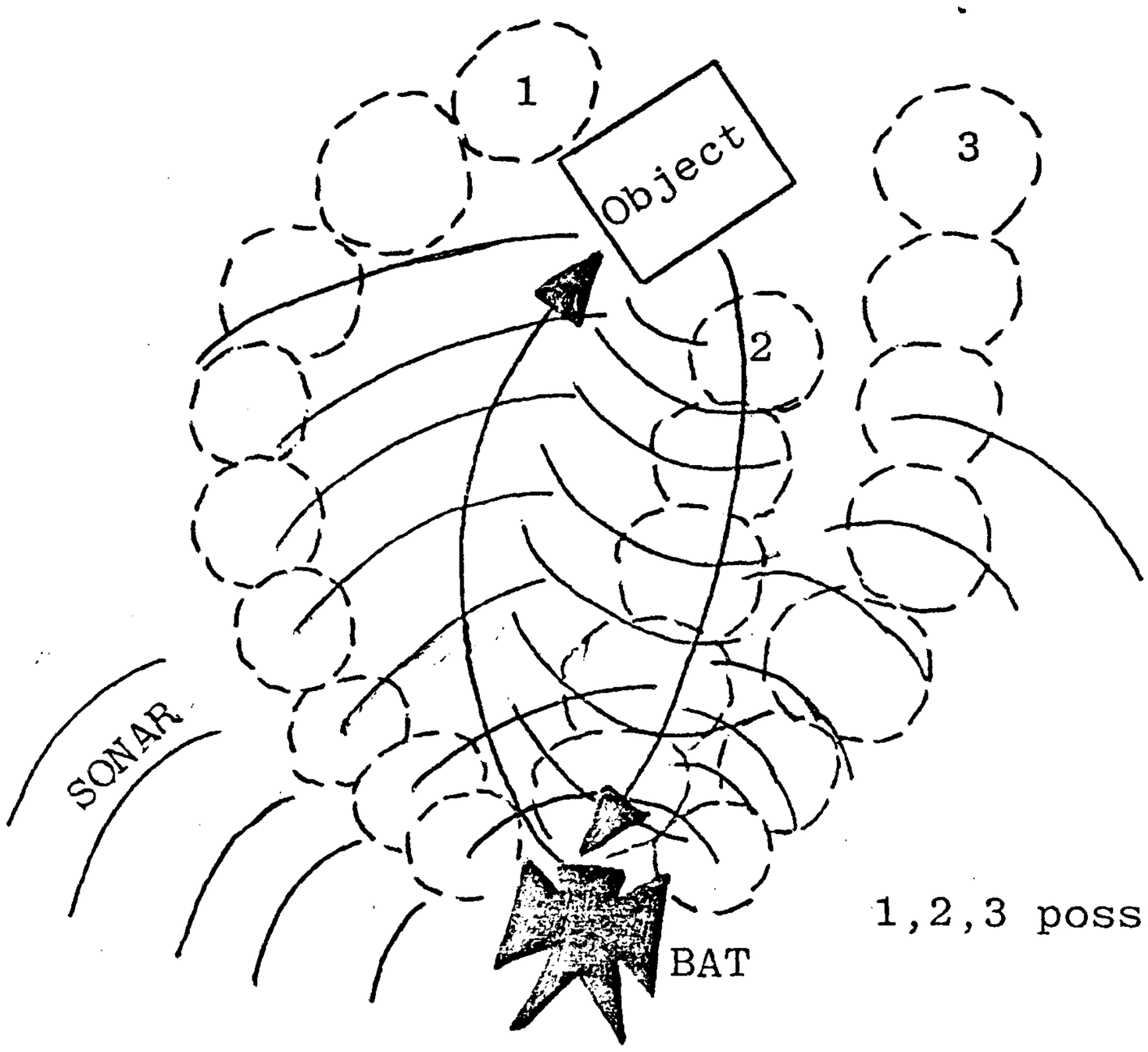
The black box concept is similar in terms of use in some respects to the figmentary concept of the physicists massless spring. It is a figmentary concept developed by cyberneticians to study control and communication in systems whose complexity cannot be handled by standard methodologies. Simply put, something can be learned by the analysis of the control and communication processes of a complex system by the analysis of the inputs and resultant outputs of such a system. The adjustments of the inputs would lead to certain definable outputs, to a pattern. A system to which one specific adjustment to an input resulting in one specific output is said to be definite. A system to which one specific adjustment to an input results in two or more specific outputs is said to be multivariant. That is, while it has a variable output, it is still a system because the output is definable and specific, it is not random. A black box whose output is random, is not a system.

The relationship, connections, between the various components of a system are its lines of communication. The state, particular pattern, way, various components relate at any specific moment reflects the information in the system. These lines of communication, the information of a system, reflect the systems' complexity and ability to generate variety, directly. When we decide to affect, to adjust the input of a system in order to derive a certain output, when we alter the lines of communication, the relationship between components, the pattern, by feeding in information; we are linking up with the system, both at the

input and output stages, incorporating that system into a larger one. Only a system can be incorporated into a larger system, random events cannot. In this way, smaller systems become subsystems of larger systems. No dynamic system can be completely isolated from other systems. Cybernetics does, however, study the isolated system, much as it studies the black box, so as to arrive at the principles under which systems function.

Each dynamic system attempts to permutate, that is, evolve, along an optimum permutation path, which interacts with other systems. It attempts to do this by means of its control processes, which reflect the variety, information, and communication within the system. The primary mechanism the control process utilizes is the feed-back loop. The feedback loop is essentially a sensing process whereby the system senses its progress, its permutation in conjunction with other systems, which allows the system to adjust its progress (permutation) towards what <u>that</u> system may consider its optimum path. Problems often arise here for many reasons. The information contained within a system may be incomplete or misleading as to what is the optimum permutation path. The sensing process may be inadequate. The feedback loop may malfunction or be inadequate in terms of its design. The primary function of the feedback loop, the control processes maintain the homeostatic balance of system in terms of its optimal permutation, in terms of its interaction with other system. If this balance is upset, if the system veers off the optimum path, if the

system ceases to interact in an optimum manner with other systems, it may go into a violent oscillation and, or its eventual cessation as a system and degeneration into random events, its destruction, the end of its dynamic nature.



feedback loop informing bat of the existence of the object, advising an alternate route or permutation.

possible future states.

1,2,3 possible future permutations.

present state

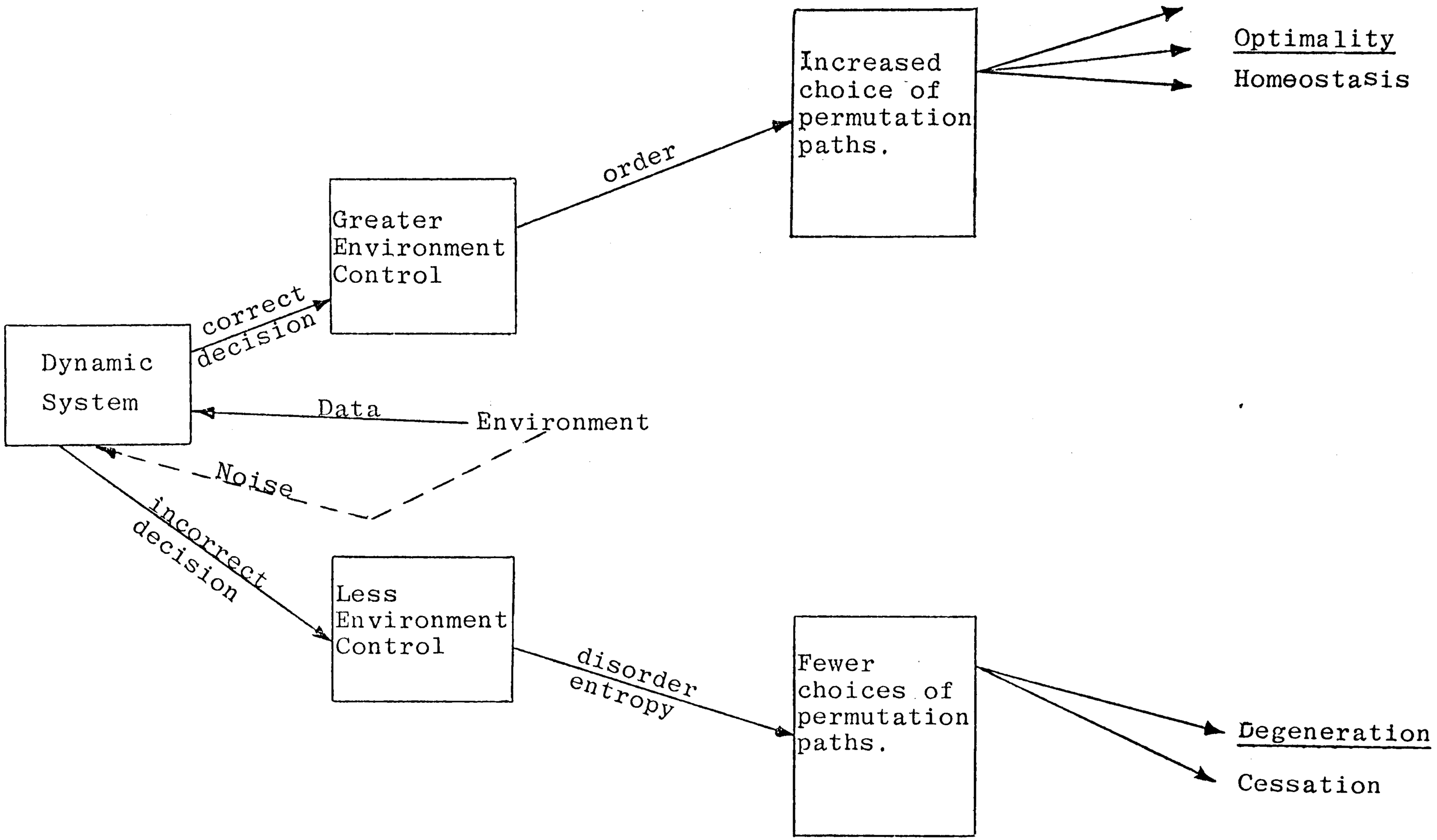
Another important central process is the ability of a system to simulate, to be an analogue, in conjunction with the data obtained by the feedback loop, possible and probable permutations of the system. Upon the results of this process to make a decision as to the optimum permutation, based upon the information maintained within the system. In biological systems this information takes the form of DNA, and 'Knowledge' in the human process, likewise in a few other mammals such as dolphins. In machines such information may exist in terms of a program. In societies this may exist in terms of what is called "culture, tradition and religion". Problems develop when (in addition to other possible inadequacies, some already

mentioned) the analogue process based on the information maintained proves inadequate, and an 'incorrect' decision is made.

Viability

A system made through the high viability of its control processes, obtain such a high optimum permutation so as to disrupt the systems it is interacting with. Similarly, it is possible even probable through the low viability of its control processes to achieve such a poor permutation so as to disrupt the system with which it interacts. The resultant disruption may be upon minor to severely complex control processes which must operate well for the system to achieve optimum permutation.

(It may be that the more complex a system, the more permutation paths there are possible.) The survival of the viability of these complex system is related to meeting a minimum permutation standard, i.e. homeostatis. In fact, all systems can only survive if they are homeostatic; that is, tend towards a balanced (within defined parameters) permutation. Perhaps the key element in a system arriving at a homeostatic state is the ability of a system to generate adequate variety to meet the variety generated by the external environment, the law of requisite variety (Ashby). In this relation the lines of relationship, communications, must be capable of transmitting an adequate amount of information to overcome any disturbance, which may also be in the form of misinformation (Noise), indicipherable data,


Dynamic System
correct decision
Greater Environment Control
order
Increased choice of permutation paths.
Optimality
Homeostasis
Data
Environment
Noise
incorrect decision
Less Environment Control
disorder entropy
Fewer choices of permutation paths.
Degeneration
Cessation

or mischanneled data (as well as physical manifestations). The more channels per line, the more capable the line may be of transmitting information in quantity. (Capacity.)

The more the system is capable of reducing complexity and (uncertainty) probabilism, the more capable the system is of controlling its environment thereby achieving an optimum permutation. This capability is related in large measure to the ability of the system to evolve, to adjust itself, to develop new, dynamic relationships between its components, to develop new feedback loops which may in turn generate new relationships, communications, information within the system. The greater the ability of a system to evolve, the greater the ability a system has of dealing(adapting) successfully with its environment, of interacting with other systems toward its own optimum permutation. Most systems evolve, some ever so minutely, but some cannot adjust, evolve, rapidly enough to survive, whereby the dynamic relationships between its components break the communication and information making it as a system cease to exist. In a sense, a system ceases to exist when the information necessary to its existence, its lines of communication ceases to exist; that is, the system cannot obtain the necessary information. Inclusive in this information are the parameters to its permutation. A system without distinctions as to its parameters becomes unstable and destructs. Parameters make the permutation of a system partially predictable. Damage or destruction also comes to a system when it incorporates

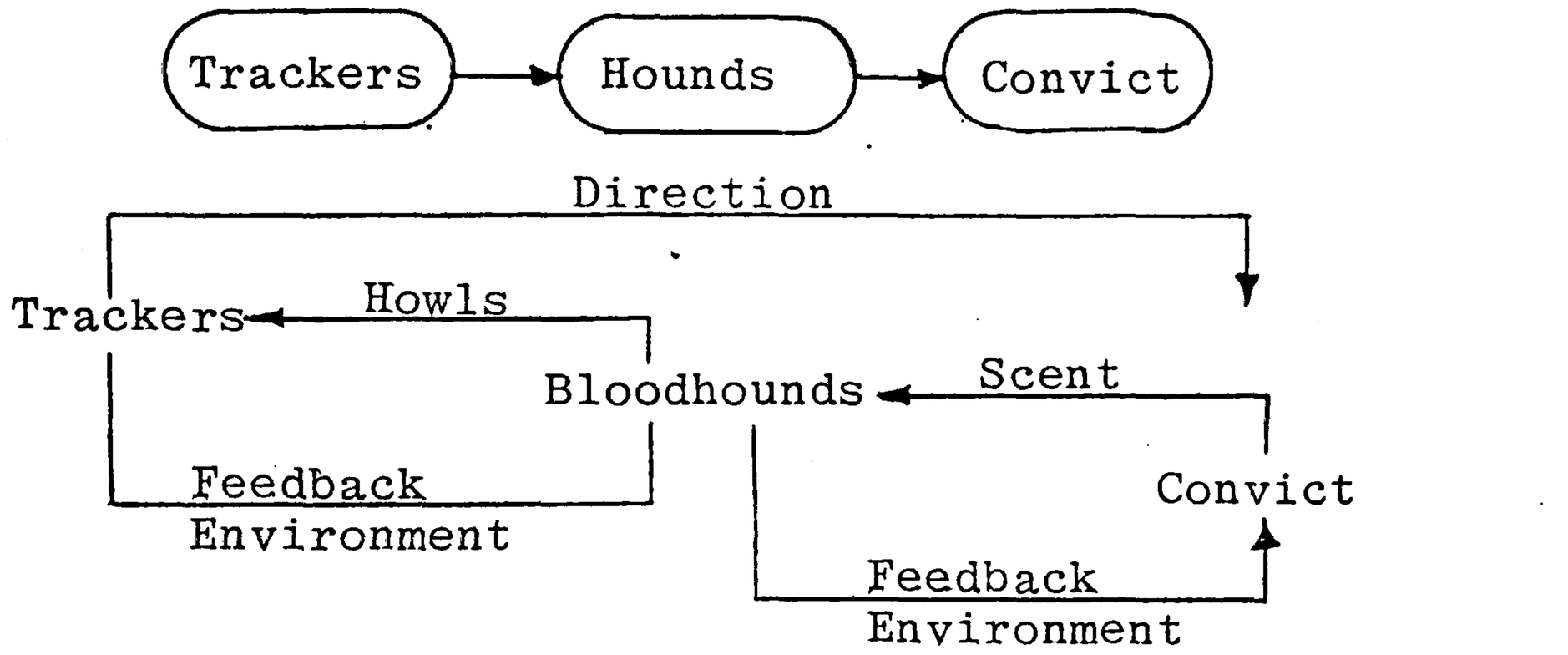
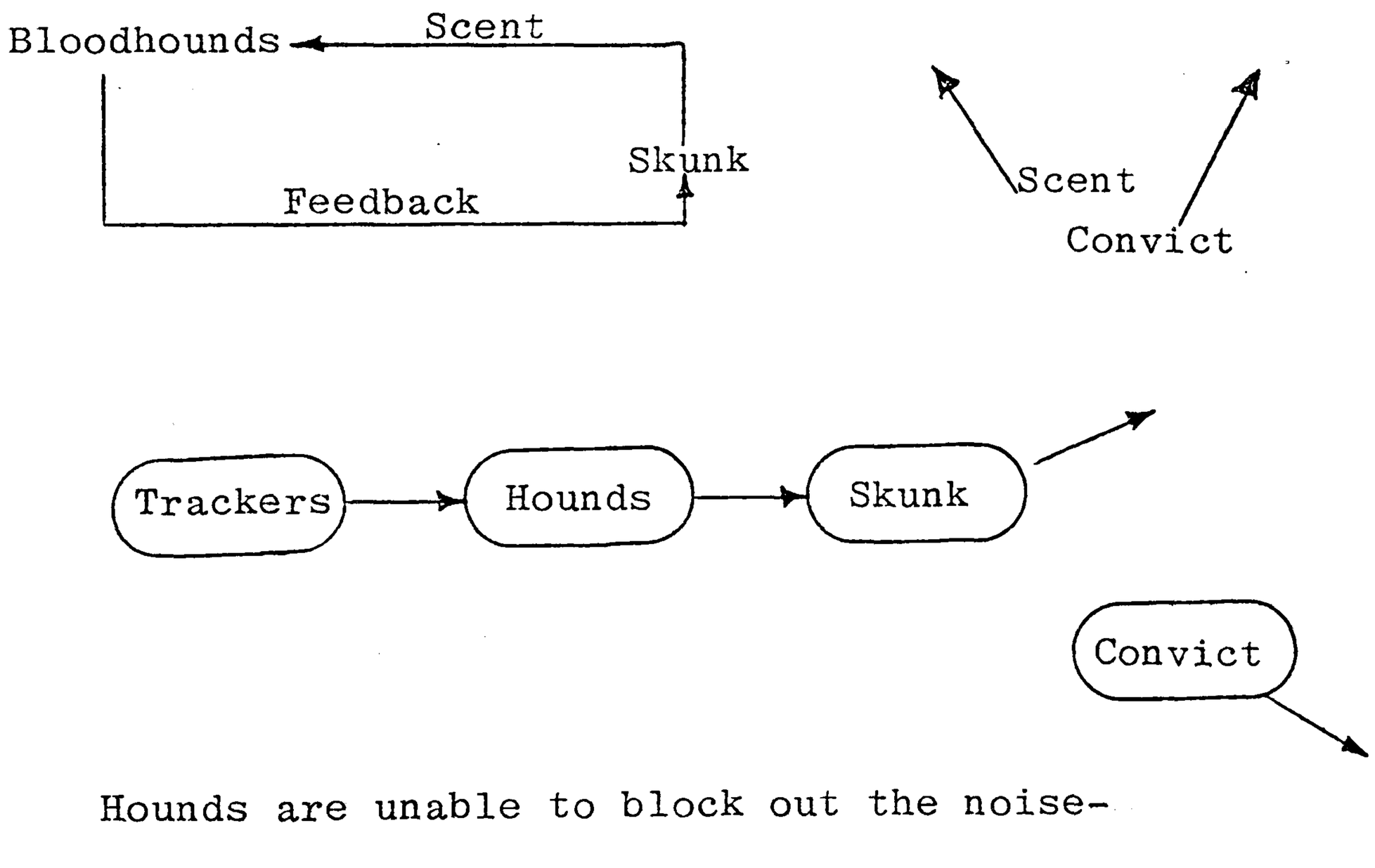


Fig. X



Hounds are unable to block out the noise-scent from the skunk. The misinformation leads them and the trackers on a non-optimal path away from the convict.

Fig. Y

data into information (mistakes noise for information) which is not relevant to its environment, to its optimum permutation. This happens when its sensing mechamism, the feedback loop cannot differentiate accurately its environment. It also happens when the feedback loop is short circuited; that is, the system receives directly data from its environment; for example, if the lever on a thermostat is manually pulled to increase the heat, the system falls out of equlibrium, it does not maintain a specified temperature of its own accord but one manually induced. This may be called a <u>disturbance</u> which displaces it from a natural permutation to a state it would not of its own accord, reach. A system may use external systems as part of its feedback loop either on a "static" or "dynamic" basis (see Fig. X). A system's survival and its ability to proceed towards an optimum permutation is in part dependent upon its ability to regulate incoming data so as to block negative data (Noise), the flow of variety from disturbances (see Fig. Y). This implies greater complexity and the ability to generate greater variety. Not all data can be incorporated as information, regulation can be achieved by blocking only data that cannot be incorporated as information. The amount of regulation is limited by the channels, the interconnections - the ability to generate and transmit variety, information. The information, channels, and connections between components are in themselves capable of generating variety.

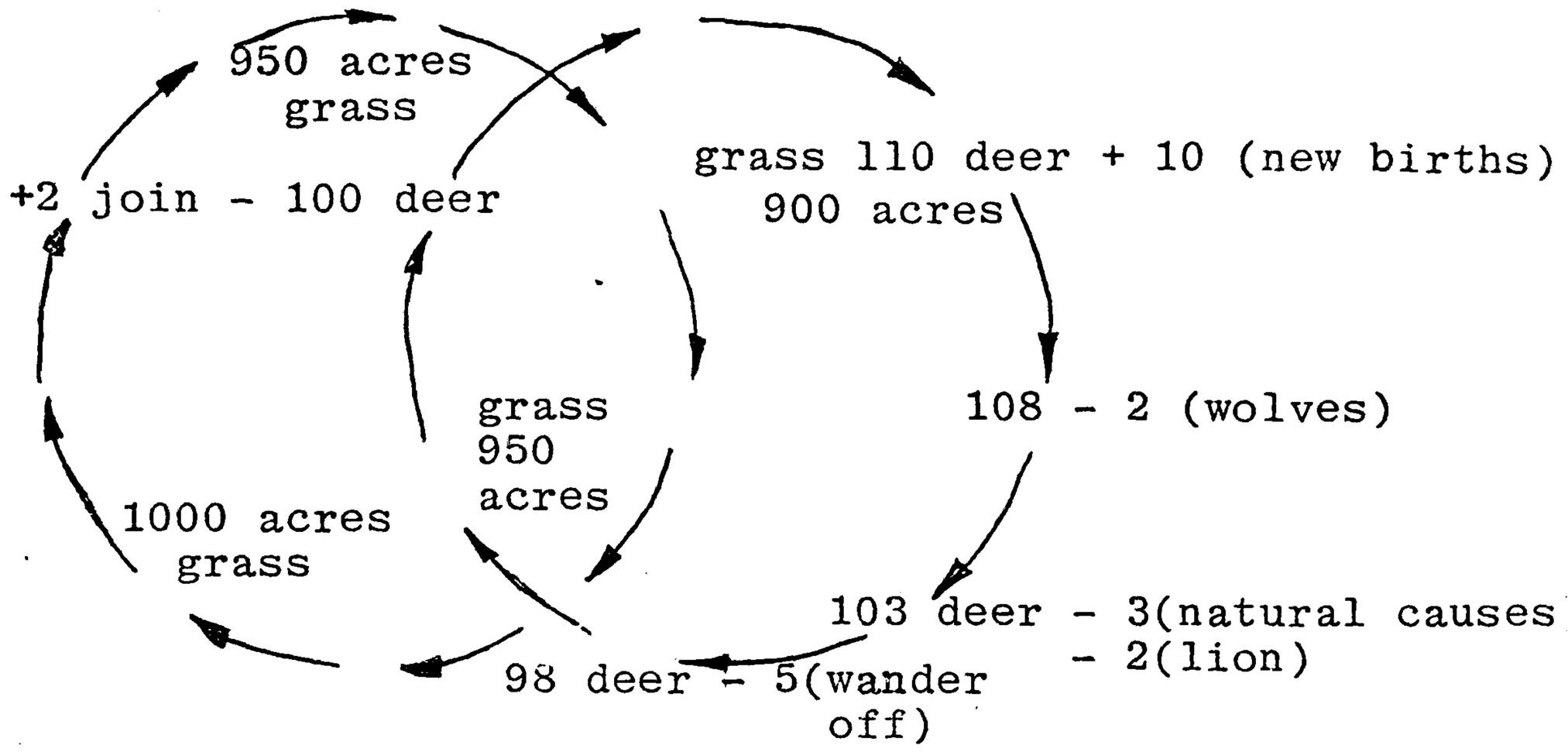
<u>Control</u>

The more a system can regulate, evolve, and generate variety,

the greater its power of selection is, and therefore the greater the power of its control will be over its environment, its permutation, and other systems (how it reacts with other systems, how other systems interact with it). The more control a system is able to exert over other systems, the more its control over its environment is magnified. A system has, therefore, a propensity to magnify, to increase its control over its environment, to incorporate other systems until a parameter is reached. As a system extends its control, each succeeding stage becomes more difficult. Control becomes more difficult to exercise as control is increased because while the system's ability to generate variety is increasing with increasing control, the need for variety is also increasing but at a greater, geometric rate, to that of the increasing ability to generate enough variety to extend further its control, a natural parameter. Also, in direct proportion to the increase in control and permutation paths a system's requirement for regulation increases geometrically. This is because its access and vulnerability to negative data increases geometrically, its vulnerability to "disturbance" increases geometrically, the potential for the direct input of data by-passing the system feedback loops or sensing mechanisms. A system's inability to generate variety adequate to overcome the variety of another system or systems is in a way a form of regulation, as this natural regulation breaks down the system's need for self generation of regulation, (variety increases in direct proportion). By increasing control over the interacting system, a system

regulates the direction of control, avoiding a particular direction which can act as a variety sink, draining variety, causing the system to become unstable and perhaps destruct. As a system proceeds through the cycle of an optimal permutation, the system necessarily increases control, increases its ability to generate variety. This means necessarily that while some systems are constantly increasing control, others are losing it. This does not apply to all systems; that is, it is possible for two systems to be increasing control at the same time, a symbiotic relationship. Generally, however, the former is true, but it does not generally mean that while some systems are proceeding along an optimum permutation other are degnerating. It does usually mean that some cycles are considerably longer than others, some are then considerably shorter. It, therefore, means that while a system may be losing control, it may be an organic part of its cycle, part of its optimum permutation. (species)

For instance, take a herd of deer who live in a certain area and a mountain lion which trims the herd of the old and infirm. It is in the interest of the herd to be trimmed so that available fodder will not be destroyed by overpopulation. The old and infirm have in a sense come to an end of a cycle. Similarly, when the deer feed on grass they help scatter the grain, the seed, while eating a particular blade of grass which has come to the end of its cycle.



If a system proceeds along a path of an optimal permutation it usually reaches a state of equilibrium, balance, homeostatis. States of equilibrium are in themselves usually dynamic; that is, new states of equilibrium are constantly being arrived at. A state of equilibrium is usually reached when all systems interacting are proceeding at an optimal permutation. When one system breaks down or becomes unstable it causes a period of unstability in the other interacting systems which the other systems may be able to adjust to and reach a new state of equilibrium. If not, the relationship breaks up between the interacting systems, and the larger system which they compose is destroyed.

