SCENARIOS FOR POLITICAL METAMORPHOSIS +)

a macro-theoretical mathematical model of political behavior

by

Manfred SCHMUTZER

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..."pour épater les verbalistes"++)

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+) A passing from one form or shape into another; transformation with or without change of nature: especially applied to change by means of witchcraft, sorcery or mathematics (Funk & Wagnall's Standard Dictionary, International edition, Vol. 2, New York 1966, slightly altered)

++) For exact references see K. Marx, L. Wittgenstein and the Bible.

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(1) INTRODUCTION

It is a wide-spread custom in Comparative Political Science to look for relations between so-called "structures" and rather vaguely defined "processes", "functions" or "activities" related to these, in order to define and compare "political systems" and their "development". Most of these approaches are successors of the former institutionalism, functionalism and the separation of power theory. None of these approaches tries to give operationalized definitions of the "structures", "functions" or "systems", the result of which is an increasing number of definitions; L. W. Pye[1] for example offers ten different definitions of "political development".

A well known model of this type is that of G. A. Almond and G. B. Powell Jr.[2] offered in their "Comparative Politics". This model "lives" in a non political environment from which it receives inputs and to which it sends outputs. The system consists of subsystems and structures which fulfill special functions, or, more precisely, parts of them, just as for instance the stomach is mainly responsible for the digestive processes. (One rapidly runs into troubles by applying these methods in respect to an empirical political system. The situation turns out to be even worse by trying to expand the analogy for a greater number of political systems. It seems very appealing to imagine that one nation's government activities are comparable to cerebration whereas an other nation's government activities to digestion). The ideas of K. Deutsch[3] and D. Easton[4] are also stated in structural terms.

In summary one may say that all of these system analytical approaches conceive of the political system as a kind of animal with organs and a centralized coordination and a will to persist. While this view may be very picturesque and vivid, I do not believe, however, that the analogy is very helpful, nor that we should define a political system as a system containing all political activities, i.e. the set of institutions concerned with politics.

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1) L.W. Pye: "Aspects of Political Development", Little, Brown & Co. Boston 1966
2) G.A. Almond & G.B. Powell Jr.: "Comparative Politics", Little, Brown & Co., Boston 1966
3) K. Deutsch: "The Nerves of Government", The Free Press, N.Y. 1967
4) Easton, D.: "A Systems Analysis of Political Life", John Wiley, N.Y. 1967

Neither can I agree when this political animal is put into a more or less unpolitical environment from which it receives inputs and to which it sends outputs. For my part, I would prefer a view in which both, institutions and environment are considered part of the political system and where especially the "institutional part" of the system has to fulfill a very specific task: that of producing decisions.

Whereas the "environmental" parts produce the tasks for which these decisions should be made, these parts must be incorporated into the system. Aside from producing tasks these parts of the system should be conceived as reacting on the "products " of the "institutional" part, in the form of new tasks and so on. We are therefore not too far away from the functionalistic concepts. But - what I suggest is to turn the emphasis mainly toward groups which decide and groups which make the others decide. Consequently we are less involved in problems like by whom, when and where decisions are made, but more in questions as how and why it is done.

These patterns raise instantly the question for what reasons the usual tool, namely the rational choice approach with its rather sophisticated methods is not going to be applied. Our argument against rational choice is based on the aims we try to meet. We try to find explanations for changes in the "whys" and "hows" or in other words to find out how "preferences" or "social decision functions" are shaped, influenced, and altered. This matter seems to us to be far away from rationality, individual preferences and choice. Therefore cybernetic concepts appear to us to be more adequate, especially since we are going to treat macrophenomena instead of individuals. The objects and aims of this paper should be seen as an experiment therefore. Thus we will reduce the assumptions as well as the applied methods down to the most restrictive simplifications. We will introduce a single decisionmaking element only, a single representative of society's groups, we assume linear relations, ignore time-lags, etc.

Hence the most simplified model of this form of political system is a dichotomous one. But in contrast to the above mentioned approaches whose proponents talk about cybernetic or self-steering regulation processes, but do not use the facilities and methods of the discipline, I would like to demonstrate that a cybernetic approach can do more than merely give a verbally expressed image of the way of life of the political animal.

(2) DEFINITIONS

Our model represents a system which consists of elements that are connected by inputs and/or outputs of these elements.

