

AN ANALYSIS OF CONGRESSIONAL PROCESS  
BASED ON THE WORK OF KARL W. DEUTSCH:  
A SYSTEM DYNAMICS MODEL

Sonja C. Powell  
Washington, D. C.

Paper presented at  
The 1985 International Conference of the System Dynamics Society  
Keystone, Colorado  
July 2-5, 1985

## ABSTRACT

In The Nerves of Government (1963), Karl W. Deutsch postulated the crucial problems of "steering" and of the "creative intelligence function" - the ability to invent and carry out fundamentally new policies to meet new conditions, the ability to combine items of information into new patterns so as to find and recognize relevant new solutions - that increasingly confront government institutions and that constitute an essential aspect of the decision- and policy-making processes on which the political system may depend.

This paper is an initial effort to conceive a System Dynamics (S/D) model of the U.S. Congressional system from this perspective, to promote further investigation of Deutsch's work in this area, and thus to effect appropriate change in Congressional institutional structure and function in this respect.

## INTRODUCTION

This paper is concerned with design of a model of the dynamics of legislative decision-making.

Based fundamentally on the work of Karl W. Deutsch, the proposed model is intended, in fact, to portray the dynamic relationship among the components of the Congressional system precisely as analyzed by Deutsch in his The Nerves of Government (principally Chapters 10 and 11).

## BACKGROUND

According to a report prepared at the request of the Subcommittee on Fisheries and Wildlife Conservation and the Environment of the House Committee on Merchant Marine and Fisheries (July 31, 1975) entitled "Computer Simulation Methods to Aid National Growth Policy":

It is not clear that the existing decision-making capabilities of the Congress and the Executive Branch permit full comprehension of the multi-dimensional nature of societal problems or proposed solutions...There is an increasingly recognized need within the Congress for techniques and resources which will better enable Members to understand the complexity of the problems they confront and the relationship among issues.....They have found it increasingly hard to rest content with partial models of isolated traits or situations.

The acknowledged need is for "the development of multi-dimensional analytical and predictive capabilities within the

Congress.....Clearly the problems of information gathering and analysis confronted by the Congress are more challenging today than in the past. Certainly the Members have needed an increased capability to obtain and evaluate information, due both to the growing complexity of societal problems and the increasing masses of existing relevant data. They also have needed an improved ability to identify trends in relationships and to estimate the short- and long-range effects of such trends. These developments could be expected to enhance greatly Congress's capacity to assess the adequacy of past or proposed legislative and executive responses to societal problems." (U. S. Library of Congress, 1975, pages 2-3)

Senator Moynihan expressed the view that:

Tracing the complex and involute interconnections by which inputs produce outputs in a large social system is not the work of amateurs.....(N)o one really knows how to do it.....If the analysis and discussion of public issues is to continue to move in this new direction, it becomes necessary to lay down certain principles which ought to guide all of those involved if the end result is to be a more creative democracy, and not simply a more effective government. (U. S. Library of Congress, 1975, pages 7-8)

The foregoing remarks and others contained in the Subcommittee Report cited were specifically focussed on the matter of application of computer simulation models as a "tool for conducting strategic policy analysis and a potential tool for aiding in the construction of the decision-making and implementing mechanisms needed to define and carry out...policy on a continuing basis." (U. S. Library of Congress, 1975, page 1) Deutsch, while also attuned to this matter, was devoted nonetheless to the broader scope of the political function:

.....(W)e are near the end of a long period of human history and in transition to a very different one. Accelerating processes of change, we feel, have been carrying us ever closer to the edge of the area in which our traditional intellectual equipment has been adequate. Such an intellectual climate of partial disengagement from tradition and uncertain but persistent expectations of change is not new in history, but the breadth and strength of this sentiment is unmistakable among such very different minds as Pope John XXIII, Teilhard de Chardin, A. J. Toynbee, Ernst Bloch, Ernst Junger, Karl Jaspers, Norbert Wiener, Leo Szilard, John Platt, Richard Meier, Bertrand de Jouvenel, and

many others..... Coming up toward this edge of our past understanding, we must either accept intellectual impotence and probable defeat, or, we must trust in irrationality, blind luck, and 'muddling through,' or else we must increase substantially our powers of thought and perception. We must increase ...the capacities of our intellectual equipment ...by increasing and improving our personal efforts together with our man-made mind extensions and mind-like artifacts, and with our patterns of effective teamwork among men, and among men and machines..... (Deutsch, 1966, page xvi)