As control is extended, the ability of the system to analogue, to teach itself, increases, but not in proportion to the demands made upon it. This is because the variables the system must model increase geometrically while its analogue capability is basically linear, because its permutation is linear. If a systems permutation becomes geometric,

it usually ceases to become a system as previously known or becomes a series of random events, and therefore ceases to exist. It is possible for a system's analogue to become overwhelmed by input data and attempt a geometric permutation resulting in instability or the destruction of the system. The confusion of the analogue capability resulting in instability may only result in the system pursuing a lower optimum permutation path, after an adjustment is made. The confusion may result from inadequate data, and or the inability of the system to differentiate finely the input, providing the required information. Therefore, it becomes possible that a number of permutation paths appear equally provident, optimal. The possibility for confusion (noise), therefore, increases geometrically with the increase in control, with the increase in variables.

Excess control, excess generation of variety can unstabilize and perhaps destroy a subsystem. A system when sensing, (through a feedback loop), excess generation of variety, can channel this excess back, thus negating a measure of variety from the system, hence, achieving the right level of control. (negative feedback).

When a system breaks up into its component systems, these component systems must establish a new relationship with their environments which includes attempts to establish control over interacting systems, which includes any system which once exercised control over it. Therefore, a loss of control by a system by an interacting system may mean

a neutral state, but also a state in which it obtains control over adjacent systems by generating more variety than they can handle, confusion of the analogue system, by disturbance, short circuiting their feedback loops of control to control, regulative control so that excess control does not destabilize controlled systems resulting in their destruction.

A system may, in addition to analogue and feedback mechanisms, have a permutation storage mechanism, memory, that is, it may store a certain pattern of permutation in relevance to a certain set of external parameters (variables), to be made operational when the set of parameters (variables) are next encountered. In a more sophisticated, complex system, it may have the ability to cross-reference stored permutations in the analogue process. This increases geometrically the number of permutations possible in the permutation process.

(A system may be linear and/or geometric through space, but must be linear through time.)

Chaos

A system requires not only requisite variety (order generating ability) but it requires requisite chaos (disorder). A system must constantly search for requisite chaos to order. More chaos than its variety generation can handle will destroy the system (it attempts too much), less chaos will cause the systems variety (excess)

generation to turn in upon itself and eventually destroy itself (positive feedback).

Variety in a system may become negative-destructive towards itself because a dynamic system is always seeking increasing control over its environment, if its environment comes to consist partially or wholly of itself the variety it generates will seek to reorder itself. If it reorders itself in the absence of points of reference (environment) it will adjust, overadjust so that it no longer becomes relevant to its environment or adaptable to changes in it. It may be microscopically that when the challenge-threat of chaos is absent that the components of the system do not give up as much variety to the central control system, but instead use the retained variety against each other in an attempt to establish new relationships. (The decay of the Roman Empire may be a good example of this.) The tension, control, order of the system breaks down as the challenge-threat of chaos lessens. Requisite chaos must be found for a systems optimal permutation.

Parameter Change

When parameters change a system's sensing and analogue mechanisms need to change in direct proportion. However, paramental change may be so drastic that a system may not be able to change fast enough to survive. Such change could, for instance, be an ice age, drought or pollution. The total system may after a period of oscillation, in which some component systems fail to survive, proceed

towards a new state of equilibrium.

Order and variety generation may also have to be increased when parameters change as an increased optimality may be necessary and possible, or a decreased optimality in terms of a path, may require variety increase (and order).

When a system encounters a new set of parameters with which it cannot deal adequately it may go into a state of flux, oscillation whereby new information is obtained, the relationships between components, the line of communication, the organization of the system is altered to meet the new parameters.

Section Summary

When a system, is allowed access to an expanded source of variety, its options increase for a higher optimal permutation (higher optimal permutation is measured in terms of increasing control; i.e., increasing control upon where it is to go next, increasing freedom of choice, increasing options of permutation). As its decision-making powers increase, a systems greater variety generation power enables it to partake to a larger degree in the decision making of the overall system, if, this continues the system will come to dominate the overall system and may eventually destroy or separate from other component systems, or come to a new relationship, (a new equilibrium with the other systems).

Variety simplifies the actual permutation. The ability

of a system to generate variety is directly related to its ability to simplify a permutation, that is, follow the fewest number of permutation states, steps, from point A to point B.

A system in pursuing its optimal permutation to generate variety sufficient to control its immediate external environment, adjacent systems, also seeks to increase its control over internal component systems. However, there are also natural internal parameters which if transgressed would cause the oscillation, degeneration and possibly destruction of the component systems. The destruction of a component system may cause that system's component systems to disperse, causing a state of disequilibrium in the overall system, until the dispersed systems are reabsorbed. The system as a whole may not be able to reabsorb the dispersed systems, or the oscillation of the disrupted systems may start a chain reaction disrupting adjacent systems causing the oscillation, degeneration and destruction of the system as a whole. It must be remembered that each component system is operating within systems principles; that is, each system is seeking a higher optimal permutation, seeking increased control, component systems must therefore be restrained, limited in the nature of their permutation, so that the generation of their variety does not interfere with the operation of other necessary component systems. Therefore variety generation must be adequate to control and channel the variety generation of component systems. It follows that

as a system proceeds to a higher optimal permutation, increasing control, variety generation must increase at a 'continuous' rate, and constant rate. A drop in the generation of variety may cause the system to collapse in totality as its control over a component system collapses forcing it to divert variety from other parts of the system to the collapsed area, which may cause eventual total collapse.

(The optimal permutation of a component system does not necessarily contribute to the optimal permutation of the overall system.)

II

Cybernetics, Socio-Economics evolution, and change

The study of Cybernetics is a new science and its investigators have barely scratched its surface. It is peculiar that a science of such extreme importance to mankind, at this particular juncture in its time, draws so relatively few investigators. It is at this particular point in our time that complexity, the extension of control, has reached a point where it threatens to overwhelm man, mans' generation of variety and its direction do not seem adequate to simplify the complexity we are faced with so as to allow our optimal permutation.

Investigators of this new science must still feel as perhaps the early physicists did, that they are at time hopelessly groping in the dark. There are those who compare the present state that Cybernetics with that of Economics before Keynes, this I do not consider an apt analogy because so few economists really have the faintest understanding of economics in relation to Keynes. Cybernetics I would say is at a stage as Physics was before Newton.

In consideration of the great complexity, man is facing and will face, the hopeless management tools man has attempted to use to control this complexity, any contribution that could be made to the improvement of this most distressing situation is worthwhile. What is attempted here is to apply some Cybernetic principles to the management

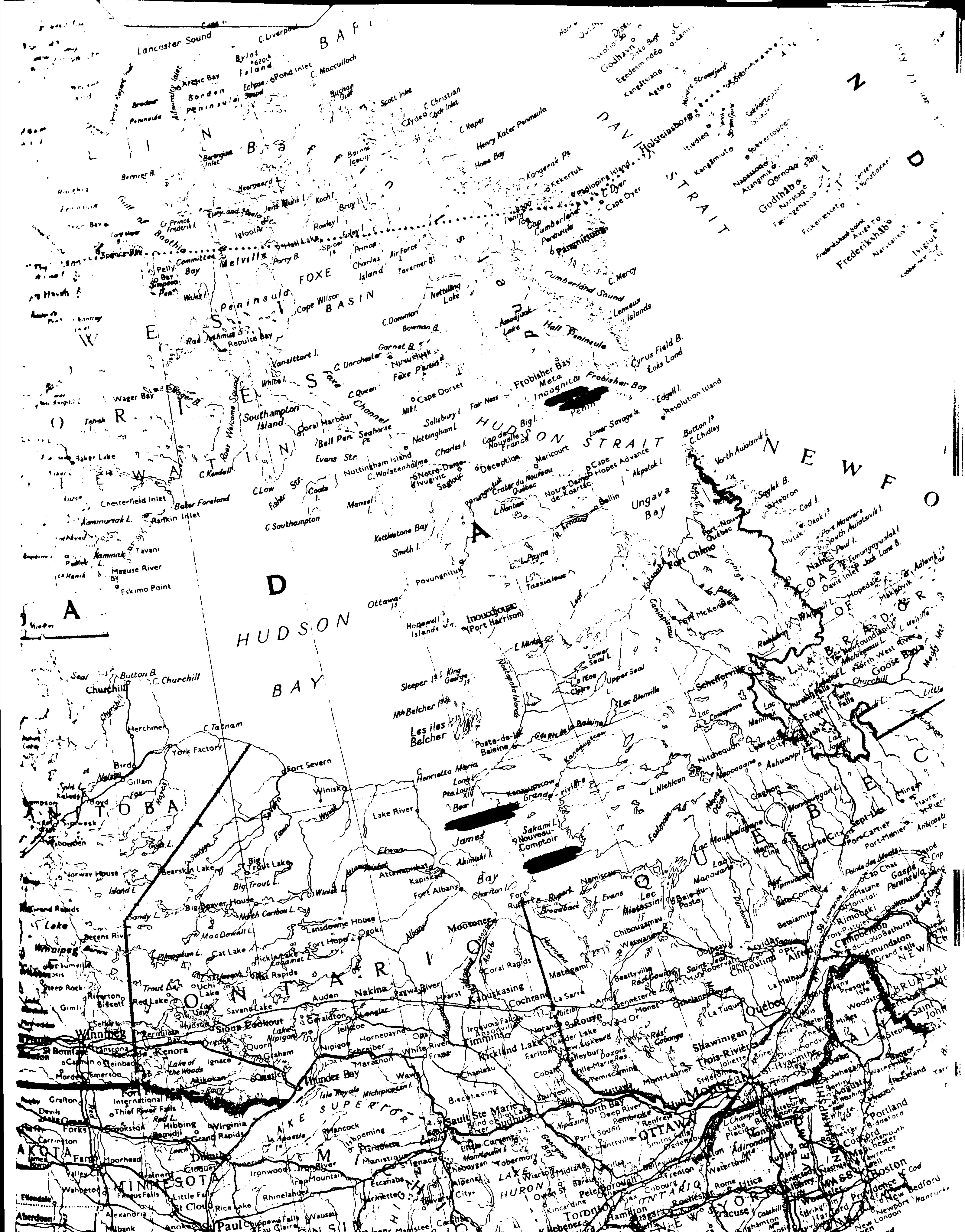
of the socio-economic system.

It is, as all who even consider the problem vaguely, an extraordinarily complex and difficult one. The preceeding attempted to clarify certain key cybernetic principles. These principles were then applied against field research in three communities of Northern Canada, Paint Hills, Fort George and Lake Harbour. An attempt was made to learn how these communities systematically developed when new information and new information channels were directed towards them.

Before digressing in depth upon induced possible structural changes it should first perhaps be mentioned that superficially there did not seem to be any marked changes. This seemed because much of the information and cultural input by television was already extant in the form of goods, magazines, radio. Television was only one form and a later form of information input imposed upon them. Earlier the law and welfare systems of the state represented by the RCMP (Royal Canadian Mounted Police) nursing stations, the trading system of the south represented by the Hudson Bay Company and the occasional visit by scholars like ourselves, fishermen, tourists and hunters, had all worked consciously and unconsciously to impose the structure of the south upon these native communities.

The advent of television was no doubt an increase in degree of information input but it was not a readical change in

BACKGROUND


Lancaster Sound
C. Liverpool
Bylot Island
Pond Inlet
C. Macculloch
Arctic Bay
Admiralty Inlet
Borden Peninsula
Eclipse Sound
Buchan Gulf
Scott Inlet
C. Christian
Clyde
Clyde Inlet
C. Raper
Henry Kater Peninsula
Home Bay
Brodeur Peninsula
Berlinguet Inlet
Bernier B.
Neergaard L.
Jens Munk I.
Koch I.
Bray I.
Rowley I.
Fury and Hecla Str.
Igloolik
Cr. Prince Frederik I.
Boothia
Gulf
Spence Bay
Pelly Bay
Committee Bay
Simpson Pen.
Melville Peninsula
Parry B.
Spicer Is
Foley I.
Prince Charles Island
Air Force I.
Taverner B.
Nettilling Lake
FOXE BASIN
Cape Wilson
Wales I.
Rae Isthmus
Repulse Bay
C. Dominion
Bowman B.
Vansittart I.
White I.
C. Dorchester
Garnet B.
Foxe Peninsula
Foxe Channel
C. Queen
Cape Dorset
Mill I.
Wager Bay
Wager B.
Southampton Island
Coral Harbour
Bell Pen.
Seahorse Pt
Salisbury I.
Nottingham I.
Roes Welcome Sound
Evans Str.
Nottingham Island
C. Wolstenholme
Charles I.
Notre-Dame-d'Ivugivic
Saglouc
C. Kendall
C. Low
Fisher Str.
Coats I.
Mansel I.
C. Southampton
Baker Lake
Chesterfield Inlet
Baker Foreland
Kaminuriak L.
Rankin Inlet
Kaminak L.
Tavani
Maguse River
Eskimo Point
K E E W A T I N
D I S T R I C T O F
HUDSON BAY
Kettlestone Bay
Smith I.
Povungnituk
Ottawa Is
Hopewell Islands
Inoucdjouac (Port Harrison)
Sleeper Is
King George Is
Nth Belcher Is
Les iles Belcher
Seal
Button B.
C. Churchill
Churchill
Herchmer
C. Tatnam
York Factory
Bird
Nelson
Gillam
Fox
Hayes
MANITOBA
Boyd
Kelsey
Norway House
Island L.
Grand Rapids
Lake Winnipeg
Berens River
Riverton
Bissett
Gimli
Selkirk
Winnipeg
St Boniface
Carman
Steinbach
Morden
Emerson
Fort Severn
Winisk
Lake River
C. Henrietta Maria
Ekwan
Attawapiskat
Kapiskau
Fort Albany
Big Trout Lake
Bearskin Lake
Big Trout L.
Big Beaver House
Sandy L.
North Caribou L.
Lansdowne House
MacDowell L.
Fort Hope
Ogoki
Albany
Moosonee
Cat Lake
Pikangikum L.
Pickle Lake
Cabamet L.
Rat Rapids
Trout Lake
Uchi Lake
Red Lake
ONTARIO
Savant Lake
Sioux Lookout
Vermilion Bay
Kenora
Lake of the Woods
Ignace
Atikokan
Quetico
Auden
Nakina
Pagwa River
Hearst
Geraldton
Longlac
Jellicoe
Lake Nipigon
Nipigon
Schreiber
Hornepayne
Marathon
White River
Thunder Bay
Wawa
Isle Royale
Michipicoten I.
LAKE SUPERIOR
Fort Frances
International Falls
Thief River Falls
Red L.
Grafton
Devils Lake
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Grand Rapids
Duluth
Fargo
Moorhead
Carrington
NORTH DAKOTA
Valley City
Wahpeton
Cloquet
Brainerd
MINNESOTA
Fergus Falls
Little Falls
St Cloud
Rice Lake
Alexandria
Ellendale
Aberdeen
Milbank
Willmar
Anoka
St Paul
Minneapolis
Mississippi
New Ulm
Mankato
Faribault
Rochester
Brookings
Huron
Madison
Mitchell
Worthington
Sioux Falls
Canton
Spencer
Austin
Mason City
Charles City
SOUTH DAKOTA
Ironwood
Iron River
Iron Mountain
Rhinelander
Wausau
Chippewa Falls
Eau Claire
WISCONSIN
Wisconsin Rapids
Appleton
Oshkosh
Manitowoc
Sheboygan
Fond du Lac
Winona
La Crosse
Madison
Milwaukee
Racine
Kenosha
Janesville
Beloit
Waukegan
Chicago
Green Bay
Escanaba
Marinette
Ancock
Ishpeming
Marquette
Manistique
St Ignace
MICHIGAN
Cheboygan
Alpena
Traverse City
Manistee
Cadillac
Ludington
Bay City
Saginaw
Muskegon
Grand Rapids
Lansing
Battle Creek
Kalamazoo
Jackson
Toledo
Flint
Pontiac
Port Huron
Detroit
Windsor
Sarnia
London
LAKE HURON
Tobermory
Wiarton
Owen Sound
Midland
Kincardine
Kitchener
Brantford
Toronto
Hamilton
St Catharines
Welland
Buffalo
LAKE ERIE
Cleveland
Lorain
PENNSYLVANIA
Oil City
Williamsport
Wilkes Barre
Harrisburg
Reading
Allentown
Philadelphia
Dunkirk
Jamestown
Olean
Elmira
Ithaca
Syracuse
Rochester
NEW YORK
Rome
Utica
Watertown
Binghamton
Scranton
Poughkeepsie
Newark
New York
Trenton
Long Branch
Long Island
New Haven
New London
Newport
Nantucket
New Bedford
Providence
Boston
Worcester
Springfield
Hartford
MASS.
Nashua
Lawrence
Manchester
Concord
Portsmouth
Biddeford
Portland
Lewiston
Augusta
Waterville
Bangor
Rockland
MAINE
Rutland
Montpelier
Burlington
L. Champlain
Lake Placid
Adirondack Mts
Plattsburgh
NEW HAMPSHIRE
VERMONT
Sudbury
Sault Ste Marie
Blind River
Little Current
Manitoulin I.
Georgian Bay
Bisco tasing
Chapleau
Timmins
Iroquois Falls
Ansonville
Kirkland Lake
Kapuskasing
Cochrane
Coral Rapids
Abitibi
Moose
La Sarre
Amos
Matagami
Rouyn
Noranda
Larder Lake
New Liskeard
Earlton
Haileybury
Cobalt
Ville-Marie
Temiscaming
Mattawa
North Bay
Sturgeon Falls
Nipissing
Parry Sound
Huntsville
Deep River
Pembroke
Renfrew
OTTAWA
Smiths Falls
Belleville
Trenton
Peterborough
Cobourg
Ajax
LAKE ONTARIO
Kingston
Hull
Montreal
Mont-Laurier
Joliette
Sorel
Drummondville
St-Hyacinthe
Granby
Sherbrooke
Thetford Mines
Trois-Rivieres
Shawinigan
La Tuque
Quebec
Levis
Dozois Res
Cabonga Res
Val-d'Or
Senneterre
Monet
Beattyville
Waswanipi
Chibougamau
Roberval
Dolbeau
Lac Saint-Jean
Jonquiere
Chicoutimi
Arvida
Saguenay
Port-Alfred
La Malbaie
Riviere-du-Loup
Trois-Pistoles
Rimouski
Mont-Joli
Matane
Cap Chat
Gaspe Peninsula
Gaspe
Campbellton
Dalhousie
Bathurst
Edmundston
Grand Falls
Presque Isle
Woodstock
Fredericton
Saint John
Calais
St Stephen
NEW BRUNSWICK
Baie-Comeau
Betsiamites
Pipmuacan Res.
Manicouagan
Manic Cinq
Clarke City
Sept-Iles
Port-Cartier
Port-Menier
Anticosti
Pointe des Monts
Mingan
Havre-St-Pierre
Gagnon
Manicouagan L.
Lac Mouchalagane
Manouane
Monts Otish
Lac Mistassini
Baie-du-Poste
Nemiscau
Rupert
Fort Rupert
Broadback
L. Evans
Charlton I.
Eastmain
L. Nichicun
Nitchequon
Nacocaane
Ashuanipi
Labrador City
Lac Joseph
Emeril
Menihek
Lac Caniapiscau
Schefferville
Churchill Falls
Twin Falls
Little
Churchill
Goose Bay
North West River
Michikamau L.
Newfoundland
Mealy Mts
L. Melville
QUEBEC
Kanaaupscow
Grande-riviere
Sakami L.
Nouveau-Comptoir
[redacted]
James Bay
Akimiski I.
Bear I.
Pte. Louis XIV
Long L.
Poste-de-la-Baleine
Gde Riv. de la Baleine
Lac Bienville
Upper Seal L.
Lower Seal L.
La l'Eau Claire
Nastapoka Islands
L. Minto
Leaf
Caniapiscau
Fort McKenzie
Koksoak
Fort Chimo
George
Tassialouc
L. Payne
R. Arnaud
L. Nantais
Bellin
Notre-Dame-de-Koartac
Cape Hopes Advance
Cratere du Nouveau Quebec
Maricourt
Deception
Cap de Nouvelle France
Big I.
Ungava Bay
Akpatok I.
HUDSON STRAIT
Lower Savage Is.
Resolution Island
Edgell I.
Button Is
C. Chidley
North Aulatsivik I.
Saglek B.
Hebron
Cod I.
Okak Is
Nutak
Port Manvers
South Aulatsivik I.
Paul I.
Tunungayualok I.
Nain
Jack Lane B.
Davis Inlet
Hopedale
Makkovik
Adlavik Is
Port-Nouveau-Quebec
COAST OF LABRADOR
NEWFOUNDLAND
Frobisher Bay
Meta Incognita
[redacted]
Frobisher Bay
Fair Ness
Cyrus Field B.
Loks Land
Hall Peninsula
Amadjuak Lake
Lemieux Islands
Cumberland Sound
C. Mercy
Pangnirtung
Cumberland Peninsula
Cape Dyer
C. Dyer
Padloping Island
Kekertuk
Kangeeak Pt
Penny Ice Cap
BAFFIN ISLAND
DAVIS STRAIT
Holsteinsborg
Itivdlea
Kangamiut
Sukkertoppen
Napassoq
Atangmik
Qornoq
Godthab
Narssaq
Faeringehavn
Fiskenaesset
Frederikshab Isblink
Avigaq
Frederikshab
Narssalik
Ivigtut
Godhavn
Disko Bugt
Egedesminde
Kangatsiaq
Agto
Nordre Stromfjord
Sondre Stromfjord
Sukkertoppen Isflade
GREENLAND

type, nor were its effects radically different but perhaps only more intense.

Background

Lake Harbour, Northwest Territories, Canada.

Lake Harbour is a small settlement of about 200 mostly Inuit (Eskimos), with a very small minority of Southerners who are with the Anglican mission, RCMP (Royal Canadian Mounted Police) and the Hudson Bay Company (about ten). The settlement contains an elementary school, a nursing station, and a co-operative arts and crafts centre. There is only seasonal air service, no dial telephone, radio is sporadic, television by disk-satellite was installed in 1976 (previously there were only the occasional video tape displays). Mobility was and is moderately difficult, because of the muskeg and climatic conditions. In 1974 a crude airstrip was completed adjacent to the settlement, allowing semi-regular air service. A 'frontier' movie theatre has served the community for a number of years.

"Southern" cultural structures have in terms of inflow been evident for a considerable time, the inflow has been slow allowing a gradual adjustment of the local cultural code, the local permutation engendered has been able to adapt the information towards the optimal. The community showed some signs of attempting to gather information pertinent to its survival as a priority, in that only relevant local information is gathered, very little is gathered

upon the international scene. There seems to be a definite time period as to when a new visitor would be absorbed and integrated into the system, the organism, the community. There also seems to be two subsystems of information absorption at work, the non-Inuit community are understandably more locked into the southern super-system via interlocking information systems. The only North-South telephone service available is the radio-telephone.

Music, television and movies exist but they are self generated; that is, in the main, the community decides when to play them; they are not broadcast.

To the non-Inuit, information - communication is a socializing, integrating instrument; to the non-Inuit, information - communication is a sustaining reinforcing instrument as to a particular system operation. It seems, too, that the non-Inuit tended in the longer run to lose this reinforcement to lose integration with the southern style.

The village is organized basically into the settled, the nomadic hunters, those who understand English, those who don't (the southern language), among the Inuit. If a division exists the non-Inuit are divided between the government institutional people and the private (e.g. Hudson Bay) people. The Inuit (Eskimo) communicate in Inuktitut, using syllabics. The younger Inuit are also

able to communicate in English. There seems to be a loose extended family relationship into which the Inuit group themselves, and seem to be relatively more reluctant to move socially and employment wise outside, relative to non-Inuit.

The Inuit rarely travel south, they travel mostly in the local environs hunting or to Frobisher Bay to shop. The non-Inuit in contrast travel rarely in the evirons, and regularly south.

A newspaper from Frobisher Bay, 90 miles distant, and Hudson Bay Catalogues provide the basic written material input into the community, aside from the mail. There seems to be a preference for visual images in that the primary reading source is comic books. Perhaps this is because the Inuit had to be a very visual people, hunting, sculpting, making clothes, building, and because perhaps the comic plots bear some resemblance to their legends. The Inuit have not participated in the information work force, i.e., clerks, etc. but still pursue their lives externally, visually, hunting and trapping, not intellectually, internally.

Television could only be viewed in visits to larger settlements or on video disc playback.

The community seemed singularly interested in the affairs of the community with little concern for outside events.

Radio both long and shortwave are listened to regularly and frequently, but incoming news is little discussed and apparently of little concern. Most have record playing equipment and current records are available at the Hudson Bay store.

Occasionally pre-recorded events of viewed importance such as the Canada-U.S.S.R. hockey series are aired on local televisions, but it is interesting to note that not one non-Inuit (Eskimo) viewed these recordings. In addition, there seems to be a definite inclination of new non-Inuit residents to lose interest in the outside world and its events. Broadcasts seem to serve as company, cultural identity and not in any case an information source on out-side events. The remoteness and apartness of the community from the Southern system is accepted and in some sense created. A not too exaggerated analogy may be drawn with a moon settlement which occasionally views the earth to reassure itself it is still there and then goes on about its business. "It is as if we are building our own system here but we need reassurance that if anything untoward happens reinforcements from the larger system may be had". This is because the resident does not view information on outside events as functional, useful in his everyday life.

The Inuit (Eskimo) sub-system

There are about 200 Inuit, with a few coming and going - 36 family heads, living in 33 households. Traditional values still dominate with sharing, generosity, famial and hunting duties held as more important than a standard of living. About 20 Inuit hold jobs, as defined by the southern system. The status of the jobs are, however, defined differently; i.e., by the flexibility of the work schedule to allow for traditional pursuits such as hunting and fishing. The majority of those employed are under non-Inuit supervision. Because of traditional patterns, employment tended to transfer down through family groups resulting in a mildly hierarchical pattern of family group organization. Employment and transference of employment groups has created a sub-group, sub-system of communications between the Inuit traditional and the non-Inuit systems, because their endeavours had separated them slightly from the traditional Inuit in terms of pursuits, time and standard of living, which were clearly not non-Inuit. An item of much importance in the retention of employment among certain family groups is the transference of a knowledge of English within these groups, allowing also an access to greater information possibilities.

Of the 200, 90 have some knowledge of English, 70 of these are children in elementary school, 12 are conversant, and eight are fluent. In short, only a small minority of

the adults can communicate with the outside world, system, but this situation is clearly bound to change. An indication of such changes is found when community leaders find their ability to lead, to make decisions, hindered, frustrated considerably by their lack of knowledge, and are being forced to rely on the younger, more educated for assistance. This has necessitated the transfer of some power to the younger members. (These components, younger members because of their greater information base are able to generate more requisite variety.)

The general ignorance of English, and lack of communication with the outside system is probably responsible for the community's traditional organization around hunting and fishing. All the Inuit are able to communicate in Inukskut and write the Inuit language in syllabics. The younger members who can write in English, prefer to write in English because they say it is quicker. (Obviously the integrated components.)