Flow: Since we are trying to develop a cybernetic model we will understand by inputs and outputs the flow of communications only, i.e. the flow of messages and not the flow of goods. Inputs are messages entering an element. Outputs are those which leave the element.

Element: For the same reason we define elements as substances which receive, transform and send messages from or to elements other than themselves. These elements represent groups which decide or claim decisions.

Transformation: Within the mathematical model the elements are represented by transformation operator T (in our case a matrix). This operator transforms the inputs into outputs in a unique way.

In reality the following process should be assumed to take place:

e.g. Element E sets an act A (i.e. asks for decisions) in response to a certain communication stimulation S.
The message m (A) that act A was set is given to element F.
Element F sets an act D (i.e. produces a decision).
The message m(D) is sent to E.
E sets a new act (or not) because of m (D) ..... a.s.o.

$$S \Rightarrow A \Rightarrow m(A) \Rightarrow D \Rightarrow m(D) \quad \ldots\ldots$$

This view involves the restriction that secret acts never will be considered or that every act is taken at its face value.
For principal reasons, our transformation operator transforms no acts, but messages about acts into messages about secondary re-acts.

System: The system consists of elements in communication connection with other elements. Elements which also communicate with elements outside the system are called surface elements. There are no elements which do not receive or send from or to other elements of the system.

Political System: According to Bahrdt [1] "political action means to exert influence on the lives of men living beyond the boundaries of their own primary groups".

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1) Bahrdt: "Politisches Handeln ist Einwirken auf das Leben von Menschen, die jenseits der Grenzen der eigenen Primärgruppen leben."
Bahrdt, et al.: "Max Weber und Soziologie heute", Zeitschrift für Soziologie, XVIII, 1965.

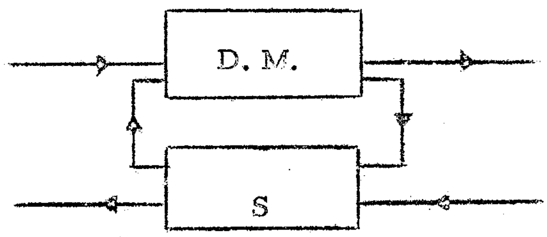
For our purposes this definition of politics which is a good starting point, has to be redefined because our model is to be a communication model. Therefore we will not talk about actions but about transformations, and stimulations instead of influence (or articulations).

Hence we will give the following definition of our political system: We consider a system in which demands are expressed by society and then transformed by political decisions which - in form of responses - exert influence on the lives of men living beyond the boundaries of their own primary groups and in which these men finally react somehow to these responses in the form of demands.

(3) THE TWO ELEMENT MODEL

The previous considerations suggested that we must adopt a dichotomous approach. This might demonstrate - owing to its simplicity - the basic features of the idea best and keep the operational necessities to a minimum. The former definition of our political system has introduced at least two elements the system will consist of, society and something we shall call the "decision making machine". In the interest of brevity we will introduce the notation S for Society and D. M. for the other element. These elements are linked with each other by communication channels, processes which are usually called input or output of the elements. Nevertheless, we will take into account the possibility that the two elements might receive or send messages from or to other systems. Thus we present our model by diagram 3. 1.

Ill. 3. 1.



This figure represents a single feedback loop of two surface elements. After having done this, we shall forget politics for a while and turn to a mathematical formulation of the above illustration.

We have already recognized that each element can be entered and left by at least two channels (indicated by arrows in our illustration). A convenient way of representing mathematical entities that consist of more than one variable is to use vector notation.

Hence we write:

$$3.1. \quad X^{DM} = \begin{pmatrix} x_1^{DM} \\ \vdots \\ x_n^{DM} \end{pmatrix} \quad Y^{DM} = \begin{pmatrix} y_1^{DM} \\ \vdots \\ y_n^{DM} \end{pmatrix}_i \quad X^S = \begin{pmatrix} x_1^S \\ \vdots \\ x_m^S \end{pmatrix} \quad Y^S = \begin{pmatrix} y_1^S \\ \vdots \\ y_m^S \end{pmatrix}$$

X denotes the input vector, Y the output vector. (For interpretation of the symbols see paragraph 4.1., 4.3., 5.)