#### WHY AN S/D MODEL?

David Easton (1964, 1965) conceived the notion of political life as "a system of behavior,...a complex set of processes through which certain kinds of inputs are converted into the type of outputs we may call authoritative policies, decisions and implementing actions,...a boundary-maintaining set of interactions imbedded in and surrounded by other social systems to the influence of which it is constantly exposed."

Models are attempts to imitate systems. They try to capture the major components and interactions of a system. By referring to models one can obtain valuable insights into the behavior of a system. (U. S. Library of Congress, 1975, page 24)

A model is an abstraction of reality and can be conceptually regarded as a substitute for the real system. It is used to capture the functional essence...of a system..... To the extent that a particular model is an appropriate representation of the system, it can be a valuable aid to policy analysis and policymaking.....

A model is anything that illuminates and clarifies the interrelations of component parts, of action and reaction and of cause and effect. (U. S. Library of Congress, 1975, page 29; Horton, 1972)

System dynamics modeling is a methodology that deals with deterministic, dynamic, nonlinear, closed boundary systems. The systems approach is a way of thinking which strives to be rational, logical, consistent, objective and quantitative in analyzing complex systems and solving complex problems. It is on the basis of all these considerations that a system dynamics model is deemed a most appropriate means for study of the behavior of the Congressional decision process. As noted

by Forrester, computer-modeled and -generated representation of this process makes possible the explicit formulation of assumptions about the behavior of the system and determination of the dynamic consequences of the interactions of these assumptions. As compared with the mental (that is, intuitive) model, the computerized (that is, mathematical) model used for describing behavior of the system is clearly advantageous: it is unambiguous, clearer, simpler, more precise.

A structure (or theory) is essential if we are to effectively interrelate and interpret our observations in any field of knowledge. ....(N)ow the concepts of "feedback" systems seem to be emerging as the long-sought basis for structuring our observations of social systems. Over the last century the theory of systems has slowly been developed to apply to mechanical and electrical systems..... (I)t is only in the last decade that the principles of dynamic interactions in systems have been developed far enough to become practical and useful in dealing with systems of people. Around the system dynamics principles... it should be possible to structure our confusing observations about political and business systems. (Forrester, 1968)

A great asset of the (S/D) method is that it forces comprehensive consideration of the system rather than singling out a particular facet and trying to understand it alone. Forrester has made us aware that interrelations in complex systems often tend to hide ultimate causes far from the point where results are seen and has shown that simulation technique gives us a feasible approach to understanding such systems. (Henize, 1975)

Major criticisms have abounded concerning the sparing use of measured supportive empirical data in application of the approach to a wide range of disparate areas. Deutsch was particularly keen about the need to check structural data against actual, observed data in his work on governmental process. He consistently elucidated and substantiated his points by numerous concrete examples that indicate clear paths to quantification of relevant data.

It is primarily the concept of feedback, along with other related engineering principles so clearly delineated in Deutsch's analysis of government process, that has drawn this author to attempt design of the S/D model. Deutsch cited the important works of many other investigators who have applied these concepts to the field of political science--William J. Foltz, Ithiel de Sola Pool, Richard L. Meier, David Easton, John W. Burton,

Dieter Senghaas, Richard C. Snyder, Ernst B. Haas, Amitai Etzioni, Harold D. Lasswell, Anatol Rapoport, Hayward B. Alker, Jr., to name but a few. In setting forth his adaptation of the concepts of feedback and cybernetics to the process of government, Deutsch draws attention to the etymology of the word "government".