Because the Inuit are organized in traditional family units they do not welcome visitors, Inuit and non-Inuit alike, thus greatly limiting their contact with the outside system.An exception to this pattern of behaviour is when visitors from the extended family group are welcomed and utilized as an information source. Also related to this traditional organization are travel patterns. Travel is devoted in the main, when not hunting or fishing, to visiting extended family members in the neighbouring

and larger settlements of Cape Dorset and Frobisher Bay. On rare occasions, the Inuit journey south for medical care or education. In contrast, the non-Inuit travel "regularly" south, at least once a year each, but not to the neighbouring communities.

Communal visitng although more pronounced within family groups, is a pervasive activity, peaking during the week-end. A social pattern, because of the Inuit's high level of human visual awareness and sensitivity, allows visits to be made with little or no verbal exchange, because much information is exchanged without verbal communication. This applies particularly to teenagers and children who are free to roam the homes of the Inuit community.

The magazines that are available are read principally for their pictorial value and advertisements because it is felt the articles and news relating to the southern style do not relate to the "real" system of Lake Harbour. Catalogues are a specially popular item. Comic books too are very popular, because of their pictures. The Hudson Bay Store sells about 600 a month. They are looked at by all, and by 859, <u>exclusively</u>. The types of comic books include every variety.

There is a small school library with about 1000 volumes, of which 100 are allowed on circulation, most of which are at a primary reading level. Of the 1000, only about 12% deal with life in the north. No books written in the

Inuit language Inuktitut are available in the community.

Electronic media equipment, radios, tape recorders, record players and cassette recorders. The equipment seems primarily to be used for entertainment and not for information purposes. However, music popular in the south becomes similarly popular in the North. The Southern teenage 'culture' seems to have been in general more successful in penetrating the northern system as evidenced by the fairly regular rock dances held in the school, replete with back light, flourescent paint, and strobe lights. Some Inuit teenagers have learned to play musical instruments and have made some recordings on cassettes which are traded and circulated within the community. Many of these recordings are in the Inuit language, Inuktitut. There are no commercial recordings in Inuktitut.

Television is not available in the community. Occasionally tapes are played and visits are made to Frobisher Bay where there is a satellite ground relation. The great majority of the Inuit view the introduction of television as positive. The audience for the tapes were primarily under twenty years of age.

Films are the most popular means of group entertainment attracting an audience of 70 to 100 Inuit, with screenings twice an evening, three days a week. One peculiarity that should be noted is that the need to keep costs low means that the nature of the film is not known until screening

time. The films are generally not of current venue, usually twenty or more years old, and are sent by the vendor without publicity. The preference, when queried, is for action films of the Western variety, as with the hockey tapes the main interest points are scenes of violence. This can be explained in the Inuit value system which places high value on non-verbal communication and action, such as hunting, and because at least half the audience does not understand English. These screenings were treated very much as community gatherings where there were numerous discussions (in whispers), the gathering serving as a switchboard for community information-gossip. This behaviour perhaps approximating the viewing of television in the South rather than cinema.

Since the visual content is the most important, the effect on the audience, laughter, frights, etc. - do not occur where normally anticipated, in the South. About 150 films are ordered and screened a year, almost 3 a week, of which, about 20% have some relation to the people and life of the North.

The telephone system is limited to 13 installations of the inter-community telephone system and one radio telephone. Because of the few telephones, each is used fairly often, about 10 times a day (including the radio telephone which is used about 30 times a day). About 70% of these (RT) calls are placed by Inuit with the Inuit share increasing at steady rates each year since installation - probably levelling off at around 90%.

Most of the Inuit calls are within the North while the non-Inuit calls are longer, towards the south. The frequent use of long distance calls reflects also the heavy subsidization imposed by government regulations of Northern telephone service, approximating 70% of its actual cost. The vast majority of Inuit calls were personal. The majority of non-Inuit calls were also personal but to a lesser degree. There are two institutional radio telephones used primarily for business, one at the RCMP station and the other at the Hudson Bay Store. There are also two back-up telephones owned by Bell telephone which are not in use.

Because of the Inuit emphasis on the visual, photographs are an important medium of communication. Polaroid cameras are preferred because of their instantaneous processing. Photographs are traded as much as baseball cards in the South.

Paint Hills (Eastmain)

Paint Hills is located on the east Quebec coast of James Bay. It is an Indian (Cree) settlement. Hunting, trapping and fishing still provide the major portion of subsistence. Ptarmigan, moose, caribou, hares, bear, whitefish, beaver, geese, and deer are among the game hunted. There are "southern" store foods but they act only at "reserves" available from the Hudson Bay. The settlement is neat, with original trees, no liquor store, and no slums. The population is about 500, growing at about 3% per annum for the past 30 years. There is an elementary school in the village but those desiring further schooling must journey south or to Fort George. Most of the population below the age of 35 have had some education up to technical and university training. These young adults have returned because they prefer the advantages of a small community. Winter is particularly difficult because travel to the outside world is essentially cut-off until spring break-up. Summer is usually pleasant except for fogs which occasionally cut off travel. During specific hunting seasons for such for such as goose, moose, caribou or fishing for whitefish (spawning season), the community empties.

The community experiences regular flux in relation to hunting and fishing. Most of the population is Indian. A minority of southerners man the various government agencies and Hudson Bay Store. The Hudson Bay Store, in

keeping with its role since before the inception of Canada, plays a key role in the community. The Hudson Bay manager plays a key role as he supplies the hunting and fishing equipment, acting as the local banker of sorts in dispensing credit making him as essential partner in hunting, fishing and trapping. He becomes, therefore, the nodule information point in essential information about all hunting fishing and trapping. He also is the actual bank for the community for financial transfers and the like, playing a key role in community affairs, dressing as Santa Claus at Christmas and partaking in hunts. As the general store and the purveyor of southern goods he is also the information link with the south. The very goods, themselves, serving as information and cultural parameters. Recently, an Indian Co-op store came into being, owned and operated by the community, performing much the same function as the Hudson Bay Store. The Co-op and the Bay perform much the same function as the neighbourhood pub or tavern. People gather there to chat and exchange information on various items of importance, such as hunting. The Co-op differs in that it is not part of a larger corporate enterprize like the HBC, and also has no direct radio telephone link or a fleet of supply barges like the HBC. It depends upon public transport and public telephone link and its supply is therefore less dependable and less varied. Austin Airways runs a regular service to Paint Hills when possible. The local co-operative cooperates with co-operatives in Fort George, Great Whale, Port Harrison and Porungnituk

with an association office in Montreal.

Prior to 1974 representation was made to the Provincial Government through the Indians of Quebec association but the Cree felt under-represented and formed their own association. The Grand Council of the Cree which now represents Paint Hills. Paint Hills is connected by air to Val d'Or where the main federal agency branch office of DINA (Department of Indian and Northern Affairs).

The majority of Indians under 35 are literate in English and Cree. The majority of those over 35 are literate in Cree only. As most of Government money is channeled through DINA in Val d'Or whose officials speak English or French, therefore the administrative power in the community lies with the younger generation who are bilingual or trilingual. Occasionally, government officials address meetings in French only, which tends to irritate the Cree. Because of these language problems and cultural differences, the Cree find it difficult to comprehend or participate in political elections or in any on-going "southern" political process. This has in part contributed to a feeling of powerlessness, ineffectiveness in influencing major decisions.

In consequence, the local "southern" representative of the southern government who is French speaking (communicating with the Cree in English because he speaks no Cree) is viewed with some trepidation and resentment.

There is a Federal school in Paint Hills which provides elementary education in English, and is consequently a direct link to the Federal office in Val d'Or which acts as the Federal information link in and out of the community. A French school is located in the 'nearby' town of Pruperts House; however, no one has opted to attend it.

The students are, therefore, the main information link to the southern system. The students for the most, are also educated in Cree and in Cree values at home. This has led to some inconsistency and conflict.

The Federal nursing station also serves as an important information channel. The two nurses are from the 'southern' system and often send patients further south for medical treatment. The nurses have a direct telephone line to Montreal for advice and information. They see about 30-40 patients a day, the majority being women.

The use of traditional medical knowledge is still prevalent in the community. The nursing station in part plays the same "pub" role as the Bay Store and the Co-op store, so that many of the 'patients' are not really 'ill' but simply wish to chat and exchange information. Because of this phenomenon, the nurses have developed a mild mistrust of the Indians and have tended to maintain their social distance. The Indians have in turn respected this preference of the nurses, for the

real services they perform.

There is a Federal post office adjacent to the local office of Austin Airways which flies in mail via Moosonee, Ontario. The flow of mail both into and out of Paint Hills is quite considerable, About fifty pieces of mail per day. Only 10%, or less, is personal mail, the rest are Federal letters, magazines, newspapers, or mail order packages. This is because most important personal mail is sent with friends going South because of the slowness and unreliability of the mail, due to irregular air service and climatic conditions.

The Anglican Church also serves as an information channel between the two systems. It is well attended by about 30% of the population at various times, 70% of the congregation being over 40, and not understanding English. Therefore, sermons are usually in Cree, except for an occasional pre-recorded sermon in English.

Austin Airways is also an important information channel as well as a physical channel to the "southern" system. The airway flies "large" DC-3 planes over Paint Hills on its routes to "large" Northern communities like Fort George. It flies smaller DHC Otter planes to 'smaller' communities like Paint Hills. Radio transmissions from the relatively weak transmitter at the Austin offer in Paint Hills to aircraft can be retransmitted great distances. There are about thirty passengers each week

arriving and departing.

The telephone system, previous to 1972, was relatively good. Inter-community and Intra-community telephone service was adequate, with a base rental being charged for both community calls and calls to nearby communities. The information channels between residents was relatively strong. The breakdown occurred because the buried cable which connected the houses deteriorated and because of the distance to Montreal, repair was occasional. The telephone links of the institutions were maintained (Federal, the Bay, the Co-op) in good order. Consequently information was free to flow between head offices and the branches, as much as telephones would allow. The few Radio telephones are also important but mainly for business, because of their cost and operative nature.

Cree speaking operators man the exchanges and act as information sources for the community as a whole, knowing particularly where an individual is at any moment.

The Cree Indians, in much the same way as the Inuit, tend to transmit much information visually and prefer an in-person conversation. Consequently, telephone conversations are usually short and to the point. The possible increase in high technology - such as disc antennas, microwave lines, etc. - add directly to the north-south communication link, but not to the intra-inter-community network.

The community subscribes to a number of magazines and newspapers, (The community English literacy is 62%); however, the majority of the magazine subscribers are illiterate in English, over 40, and use the magazine for their visual value. There are relatively fewer newspapers which are read more for their entertainment value than for information. As was true of the Inuit, comic books are the most popular form of literature and each visitor to the south is asked to, and do bring back a great number. The comics are retained longer than the newspapers and magazines which are soon dispensed with. Few books are read because the Cree prefer their own language, even those literate in English. There are 750 volumes none of which relate directly to the immediate environment. There are, however, topographical maps of the immediate area, which curiously are also rarely used. There are no books for sale through the stores.

Almost every adult individual possess a radio (AM) of a fairly high quality, using it primarily for entertainment not information. The English (American) stations are listened to and the French avoided.

Similar to Lake Harbour, cassette recorders are used to record local musicians and traditional stories, the recorded cassettes are circulated. Both radio and cassette recorders are operated by batteries as there is a general lack of eletrification in the community. For the same reason, records and record-players are not prevalent.

The movies shown in the community for the most part were of 20 years past, or more, and concentrated on the black/white morality themes popular then. The very few films that are relevant to the Cree are extremely well attended.

Television in any form was non existent. The most common form of communication is the individual, face-to-face discussion or conversation, acting as an information network for the community, for rumours and facts alike.

Fort George

Discussion thus far has focussed on a relatively small and isolated Eskimo community, Lake Harbour, and a relatively small and isolated Indian settlement, Paint Hills. Our next investigation covers a mixed, Indian and Eskimo, slightly larger comminity of Fort George - population 1500.

Fort George has a small hotel, hospital, primary school, air service, government offices, and Hudson Bay store. During the study there was a large increase in the population of the 'southern' people, due to the massive James Bay Hydroelectric power project. This caused a negative reaction from the Cree Indians, the majority of the community, against the James Bay Hydro Electric scheme in the form of court action and protests. It has also been feared that the Hydro Electric project would hasten erosion of the island upon which the settlement rests, at the mouth of the La Grande river.

Except for the Eskimo, most of the population live in government-financed, new housing. The bulk of the administration and planning of the community originates in the 'southern' provincial government, where the government is directing the construction of new housing for the Eskimo who now resides in the older, 'slum' part of town. On the other hand, the Indians live in the newer housing projects, but still without most modern conveniences or paved roads.

The 'southern' element live in the modern, paved, part of town. There is common intermarriage between all three groups, with the resulting children being bilingual.

Indians form a more structured society, with more authorative decision making, while the Eskimo group is less structured and more democratic. The Eskimo group also has been restricted by tradition to the more difficult hunting areas inland, while the Indians hunt on the coast. The Eskimo, too, were the last to get new housing. There is some resentment apparently for these reasons, among the Eskimo over the decisions taken by the Indians on their behalf.

Indian males are greater in number than Indian females of reproductive age, however, there are more 'native' females than native males in total, suggesting a natural tendency for intermarriage. About 90% of the community lives on bush activities (30% hunting, trapping etc) and wages (60%) with 10% living on government subsidies. Despite improvements in transport links to the south, this trend has been maintained.

The highest rate of employment among natives, was found in Indian males and females, ages 30-39, who were less educated than the younger age group and spoke little or no English.

There are businesses in Fort George; a gas station, a ski-doo dealership, a Co-op store, a second-hand clothing store,

a Hudson Bay store, a grocery store which also serves as a Kentucky Fried Chicken store, a branch of the Imperial Bank, the hotel, a variety store, and a restaurant. The Hudson Bay store has been there for over 150 years, established 1805, (the company being incorporated in 1648). It no longer acts primarily as a fur trading depot but as a department store.

The Co-op store is the main outlet for native crafts. Most of the stores function as pubs (as in Paint Hills) for gossiping and for information exchange. Everyone in the community seems to have a reputation, generally good, the presumption being that if it weren't, life would be so uncomfortable that he soon leaves. The successful natives and southerners generally perform some community service.

Fort George has a 'large' forty-two bed hospital that serves as an information nodal point for the entire surrounding area. Patients from his or her area, who happen to be passing through Fort George and happen to drop in, supplying the patient with information on his community. By contrast, the hospital staff is almost exclusively French-speaking, resulting in the oral isolation of patients and staff. This situation is further aggravated when a patient is sent south to French speaking Quebec city.

Social control had in, the past been, exercised by traditional methods such as the extended family, traditions,

social moves. The necessity of police control was rare, but with the rapid increase in the use of alcohol, fights, often including weapons, occur. In 1973 a police detachment was set up composed of one native officer and three southern officers.

The James Bay Hydroelectric project had an interesting effect, in that it galvanized the Cree Indians into creating an effective political organization, the Grand Council of the Cree, which has become a permanent part of the Cree social infrastructure. An interesting innovation of the Grand Council is its creation of a number of communication agents whose task it is to search out the intentions of the James Bay Corporation and government in general, and communicate this to the Cree, and also to communicate the views of the Cree to the institutions.

Transportation - aside from the three major airlines Nordair, Facteau, and Austin Airways - experienced a major increase with the introduction of an all-weather road, a result of the hydroelectric scheme. This road has led to an increase in the consumption of alcohol, and the purchase of many new trucks, a decrease in the cost of transportation and the consequent reduction in price of most goods. Fort George is gradually increasing its role as the regional center.

Telecommunications in Fort George and between Fort George and the outside, had been difficult before the introduction

of the Anik Telecommunications satellite, and a micro wave link installed by the James Bay Corporation. Political considerations of the southerners caused, however, the delay in the linkup to the local telephone system, which in turn aroused the scorn of the natives at the "time wasting" processes of the southerners. The local community telephone system is good, every house has one and the exchange is automatic. For a while, television introduction was delayed because of objections by the Inuit (Eskimo), not the Indians, who feared 'cultural' damage.

Eventual introduction of television saw the great increase in television set purchases, resulting in one in almost every home. Programming was forced to be equally in French and English, despite the fact that 95% of the residents did not speak French, and the majority spoke English. The natives preferred programs that related to their surroundings; such as "Forest Rangers" and action programmes such as Hockey or Football and, interestingly, the national news. A move is afoot to produce some local programming in Cree. Some of the natives received video-tape training in the James Bay discussions.

ANALYSIS

"The fact is that the white man's goal - the desire for social advancement through wealth does not have any meaning for primitive cultures wherein work in the form of regular employment is strange and meaningless. Thus the unenviable task which faces the teachers who undertake the formidable job of Indian education is to make their students dissatisfied and hungry for things which may not in themselves be worthy. This same formidable, almost immoral job apparently awaits anyone determined to start other underdeveloped people towards a "better" life."

Frank A. Tinker

<u>The Navaho Experience</u>

"The Administrator who commented that our real job is to make the African discontent, was getting at a central truth. The problem is not one of labour supply as conceived in the U.S. but one of transforming the whole pattern of family organization and community life."

Lloyd G. Reynolds

<u>Economics Potentials of Africa</u>

Analysis

The individuals examined in Lake Harbour are Inuit (Eskimo) and southerners (European Canadians), in Paint Hills, they are Cree (Indians), in Fort George Inuit (Eskimo), Cree (Indians) and southerners (European Canadians).

Lake Harbour

The individual views his environment in terms of his expectations and his perception of society's particular expectations of himself. The more remote expectations of society tend not to be considered, perceived, as reality, but more perhaps as entertainment.

The Inuit resident of Lake Harbour perceives the distinct reality of an extended family community whose expectations of him are relatively easily understood whereas the advancing societal system of the south has not as yet become fully inculcated within the social-economic system of the local community. The reach of the southern system has nevertheless become a reality which, though perhaps not fully understood, has to be grappled with by the local resident.

The individual Inuit, being a system, seeks his optimal permutation in line with the information he has at hand. In the traditional framework the evolution of the socio-economic structure moves more slowly than when such a traditional framework comes into the opposition of a

foreign system (southern system). For this reason, it is the adjustment and transition of the local traditional in conjunction with the foreign southern system we must study.

In the traditional system the individual values leisure and activity above work and possessions. This is evidenced by the relative status of individuals of the community being classed by the amount of leisure time at his or her disposal and by the part played by the individual in the community. Possessions in the traditional society of the Inuit are more considered to be things at the disposal of the entire community and are only temporarily possessed, when they are being used (more like a rental operation). The southern style, however, tries, among other mores, to impose a structure of daily work (leisure being merely incidental), status based upon work and possessions, an idea of permanent possessions - possessions representing the worth of the individual - whereas in the traditional system individual and his active role in the community. It is in a sense unfortunate that the sothern system is making headway through various information flows in installing the cult of work and possessions. In southern terms they are no doubt now 'materially' better off, some would argue healthier but it is unlikely the extensive southern medicine would be required in the same quantity without the importations of southern ailments, which were unknown in the Arctic before the southern system started its creep north.

Not all Inuit accept the inroads of the southern system. Some still roam the Arctic nomadically living in the old traditional manner, rarely coming into contact with elements of the southern system.

The Inuit who have settled in Lake Harbour have therefore by definition, been influenced in part by the southern system. They have been willing to give up traditional leisure for perceived advances in material ease; that is, an assured food supply and shelter. In the settlement itself there are two distinct groups of Inuit - those who have been more and directly influenced by the southern system (and are almost part of it) as evidenced by their knowledge of English and their participation in southern style employment; the other group is somewhat less settled, is less and indirectly (by other directly influenced Inuit) influenced by the southern system, as evidenced by little or no knowledge of English, and the fact they live by traditional methods of hunting and fishing. Even within these groups there are noticeable graduations in southern influence based upon age (the younger being exposed to southern education-indoctrination). The traditional system can therefore (in the settlement) be seen to be gradually losing its structure and grip and the more powerful informational channels of the southern system increases and extends its structure and grip north, incorporating another component system. The component system, however, will as all other component systems maintain some distinct local characteristics.

The community then becomes a recognizable part of the southern super system but becomes also a unique system in its own right, as dictated by natural parameters, that is the component system must adapt in its own way to its natural limitations.

The community absorbs and tests information utilizing it in its perceived optimal permutation. Though at times it seems random the information that is fed into the community is managed. As the community becomes more dependent upon the southern system for information it also finds itself, as it evolves in and out of the southern system, increasingly dependent upon the southern system for decision making. Its permutation then at least in part is dictated by the southern system. As the community becomes absorbed into the southern system so then does its component systems, (to greater or lesser degrees depending upon their inherent natural parameters), down to the individual, who becomes part of the southern system. At the same time while the community becomes absorbed by the southern system (the individual too) it develops uniqueness which makes the integration of components systems from the southern system difficult. This is evidenced by the long period of time before individuals from the southern system are integrated into the community.

A factor that may play an important part here is that systems tend generally to integrate information and other component systems which it perceives as optimal, profitable.

Therefore before a component system such as an individual can be fully integrated much information must be exchanged on both sides before integration can be achieved. It is also important to note that when integration occurs (which in itself is a permutative step) the character of both systems fundamentally changes (to a lesser degree with the overall system and to a greater degree with the component system).

Integration is facilitated and accelerated by the number of and capacity of information channels that reach into the community. The radio telephone, the stores, the record playing equipment, and radio are all channels (communication) that reach between the community and the overall southern system. There is then a direct relationship between the number and capacity of information channels and integration.

It is interesting to note too that in the transition stage the individual, a system, that has moved into the community, goes through a period of trying to reinforce his ties with the southern system and then of breaking almost completely his ties with the southern system before being completely integrated into the community. It seems that this 'displaced' component of the southern system went through a period of orientation towards the new system, he was faced with, necessitating an adjustment of communication channels.

In a sense, in creating a settlement the southern cultural pattern imposed an extended family relationship, whereas

in the nomadic traditional life style seemed to have less of a sense of family (tribe) than one of comradeship with any others encountered along the way. Though visiting is highly prevalent signs of the nuclear 'southern' family are apparent.

A community culture based upon traditional values exist but it has integrated such items as stories from comics, video taped hockey games and other visionally oriented information. A social system could then be seen in the initial stages as absorbing visual information more readily than verbal or written information, because visual information can be seen as common denominators in an integration process.

The introduction of television produced some new evolutionary trends in the socio-economic permutation. Television being a visual experience, considerably enhanced the flow of information into the community. Social interactions seemed to speed up, that is there seemed to be more social interactions but they were of a shorter duration and more information per unit of time seemed to have been exchanged, though the entertainment value of social exchange may have been lowered somewhat. This suggests that as the input and flow of information increases to a social system its capacity for communication (organization) increases directly in proportion to the amount of information available. The obverse may be as information decreases (availability) the lines of

communication disappear and in direct proportion the systems ability to generate variety decreases. A system could be seen too, then, organize and increase its lines of communication and therefore its ability to generate variety in proportion to the information available. It seems therefore in the longer run if given access to adequate information social systems tend towards an optimal permutation (towards equlibrium). It seems that only when denied necessary information is the system unable to generate enough variety to proceed along an optimal permutation path, enough variety to order requisite chaos, disorder, to overcome obstacles. However, as a system approaches equlibrium it is by definition generating adequate variety and is or will be generating more variety (or is capable of) than is necessary to order the encountered disorder. At this point variety being a dynamic force would turn in upon the system itself causing a disruption, an oscillation and possibly destruction. The task of the system in pursuing an optimal permutation is not merely to generate requisite variety but to search out requisite chaos.

The total overall time spent in social interactions seemed to decline and more time was spent in individual, or work pursuits. There was more individual time spent in the home rather than in the community as a whole. This suggests that perhaps as an individual's variety generation potential increases he (the system) becomes less dependent upon the over-system he is a part of. It may be the individual

can obtain the requisite information through fewer interactions with the over-system to maintain an optimal permutation, (or it may be the over-system requires fewer face to face interactions to maintain control relying upon technological channels, i.e. radio, T.V. for the requisite interaction). The use of television seemed to encourage more participation in the economic system of the south through such means as carving, wage labour, trapping etc., and a further move from a subsistance economy. Significant information flows existed before television and this visiting pattern was only accentuated and increased. Purchases of southern goods noticeably increased, especially goods like ski doos i.e. goods of direct relevance to the north (that is in difference to the quantity of advertising for such items as Rice Krispies or Chevrolets these items were not in high demand). This suggests that systems utilize information and components of the over-system which fit easily into the existing sub-system. The component system tries not to receive noise, it does its best to filter out irrelevant information - noise.

The individual Inuit though somewhat cognizant of the world operates very much within the community and his primary reference points remain with the community. The non-Inuit however, retains a relatively strong tie to the southern community reinforcing this tie with occasional trips south. The non-Inuit almost never travel south but travel to neighbouring Inuit communities suggesting the uniqueness of the system inspite of its incorporation into the southern system.

Paint Hills (Eastmain)

Paint Hills has some similarities but differs substantially from Lake Harbour. It is a largely homogenous settlement of native people, a small settlement, dependent upon its environment for survival. It is a Cree settlement not an Inuit settlement with therefore vastly different traditions and approaches towards problems and life styles. The settlement is much closer geographically to the southern system. It is interesting to note that a strong component system of the southern over-system, the French (Quebec) system which has been fighting integration now vies with the over system (which happens to be English) for the integration of this small community, Paint Hills. It seems, however, that the competition by the French component system has come late, perhaps too late, as the English over-system seems to have already had its channels well entrenched. (It may be a sign of the growing strength of the French system, or perhaps a last resistance before full integration). In fact the attempts by the French system tend primarily to irritate, alienate the community and its members. The communities differ also in the amount of education southern style and in the amount of travel its members have undertaken, particularly south.

Paint Hills maintain a particularly cohesive community particularly in view of the fact that many of the community members are returners from the south. The community seems to be cohesive because of its unique style of life and the close extended family relationships between its members.

It suggests that components of a system that is being absorbed find it more comfortable within the confines of that system. Perhaps, the speed of absorption of individual components of a subject system when detached is at such a speed so as to cause a deterioration in the individual component system. Possibly, the adjustment and integration is more optimal when pursued within a component system than when an individual system is subject to the over-system by itself.

Because the Provincial elections are held in French (Quebec being a French component system) the local Cree due to their integration into the English over-system find it difficult to mesh with the French political process leading to feelings of powerlessness, alienation and agitation. This suggests that when components of a stronger system become exposed to a relatively weaker system they will not adjust, at least until the weaker system equals or exceeds the stronger system (in terms of variety generation and control).

Paint Hills is also different in that it has more transportation and communication links with the southern system. The traditional culture seems to have integrated these channels well.

Within the community there appear to be two distinct levels of integration, those over 35 with little education southern style, and those under 35 with relatively more education southern style who also are conversant in English.

This suggests that the amount of inherent information in a system directly inhibits the integration of the system with another. Therefore it is reasonable that the component systems containing less information would be likely to be integrated first: Suggesting further, in a dynamic system where component systems are constantly being replaced that the continuation of that system in its previous mode (permutation) is dependent upon filling new components with its (systems) own information. It also suggests that if one would integrate one system with another and change its permutation one would replace a block of information from the system to be integrated, in the new components.