These vectors have to be transformed one by one. For the time being we will do this without formulating specific relations by writing

$$3.2. \quad Y^{DM} = T^{DM} (X^{DM}) \qquad\qquad Y^S = T^S (X^S)$$

This means: The output vector depends on the input vector according to a certain transformation rule. T thus denotes an operator. Later, however, certain parts of the output of one of the elements will become part of the input of the other one. We write

$$3.3. \quad X^{DM} = C^{DM} (Y^S) \qquad\qquad X^S = C^S (Y^{DM})$$

The operator C will be called coupling matrix, telling us only whether a specific component of one of the output vectors will appear as a component of the other element's input vector. Hence this operator will be a zero-one matrix.

(4) INTERPRETATION OF THE MATHEMATICAL SYMBOLS

We will return to politics again and look for possible interpretations of the mathematical symbols X, T, Y.

<u>4.1. The input vector of the DM, X^{DM}:</u> What we try to do here is to characterize the flow of communication by typifying the possible content of it. We have already noted in chapter 2 that the input consists of more than one component. We have therefore employed vector notation without asking ourselves how many components we would need. This gap shall be filled now. It is a common method to divide the input into two different

kinds of components, demands and supports. There is no reason why we should not follow this custom. Out of politometric considerations only we propose to modify the concept of "supports" a little and talk of the degree of discontent rather than of positive support. The underlying assumption is that, when there is no discontent whatsoever, support can be taken for granted. But apart from these two specifications we must not forget that we have linked our system to possible other systems. This part of the vector will be called "interference".

So far we have distinguished three types of components; we now will have to go into greater detail and split them up into more components, in order to obtain a more precise system of classification. But this is already part of our politometric considerations which will be dealt with in the next chapter. Before leaving this subject let me summarize once again: We have defined three kinds of components, demands, discontent and interference. Every one of them is to be split up into more components which are not yet defined. So we may employ a previous notation and say that the input vector is a compound vector which consists of the above mentioned subvectors:

$$X^{DM} = (\vec{x}_1^{DM}, \vec{x}_2^{DM}, \vec{x}_3^{DM})$$

4.2. The transformation process of the D. M. element:

The operator $T^{(D)}$ transforms the input vector X^{DM} in a specific way. What we are interested in is to what phenomenon this operator corresponds in reality. We may certainly assume that the capability of the apparatus is responsible for its way of acting. But what does this capability depend on ? In our case capability is dependent on ideology and organizational resources. We have agreed earlier not to discuss units smaller than elements. Therefore we will assume that the D. M. element is capable and willing to generate the structures necessary to perform transformations which satisfy S. (In order to understand the concept of "satisfaction" see paragraph 9, under the concepts of"legitimacy"and"rejection").If DMis not willing to transform satisfactorily this is due to the remaining factor, ideology. Thus we shall call this operator the "practical ideology" of the system. The adjective "practical" is used in order to draw attention to the fact that we do not mean verbally expressed political programs nor philosophically determined political creeds. Practical ideology may be regarded as a sort of compromise between those and political necessities.

4.3. The output vector of the DM element

Corresponding to our reflections on the input vector we shall construct the output vector. Hence we get three kinds of components which will be classified in the same manner as the input vector. The transformed demands will be called "responses". The component corresponding to the degree of discontent will be the degree of authoritarianism. Authoritarian acts are reactions attempting to change the inputs by force rather than by response. The equivalent of the degree of interference is again called interference. This is the communication flow concerning the results of decisions, to which elements outside the system might react.

4.4. The transformation of the society element

We will treat this element much in the same way as the DM element. Thus we will get the same components of the two vectors and talk about the "practical ideology" of society, i.e. the transformation $T^{(S)}$.

(5) POLITOMETRIC CONSIDERATIONS

After having assigned empirical meanings to our mathematical formulations we ought to find a way of collecting empirical data and give thought to the subsequent restrictions on the theory. The following example will illustrate the theory.

5.1. We assume that a given society formulates the following two demands within a period of time:

$x^{DM}_{1,1}$ .... more hospitals for specific regions

$x^{DM}_{1,2}$ .... less income tax (which is used for welfare programs)

Let us try to imagine some possible reactions to the demands to get an idea of the problems of observation of political action.

Solution 1:

DM decides to build the hospitals and finance the project by means of bank credits; moreover, it decides to reduce income tax.
S formulates no more demands concerning hospitals and does not react any more further, it formulates no more demands concerning tax reduction.