Let us recall that our word "government" comes from a Greek root that refers to the art of the steersman. The same underlying concept is reflected in the double meaning of the modern word "governor" as a person charged with the administrative control of a political unit, and as a mechanical device controlling the performance of a steam engine or an automobile. On closer investigation we found that there is indeed a certain underlying similarity between the governing or self-governing of ships or machines and the governing of human organizations. Steering a ship implies guiding the future behavior of the ship on the basis of information concerning the past performance and present position of this ship itself in relation to some external course, goal, or target. In such cases, the next step in the behavior of the system must be guided in part by information concerning its own performance in the past. (Deutsch, 1966, page 182)

Deutsch expanded on the obvious connection here with engineering concepts in his description of the coincidence of development of communication theory, control theory and cybernetics, Deutsch as applied to the social, hence, political sciences:

The first is the most obvious and well-known. It is the vast rise of electronic communications technology, large-scale computers, and automatic control systems.

The second is less obvious but readily discerned. It is the confrontation of the social sciences with many problems for which the traditional mechanistic, organismic, historical, or literary forms of thinking had proved inadequate. In order to reformulate these problems in ways that made them more amenable to empirical analysis and research methods, and to mathematical treatment, it was necessary to develop concepts and models embodying notions of feedback, information, memory, self-steering, automatic pattern recognition, and the like. Such notions proved increasingly helpful, regardless of whether they were called "cybernetic" or went under some other label. . . . (Deutsch,

1966, pages xv-xvi)

The third source of the increase in interest may be social and historical -- deriving from a sense of the current state of transition of human history and of disengagement of human society from tradition, accompanied by the stark realization of the need for substantial increase in our intellectual capacities and for new tools for thinking.

Forrester has expounded fairly identical linkages and confluence in describing the background threads out of which system dynamics has arisen:

- (1) the classical, liberal arts approach to social behavior
  - (2) the formal theories and principles of cybernetics (or, servomechanisms, or feedback systems)
  - (3) the development of the high-speed electronic computer
- (Oltmans, 1974)

### THE MODEL

As a first step in designing the dynamic system model, Figure 1 presents a simple causal loop diagram -- basic structural element -- describing the system behavior in terms of its boundary and feedback loops.

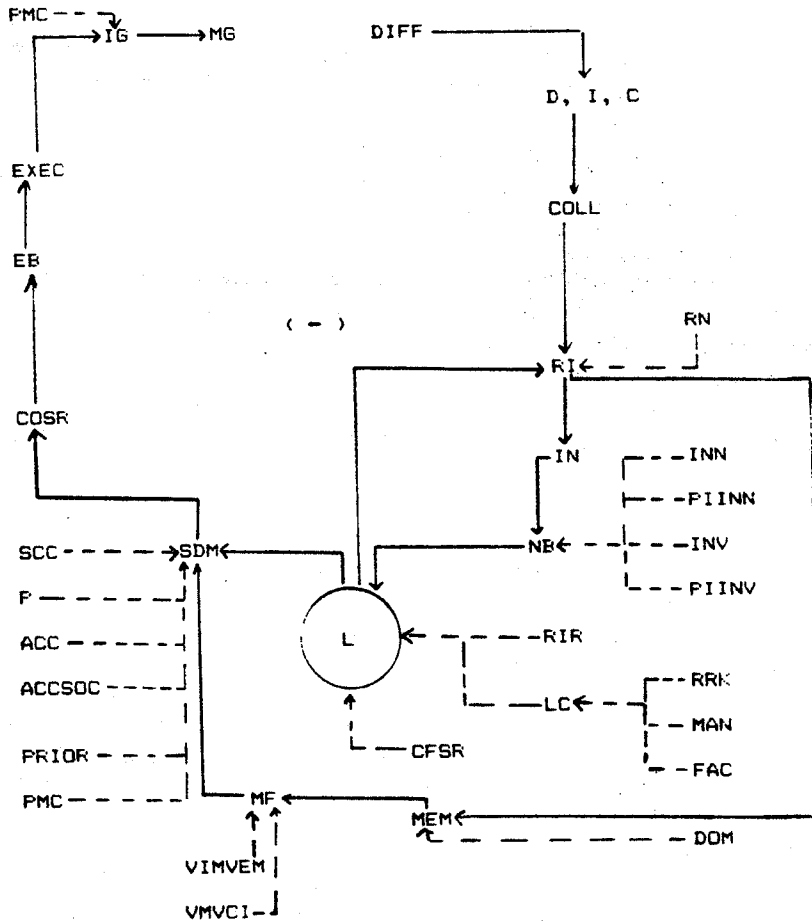


Table 1 lists and defines parameters of the model conceptualized in Figure 1, as derived from Deutsch's analysis.