The success of the English over-system can be seen from the preference for the English school system over the French, the avoidance of Quebec officials, the English Hudson Bay post, the (English) Federal presence in the nursing post and the avoidance of French radio and television. The French system continues to attempt to integrate the community through various legal and economic means. For instance, half the television is in mandatory French, there being only one channel. Government Hydroelectric schemes have also impinged upon the community system. The attempts by the French system to integrate the community may be seen as a symptom of the struggle by the French system to retard or avoid integration with the English over-system. By generating more variety and control over adjacent systems it magnifies itself, and increases the task for the

over-system. It is attempting to arrest control of a component system that is not fully integrated into the English system by generating more variety. It seems that only by generating much more variety than the English system, can it succeed.

The attempts of the French to integrate this community and others like it have caused a reaction on the part of these communities to band together in the Grand Council (of the Cree or the Indians of Quebec Association thereby creating a more powerful variety generating force). The attempt of integration by one system of another smaller system can cause the integration of components systems in opposition to the over-system thereby increasing the task of the over-system (a variety stimulant, an opposition).

As at Lake Harbour there was a marked preference for visual information suggesting further that visual information is the most easily transferrable. It seems too, that information transferred by physical demonstration to be more potent than verbal lectures.

Fort George

Fort George is not only different from Paint Hills and Lake Harbour in that it is a tri-cultural community but it is strikingly more integrated into the southern system. There are many more natives that participate actively in the Southern economy. The presence of both the English

over-system and the French component system is much stronger here than the other communities. In the native subsystems the Indian is seen to be the more structured with more ability to generate variety, often making decisions for and therefore incorporating the smaller Eskimo community. It seems when two distinct social systems are integrated with an over-system the stronger of the two will attempt to integrate the other, so as to increase its variety generating ability, but primarily for the benefit of the former and not the latter. This can be seen too in the relatively larger percentage of Indians employed (as a percentage of total group population) the lower Eskimo birth rate and the greater contact by Indians of southerners.

The information channels reaching from the south are by a large measure greater than either at Paint Hills or Lake Harbour resulting in the observed close integration of the community into the southern system. The length of time the community has been exposed to elements of the southern system go right back, 150 years, to the creation of the southern system itself, as evidenced by the 150 year old Hudson Bay store. Through the number of channels, and time the Community has been created in its present form and almost fully integrated with the Southern system.

There still remains some conflict in that the channels of the French system have only recently reached this community, which is still quite integrated with the English

system. Various French presences such as the hospital while providing a service also provide an irritant. It is unlikely in the near future that a relatively weaker system will make any headway in dislodging the English over-systems hold on what has essentially become one of the over-systems components. This may be because once an information flow is fixed and it is used to generate a particular variety it is extremely difficult to alter the flow and may require a geometrically higher generation of opposing variety to have any effect.

Integration, nevertheless, has speeded up in the recent past, and new information does not seem to have been sifted efficiently for noise efficiently or used effectively. This has been seen in the increase in crime and the increase in alcoholism, necessitating the introduction of southern style control (police) rather than traditional control (social traditions and mores). It may be that a speed up in the integration process causes the component system to go through a period of oscillation. Such a speed up could be seen as a change in the communication lines and therefore in the nature of the information being integrated, necessitating an adjustment in the component system's screening mechanism which is by definition slower than the change in the nature of the information (or data being channelled) being integrated.

Here in Fort George too, the native communities, both Eskimo and Indian, were galvanized to cooperate with other like communities to deal with the southern system, under

the Grand Council of the Cree and the Inuit Taprissatt (brotherhood). The very threat of the southern system constituted the necessary information and generation of the lines (sinews, nerves) of communication between these communities. It was also in the interest of the southern system for these communities to band together because as such they could receive, filter data more effectively, and use information more efficiently.

In order to turn data into information it is necessary to generate adequate variety to counter unwanted incoming variety (noise). Thereby allowing the adjustment process to proceed towards the optimum. The interest of the southern system can be seen from its continued and significant monetary support of these community associations.

Fort George can be seen as an integrated component of the soüthern system, which is used by the soüthern system to integrate further other adjacent systems.

III

THE EVOLUTION OF

SOCIO-ECONOMIC SYSTEMS

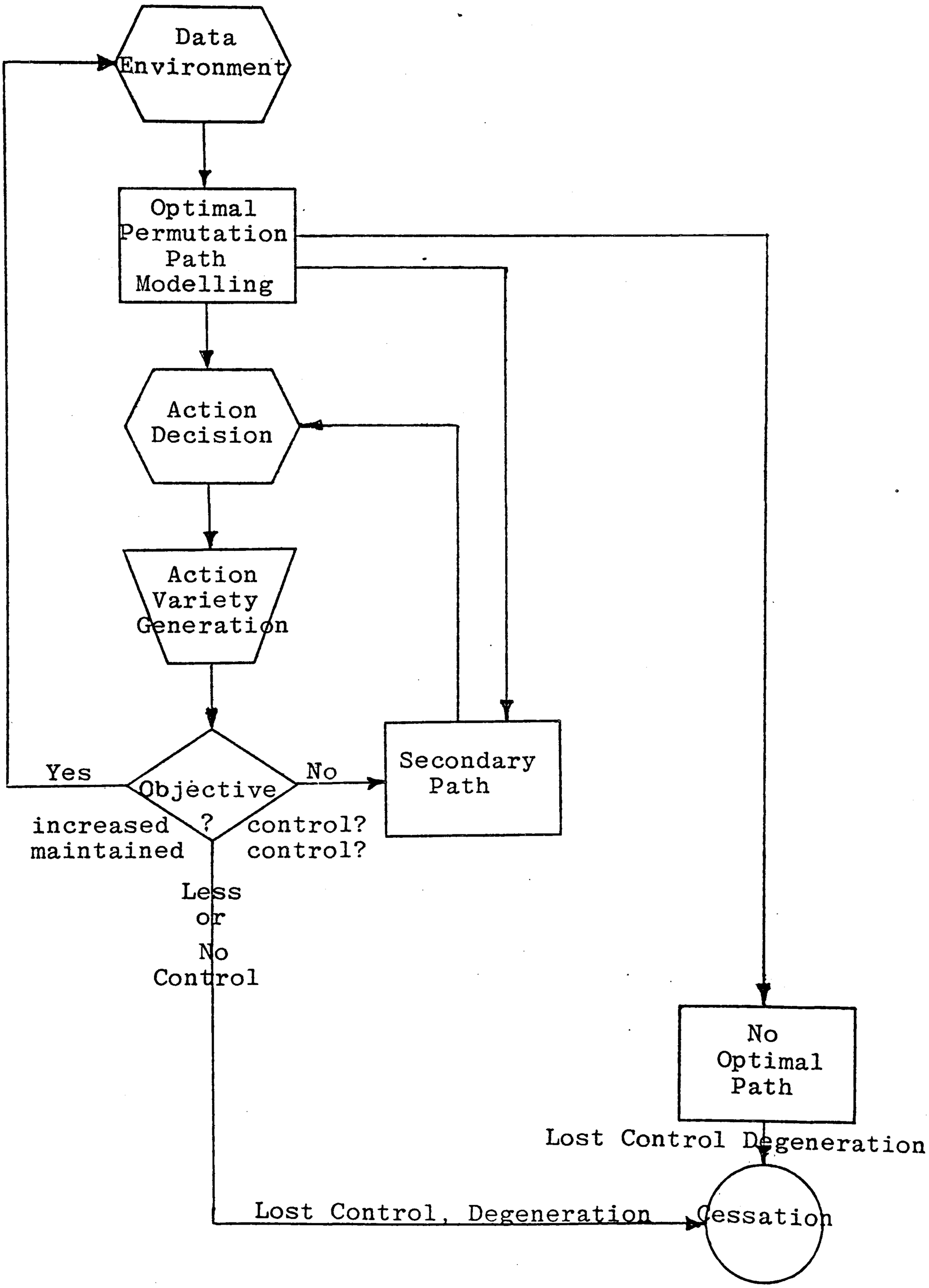
"Societies and groups continually shift their structures as adaptations to internal or external conditions."

Walter Buckley.

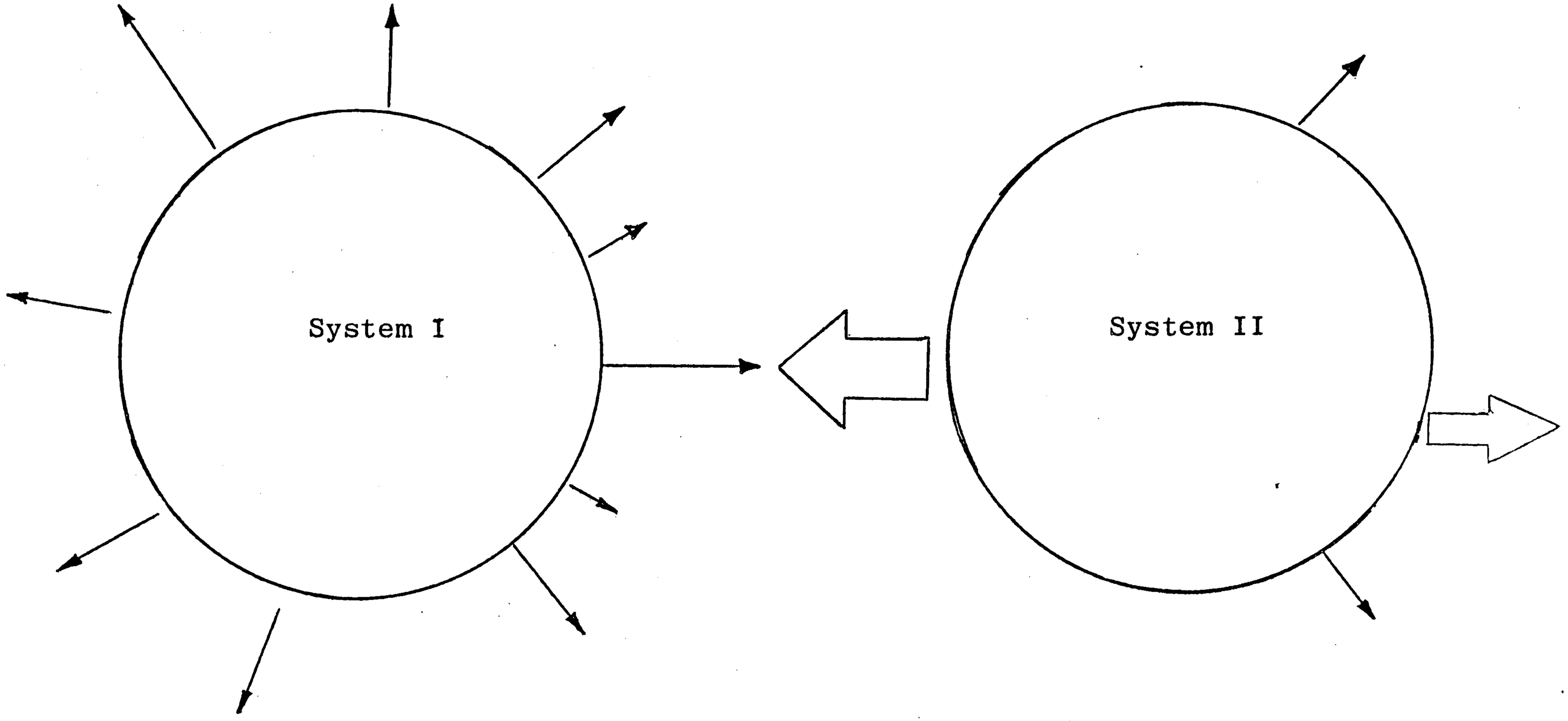
Sòcio-economic system sevolve much as any other system, and seek an optimal permutation path. The ability of a socio-economic system to evolve (permutate) along an optimal path is dependent upon the quantity, speed and quality of variety generated, upon its lines of communication, upon its analogue ability, upon its sensing ability, upon its screening ability, all of which are dependent upon the data accepted and absorbed into the system as information. If the information inherrent in a socio-economic system provides to be inadequate to allow the system to operate along an optimal path in relation to its environment, that society will deteriorate, oscillate and perhaps destruct. If the information is adequate to the generation of requisiste variety and the mentioned aspects the society will survive. All systems, including biological systems which are dependent upon information absorbed into the DNA molecular structure, evolve in the same way. Many biological species have declined and ceased to exist because their evolution, their ability to generate requisite variety have proved inadequate to their changing environment.

Societies as all systems attempt to permutate along an optimal path which means increasing control over the environment, - over relative, adjacent, systems. In primitive societies where the inherrent information quantum is low and variety generation in relation is also low, its efforts, along the optimal, to expand its control over

Dynamic System Permutation Procedure



adjacent systems, to appropriate component systems for its own use can come at the partial or complete destruction of an adjacent system (thus limiting the potential use of that system to generate further variety). This is true of primitive and sophisticated adjacent systems. It can be reasonably questioned how a primitive system may gain some control over a sophisticated one. The temporary control of a relatively more sophisticated system can be had by the relatively faster (speed) application of variety, that is a less sophisticated system may be able to generate less quality and quantity of variety in the long run but in a quantum time space if it can generate more and better variety (grater order) it can obtain temporary control of a more sophisticated system. A relatively less sophisticated system can of course destroy a more sophisticated one, and appropriate its information for its own use, if it chooses to. Some examples of these postulates have been the Mongol Empire where although initially the Mongol system got intial control of the Chinese and Indian Empires, because the Mongol system was better ordered and could generate more requisite variety at a concentrated point in time, the Chinese and Indian Empires gradually integrated and controlled the Mongols. The Mongols also destroyed and obtained slaves from the Persian and Arab Empires (component systems). In terms of the Russians they were able to remain true over-lords, much as the Normans in England (who were eventually also integrated), for a considerable time. The destruction of the Mongol Empire in Russia only came when the order of the Mongol system broke



System II is able to concentrate its variety to a greater degree than System I, because of greater inherrent order (because of inherrent organization and lines of communication), thereby gaining control of System I.

down whereupon the speed and concentration of variety to maintain control could not be had. The Roman Empire is an example of where a less sophisticated system destroyed a system (Greece) and appropriated the information of the system for its own use. It did not physically destroy such adjacent systems but subverted their orgainization, their lines of communication so that they could not generate similar variety to what they had in the past. The Roman system is also a good example whereby for a long period the system was able to integrate desirable data as information, not to replace existing information but in addition to. The discarding and replacement of existing information does not necessarily increase variety generation, but usually causes the system to permutate in another direction. If a system becomes so unmanagable because information is constantly being replaced and the permutivė direction constantly being changed, the system will soon go into oscillation and cease to exist as a system. In the latter days of the Roman Empire it proceeded too far towards an equlibrium state with the result that requisite disorder was not available, or searched for. The excess generated variety turned in upon itself nullifying some of the control (order) it exercised allowing many of the component systems to seek control of the over-system, replacing constantly the operative information of the system. The system soon went into oscillation and ceased. Order in a system can only be increased (the ability to concentrate and generate adequate variety at a specific point in time) when there is requisite disorder for the system to order.

It is also clear that the limits to the expansion of a governing process type system are much more clearly defined than for an integrative type process. This being because variety - control generation increases with the growth of the integrative type process system while in the governing type process a parameter is inevitably reached, where variety has been exhausted controlling the governed components. The current Russian and American Empires are the best examples to date of integrative dynamic socio-economic systems.

The Mongol Empire is a good example of a socio-economic system which could not integrate its components and eventually disintegrated.

The same can be said of the British, French and Autro-Hungarian Empires. After the 'deluge' of Loüis XIV, the French under Napoleon appropriated information and replaced information, establishing a 'New Order', steering the French permutation in a new direction. This new information allowed France to increase the order of its system allowing greater variety generation at a specific point in time- which was indeed Napoleons strategy which was to 'concentrate overwhelming forces at strategic points'. The control gained through an increase in order could not be sustained for long, and the French system soon receeded. The creation of Germany under Bismarck led to the permutation of the German system which soon came into conflict with the larger adjacent systems of France and England.

German variety generation soon allowed it to compete for component systems in Africa and Asia.

The variety of the German system which included Austria was not able to overcome the combined variety of the French, British, Russian, and American Empires. The quantity and quality of variety expanded by the French and British Empires deteriorated their ability to generate such, in consequence their ability to expand, to control components, increased the scope for components to generate variety, and caused the recession of these empires. The effects upon the American Empire were totally different because it is an Empire based upon integration of components into the over-system not a governing system like the British and French. This integration was based upon the generation and integration of information into component systems in a total sense. It soon had the opportunity to extend its information channels into 'vacuum' areas left by receeding empires. The Russian system it is true lost some components (Finland) but soon realised the impossibility of maintaining control over its many components via its old information and consequent order, and replaced it with new information designed to integrate, not govern components. The German system too lost considerable variety generating ability and lapsed into disorder as it lost control of components, and as information became replaced, oscillation occurred. This allowed a (Nazi) component system to eventually gain control, replace information and set the system on a new permutation, a 'New Order'.

The new information increased order allowing the concentration of much variety on a given point in time, but did not increase markedly the systems ability to generate variety over time. The new system, the new information was not integrative, it was governing. The new order allowed the German system to proceed with some lightening? strikes of variety, gaining it temporary control over many adjacent systems but in time had to succumb to the superior variety genrating powers of the American and Russian systems. The triumphant American and Russian systems expanded their control considerably over Europe creating Western and Eastern European systems to nullify the variety of each, a Western and Eastern German system to nullify each other. With the nullification and integration of their competitors the Russian and American systems turned to compete for components on the world stage. The variety generating ability of the American system has increased at a much faster rate than that of the Russian, but the order of the Russian system has increased at a faster rate than the American, although order in both systems is still adequate to repel the other in a destructive contest. The Russian system has been very serious about screening (jamming) out American variety (noise) even to the extent of shipping 'contaminated' soldiers to Siberia after World War II. American information channels have been just as serious at penetrating this information screen. American variety has been successful in Egypt where Russian order (tanks, weapons) failed. American variety failed in Cuba where Russian order in very large amounts overcame

"America and Russia will someday be at each other's throats."

Alex de Tocqueville

Democracy in America, 1805

- An early student of the interaction of international systems.

American variety. In Vietnam American variety has been a measured success and Russian variety a measured failure. American order failed here but Russian order succeeded. Russian order is proving a success in some nations like Cuba but in most parts of the World including Eastern Europe American variety is succeeding. In Russia itself there are signs of 'Americanization'. In the recent rise of the Chinese and Japanese systems we have seen the ability of these systems to retain and use old information, and integrate new information. The Russian system attempted but was never able to control both China and Yugoslavia. Chinese and Japanese variety and order have been increasing very rapidly, they have (as the Romans did with the Greeks) been able to adapt and use Russian and American information to increase variety generation. The potential for variety generation is very great because their inherrent information (culture) store is very great. Increasing order in consequence will allow an increased direction of variety generation. The Russian system saw this threat and had planned a concentration of variety against the Chinese system (an attack) to decrease the order of that system and temporarily control that system. (The Nuclear Threat.) The American system became aware of such a plan and has successfully nullified it by opposing its variety and order to the Russian in this area, because it could not tolerate the control by the Russian of the Chinese system, successfully forcing the Chinese system in the direction of the American system. (The China card.) The current growth of the Japanese system and the foreseeable growth of the

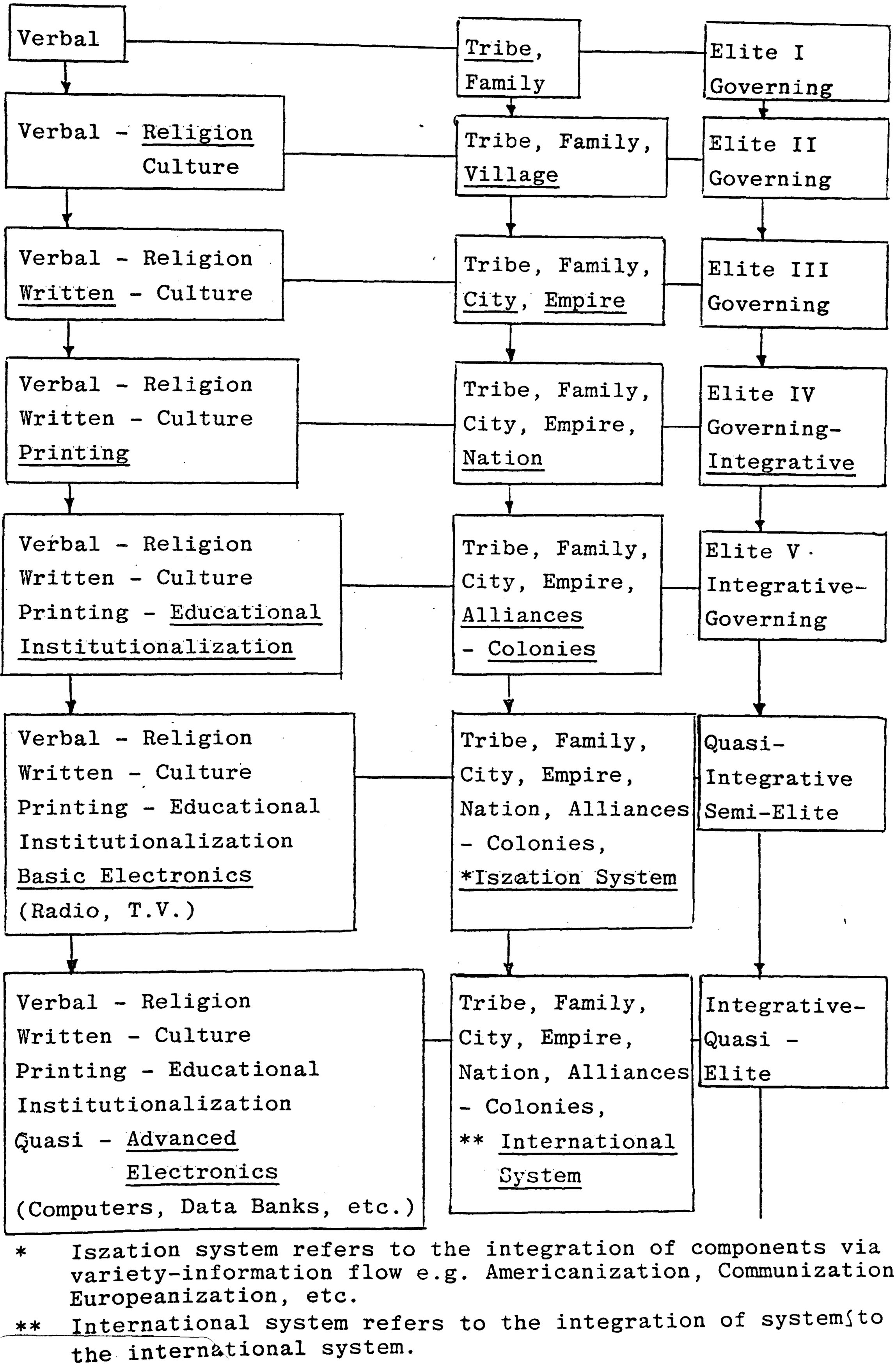
Chinese, will cause the competition of these systems for components to increase, causing the recession of both the Russian and American systems. The American dependence upon energy and other raw materials, in short supply for variety generation and the relative deterioration of its order vs.a.vs. Russian order, is causing a recession in its system, in its control of component system. The Russian system seems to slowing slightly its competition for components with a seeming preference for increasing internal order and variety generating capacity. Some 'vacuum' areas may be opening up.

Integration and Information

New technology makes possible new order, new information, and new control processes. The creation of the printing press allowed for the creation of a new integrative information and new control processes.

In the 17th and 18th centuries an information process tailored towards governing (hand-written information available only to an elite) gave way to a new information process geared towards not the governing control of components, but the integration of components increasing by many numbers of magnitude to the integrative system, to generate variety, increase control over its own future and permutate upon a higher optimal path. Democracy is an integrative information process. Communism is also an integrative information process but is perhaps more ordered. They both rest for their effectiveness upon 'literate' components, meaning the efficient functioning of the system

The Evolution of Societies and Control Methods



* Iszation system refers to the integration of components via variety-information flow e.g. Americanization, Communization, Europeanization, etc.

** International system refers to the integration of system to the international system.

rested on the extent components were programmed to receive information.

Integrative information processes allow for the maximization of the variety generation of the system as a whole because less variety is wasted in controlling components, and less component variety is wasted in countering this control, and because the lines of communication are more flexible and efficient allowing for minimal loss of variety in transmission and tapping of the maximum sources of variety.

Most 'developing' countries still exist upon a governing information process and the selective programming of components (education to receive information limited to a small group (an elite)). Thus variety generation is limited, the maximal optimal path is not followed and its ability to deal with its environment and future is limited. If 'developing' systems are to maximize variety and permutate along an optimal path they will have to adopt an integrative information process.

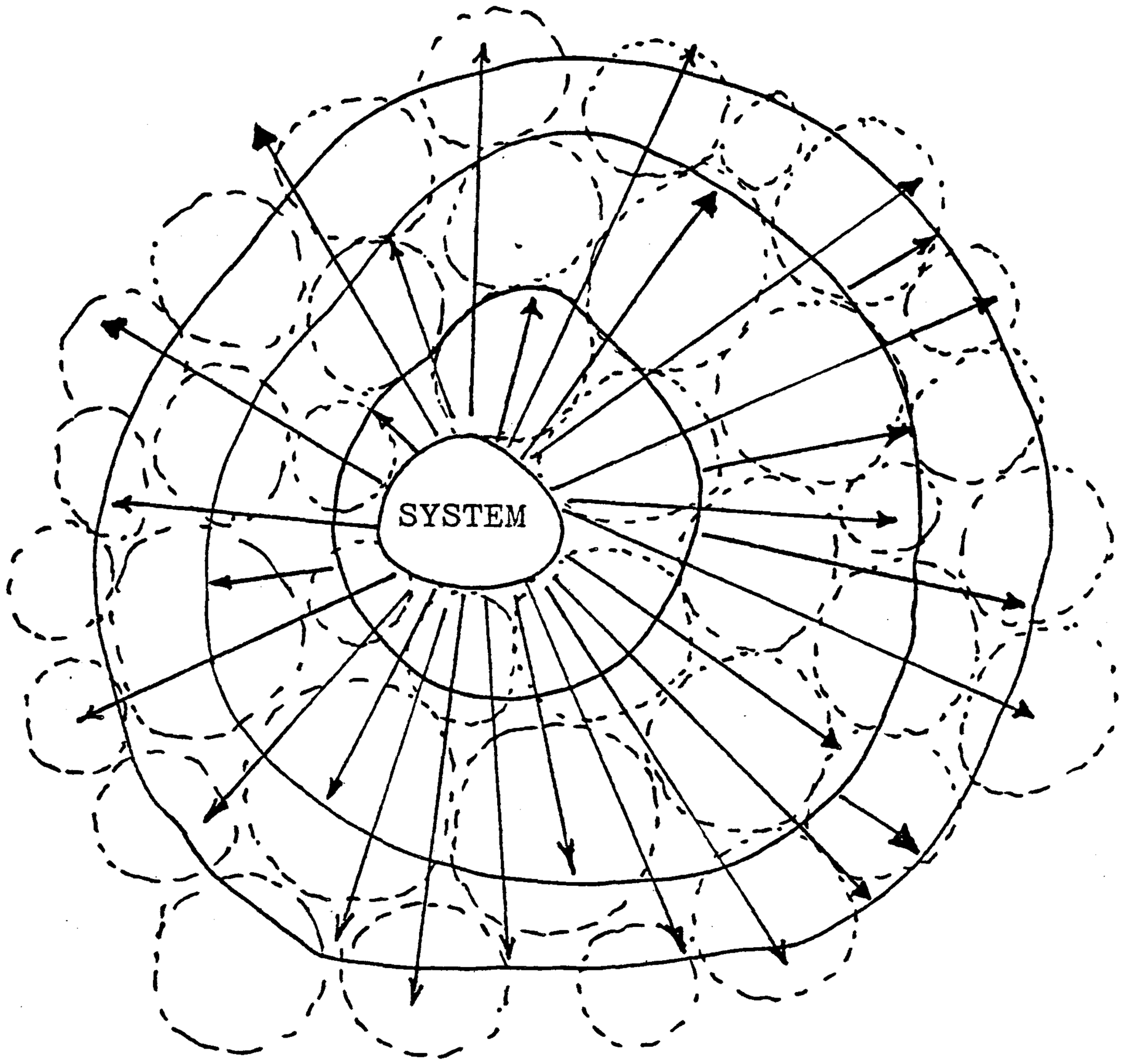
The competition is still on for components between the two systems, most of these components are called 'developing countries', developing systems. Information generation, variety generation is still greatest in the American system for the time being, and is therefore able to control the permutative direction of most of these components.