Solution 2:

DM decides to decide nothing concerning hospitals

DM does nothing concerning tax reduction

S formulates its demands for hospitals again and is waiting;

S formulates no new demand but starts with tax evasion.

Solution 3:

DM spreads the news that it is working on the problem but needs time; after a while it decides to build smaller and fewer hospitals, fewer schools etc. and reduces tax a little.

S formulates no more demands and is content.

S formulates no new demands and is discontent.

Solution 4:

DM decides to reduce the communication flow between DM and S by force; it decides to reduce income tax but raises other duties.

S feels discontent but keeps quiet;

S feels content and makes no more demands.

This comparatively simple example gives a demonstration of the degree of interdependence of problems.

The following questions will immediately arise, concerning:

solution 2 - Did the demands enter the DM element ?
solution 3 - What happened to them within the DM element ?
sol. 2, 3 - How long will it take until an output is produced ?
sol. 1-4 - Which outputs are produced and how many ?
sol. 1-4 - How and when does society react to the outputs ?
sol. 1-4 - Does the DM element receive new inputs referring to its outputs ?

Each of these questions incorporates a number of problems of observation and measurement. In order to give an answer to any of the above questions we would have to follow step by step the courses of our demands. But even if this were possible practically, we would not gain very much. We would know a lot about two subjects, but could make no general conclusions which would indicate the way in which the system operates. If we wanted to discover this we would have to observe a tremendous number of subjects.

Hence we had better leave this approach before we really start working with it and try another idea.

If I wanted to find out which functions a certain building fulfills, without being able to enter it or ask about it, I could do the following: watch every entrance and count everyone who enters or leaves at certain intervals of time, then classify the people passing by in terms of simple properties like age, sex, etc. and draw conclusions after a week or so. If about 80 % of the people passing by are boys younger than 20 but older than 10, and mainly come in the morning and leave at noon, I can be sure that the house is a boys' secondary school.

Using this approach for our problem, many of the former questions disappear. What we would have to do is to find the entrances and to define our categories. Whatever happens within the transformation process will be found by way of deduction.

Our suggestions reduce the number of questions to three. The first is about how the "entrances" and"exits" are to be found. As the previous example illustrates instantly, no general rules can be given for this.

Every research team will have to decide this at the very beginning. The other question is how to categorize the inputs and outputs. Here we return to chapter 4 when we decided to talk about splitting up the subvectors later on. Of course our suggestions would have to undergo a factor analytical examination, but nevertheless everyone is bound to some imaginative beginning. Therefore we will propose the following components and hold them out for discussion:

$$X^{DM} = (\vec{x}_1^{DM}, \vec{x}_2^{DM}, \vec{x}_3^{DM})$$

$\vec{x}_1^{DM}$ ...... demands $\vec{x}_2^{DM}$ ...... discontent $\vec{x}_3^{DM}$ ...... interference

$x_{1,1}^{DM}$	defense	$x_{2,1}^{DM}$	loss of electorate
$x_{1,2}^{DM}$	inner order and regulation	$x_{2,2}^{DM}$	publications criticizing government, polls
$x_{1,3}^{DM}$	education	$x_{2,3}^{DM}$	demonstrations against government
$x_{1,4}^{DM}$	communication	$x_{2,4}^{DM}$	tax evasion
$x_{1,5}^{DM}$	economy	$x_{2,5}^{DM}$	new parties and/or political leaders

$x_{1,6}^{DM}$ welfare

$x_{1,7}^{DM}$ foreign affairs

$x_{1,8}^{DM}$ maintenance of the system

$x_{2,6}^{DM}$ riots, general strikes

$x_{2,7}^{DM}$ increased emigration

In a similar way we will handle the output vector

$$Y^{DM} = (\vec{y}_1^{DM}, \vec{y}_2^{DM}, \vec{y}_3^{DM})$$

$\vec{y}_1^{DM}$ ... responses $\vec{y}_2^{DM}$ ... authoritarianism $\vec{y}_3^{DM}$ ... interference