ACC	Acceptance and Support of Solutions to New Problems
ACCSOC	Acceptance of Solutions by Individuals & Groups
C	Challenge
CFSR	Capacity for Structural Rearrangement
COLL	Apparatus for Collecting Information from Outside World
COSR	Commitment of Structures & Resources
D	Data from Past
DIFF	Diffusion of Fundamental Items of Knowledge & Information
DOM	Death of Memory
*DRIFT	Habits, Preferences, Beliefs, Personality Structures
EB	Changes in External Behavior
EXEC	Execution of Solutions
F	Feedback
FAC	Facilities
I	Information
IG	Intermediate Goals
IN	Information Turned Into New Form
INN	Innovating Capacity
INV	Inventing Capacity
IOI	Intake of Information from Outside World
L	(Creative) Learning
LC	Learning Capacity
MAN	Manpower
MEM	Memory
MF	Memory Facilities Available for Recall & Application to Action
MG	Major or Strategic Goal Preference or Value
NB	Set of New Kinds of Behavior for Learning
P	Power Pursuit
PD	Present Decisions
PMC	Probability of Meeting Challenge
PRIOR	Operating Preferences or Priorities
PTINN	Propensity to Innovate
PTINV	Propensity to Invent
RI	Range of Intake of Information from Outside World
RIR	Range of Inner Recombinations
RN	Responses Needed to Solve Problem to Meet Challenge
RRK	Range of Internally Available Recombinations of Knowledge
SCC	Steering Capacity or Coordination
SDM	Steering & Decision-Making
SP	System Performance in Present
SS	Self-Steering
URCR	Uncommitted Resources/Committed Resources
URRN	Uncommitted Resources/Responses Needed
VCIVN	Valuation of Current Ranges of Intake/Valuation of New Data
VIMVEM	Valuation of Internal Messages/Valuation of External Messages
VMVCI	Valuation of Memories/Valuation of Current Ranges
VPVF	Valuation of Present/Valuation of Future



Overall polarity of the loop is indicated as negative. This is a goal-seeking system. The goal or purpose of the political decision system is "to invent and carry out fundamentally new policies to meet new conditions;.....to invent and execute an effective new 'response' to some new 'challenge' presented to the state or the society by its environment". (Deutsch, 1966, page 163)

Deutsch explains the negative-feedback, goal-seeking process thus:

(The) system first of all is given a major internal imbalance or disequilibrium that functions as its drive, in the sense that the system tends to move toward a state in which this internal disequilibrium will be reduced, or more loosely expressed, in which its internal "tension" will be lowered. Moreover, this inner disequilibrium must be of a particular kind, such that it can be reduced by bringing the whole system into some particular situation or relation vis-a-vis the outside world. This situation of the system to the outside world we may call a goal situation, or briefly a goal: once the system has reached such a goal its inner disequilibrium will be lower.

Second, in order for the system to approach the goal effectively, the feedback condition must be given. The system must receive information concerning the position of the goal and concerning its own distance from it; and it must receive information concerning the changes in its distance from the goal brought about by its own performance. The messages are often negative in that they oppose the previous actions of the system, so as to oppose overshooting of the target.

In the third place, the system must be able to respond to this information by further changes in its own position or behavior. With these facilities, and given sufficient freedom, the system will therefore tend to approach its goal.

Finally, if these changes are effective and the system reaches the goal, some of its drive or inner tension usually will be lowered.....

Governments may seek goals in domestic or foreign policies. In order to approach these goals they must guide their behavior by a stream of information concerning their own position in relation to these goals; their remaining distance from them; and the

actual, as distinct from the intended, results of their own most recent steps or attempts to approach them. (Deutsch, 1966, pages 183-185)

(T)he goal may be a changing goal. It may change both its position,...and even its speed and direction..... (Deutsch, 1966, page 187)

It is also quite possible for the goal itself to be changed.