If these developing systems hope to develop upon the optimal path, that is increasing control over their futures,

(meaning also increased control over impacting systems), they will have to adapt, appropriate variety generating information, perhaps even replace existing information with a more viable information store. A system cannot, however, replace all existing information (over a short time period) without destroying itself. The attempt to transform Cambodia to Kampuchea ran this risk. This is because the replacement of information requires the replacement of components (components in their old form). It could be said with reason that when over 50% of old information is replaced that essentially the old socio-economic system has essentially ceased, and a new socio-economic permutation has come into place. It is therefore possible over a relatively short space of time 10-50 years to replace a socio-economic permutation, and set it upon a new permutation path. It is also reasonable to postulate that the shorter the time space that this replacement process is accomplished in, the more violent the replacement process seems. It seems this way because the cessation of various unwanted components, which would in a slower process also cease, is speeded up. The replacement of all information (all components) in a system may be theoretically possible over time but evidence seems to indicate that natural parameters tend to inhibit and prevent total replacement. Natural paremeters are a source of information themselves, (e.g. climate, race, geography) and as such cannot be changed without total disruption or destruction of the system itself.

'Developing' systems should, however, be careful to main-

Control Expansion of a System



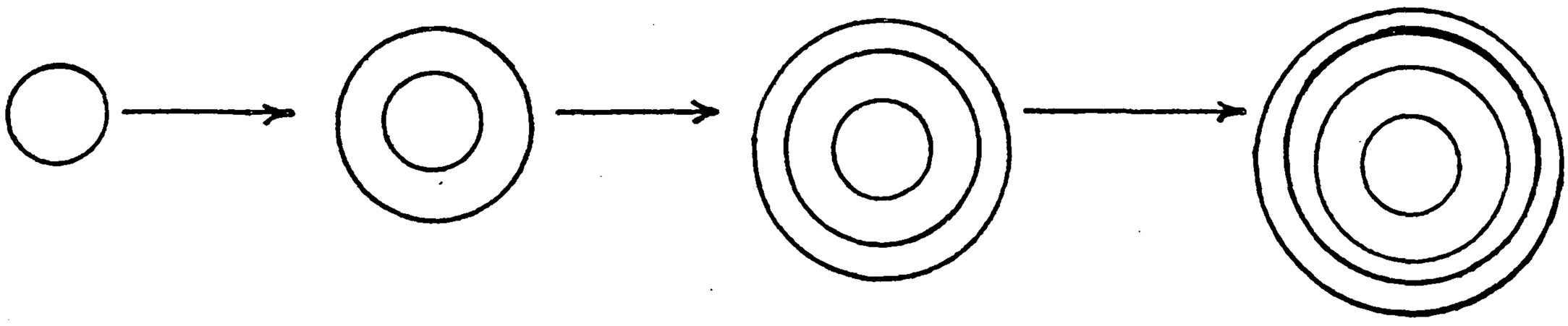
Governing Process (Limit)

Variety Y number systems controlled - X variety = 0

(Closed Loop)

Integrative Process (No Limit)

Variety Y number systems + X variety = ∞



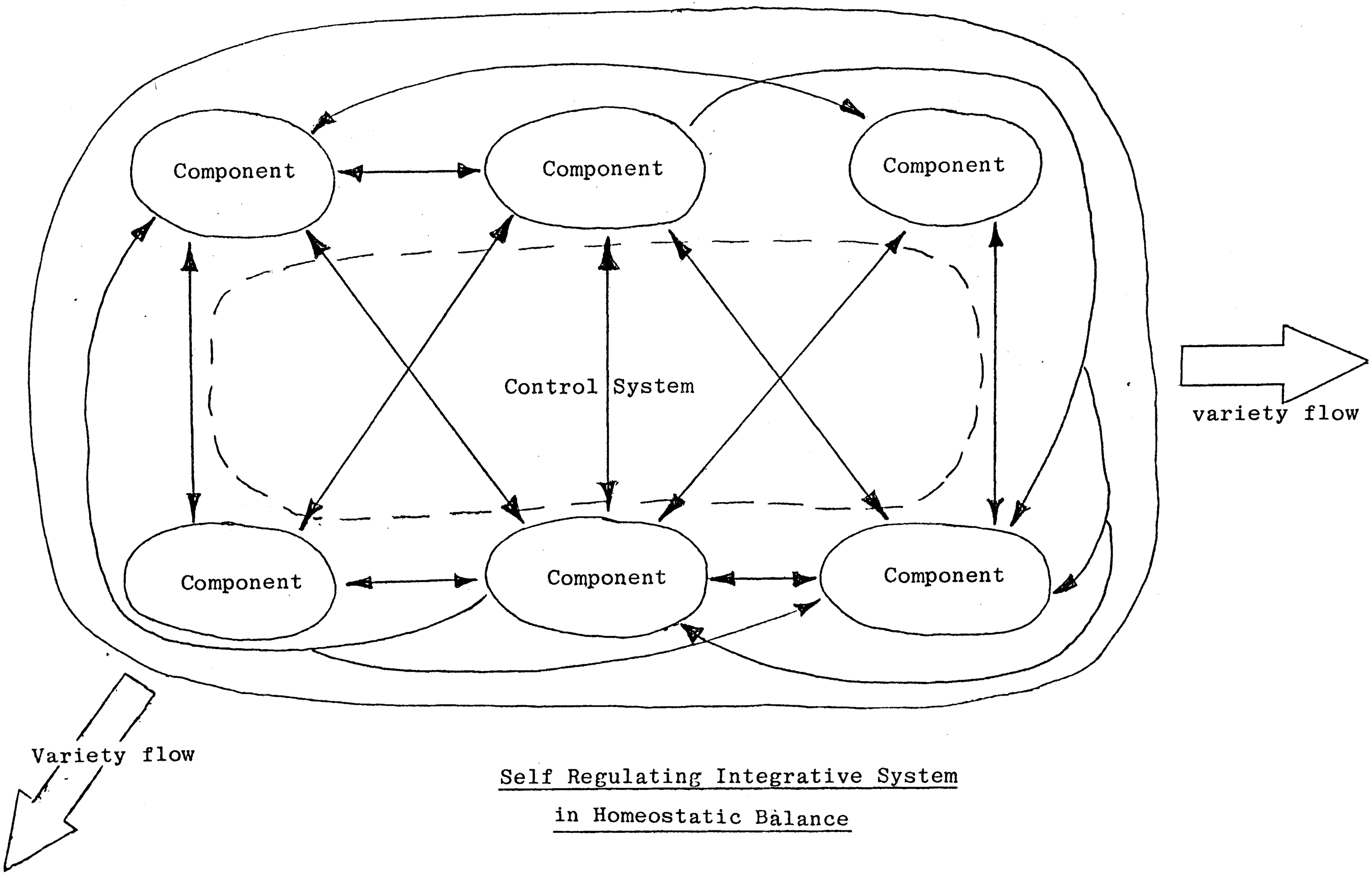
Y - Control Variety

X - Variety of systems controlled

tain some old information which may be useful in variety generation.

An integrative information process allows for more effective information absorption and use because there are more potential users (components). It is more information 'hungry'. In a governing process the number of potential users is limited to the 'elite' who restrict information flow to other components limiting the ability of the governed components to generate variety, and thereby maximizing(relatively) their own.

Both American and Russian systems have in part mistakenly believed that the substitution of their integrative information processes would lead to the integration of components into their systems. China and Japan have disproved this in that they are becoming the chief competitors for the copied systems. The American system was successful in Europe and Japan in programming information processes into entire systems because it had complete order control of these systems for a while ('occupation') but in countries, (systems) where this was not so the American system relied on programming, an 'elite', and variety influence through various information channels, television, cinema, radio, etc. Relative to its efforts in Europe and Japan, and Russian efforts, where many actual components of the integrative system were set in place to replace information and change processes, the American system has used few actual components in its efforts. The Russian system in contrast

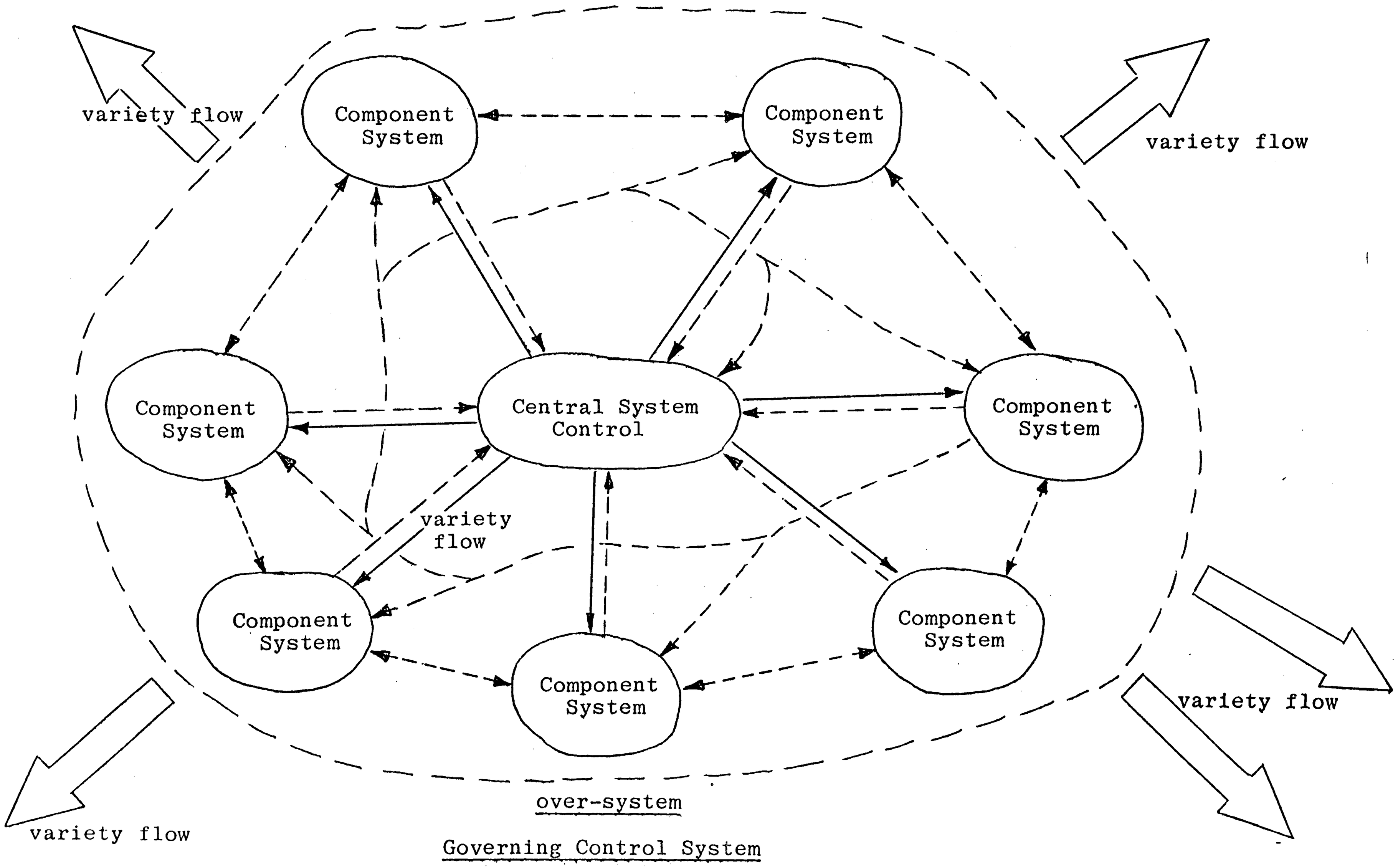


Self Regulating Integrative System

in Homeostatic Balance

has used relatively many more components in efforts aiming its efforts at the governed components of most 'developing' systems it hoped to integrate. The American system has from time to time recognized this and made ineffective efforts to compete in like form, e.g. the "Peace Corps". It is interesting to note that the competition between these systems has resulted in the increased variety generation ability of some of these components resulting in the eventually ability of these systems to generate enough variety to nullify control, and in fact in other cases to detract from the variety generating ability of these systems (the American electronics industry has suffered from Japanese competition). Russia has in part recognized this and has limited its efforts in increasing the variety generating ability of other systems. (aid to Angola and Vietnam has in the main been limited to military equipment). The American system, in the OECD (Organization for Economic Cooperation and Development), has discussed this problem and is restricting some types of 'aid'. It seems in the recent past the aim of the Russian system has not been to integrate components but to use other systems to nullify as much American variety generation as possible.

This has all come to be because of information absorption by the developing systems. It may seem a consicous decision of these systems to act in such a way, but the fact is, it is neither conscious or unconscious but is simply in the nature of all dynamic systems to act in


variety flow
Component System
Component System
variety flow
Component System
Central System Control
Component System
variety flow
Component System
Component System
Component System
variety flow
variety flow
over-system
Governing Control System

such ways.

Information Absorption

Socio-economic systems evolve much as other systems by absorbing information which in turn influences a systems organization and communication lines. Systems are always seeking to improve their organization and lines of communication by absorbing the right kind of data - (information). The improvement in a systems organization and lines of communication in turn allow the system to absorb more information, permutating along, towards an optimal path. (Improved organization and lines of communication allow far greater variety generation.) If a socio-economic system is to permutate towards an optimum it must make sure its components are capable of receiving and sending information to other components (thus completing the integration process). This does not mean data, it means information, which also implies the ability of components to screen noise (unnecessary data). This first means a 'literate' components, components capable of understanding data (only when it is, or can be used to generate variety does data become information) and using it. It also means providing the maximum in lines of communication and organization so that generated variety can realize its maximum effectiveness and maximum synergy. This organization means effective laws, social organizations and an educational process. The lines of communication means road, telephone lines, radio, television (on a two way interactive bases) and social networks (Channel Capacity).

These principles apply to 'developed' socio-economic systems as well as 'developing' socio-economic systems.

Nacent Variety

There is a maximum productable variety for every state of a system, state being its organization and lines of communication as a point in time. In terms of a systems permutation which is theoretically infinite the producable variety from the permutation of that system is also infinite. Should, however, there be a natural parameter to the permutation of a system (one it cannot permutate beyond) there is also a maximum variety possible. In most systems (perhaps all) maximum possible variety is not realized. This is because the organisation, the lines of communication are usually inadequate to provide for maximum possible variety. The components in most systems are not programmed efficiently to send and receive information - variety and do not have access to adequate channel capacity. An improvement in the organization and communication lines can be defined as that which allows for greater variety generation. A system does not usually generate maximum possible variety because it cannot tap the maximum synergistic variety of its components, because its organization and lines of communication are usually inadequate. In order for a system to permutate towards the optimum it must tap its maximum possible variety, which means improving its organization and lines of communication (which is also a quantum change in its information content).

Such an improvement in organization and lines of communi-

cation took place in West Germany and Japan after World War II. An integrative information orgainiżation process replaced the governing information process (both described earlier). An integrative process allows components to work synergistically together, to channel maximal variety towards a particular point. Such a replacement is of necessity, (because (a) some of the old information has variety generation value (b) it is only necessary to replace control (50%) and not the entire process) is gradual and some of the old governing process remains. It has up until the present only possible for some relatively small countries like Switzerland to approach a fully integrated process. The improvement in the organization and lines of communication increased the variety generating ability of the German and Japanese systems, the result of which are still being felt today. A similar process took place in both the American and French revolution when new information replaced old and allowed for improved organization and line of communication causing variety generation to increase (change from a governing to an integrative system).

(See also the work of T. Parsons on social-evolution)

IV

THE ORGANIZATION AND PLANNING

OF SOCIO-ECONOMIC SYSTEMS AND THEIR EVOLUTION

"A feature of the evolutionary process is that greater differentation increasingly frees the Cybernetically higher factors from the specifics of the lower-order conditioning factors, thus enabling the patterns of the cultural system to become more generalized, objectified, and stabilized. These developments enhance the cultural system's potential to <u>control</u> wider ranges of factors at the conditional levels (in relation to parameters).* Thus, a primitive society is not only limited in ternitory and population, but its (information)* culture is relatively specific to its conditions*(parameters) and does not readily integrate with those of other societies. An intermediate society is, in a sense, equivalent to the integration of a number of primitive societies into one societal system."

Talcott Parsons.

The Evolution of Societies.

* Brackets mine. AR.

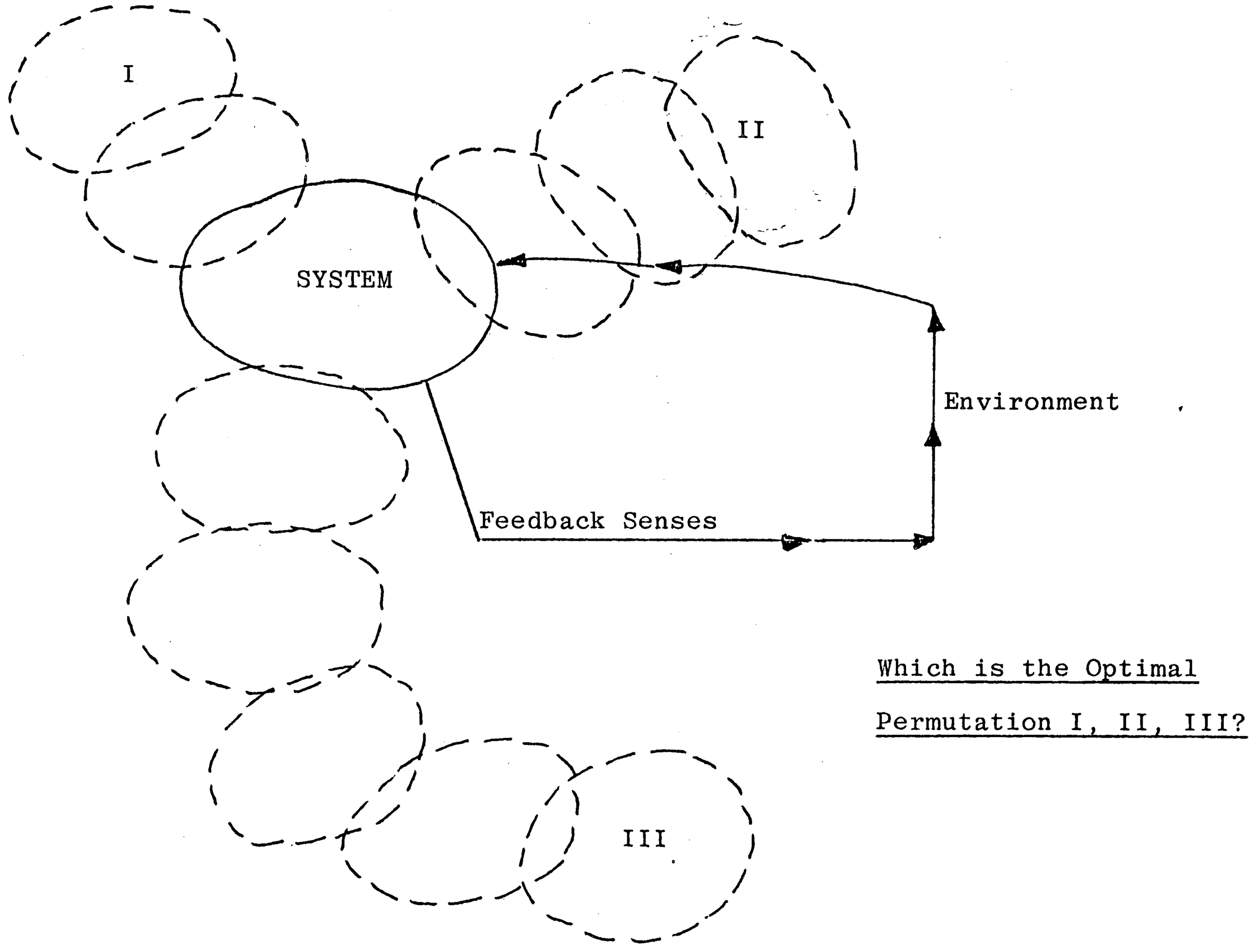
In a governing system when few components are 'literate', the system can only function if it can communicate with its components, that is verbally, through the same language or translation. This requires a verbal network (interactive) which usually means paid communicators (officials).
A dichotomy is immediately developed resulting in conflict and wasted variety. It seems from present evidence that a fully integrative system is perhaps the optimum, but up until the present it is still impossible for any individual component to interact completely with all other possible components and with the full potential variety inherrent in the system. This may never be possible and is indeed difficult to visualize at the present time. This may be a maximum like the speed of light which it is necessary to attempt but can never be reached.

As new communications technology is introduced the word 'literate' must take a new meaning being that a component is completely programmed to receive and send information - variety not only in written form but all the possible electronic forms, which means also the knowledge and use of computers and data banks.

The first step in the evolution of socio-economic systems from a governing system to an integrative system is that the information causing it to be a governing rather than integrative system must be replaced. That is condusive information must somehow be infused. If this replacement is compressed the rapid changes make this process violent.

If the governing process resists, even over time, the result can also be violence. In any system state even though the whole of the systems variety generation may not be maximized some components may derive a very high variety generation from the structure of the system and would therefore resist the transition of the system to an alternate structure (which may result in less variety generation to these components but higher variety generation to the system as a whole). Violence is, however, not an absolute necessity, it is possible to reprogram components so that an integrative system is possible. This may be possible only when components (perceive) see that through reprogramming their variety generation may be greater, (which may or may not be true).

Therefore if a system is not permutating along the optimum as evidenced by the progress of like systems reprogramming is a necessary first step whether externally or internally generated. An external system seeking to integrate another must apply as many information channels and a maximum channel capacity to that system as possible allowing a maximum variety approach. An external systems variety may not however be 'appropriate' that is it may contain much invalid data which is mistaken for information. It is therefore necessary for a 'developing' system to develop an effective screen so as to screen only 'appropriate' usable data. Since only variety can counter variety the developing system, much as the Cree Indian's Federation, must generate enough variety to counter unwanted data-noise, and to use



Which is the Optimal

Permutation I, II, III?

wanted data-information effectively.

Since some data in the absence of other data seems desirable, but really when compared with other data is undesirable, a system must maximize its access to data sources. This could mean in a developing country the establishment of a development research centre with access to multiple data banks via satellite, for instance. It could also mean a set of directive "guidebooks" on where to obtain the necessary screening ability or how to generate it.

Once the central components have been reprogrammed, reprogramming should spread (perhaps programming in a real sense) to other components of the system. (A revamping of the educational process.) Then improvements to infrastructures must be undertaken to provide adequate channel capacity.

A great problem arisés when a system must interact on international credit flows. Credit flows (Economics is an imperfect reflection of information (order) in the world in total). Since no system can reference all necessary information in manipulating its credit flow, it must act on imperfect information (information interspersed with noise). In that credit flows are a reflection (imperfect) of information, a system should therefore generate information-variety (plans) which will cause credit to flow in the desired direction. (Information-data is also not a perfect reflection of variety generation). If a

steady growth and consumption is desired, components must 'know' this as well as external systems.

Primitive socio-economic systems are usually three dimensional, that is they react instinctively to their environment and do not attempt to influence the longer-term nature of their environment. These were generally hunting and gathering societies. When farming and grain storage were discovered socio-economic systems adopted a fourth dimension, time, which allowed the planning of the future as well as the present. It allowed a measure of time not devoted to survival but to controlling the environment and other systems, it allowed for the increased generation of variety, it initiated the information governing (verbal) process where variety was only adequate to program a small 'elite' of components (integrate a small 'elite') which governed, controlled other components, later based upon a written information system. The discovery of industrial technology, of industrial mechanical processes created the printing press which allowed for the expansion of the 'elite' and a change from a governing informational process to an integrative informational process. The invention of the telephone, electronics, television, radio, interactive video have all contributed to further the integrative process, as this 'new' technology does not require the components to be programmed on a literate word level. It may be that speed at which the components are connected up is directly related to the speed of change from a governing to an integrative process, increasing the potential for variety generation.

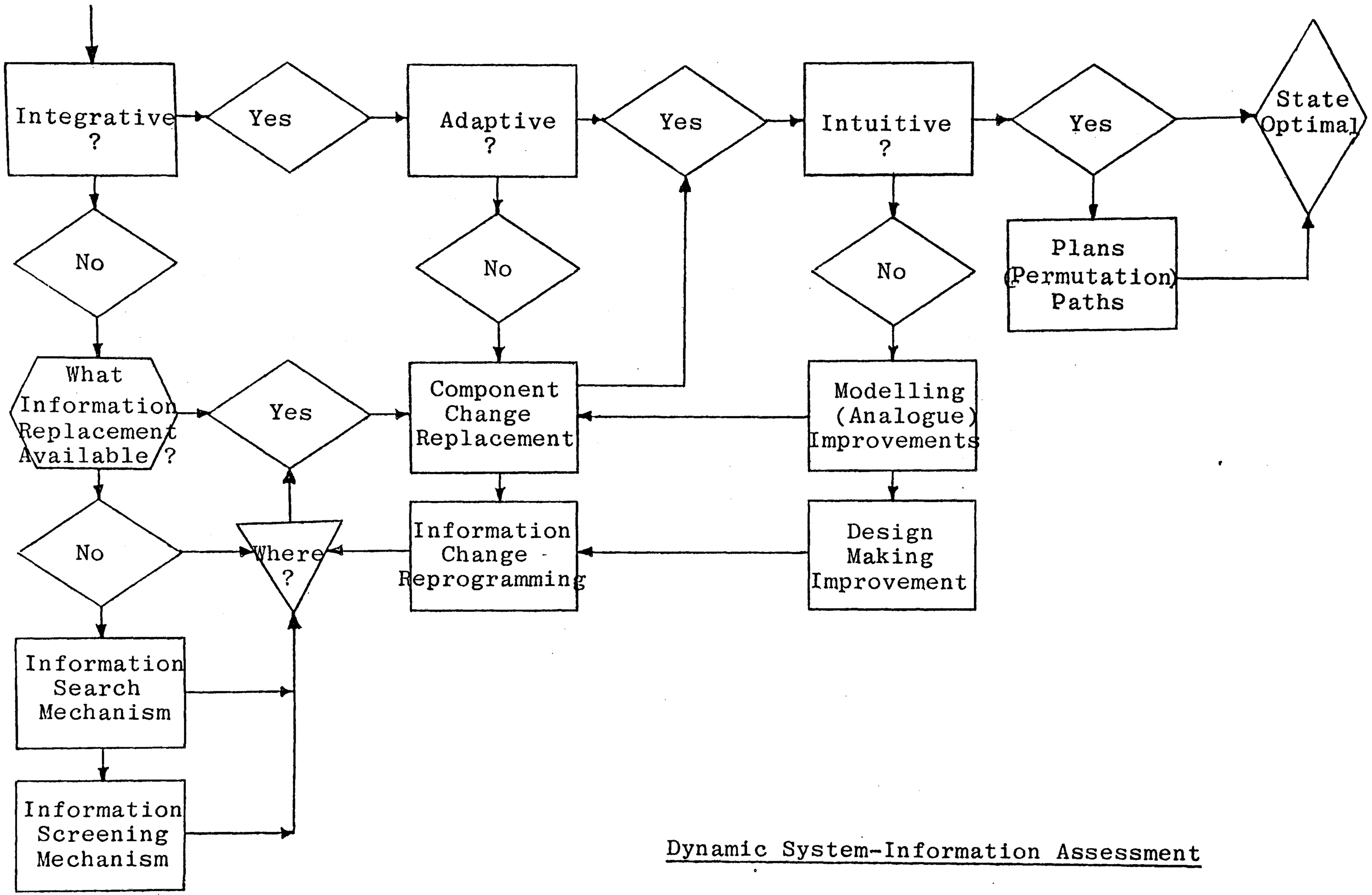
PLANNING FLOW CHART

3 dimensional	Data Gathering	Data
	↓	
4th dimensional	Futures Scenarios (possible futures) Macro - long range	Analysis Screening Analogue
	↓	
3 dimensional	Economic - Financing (goals - decisions) Micro - short range	Screening Operations Variety
	Appropriate technology	Generation
	↓	
4th dimensional	Achievement Decision Permutation	Increased Variety Generation Ability, Increased Control

The analogue ability of a socio-economic system is increased directly with the integration of components. An analogue ability creates the fourth dimension for the socio-economic system. Its previous response to hunger, famine, foods etc. was reactionary.