$y_{1,1}^{DM}$ defense

$y_{1,2}^{DM}$ inner order and regulation

$y_{1,3}^{DM}$ education

$y_{1,4}^{DM}$ communication

$y_{1,5}^{DM}$ economy

$y_{1,6}^{DM}$ welfare

$y_{1,7}^{DM}$ foreign affairs

$y_{1,8}^{DM}$ maintenance of the system

$y_{2,1}^{DM}$ prevention of elections

$y_{2,2}^{DM}$ censored publications, false news

$y_{2,3}^{DM}$ prohibition of demonstration

$y_{2,4}^{DM}$ exemplary punishment for tax evasion

$y_{2,5}^{DM}$ prosecution of parties and politicians

$y_{2,6}^{DM}$ suppression of riots and strikes by armed forces

$y_{2,7}^{DM}$ forcing or prohibiting emigration

Here we have offered possible components of the vector of the DM element only. But we bear in mind that our coupling operator is of such a nature that the entire output vector, except for the interference subvector, becomes the input vector of the other element without any further transformation. Hence we need not define X^S and Y^S any more.

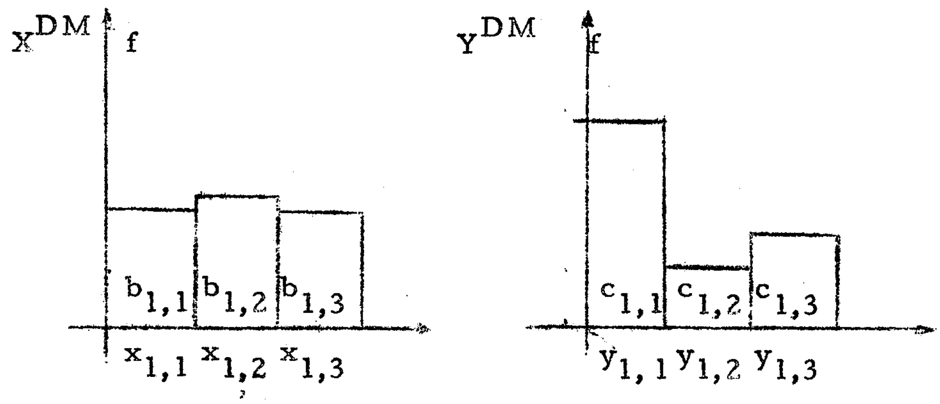
Let us assume that it is possible to define sufficiently accurately the communication units and to count these units.

But before we start counting we will have to fix the period of time within which we will count. At the beginning this will have to be done more or less arbitrarily, so let us take a period of one year. At the end of this year we already know a lot about the vector X, which we write down in the form of two relative frequency distributions. Now we are able to draw our conclusions.

(6) THE COMPUTATION OF "IDEOLOGY"

After having found out how many communication units of types x_n^{DM} or y_p^{DM} have passed our "entrances" and "exits" we will draw conclusions from the relative frequency distributions.
Example: our distributions are as shown in figure 6.1.

6.1.



This illustration shows that for example $y_{1,1}$ must be influenced by something else than $x_{1,1}$ only. It is obvious that two explanations could be offered. First of all, we might assume that for instance $y_{1,2}$ was reduced for the benefit of $y_{1,1}$. But moreover, there might have been something in the machine before we started to count. For instance, if we counted 20 boys entering a house within a certain period of time, and if a little later 18 girls leave the house, it would not be reasonable to assume that out of the 20 boys 18 have been transformed in the meantime. We would rather come to the conclusion that the input vector has changed. In this chapter, however, we will make the assumption that the input vector X does not change during a given period of time, or that it changes so slowly as to be negligible.

Hence we may use the frequency distribution - which we may well assume is constant - of our year of observation for computation. We assume that linear interdependence is given: We split our period of observation into a number of equal intervals, let us say months, within which variations of the vectors are purely random. Then we will employ the usual method and calculate by multiple regression analysis a transformation matrix T, i.e. the ideologies of the elements.

The matrix of the DM element will look like this:

$$
\begin{array}{l|llll}
c_{1,1} & a_{1,1} & a_{1,2} & \cdots\cdots\cdots & a_{1,p} \\
c_{1,2} & a_{2,1} & a_{2,2} & \cdots\cdots\cdots & \\
\vdots & & & & \\
c_{1,4} & & & & \\
c_{2,1} & & & & \\
\vdots & & & & \\
c_{3,p} & a_{p,1} & & \cdots\cdots\cdots & a_{p,p} \\
\hline
 & b_{1,1} & b_{1,2} \cdot\cdot b_{1,4} & b_{2,1} \cdots & b_{3,p}
\end{array}
$$

With the same method we calculate the ideology matrix for society. Here we will interrupt our methodological considerations once more and look for some possible interpretations of the above matrices.