This may occur gradually, through a drift in the characteristics or behavior of some parts of the system. Gradual changes in the culture patterns or personality structures of a population, or in the personnel of a political elite, may thus change the goals sought by a political decision system. Studies of the political effects of changes in the "national character" or in prevailing personality patterns, such as the change toward "other-directedness" suggested by David Riesman, might be developed in this direction.

In some organizations, goal-changing is a part of the pattern of feedback processes itself.....

Isolated instances of goal-changing are well known in politics..... How, when, and how quickly goals are changed by individuals, groups, and organizations might be a fruitful subject for political research.

A more specifically political problem arises in situations where a major strategic goal must be achieved through a sequence of intermediate or tactical goals. (Deutsch, 1966, page 196)

An organization, having pursued one kind of goal, might come to pursue a very different kind of goal..... This may involve more than the change of just one or several values. Rather, where such changes in major goals occur, we may find at work a process of long-range reconstruction; and where they occur in a relatively short time we may face the phenomena of renovation, reformation, revolution, or conversion. All these involve a major change in over-all function and behavior, as well as major structural rearrangements of the political decision system, and usually of the rest of the society. If we ask, "How likely are such major changes to occur in a particular political or social system?"

And how likely are they to occur without self-destruction on the part of the system?" -- then we have gone beyond the problem of simple goal-changing feedback. We are asking about the learning capacity or innovating capacity of that society. (Deutsch, 1966, page 199)

As a final note on this subject of goal-changing, Senator Moynihan has stated in the Report of the National Goals Research Staff:

For well over a century observers of American society have been turning out elaborations of de Tocqueville's original perception that as conditions for a group improve, the gap that remains grows steadily less tolerable, with the rough result that the better things are the worse they are said to be. More recently social scientists have formulated this in terms of "goal gradients, with the hope that the phenomenon cannot only be described, but can be measured. But it remains part of the reality; part of the price a society pays when it consciously seeks to change things for the better. (Moynihan, 1970, page 472)

The reference mode -- which identifies the essential problem of interest being modeled over time -- is the measure of the creativity of political decisions, of "learning capacity," which Deutsch defines as the proportion of uncommitted to committed inner resources within the system compared to the set of responses needed to solve a particular problem, or to meet a particular situation or challenge. It is an idea which he adapted from the concept of the learning curve.

The dynamic hypothesis being examined states that the ability of the Congressional system to invent and carry out policies appropriate to conditions of the environment of the system is related to its ability to combine information into new patterns for new solutions as may be required and appropriate. In addition to being invented and recognized, new solutions and sources must be acted on to be effective. This can be done only to the extent that uncommitted resources are and can be available within the system; and then what counts is the ease or probability with which they are available for unexpected (re)commitment. Learning consists in this case in internal structural changes followed by changes in external behavior, causing the system to give a different and possibly more effective response to repeated external stimulus. Consequently, learning capacity of the system is related to the amount and kinds of its uncommitted resources.

In contrast to the simpler causal loop diagram presented in Figure 1, a more detailed diagram of the dynamic multiple-loop, nonlinear feedback system would elaborate the interrelations of the major levels of the system -- Range of Possible Intake of Information from the Outside World, Range of Inner Recombinations or Range of Internally Available Recombinations of Knowledge, Manpower & Facilities, Responses Needed, Commitment of Structures & Resources and principal decisions/actions concerning Creative Learning, Changes in External Behavior, Internal Structural Changes, as well as key intermediate concepts and factors -- Load, Lag, Gain, Lead, Information, Goals/Purposes.

By way of explaining the mutual effects of the system components and the ensuing fluctuations in the state of the system, with respect to the resourcefulness or "creativity" of political decisions, Deutsch notes Toynbee's analysis of the failure of rulers to invent and execute an effective "response" to some new "challenge" presented to the state or the society by its environment.