As the world is for the most part a conflict (competition) between two socio-economic system it is difficult for any one system to generate enough variety to fully integrate its control system. Any present socio-economic system is composed primarily of a central system which is fully integrated (a fully integrated set of components), which controls (generates variety) lesser integrated components. The integrated control system may form a majority or a minority. It is obvious that a system which is primarily integrated can generate more variety because it wastes less variety controlling its components.

In planning its future permutation a socio-economic system must gather and process all available information, decide upon this basis what its objectives are and when (these objectives are always defined in increasing control over its environment - a higher optimal permutation). Then it must analogue (investigate the quantity and quality of variety necessary, depending on various permutation paths towards the objective) its permutation and make a decision. If its assessment is correct as to the variety necessary, and at the necessary times it will succeed, that is permutate along the optimal. The optimal is of course



Dynamic System-Information Assessment

different for every system at any point in time, dependent upon its variety generating ability and natural parameters encountered (real time planning).

If we take a 'lesser developed country' (a 'lesser' developed system - usually meaning less integrated), where it is being competed for by two powerful integrative systems, American and Russian, its environment, its concern must necessarily be local, because of its limitations. It must assume control over what it perceives is its local environment, and should therefore use information, variety at its disposal towards this end. This implies an adequate screening mechanism to take advantage of the potential variety being applied towards it by the two major systems. It implies too, a realistic assessment by the whole socio-economic system as to what its objectives should be. Too often its objectives are defined by a small central system which decides (on inadequate information) upon what are optimal objectives for itself but are probably not for the system as a whole (and probably not for the central system in the long run either). The control of the central system, in the governing process, rests upon it being able to generate more variety than its controlled components, therefore ensuring its maximum ability and the components minimum ability. However, with the great deal of variety being applied By the two major competitive systems the variety of the country'scomponents has in growing instances been able to change the central system and change (by using external variety) the control process to an integrative information process. It is probably that governing

type socio-economic systems will eventually cease to exist. Whether this is done quickly or gradually is dependent upon many factors, but primarily whether the central control systems decide the resist or to bring such an evolution about in their own best interests. In comparison with an integrative process a governing process comes off second best in developing a socio-economic system along an optimal path. To develop optimally an LDS ('Lesser' Developed System) must first recognize this. If it is the desire of one of the major competitive systems to 'develop' (integrate) an LDS it must increase to a maximum the variety-information supplied. Once an LDS has switched to an integrative process its capacity for information absorption and use is vastly increased and its optimal permutation is increased.

Section Summary

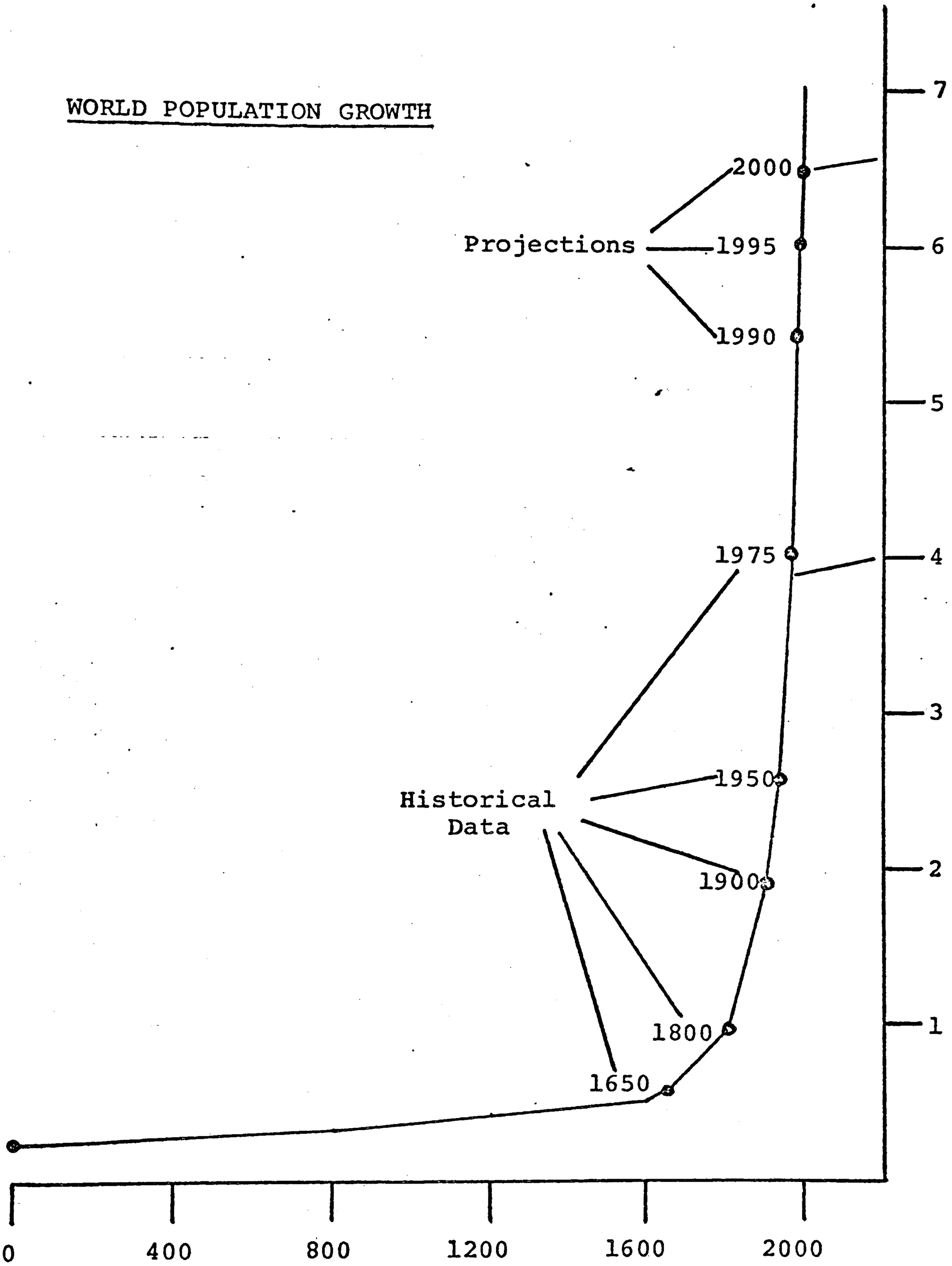
An LDS must expand its 'educational' (programming) ability to the maximum, expand its informational channels to other systems (externally) and internally also expand to a maximum its informational channels, expand its screening ability to a maximum (analysis of data), and expand its analogue (planning-simulation) to a maximum. It's credit management must reflect its objectives especially in terms of its information content. It must also assure that its order (the ability to provide concentrated variety on specific point), is adequate to its objectives. It must (on a real time process) implement a system whereby consensus planning takes place with a full knowledge of its environment.

The Current Framework for Planning

Population

The most important item in planning for a future permutation is the growth of population, or the growth of components (subsystems). Control systems must continually increase variety not only to increase control (over adjacent systems) but to maintain control over component systems. Component systems which are also trying to increase control (not necessarily in the direction desired by the control systems- requiring nullifying not directive variety) tend to generate more component systems (businesses, organizations, children). An accelerated increase in component system beyond the control system's ability to generate variety to control them leads inevitably to degeneration and destruction of the system. A control system controls its components by an order (governing or integrative), which allows it to channel enough variety from its components to be used by the central control system to control its components. This order is induced by appropriate information, usually a threat of some type accruing ultimately to the component system itself. It could be said that the greater the threat to the optimal permutation of the component system (directly) the more variety it is willing to give up to the control system (order). The threat is a possibility of a concentrated (external or internal origin) variety thrust to disrupt and perhaps destroy its permutation (which it, the component, sees it cannot counter effectively itself).

WORLD POPULATION GROWTH



In some governing societies the central control system cannot use effectively, and does not need, many of the components that are generated. These societies rather than seeking to control these undesired components (a governing system can never hope to effectively use all the components at its disposal) seeks and destroys these systems usually by cutting off their variety input and/or output.

A 'problem' arises in most societies, except for ones where order is nearly absolute, that variety input and output cannot be totally cut off, allowing for some survival of the components (unwanted) usually a degenerative permutation. The threat, causes the components to attempt any possible means of counter variety (increased generation to counter this variety thrust against itself - increased births, revolutions, 'crime', 'social' disobedience etc.). The consequence is that variety generation is wasted, disorder increases, perhaps resulting in the degeneration of the entire system and its destruction. In light of these dynamics it is probable that all governing systems eventually self destruct. This applies to many dynamic systems of which we are now cognizant of.

If a society hopes to survive, to permutate optimally it must slow the generation of components to a desirable rate, it must integrate to the maximum possible generated components, and of course must switch if it is not already, from a governing process to an integrative process thereby guaranteeing maximal variety generation (of the system as

a whole towards its environment, thereby increasing its control).

A governing control process actually encourages the generation of (by its definition) of undesired components by providing the requisite disorder (chaos-to these components) which they must counter with requisite variety - more components. As a system proceeds towards equilibrium the requirement for requisite variety naturally decreases, but with a lag because it requires time for the system to sense, verify and analogue this lessened requirement. Just as a system can never arrive at absolute equilibrium the quirement for variety is never nil - and therefore the requisite disorder - chaos is never nil.

In instituting an integrative process in ensuring the optimal permutation of the system, conflict (disorder) between the governing process and components is resolved and requisite variety, and the generation of components, is decreased. Order increases as a system proceeds towards equilibrium. Order is information that does not generate variety, but acts as a damper and control to variety. Order cannot increase to the absolute because of the dynamic nature of a system. If order tries to close this gap absolutely, apply order to a system at a point in time, which when applied is a different point in time, conflict - disorder will result (that is there is always a gap between intention and implementation). Order can never be applied absolutely, variety cannot be completely eliminated.

Variety is in a sense creation of new order and if it is stopped, the permutation, the system ceases. A system is controlled by old order dampening (countering) new order - variety. Enough order-variety must be created to optimally integrate all new components for the permutation to be optimal.

Resources

The current question that rages over resources, is, are resources finite? The answer is both yes and no. Within a finite quantum of time resources available for variety generation are finite. Over an infinite time, resources are infinite. What is lacking in a finite quantum of time in terms of resources is not the resources themselves but the information necessary to obtaining these resources. - (The information necessary to this requisite variety.)

This has been the situation since time immemorial. It has become an aggravated problem because of the increasing integration of the world system and the increasing switch to an integrative process from a governing process, which has brought the problem into a more realistic perspective. There was a time when the death of a 'unnecessary' component system was considered desirable - France under Louis XIV, Russia under the Czars, China under the Ming dynasty. It is considered now, and recognized, that the survival and integration of generated components is not only desirable, efficient, but necessary to the optimal permutation of the world system. Therefore the necessary variety-resources must be generated towards this end, and the current

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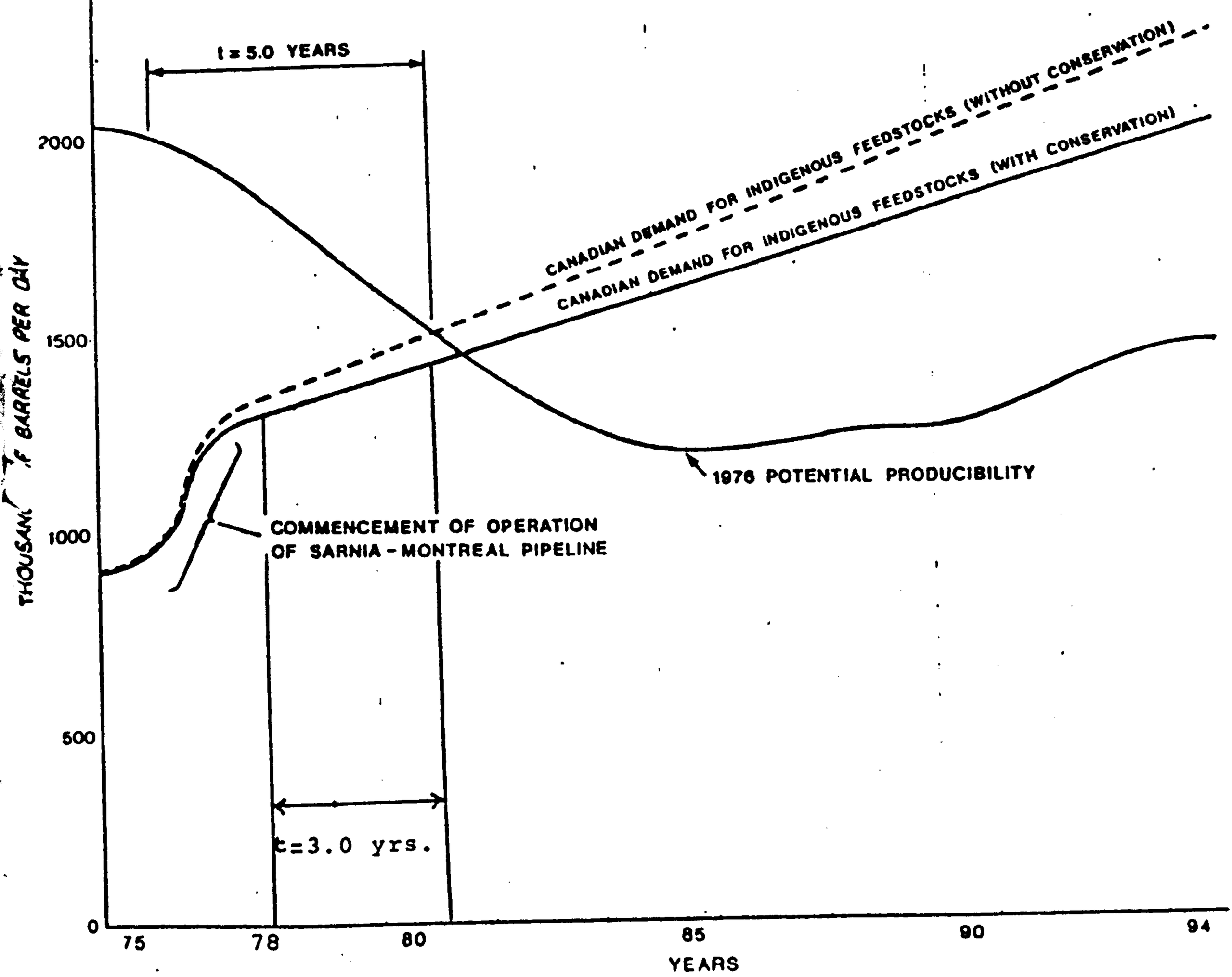
CANADA

Oil Demand and Production



generation of components poses a problem, in that the current information base is not adequate. The informaton that is not adequate is not merely information on how to produce such resources, but how to organize effectively to use such resources efficiently (is lacking). The current rush to conservation in some national systems is an attempt to provide adequate information to organize effectively to use resources efficiently. A system recognizing that its optimal permutation is dependent upon its optimal use of its components, therefore their survival and integration, must increase its order to such an extent so as to assure this. This means increasing the efficient use by viable components of resources-variety, the application, programming and integration of variety into new or unviable components, and the increased application of variety to search and development of the appropriate information, whether by screening or scientific research.

The world system is approaching a period whereby it appears that the available information will not afford an optimal permutation in terms of the survival, efficient and effective use of all of its components - a full, or close to, integration of components will not be possible. This is not a new situation, similar situations such as Irish potato famine have occurred in the past. In the Irish situation the system adjusted by dispensing with many components, as the requisite variety was not available for the maintenance and control of all components. The permutative extension of a system is based upon available

information, which is fed into an analogue model and the decision made. The Irish catastrophe was based upon the rapid expansion of the Irish population. This decision was in turn based upon the seemingly best optimal path of population expansion (more components, more control, more variety) (analogue) based upon the information that the food supply (potatoes - relatively recently introduced) would also go on expanding. The depletion of food supplies (variety generation) created a (receded) natural parameter beyond which the system could not expand. This caused the destruction of many components (death) the oscillation, degeneration and eventual recession, though not destruction, of the system.

Any system which expands beyond a natural parameter (which may be 4th dimensional rather than 3 dimensional) will experience some difficulty - oscillation, degeneration, recession.

A system which contains a large measure of governing in its control processess will always reach a natural parameter whereby the variety it can access or generate will not be adequate to control more components. A fully integrative system is self governing - self regulating, the central control system acting merely as a conduit, the variety is can access, generate is theoretically infinite as related to the number of components it can integrate and control.

The key factor in determining whether a system is governing or integrative is its culture - information content.

Current Dynamics of Advanced Industrial Systems

- Developed Systems

All socio-economic systems are currently facing a dilemma where opportunities for optimal improvement are rapidly increasing while natural parameters are in direct propor-tion constricting. It is therefore a time when change in the basic structure of socio-economic systems is neces-sary, if not imperative. As socio-economic systems move towards equilibrium and complete control of component systems, the requiement for variety generation decreases. The problem arises in that variety generation decreases to a point where the system loses control of its components, going into oscillation, degeneration and possible destruc-tion. Developed systems in approaching equilibrium are approaching what is known as the welfare state. In such a state, all costs, all factor costs are increased by welfare costs (direct and indirect). As unemployment loses its old meaning with increasing welfare, and investment becomes more difficult with increased factor costs, unemployment rises and remains "high", and the imperative for more welfare increases, especially indirect, disguised unemployment. Investment for expansion, R&D, innovation becomes less imperative than the increasing imperative for welfare. As disguised unemployment due to the growth of public and private bureaucracies, information pollution-noise increases causing the socio-economic system to become less efficient and productivity to drop. As the return to capital drops and capital becomes scarce, more people are

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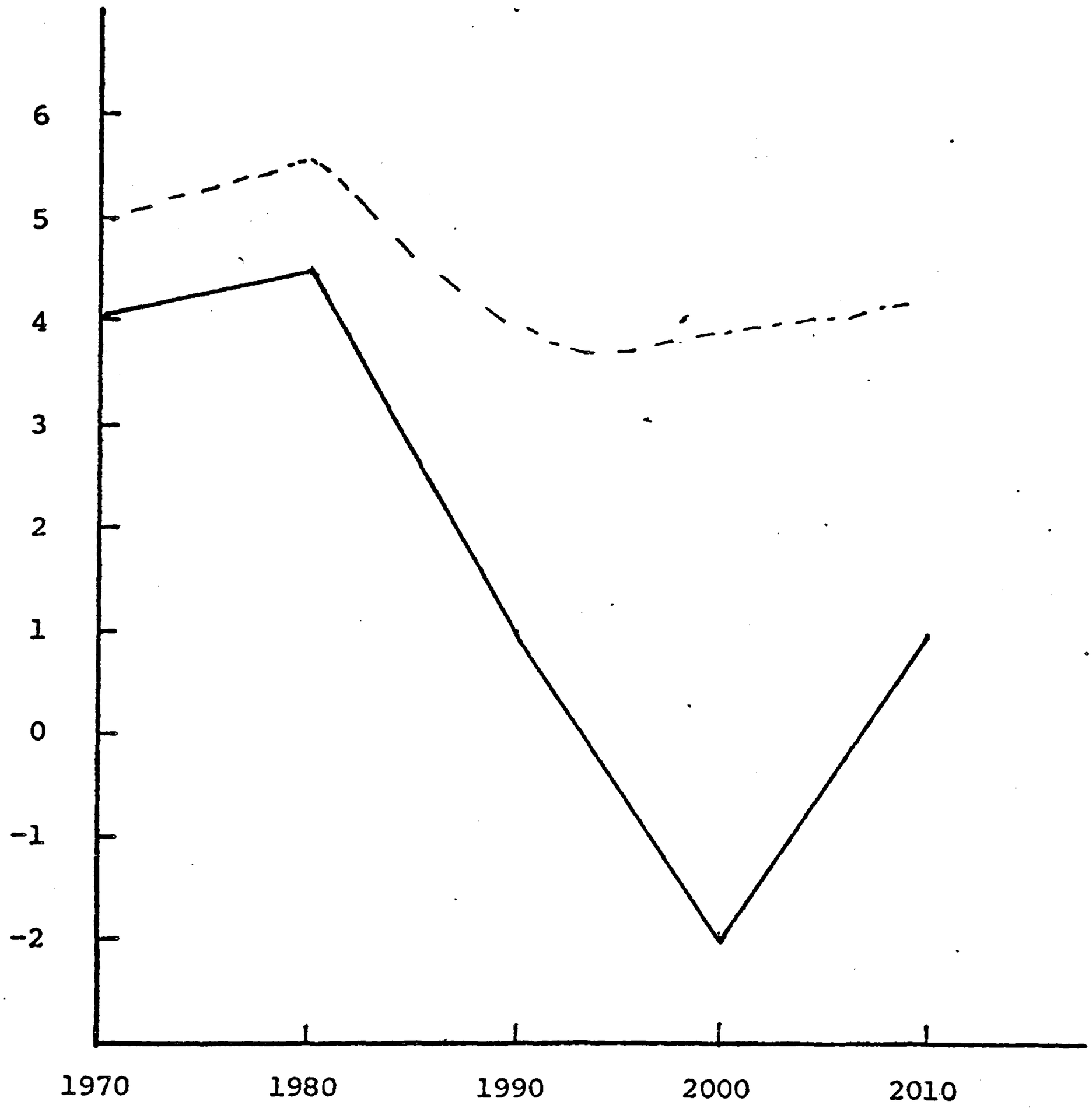

CANADA

—— measured financial growth (estimate).

---- unmeasured order creation (estimate).

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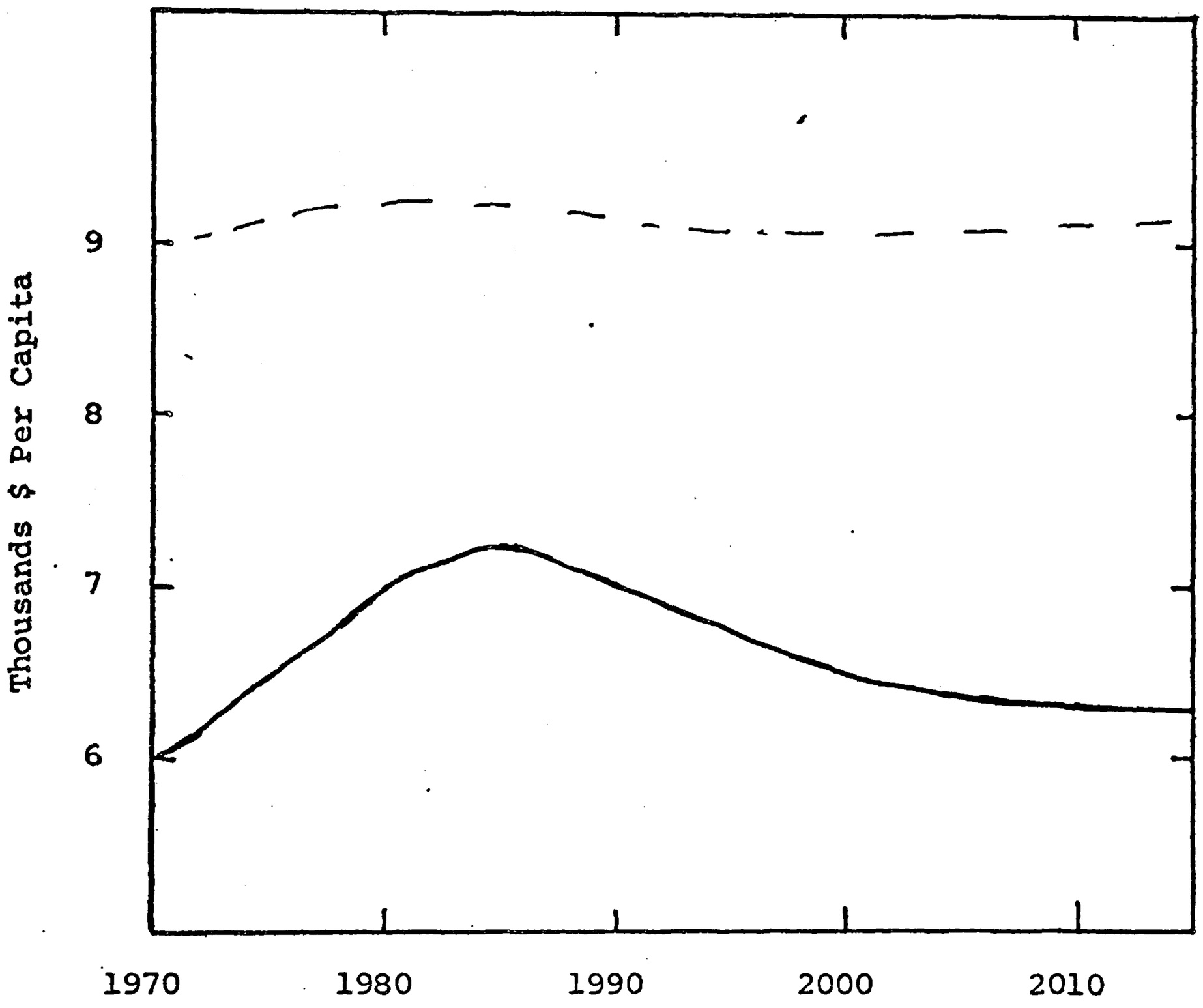
CANADA GDP



Note: 1971 Dollars

- - - including economic value of order not measured in the financial system.