(7) TYPES OF IDEOLOGIES

In order to show the following in a most simple and impressive way, we will return to our previous notation for the vectors

$$X = (x_1, x_2, x_3)$$

$$Y = (y_1, y_2, y_3)$$

and thus obtain transformation matrices of the following type

$$T = \begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix}$$

It is obvious that we cannot discuss every possible combination of the diverse matrix components, but we might take some special cases for discussion. In any case an interesting type of matrix is the zero-one matrix. Hence we will start our discussion by interpreting several interesting matrices of this type, which can be done best by means of a table. In this table the first five matrices are zero-one matrices, followed by some other matrices of interest.

Table 7.1. is succeeded by a second one which offers two examples of "subtypes", variations of the above mentioned "main types". These subtypes could be easily developed from variations of the diverse positions of the one-and-zero components; however, these will not necessarily be susceptible to reasonable interpretations. Finally, we will particularly point out that one-zero matrices will probably never appear in reality. Thus we might call them "pure types". Actually, we expect matrices whose components consist of figures not too far off from one or zero, if one of the following interpretations is to be applied.

Table 7.1. "MAIN TYPES"

Matrix	Explanation	Interpretation of DM	Type No.	Society
1 1 1 0 0 0 0 0 0	$y_2=0$ $y_3=0$ $y_1=f(x_1, x_2, x_3)$ Every possible input produces y_1 only	Ideal government every demand and sign of discontent is followed by responses only	1.1	Most disciplined soc. whatever govt. does, no discontent is expressed but every response is followed by a new demand (even authoritarian acts)
0 0 0 1 1 1 0 0 0	$y_1=0$ $y_3=0$ $y_2=f(x_1, x_2, x_3)$ Every possible input produces y_2 only	Despotism whatever happens the only "responses" are authoritarian acts	1.2	Revolutionary soc. whatever govt. does, soc. reacts with discontent
0 0 0 0 0 0 1 1 1	$y_1=0$ $y_2=0$ $y_3=f(x_1, x_2, x_3)$ Every possible input produces y_3 only	Escape into foreign policy govt. is unable or unwilling to solve internal troubles (breakdown of the system)	1.3.	Depolitized soc. no more feedback to DM (breakdown)
1 0 0 0 1 0 0 0 1	$y_1= f(x_1)$ $y_2= f(x_2)$ $y_3= f(x_3)$ Every x_1 produces y_1 only, ditto x_2--y_2 x_3--y_3	Perfect government every demand is responded, discontent is answered by authoritarian acts	1.4	Discontented soc. no response remains unanswered. Every authoritarian act is followed by expression of discontent
0 0 1 0 1 0 1 0 0	$y_1= f(x_3)$ $y_2= f(x_2)$ $y_3= f(x_1)$	Incapable govt. responses of demands are not fed back. Discontent is answered by authoritarian acts.	1.5	Content society all demands are coming from outside the system. Every response is leaving the syst. Only auth. acts are answered by discontent.
a 0 0 b 0 0 c 1 1	$y_1= f(x_1)$ $y_2= f(x_1)$ $y_3= f(x_1)$ $a+b+c=1$ Only x_1 is recogn.	Conservative govt. only demands which produce all 3 types of output are recognized.	1.6	Authorit. society only responses are recognized. Auth. acts are tolerated. No own demands.

0 a 0 0 b 0 1 c 1	$y_1 = f(x_2)$ $y_2 = f(x_2)$ $y_3 = f(x_2)$ $a+b+c=1$ only x_2 is recogn.	Inactive govt. reacts upon discontent only	1. 7.	Disinterested soc. reacts upon auth. acts only
0 0 a 0 0 b 1 1 c	$y_1 = f(x_3)$ $y_2 = f(x_3)$ $y_3 = f(x_3)$ $a+b+c=1$ only x_3 is recogn.	Govt. directed from outside (colonial govt.)	1. 8.	Most content soc. reacts upon new problems only