This ability to produce novelty, and to recognize relevant new solutions once they have been found (this creative intelligence function), seems related to the combinatorial richness of the system by which information is stored, processed, and evaluated. (Deutsch, 1966, page 164)

The combinatorial effects of multiple level variables introduce time delays (lag) -- critical factors in the Congressional decision process -- which result in oscillation in the mode of behavior of the system. Deutsch describes the mutual relationships among the intermediate concepts of load, lag, gain and lead - among others - and the contribution that the introduction of such concepts makes to increasing understanding about the performance of governments:

Feedback analysis permits us to identify and in principle to measure a number of elements in either goal-seeking or homeostatic processes. We can evaluate the efficiency of a feedback process in terms of the number and the size of its mistakes, that is, the under- or over-correction it makes in reaching the goal. (Whether or not the goal will be approached successfully...depends on the mutual relationship between four quantitative factors.

1. The load in terms of information, that is, the extent and speed of changes in the position of the target relative to the goal-seeking system.....
2. The lag in the response of the system, that is, the amount of time between the reception

of information concerning the position of the target and the execution of the corresponding step in the goal-seeking behavior of the system.....Clearly, this lag may be influenced by a number of factors, such as slowness in the reception of target information, or in its interpretation or transmission; or by delays in the response of parts of the system in executing the new course; by the inertia of the system; and so on.

3. The gain in each corrective step taken by the system, that is, the amount of actual change in behavior that results.....

4. The lead, that is, the distance of the accurately predicted position of the moving target from the actual position from which the most recent signals were received.....The amount of lead, in turn, depends on the efficiency of predictive processes available to the goal-seeking system, and on the amount of inaccuracy that can be tolerated.....

The chances of success in goal-seeking are thus always inversely related to the amounts of load and lag. Up to a point, they may be positively related to the amount of gain, although, at high rates of gain, this relationship may be reversed; and they are always positively related to the amount of lead. (Deutsch, 1966, pages 187-190)

The influence exerted on the system by other equally important structural and dynamic elements has also been explored by Deutsch.

## CONCLUSION

Focussing on the four key concepts of load, lag, gain and lead in Deutsch's analysis, this paper concludes:

A feedback model of this kind permits us to ask a number of significant questions about the performance of governments that are apt to receive less attention in terms of traditional analysis:

1. What are the amount and rate of change in the international or domestic situation with which the government must cope? In other words, what is the load upon the political decision system of the state?.....

2. What is the lag in the response of a government...to a new emergency or challenge? How much time do policymakers require to become aware of a new situation, and how much additional time do they need to arrive at a decision? How much delay is imposed

by broader consultation or participation?  
How much time is required to transmit a series of changing orders to the officials...and citizens who are to execute them, and how much time do these persons require to readjust their previous behavior patterns, habits, and values, so as to be able to comply effectively?.....What is the lag in the response to new information that is brought into the political decision system through one channel rather than another, for example, the lag in the reaction to information that is reported more or less "straight from the top"..., in contrast to the information that is first accepted among some particular social or occupational groups?.....

3. What is the gain of the response, that is, the speed and size of the reaction of a political system to new data it has accepted? How quickly do bureaucracies, interest groups, political organizations, and citizens respond with major commitments of their resources?  
.....

4. What is the amount of lead, that is, of the capability of a government to predict and to anticipate new problems effectively? To what extent do governments attempt to improve their rate of lead by setting up specific intelligence organizations, strategy and planning boards, and other devices? (Deutsch, 1966, pages 187-190)

In a 1983 Conference paper, George P. Richardson noted John Platt's arguments in The Steps to Man (1966) concerning the implicitness of the feedback loop concept in political thinking and devices of the eighteenth century: "that the 'checks and balances' assiduously built into the U.S. Constitution were a conscious effort to design a system of 'stabilization feedbacks,' and that...there are clear indications (in The Federalist Papers) of designing (the new Constitution) for stability, for speed of response without instability, for different time constants of response for different purposes, and for achieving a desirably self-regulating structure out of the natural self-interests of the participants."

An effort has been made here to illustrate the vital S/D role in appraising and sustaining this dynamic governmental system and process, as originally conceived.

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