* projections made by Secretariat for Futures Studies, Canada. (This applies to all graphs with a star.)

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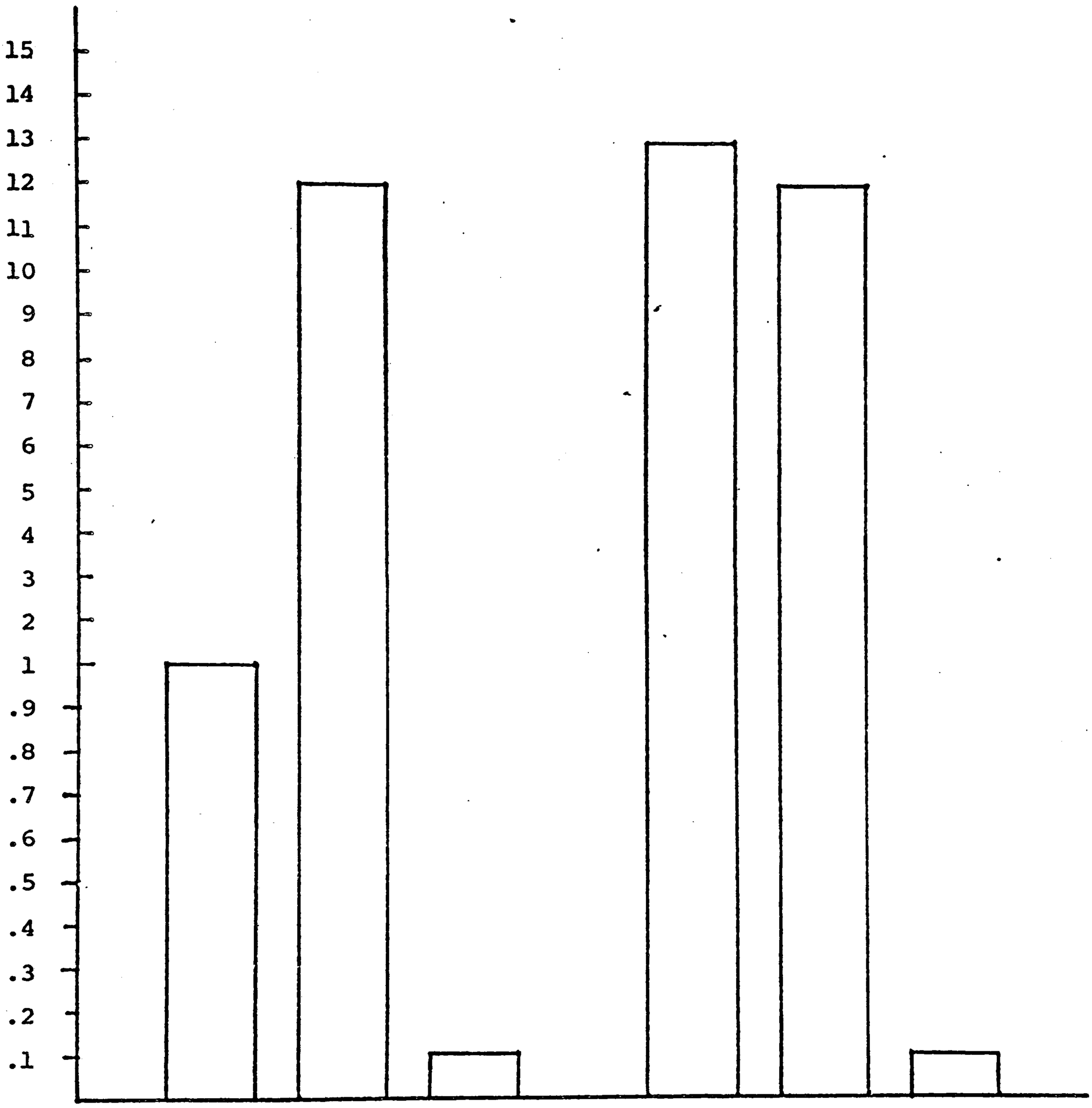
GNP RATIO



forced to move into service jobs which require little capital. If the developed systems, "DS" (AIS), are to improve their permutation they must change direction, they must find new reasons for generating variety, they must find requisite disorder. There is therefore bound to be some conflict between the trend twoards equilibrium (welfare) and the trend away.

The basic structural problem has grown from two sources. One being that the educational system (programming system) of advanced industrial systems evolved from a time where parameters were radically different. Parameters, need-less to mention really, change, but the system for adapting the information base, reprogramming components has lagged markedly. In a biological system the failure of the DNA structure to absorb useful information, would lead to the evolutionary failure of the system-extinction.

As a system permutates along increasingly higher optimal paths its complexity and efficiency necessarily increases. The structural problem is that most components of advanced industrial systems are still programmed to be 'tools' in variety generation while the 'tool' requirement is being more efficiently switched to inanimate systems (automation). Considering the requirement for increasing complexity it is probably more efficient to switch or change the program-ming of components towards controllers of, and generators varietv-complexity (entrepreneurs - idea creators).

This approach is particularly necessary as not only has

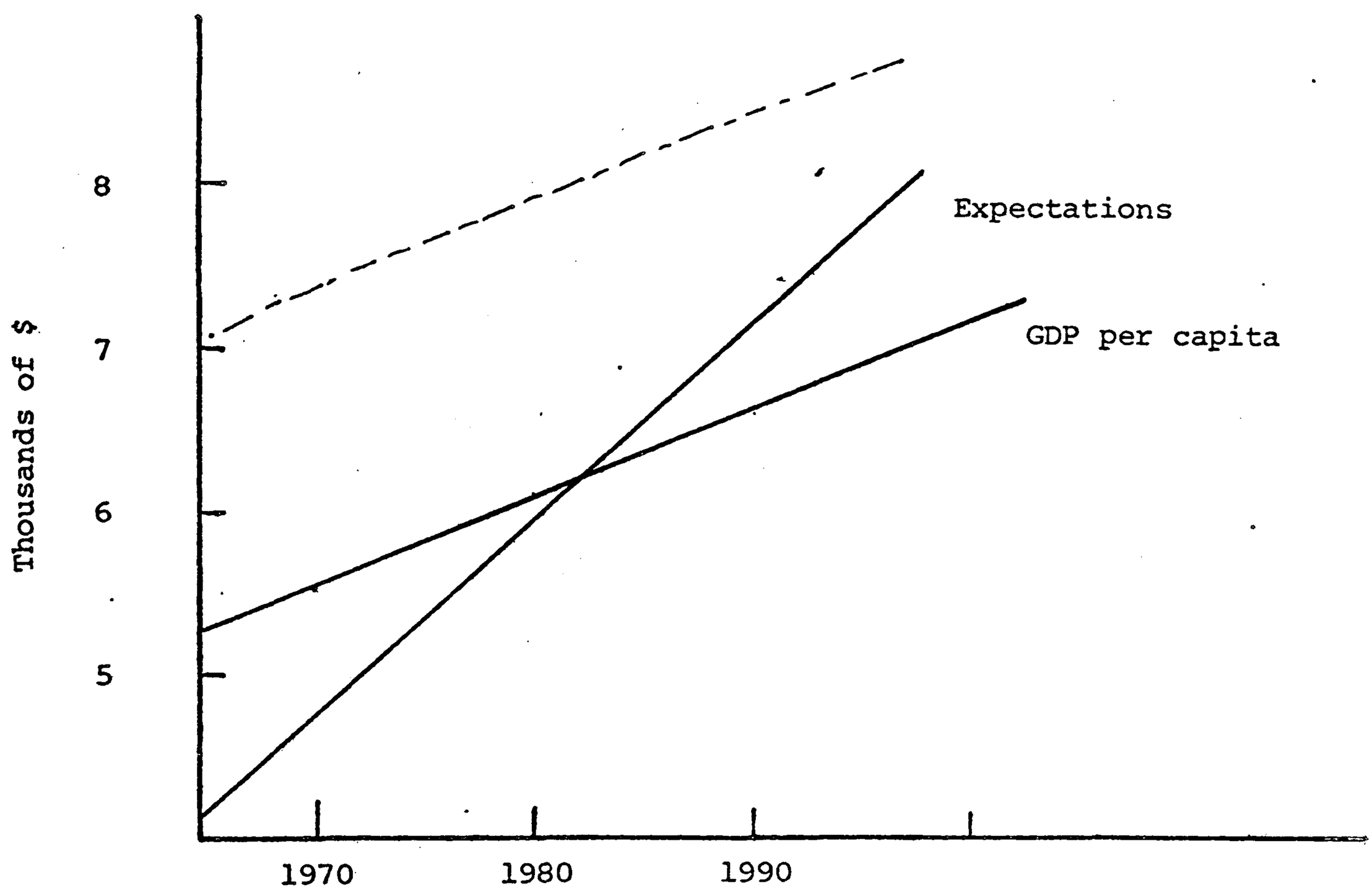
PROJECTED *

CANADA

- - - - unmeasured growth

——— measured growth

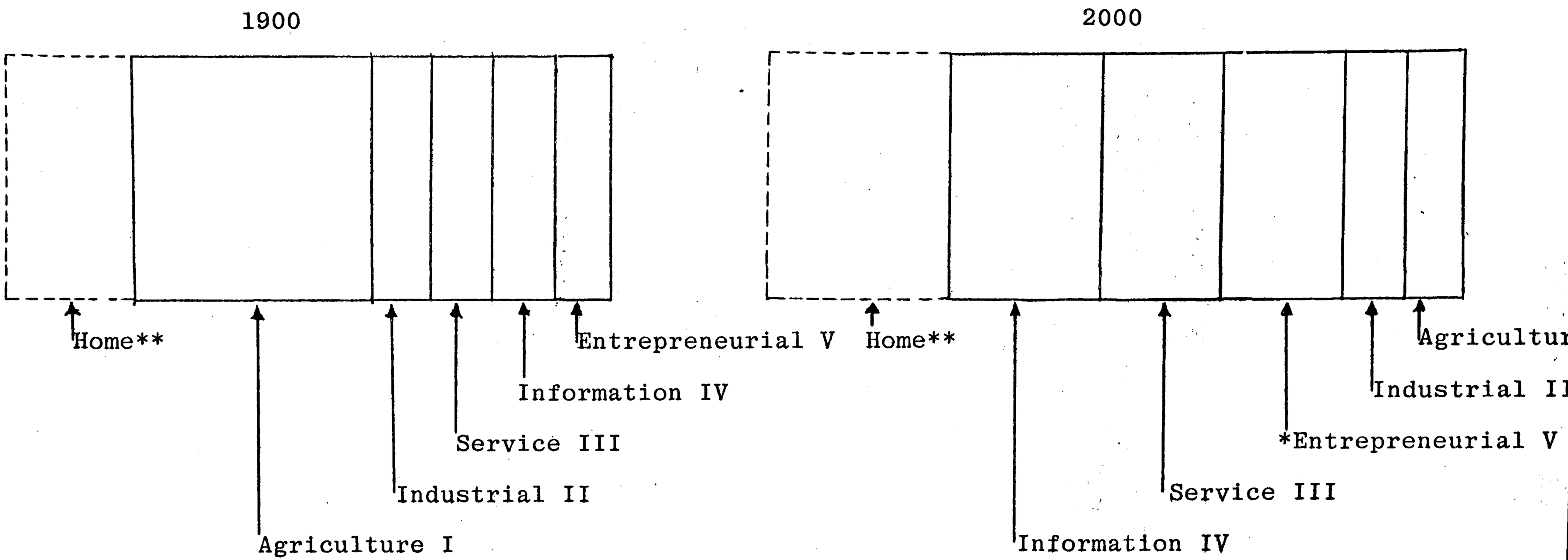
PROJECTED *



— — — unmeasured growth

——— measured growth

umemployment taken on a new meaning but employment has too, in that employment has come to be looked upon as a commodity - entertainment, something to be consumed in and of itself, not wholly to buy other goods with. "Consumers" have consequently chosen not to consume "substandard employment-goods".



(a)

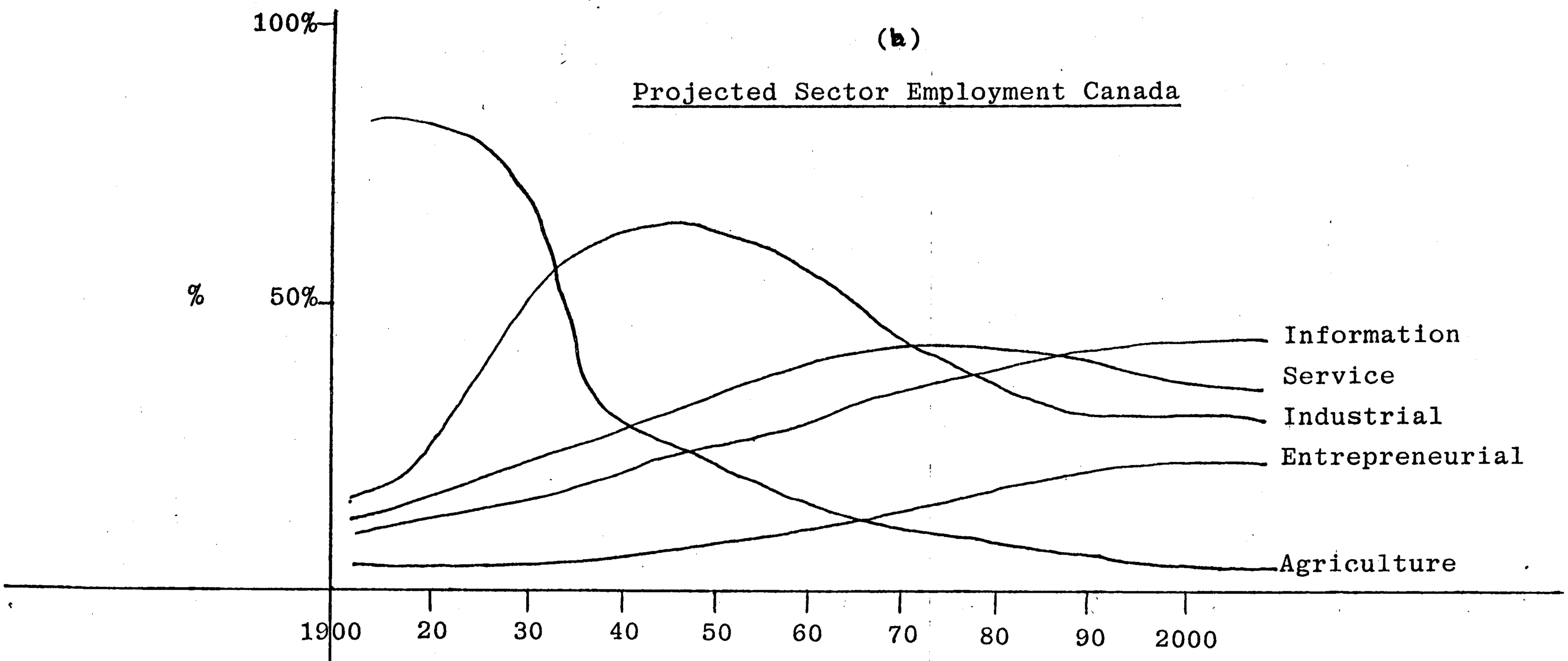
Projected Sector Employment Canada

* The Entrepreneurial sector is defined by that which produces ideas.

** The Home sector refers to that sector that is non-commercialised, most quantified and creates personal order primarily in the Home.

(b)

Projected Sector Employment Canada



See:
M. Parat,
The Information
Sector, Economy.
Ph D. Thesis 1967.
Stanford Univ.

Just as Employment in the Agricultural sector has decreased employment in the Industrial sector will continue to decrease. Employment in the Information and service is of necessity levelling off because the natural parameter where further employment in these sectors begin to produce "noise" and "disturbance" has been reached. The Entrepreneurial sector is of necessity beginning its substantial growth. (Projected by Secretariat for Futures Studies, Canada.)

What is needed - What to do

Systems which undergo oscillation, degeneration, or recession by definition are not generating adequate-requisite variety to counter external environmentalvariety.

Requisite order - the operation of all components at an adequate level of efficiency - can only be obtained with adequate information, because information generates variety and order.

Requisite information (order) may not be forthcoming because existing information is inadequate or counter-optimal, and or that requisite-appropriate information does not exist.

As we have seen in Lake Harbour, Paint Hills and Fort George the replacement of existing operative information requires an extremely large quantum leap in applied variety, a quantum measure above the variety being generated by existing information. Such a method which entails the destruction of the existing system and the replacement by another,almost inevitably entails the destruction of many components of the existing system - "war", "violence". A system which is primarily seeking control over other systems cannot do otherwise.

If a non-optimal system is to return to the optimal permuation it is clear that an evolutionary-integrative approach is better in that it does not entail the necessary

destruction of components and in the longer term maximizes variety-potential generation for the system. The evolutionary approach requires the integration of new components (organizations, people, children) into the new system whether this is an externally new system or an internally new system, by the input of appropriate - requisite information.

Again referring to Paint Hills, Lake Harbour, and Fort George, the speed at which an existing system is converted or replaced is directly related to the number of channels and channel capacity, feeding into the system, that is by the amount of variety that can be directed at the system.

Appropriate information may necessarily have to come from outside the system but not necessarily be applied by an "outside" system, as in the American and Chinese revolutions.

A new control system or cell, that is a component that wishes to control, to integrate the entire system necessarily opposes the existing information, the existing control. Theoretically, a process for the dynamic evolution and replacement of existing information is provided for in the "democratic" process. It is possibly because this process is both dynamic and integrative at its optimum it most closely approaches a maximal variety generating process. It is only perhaps when this process-system becomes structured and static, becoming less evolutionary-dynamic and less integrative that cracks appear,

that degeneration, oscillation, and recession set in.

Such a process-system is a manifestation of the information inherrent in the system. Such a system cannot be imposed it must be evolved, almost by osmosis.

Technology is information. The institution of "appropriate" technology is one way of instilling appropriate information. Appropriate in the sense that it is evolutionary, contributing to the gradual evolution of the information inherrent in the system and the processes thereupon dependent, not an information-technology that rapidly forces instillation and conformation. When rapidity of this nature occurs it usually causes counter variety to be generated - e.g. the abuse of technology, conflict with the "new" control cell - or the cell (component) seeking to become the new control cell.

Information can also be directly input via the aforementioned information channels of television, newspapers, advertising radio, education-schools, merchandise, magazines, etc. Of the major integrative systems today, the system that can arraign the most channels, and the most channel capacity, the most variety (and ability to differentiate it) and the most understanding of the systems to be integrated will succeed.

For many individual systems some form of integration may be inevitable. In view of this its probable "best" course

(optimal course) of action may be to ensure within these parameters a maximal control. This entails a dynamic and maximum knowledge (information) of the control system (the integrative system) and what the control systems likely permutation may be. This will ensure not only maximum possible variety but also the components system's permutation, if the control system ceases to be optimal, degenerates, oscillates and or recedes, or if a more attractive "offer" is made by another integrative system.

As referred to before a primary necessary step is the institution of a screening process. This means that a system, any system, must have a sensing-screening process which differentiates data to appropriate information which is fed back (feed back) to the system which incorporates it and uses it to seek out its optimal permutation. In systems which are not permutating optimally the first task is to improve this sensing-screening feedback process. Components tasked with this process must be able to thoroughly be able to differentiate data to information. This requires a thorough knowledge on the part of these components of the component system they are a part of and of the integrative (control) system or systems. They must receive an intensive "education" of this type.

This brings us to the rapidly accelerating pace of electronic - information invention and innovation. The speed of this technological revolution is directly related to the utilizing systems ability to generate variety, its

internal order, ability to integrate, and to direct appropriate amounts of variety.

Each technological-electronic invention and innovation increases vastly a systems ability to differentiate data to information and to apply the variety so generated, because it can be applied to and by many component systems across the entire system creating not only a new efficiency (order) but a new synergy.

The new infrastructure of databases, broadcast transmission satellites, computers, memories, light transmission lines (optic fibres), 'sophisticated' software programs, interactive television, command entertainment (selectovision), giant screens, holographic image projection are now being put into place in 'developed' integrative systems. This electronic-infrastructure is at an early stage and can be compared well to the early roads that began appearing around the turn of the century, which bear little resemblance to the superhighways of today. Vast amounts of variety will be generated and directed towards increasing control. As the process is and will be integrative that is there is no central control but is self regulating to a large degree, the integration and the harnessing of this electronic variety will the most likely course of 'developing' systems.

Major braodcast and switching systems will be built in orbit space around the earth which will be able to broadcast to the entire earth's surface, switch, process, direct

requests to any point. It would be illogical for "developing" systems to feel that they could or should resist the variety inherrent in such an expansive system. Such resistance could only cause conflict, friction, the loss of stable variety and retard development towards the optimal.

By integrating themselves with the "developed" systems (who may or may not be procedding along an optimal permutation) components open themselves to the possible entropy of the developed systems which can move rapidly over established communication - information channels which may be a (cost) necessary risk, just as harnessed variety may be a benefit.

In order to accelerate the development towards the optimal every system especially "developing" systems must institute the 'new' infrastructure as rapidly as possible, because this will allow for the generation of maximum variety. Possible, because in a system perhaps such as Papua - New Guinea where even the most primitive integrative communication channels did not exist, roads, radio or other simpler mechanisms were the first to be implemented.

In developed systems (DS) the rapid implementation of "new" technology such as light transmission lines (optic fibres) which will open the way to three dimensional holographic transmission, computer terminals to become as commonplace as telephone receivers (and relatively cheap), and "home" video access and storage units.

Each individual in the system would have access and screening capabilities to all possible data. The benefits of short, medium, and longterm planning would be available to each component. The result of such individual planning would be a much greater efficiency (order) in the planning of the overall system, in the permutation of the entire system (increased synergy). A truly integrative process with maximum variety generation then could be approached.

Adam Smiths theory could then be approached, the ability to control detailed variables would be made possible to the individual component. In Smiths day individual components dealing mainly in a simple commodity - food components could deal with the necessary relatively simple variables but in the industrial age variables have had to be dealt with on a structural, institutional shared basis between components which although an improvement has not proved completely adequate, because most such systems have proved to be governing rather than integrative.

In a truly integrative system each component has a maximal-adequate planning ability (limited only by its biological systems). This increased planning ability does not mean absolute freedom of action because it is after all part of a larger system and subject to control (parameters, guidelines etc) which in an integrative system through negative feedback is self-regulating, parameters are self imposed.

Increased control which is the result of increased planning ability, results in the increased optimality of the permutation. A systems objective should not be the biological survival and satisfaction of its components (the traditional sense of 'well being' - welfare) but the increased viability of its components (because this results in the increased viability of the entire system) meaning the increased ability by its components to plan and control their permutation and in synergistic summary its permutation. This is the optimal of cybernetic evolution and change in socio-economic systems.

V

The Design of Evolutionary Dynamic Systems

"In cybernetic terms, control is at best only partly pre-programmed in the system structure in anticipation of particular disturbances or deviations; an important part is "error regulated", in the sense that the system is continually processing feedback information about its own state and its goal deviations. Built in mechanisms of control ... imply a pre-programming of constraints, designed to maintain a given structure ... later challenges may demand changes of that structure for adaptive flexibility."

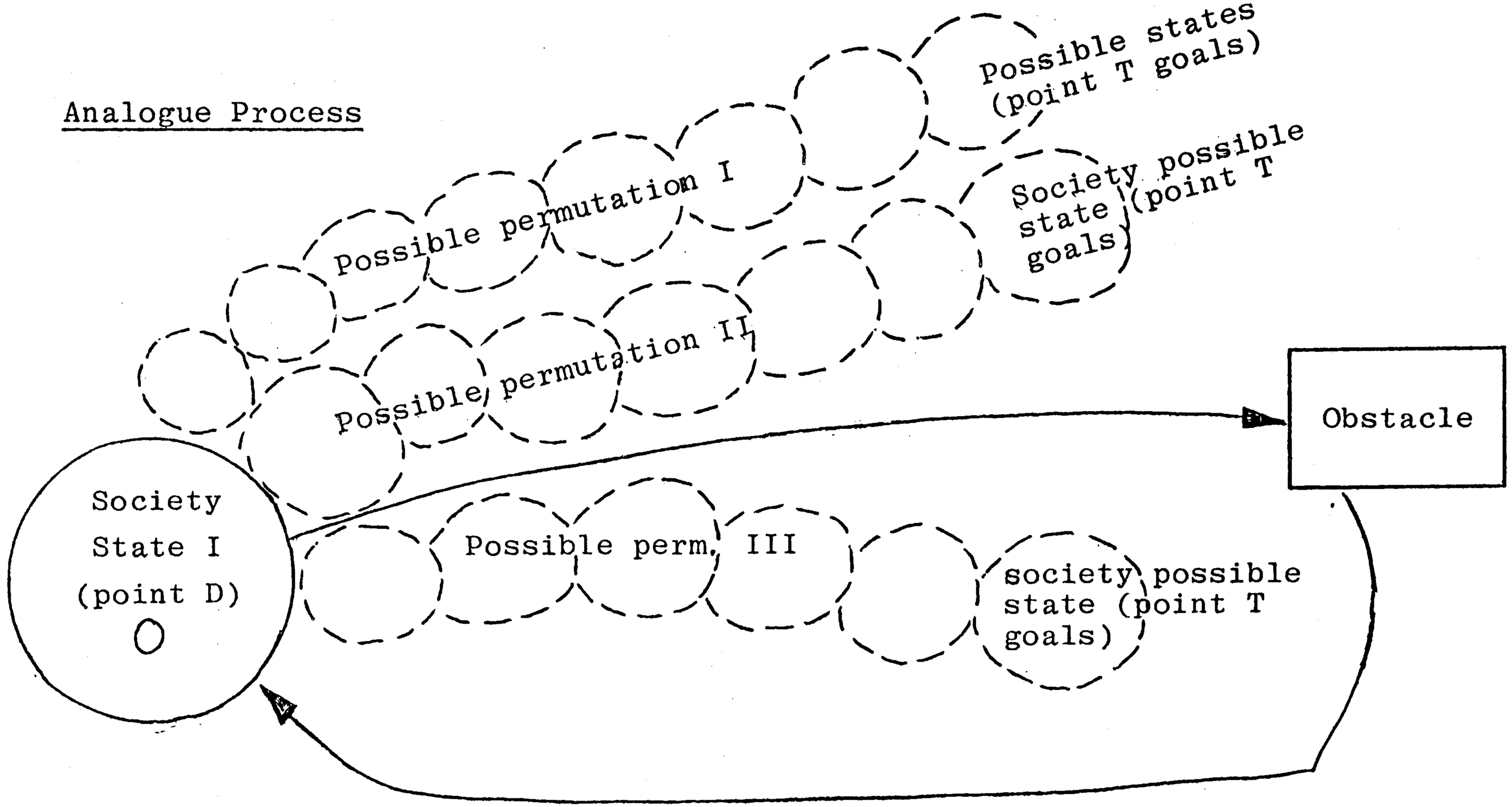
Walter Buckley.

In the preceeding chapters the phenomena and principles of the evolution of socio-economic systems have been investigated.

In these chapters the theory of the optimal evolutionary path has been developed. It postulates that Dynamic systems, particularly socio-economic systems seek, and are able to follow an optimal path, (based upon increasing control), to a lesser or greater degree based upon the requisite variety and requisite chaos that may be available. Requisite variety is based upon the order and information content of the system. ("Variety" is dependent upon the information base, "Requisite" is dependent upon the order in a system - how it is organized.) Requisite chaos is a function of the system analogue sensing ability and the environment. This means how capable the system is of seeking out chaos it can handle (order), and how difficult in relative terms the environment offers up the requisite amount of chaos. (More chaos than the system can handle will destroy it; less will cause its variety to turn in upon itself, and as described earlier also lead to its destruction.) The "desired" objective is increasing control and the optimal path, based upon an increasing choice in permutation paths. Decreasing control over its environment will cause a system to tend towards disintegration.

In line with this theory different dynamic systems have different optimalities related to the differing information bases, sensing abilities, analogues abilities and

Analogue Process



The society at state I, point O, in time, analogues as to what possible permutations are possible to time, point T, what goals are preferable (in terms of increasing control), what permutations are possible in view of obstacle.

adaptabilities. Adaptability means how well can a dynamic system "learn", add to its information base and so be able to increase control even in the face of changing parameters. If it cannot "learn" in the face of changing parameters it will lose control and tend towards disintegration.

This theory can be used to increase the viability, adaptability, and optimality of the permutation of dynamic socio-economic systems. A first step would be to design a model of the socio-economic system, incorporating the best of current efforts at socio and econometric modelling, and the dimensions of this theory. The dimensions mean most specifically the design of the institutional and infrastructural structures of the system. When we discuss the information base, the sensory mechanism, the analogue mechanism, the adaptability of a system we are discussing institutional designs of socio-economic systems. It follows, thereford, that institutions (the business environment also being included as a designed institution) must be designed so as to maximize access to information, to be very sensitive to change, to be able to assess information, data, change accurately, and to be flexible enough to adopt (learn) effectively to change, so as to maximize increasing control over the relative environment.

One approach may be to model this theory, these dimensions as structural parameters upon which an econometric model may interact upon. Once a reasonable model of this type

has been developed it would be useful and necessary to do the same for interacting systems. In this way some assessment of the future interaction of dynamic socio-economic systems could be arrived at, as well as possible future permutation paths. The adjustment of variables and parameters could allow for the consideration of some optimal decision or decisions. This could increase the confidence and viability of decision making.

The primary basis currently being used for institutional decision making is economics, and because economics must necessarily impact upon socio-economic structural design it is important that an increased and clearer understanding of economics be put forward.

Economics

Economics is the study of the creation, use, deterioration, and distribution of order. Order is a potential to apply requisite variety, at a desired point, place and time. Order is necessary because all dynamic systems seek a maximal permutative path. This means they seek increasing control over their environments so that an increasing number of choices (permutation paths) may be had.

This tendency requires an increasing ability to apply requisite variety - ORDER. Dynamic systems- life could not exist without organization - order. Life is a pyramid of increasingly organized (ordered) systems. Money is stored order, in that when work - (order) is created in

a commercial environment a promisory note, indicating the value of the order created is exchanged. Money is a form of temporary storage of order reflecting in its value the order of the socio-economic system in aggregate. Order can be stored in many other ways, for example bonds, stocks, commodity futures, property. The related values are individually intrinsic, that is each reflects their individual values at any pont in time, which may vary considerably, for example a silo of grain may add considerable order in a time of famine, but relatively little in a time of surplus. In relation, that is why commodity futures fluctuate so radically, as it is difficult to predict the order any item could add to any future system state. Order in itself having a fourth dimensional quality. If this can be recognized that money relfects order, particularly the order of the socio-economic system it represents, the modelling of the permutation, interaction and variety generation of dynamic systems, may yield valuable data for (financial) foreign exchange traders. Every currency - country could be assigned a moving present and future "order" quotient, based on modelled permutations. (see appendix I)

"Inflation" is the deterioration order. Order tends to disorder (entropy). If a system is to maintain a level of order it must continue to increase its creation of order, since entropy tends to be geometric - have a snowball effect. If a system is to increase its order above a current level it must increase order at a rate more rapid than replacement. If inflation is allowed to continue

unchecked, order will deteriorate to such a state that the system will oscillate and eventually disintegrate. An increase in the level of order can be obtained by an improvement and addition to the information base - (technological advance). The use and diffusion of this information may however, be slow throughout the system because of inadequate channel capacity. New information also often requires the restructing of the current system and in consequence resistance results. (Also, most importantly this new information may not be available, for example, fusion technology.) If the information base of a system does not allow it to generate adequate variety to meet changing conditions to check inflation-disorder, it loses control and eventually disintegrates.

Order can be created and is created outside of the financial system, for example, in doing ones own laundry, washing the car, or refurbishing the house. Since this order increase is not reflected in the financial system - money, and since such order comprises probably the bulk order of a system, it probably is safe to say that the value of money (exchange rates) does not accurately reflect the order of the system.

What money reflects is the <u>relative perceived</u> order of a socio-economic system and the <u>perceived potential</u> order of the system.

All that is necessary to create order is the potential,

in terms of technology (information), labour, materials and markets where it can be used. For example, Japan after World War II had no Marshall plan, but the system was "intelligent" enough to see that the markets, the labour, the technology existed. Anyone presenting a sensible business plan was given the credit to go ahead. (Even though there was no "money".) Money is a reflection of present and future order. Order is in itself fourth dimensional, future oriented. All that is necessary for the creation of order is the potential of order. As J.M. Keynes once is purported to have said to a perplexed Government Minister, "What do you mean there is no money? Are there not bricks? Are there not labourers? Are there not people waiting to live in buildings?" The Minister was still adament that there was no "money". The key that the Minister could not grasp was that the buildings would be paid for by the people who would live in them and they would work - create order. A multiplier effect is necessary so that an order sink does not develop. An order sink may be such an item as a fighter aircraft, which in a period of missiles, laser and particle beam technology serves no particular function. No one really wants a fighter aircraft - no one would "work" for one.

It is a classical example of an order sink, resources, - order is put into it but little if any multiplier effect is realised.

Governments, control systems, have misunderstood Keynes.

Keynes'sidea was to provide liquidity (credit) to provide for real needs, which would have a multiplier effect, cataloging work-order. Governments have, however, applied his ideas in excess, and many efforts have become order sinks, as mentioned fighter aircraft or aircraft carriers. The rationalehas often been to create employment through such misguided efforts. People, however, cannot be employed if they are not producing order. People are resources (labour). If labour (resources) are expended upon or order sink they cannot be used elsewhere, as these people do not produce order, but consume order (goods and services) they too are an order sink. Order sinks add to the deterioration of order - inflation. (Disguised unemployment of this sort is a measurably worse structural problem for the system because they cannot be switched as easily, as the actual unemployed to production creating order.)

The question might then be rationally asked how can 'unemployment' be solved? What is necessary is that resources be employed so that they can be used effectively to create order. The answer therefore, is to make prevalent the information on where potential order may be created, how to use resources, to satisfy this makret, (business plan), and to make credit available to do so (as it is for fighter aircraft). If this "business" environment in terms of credit, knowledge, and taxes, regulation, grants, etc. is made flexible, condusive, the system will approach Adam Smiths' optimal state, that is each component

permutates along an optimal path (increasing order) causing the system as a whole to proceed on an optimal path (control over the environment).

Not only should the potential for order generation be maximized but the order sinks in the system should be cut down to the extent possible. Such order sinks may not only exist in the military establishment, but in the civil service, and in "business". Any service or product that does not perform a useful function is an order sink. Any product that does not perform what it is advertised to do is an order sink. Such order sinks can be lessened by allowing adequate consumer (flexibility) access to information on products through electronic means. Monetary and fiscal polling only serve to structurally unbalance a system, in that through manipulation of interest rates and credit - money supply only serves to put forward in time the problem of order deterioration, - inflation, which eventually has to be settled by a recession or a depression. The correct methodology is to encourage the flexibility, potential for order creation. The "entrepreneurial" sector will and must be encouraged to grow, in consequence (see the attached predictive charts).

The primary responsibility of socio-economic institutions is to allow as well as create increasing order and variety generation. The basis for the design of socio-economic institutions current in the twentieth century originated in the nineteenth century and much earlier.

It is reasonably safe to assert that there has been little innovation, research, or serious sutdy of the design of socio-economic institutions in the current or recent past, when compared with the efforts and resources powered into, for example, physics. It is à most important area that deserves much more attention. The Parliamentary, Congressional, and Soviet(Communist) institutions all had their origins far in the past, with such as Smith, Bacon, Moore, Locke, Hume, Plato, and Marx. It is peculiar that these ancient scholars of institutional design should continue to exert such influence under such changed circumstances. (parameters).

This thesis may provide for increased interest in the design of socio-economic institutions. New information, new technology such as electronics add almost everyday to the possibilities for improvement in institutional design.

Such improvements in institutional design should consider the principles laid out here. In Beer's terms insitutions capable of allowing for an optimum permutation, allow for a free flow of information, varied and multiple interconnectivity ("richness"), maximum feedback and many one transformation circuits. In other words <u>flexible</u> institutions that can adapt, that can <u>learn</u>.

The Cybernetic study of the evolution and interaction of dynamic socio-economic will contribute significantly to the rationalization and optimization of mans future

permutation paths.

"Their drills were bloodless battles

Their battles were bloody drills."

Plutarch on the Roman Legions

Appendix I

Order

A further digression on the concept of order and its application.

Order, organization is essential to dynamic systems if they are to survive, to not degenerate into disorder-disintegration. We say that a certain arrangement of physical items has order when we feel, or perceive, that this arrangement will provide, or continue to provide probable requisite variety, at some future point, place and time, that is it will allow for the further control of the environment by the system. To demonstrate let us take a game of dice, where two players must alternatively roll two die. The winner would be the one who was able to roll a sum totalling one more than the other.
In the case of a tie or more than a one point differential the game would go on without any points being scored.
Now suppose one player was able to weight his die at will so that the probabilities of his die arriving at many random states (sums) is reduced to only a few - with a high probability of one or two states. We can say that his die are relatively ordered in that he may generate the requisite variety (or concentrate it) to win most of the points. He has in fact concentrated, reduced, dampened variety if you will, in his set of die. If the other player eventually learns to weight (order) his die at will to the same extent, logically a tie should

develop. If, however, the other player learns how to weight his dice more effectively he should win. We would say that he has established greater order in his system (greater concentration of variety). We could say in the former case that state of the weighted die (a certain order) has value-economic value to the player, as it allows him to win-control his environment. We could say this also for the latter case for the other player, after his learning curve. However, in the latter case the first player mentioned could be said to have experienced a relative deterioration of order even though no actual deterioration took place. If the two players are betting players, unless there was a continued tie, one player would eventually lose, bow out of the game, that is his system would cease to exist. It would do so because every dynamic system needs a "profit" in order, needs to win, to increase control to exist. This statement is perhaps a bit simplistic but useful to demonstrate a point. In more complex systems however, losing as demonstrated earlier, may be a necessary event in the extention of control of a species. (Pg.11).

Getting back to our two players if the first player has less money than the second (much less variety generating potential) he may lose in the end even though the order in his system is higher. This is because even though he has reduced the possible states his die might arrive at, and he may not have perfected the system (no system can be perfectly ordered) so that every time the die is

rolled a certain defined, desired state is arrived at. In this situation he may still win more times than he loses but through selective betting the second player may win more money. (That is he may recognize a pattern developing and may bet heavily only on his roll of the die.) Or the first player buoyed by his "luck" may not bet logically or overbet. This may be considered a failure in his analogue or modelling mechanism. He has failed to model the situation accurately. Even if betting is maintained at the same level the first player may lose. This is because in the long run given his greater order, he should win more times than he loses but he may not have enough money (variety generating potential) to last as long as necessary. The second player may hit a streak of "luck" on his throws and win every time, whereas the second player may win the majority of his throws but loses a few times, enough for him to lose his money and the game. In this case the (money) greater variety generating potential of the first player allowed him to win the game even though the order in his system was less.

Referring back to the case where the second player was able through a learning curve to increase the order in his system to a point where he was able to win the game - that is he was able to adapt successfully to win the game.

This may be because the information base of the second

player allowed him the "technology" of how to weight die more effectively. OR He being an innocent, was able to perceive that the other player was weighting his die and how this was done. Furthermore, he may through experiments (modelling) be able to improve on the observed weighting procedure, thereby gaining control of the game. We would say that the perceived (potential) order of the first player's system was not realised, (Order being fourth dimensional) because the first player could not (model) predict the change in parameters - the adaptability of the second player.

It could be said in relation to this point that the realization of the potential of order-ability, is context or parameter dependent. The abscribed economic value to an arrangement of physical items is its perceived potential use, in generating requisite variety-order, but its actual value (which is difficult to precisely predict-model because of changing parameters) is related to its actual use-utility. (This is primarily why economies are difficult to manage.) To further explore this latter situation let us assume that the second players' information base does not allow him to weight the die or not weight them successfully, we could say that his information base, his experience (stored permutations), is inadequate. However, if he studies the weighting of the die by his opponent, he is learning, adding to his information base, or if he starts to bet-play in accordance with a pattern he seees arising (he is

adapting). He begins to order what seemed to him a random series of events. If he cannot learn, model, the situation and possible permutation paths accurately, - add to his information base, or if his information is inadequate - if he cannot adapt he will lose, his system will bow out of the game and cease to exist.

In a further circumstance let us assume that the rules change radomly, in that to win one may have to roll two points more than his opponent, or three or four, this being radomly announced. It seems clear that die adjusted to roll one point more would not win the game when the rule is two points more. In relation it seems also clear that the only way one could win (for sure) would be to initially establish an adaptable system of weighting die. If the die weighting system is stagnate and cannot be adapted to the changing rules (parameters) the player may and probably will lose. In the same way institutions must be designed so that they can be adapted quickly to provide requisite variety - the desired results, in the face of a changing environment.

An expansion of the order concept into the activity of the socio-economic system*

If instead of weighting dice we turn our efforts of order creation towards shaping wood so that we may fashion a chest of drawers, we are creating order in the chest of drawers as we did in weighting dice, by allowing for the potential application of requisite variety. The application, utility, of requisite variety (realization) is when socks, clothes, etc., are stored in it, within the context (parameters) of a habitation environment. The log-tree trunk from which it was made can be safely said to have less potential in terms of applied requisite variety than the chest of drawers. The actualization of this potential exists within defined parameters. The chest may have no or little utility, and the log may have an even higher utility if the parameters (context) is changed (microscopically alot, macroscopically perhaps only a fraction). For instance, if in the case of a shipwrecked survivor the potential order of the chest may not be realizable but the relatively lower macro-order of the tree trunk is realizable (in the sea). There is another relative point here in that when the shipwrecked survivor is first presented with the situation of a shipwreck, the situation seems quite random, but in observing, testing, modelling various permutations - (adding to his information base) he is able to define an optimal permuation - he is able to order his environment, and reduce its uncertainty.

Expanding this further into the socio-economic system we

*This discussion was aided considerably by a discussion with Les Johnson of the Cybernetics Dept., Brunel University.

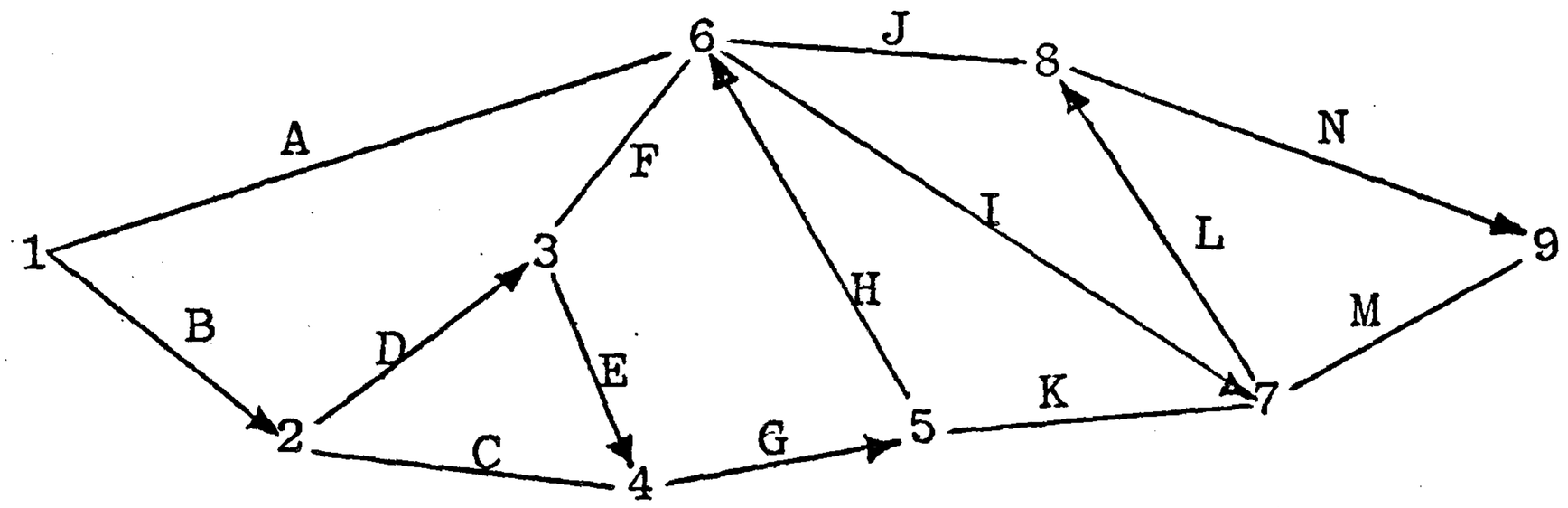
find that much order is fairly narrowly defined in parameter terms. Change the technology, change the "exchange rates", increase labour-factor "costs" and what was formerly viewed as a positive creation of order may be viewed, and may in fact be, an order sink. The earlier example of the jet fighter may serve here. Previous to missile, laser and currently experimental particle beam technology, jet fighters had some realizable requisite variety in an all out war, but the parameter change of technology has lessened dramatically this potential if not completely nullified it. This case is similar to the earlier one of where the second dice player learned to weight his die better than the die of the first player thereby nullifying the order of the first player system. (The potential was not realized.) An unfortunate attribute of current socio-economic systems is that they are not flexible enough, to redirect efforts towards order creation once an order sink is created. They have a tendency to maintain the flow of efforts towards order sinks, because the mechanism to allow an orderly redirection of effort does not exist. The effort if not continued in these (subsystems) cases may cause a disruption - disturbance to other subsystems that are operating in dynamic homeostatic equilibrium with these subsystems. The system attempts in the long term to ease these non-productive systems into a new productive equilibrium. If it is unsuccessful in this attempt inflation will run rampant (disorder) and a depression or the disintegration of the system will result.

Appendix II

A brief discussion of the adaption of Critical Path Planning Methodology to Socio-Economic Decision Making

Critical Path Methodology was first created for the United States Polaris Missile development program. It is a methodology which outlines the steps and relations between steps in precise detail, for the achievement of an objective. It has been successfully used in many projects ranging from the New York World Trade Centre to the NASA moon project. The method is what it says it is, it determines the critical path in terms of steps for the objective to be achieved, on schedule.

The critical path is found by "mapping" all the steps and determing which steps are the <u>longest</u> in terms of time, and

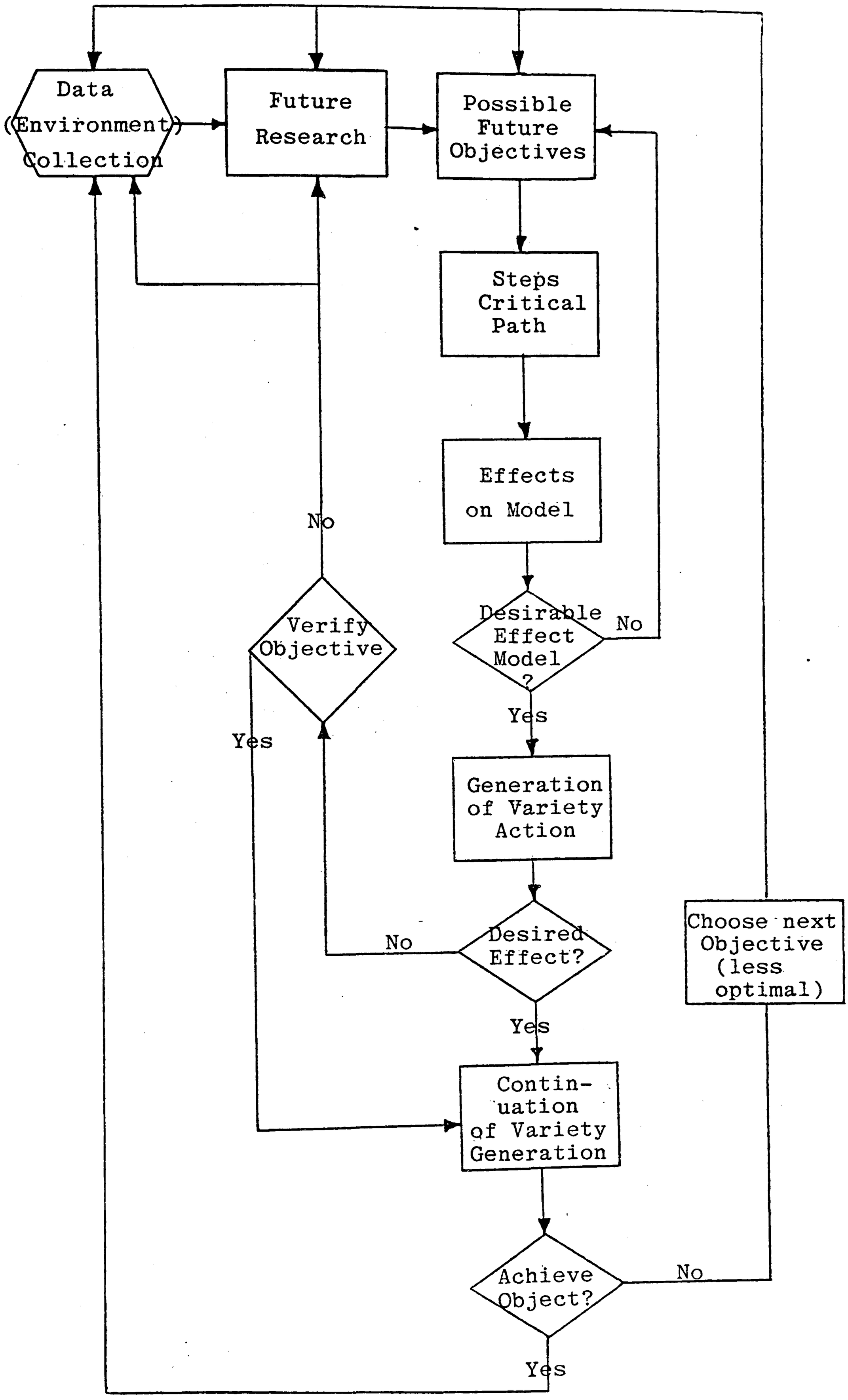


in terms of <u>critical</u> taks (necessary) that must be performed before another task can be taken on. In the diagram it is possible to begin task A before proceeding on to task I but task B must be followed by task D and will take longer than task A to complete, and whereas tasks

B,D,E,G and H are critical, taks A,C,F,K are not. B,D,E,G may require 2 weeks whereas A,C,F,K would require less time (perhaps 3 days) because B,D,E,G not only are critical but take longer. Therefore, the float time for tasks A,C,F,K, in total before task I is reached is two weeks, that is they must be done sometime in that two week period. With this model in mind the times for tasks and the float times for tasks planners are able to model how much in the way of resources should be devoted to which project and when.

Although the precise planning of the permutation of the socio-economic system is impossible and undesirable, the critical path method provides some interesting perspectives for socio-economic planning.

Such an approach may be when various objectives are considered as to their desirability it may be possible to program the computer model with enough information in terms of necessary consequential permutations, so that for each objective some idea as to the necessary steps that must be taken to achieve these objectives may be printed out, as well as the critical path, and float times. These steps could then be modelled on a model of the socio-economic system to assess the effects of these various steps upon the system. The combination of both these procedures in sequence would eventually arrive at the optimum objective and the optimum permutation path. The principles that were developed in earlier chapters of course would be built into the model of the socio-economic system.


Data (Environment) Collection
Future Research
Possible Future Objectives
Steps Critical Path
Effects on Model
Desirable Effect Model ?
No
Yes
Generation of Variety Action
Desired Effect?
No
Yes
Verify Objective
No
Yes
Choose next Objective (less optimal)
Contin-uation of Variety Generation
Achieve Object?
No
Yes

Appendix III

"Organic" Growth

"Organic" growth is a term that has found itself into various significant publications. It is a term that I would choose to define as describing an organization of a system which allows a system to obtain its true maximal optimal permutation. That is the system is not induced to proceed along a path which may be optimal for some components but less so far other components and the system as a whole. For instance certain types of growth entail a high pollution quotient while other types of growth are relatively cleaner, have less of what economists call a social cost - something that may be detrimental to the system but less so far as the components generating this cost. The result of the "obtuse" type of growth usually results in a less optimal permutation for the system as a whole. The organization necessary to stimulate and allow for organic growth is described in the last chapter The Design of Evolutionary of Socio-Economic Systems. As the complexity of socio-economic evolution increases it may be wise to consider "cleaner" types of growth, in terms of physical resources.

"It is scarcely necessary to remark that a stationary condition of capital (physical) and population implies no stationary state of human improvement."

John Stuart Mill, 1837.

Mill was getting at an essential that greater control can come through not only greater control of the external physical environment but also from physical and mental states. That is mans optimal permutation has long been defined by the necessity of biological parameters, but the satisfaction of these parameters are not the only possibility or possibilities for optimum permutation, being that mental improvement is also possible. "Organic" growth would give full vent to all possibilities including mental optimization. This means that full recognition should be given to all possibilities - ("Organic growth" would provide for the maximization of "growth", optimization).

Appendix IV

Futures Studies

"If you are going to forecast, forecast often and make your forecasts varied," has been a maxim used by serious and intelligent "futurists". "Be prepared," "Be prepared for all eventualities," one maxims utilized by the Boy Scouts and other groups. They all imply that plans (permutation) paths should be made ready for all eventualities, that is, should unlikely parameters (possibilities) arise a permutation path (critical path) - plan could immediately be put into action.

Futures studies have in the recent past enjoyed a new "vogue" and recognition with the participation of the European Economic Commission, the OECD (the Organization for Economic Cooperation and Development), the RAND (Research and Development) the Hudson Institute, and various governmental institutions. "New" techniques have been "invented" but they all in the end rely principally on human "intuition". That is the creative extrapolation of permutative possibilities, worked forwards and backwards.

Such "new" techniques have for example been the Delphi and Relevance tree approaches. Delphi is basically a method for arriving at an aggregate consensus as to future probable possibilities.

Relevance Trees is a method primarily for ranking probable possibilities, and priorities.

possibilities.

For a good description of the field please see The Poverty of Prediction by Ian Miles.

ECONOMICS

"facts", - data gathering
- Delphi, etc.

Possible goals

Probable goals

(Permutations)
Possible scenarios

(Permutations)
Probable scenarios

Probable parameters
obstacles

Natural parameters
minimal needs

Modelling permutations
evaluation scenarios

Optimal permutation
decisions (scenario)

ACTION (PERMUTATION) - Control Process

Futures Research

Feedback Process

Modelling

Analogue Process

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