Table 7. 2. EXAMPLES OF SUBTYPES

0 1 0 1 0 1 0 0 0	$y_1 = f(x_2)$ $y_2 = f(x_1, x_3)$ $y_3 = 0$	Weak despotism reacts upon discontent with non-authoritarian acts	2. 1.	Feudal society
0 0 1 0 0 0 1 1 0	$y_1 = f(x_3)$ $y_2 = 0$ $y_3 = f(x_1, x_2)$	Dependent gov. govt. is directed from outside	2. 2.	Suppressed soc. society accepts every governmental decision and formulates new demands

(8) DYNAMIZATION OF THE MODEL

So far we were mainly concerned with the attempt to define structures by means of which we finally were able to compose a system with the following qualities:

1. The model is static with respect to the fact that only a single time-period was taken into account.
2. The model describes a process of transformation of messages about political actions, into messages concerning reactions upon those actions.
3. By means of our employed tools we were able to propose a systematic typology of our transformation-operators, i.e. ideologies.

But so far we are not yet in the position to forecast what the following time-periods will offer. Since this question is of utmost importance, because only dynamic processes seem to be powerful enough to describe the political reality in a fairly adequate fashion, we will start with a contradiction to our own statement. That is, we assume that ideologies do not change or that they change so slowly that it appears negligible at the moment. Later on we will expand this restriction and state criteria which allow one to analyze precisely why and when ideologies do change. The reason for the above assumption is that it appears to us to be of prior importance to predict the development of the flow of messages, as they will change more rapidly than ideologies ever will.

8.1. Conventions concerning time counting:

Despite the fact that employing concepts of time-lag would appear to be more realistic than our suggestion, we will not enter into this discussion because the expected payoff seems not promising enough compared to the formalistic burden one would have to shoulder rather quickly.

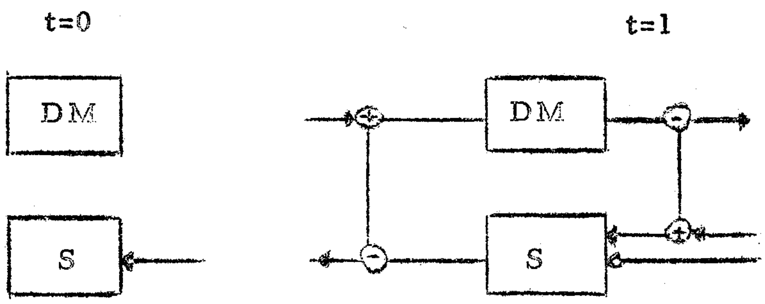
Using our former concepts of inputs, outputs and elements (transformation) we suggest the following procedure for time counting. We agree that both elements react within a given time period to every input, i.e. instantaneously. In other words, after precisely one loop, one time unit has passed by. What we still miss is a checkpoint. We shall arbitrarily establish it at the entrance of our society element.

Hence the following situation should be accepted (as exemplified by diagram 8.1.):

Time t=0 : S is stimulated, the imaginary clock starts to run.
S transforms
Interference component is added to X^{DM}
DM transforms

Time t=1 : The message of DM enters S again.
Exactly one time unit has passed by.

Ill. 8.1.



(Graphical demonstration of time-counting)

8.2. Definition of the input vectors at time t+1:

(a mathematical definition of X^{S}_{t+1}, X^{DM}_{t+1})

Resulting from our previous statements we will arrive at the following mathematical formulas. We stated before

$Y^{S} = T^{S}(X^{S})$ $\qquad$ $X^{DM} = C.(Y^{S})$

$Y^{DM} = T^{DM}(X^{DM})$ $\qquad$ $X^{S} = C.(Y^{DM})$

We will designate

$R^{S} = C.T^{S}$ $\qquad$ $R^{DM} = C.T^{DM}$

We start at t=0 and denote this by $X_{t=0}$. Since we decided to start time counting at the entrance of the S-element, our first operation is

$$V^{DM}_{t=0} = R^{S}(X^{S}_{t=0}) \qquad V = \begin{vmatrix} v_1 \\ v_2 \\ 0 \end{vmatrix}$$

Naturally, we receive zero as the third component of S. This is the vacant position we saved for a possible outside stimulation, say interference. Hence we add a vector I^{DM} of the given shape before we continue our operations.

$$I^{DM}_{t} = \begin{vmatrix} 0 \\ 0 \\ i^{DM}_{3} \end{vmatrix} \qquad V^{DM}_{t=0} + I^{DM}_{t=0} = X^{DM}_{t=0}$$

$$V^{S}_{t=1} = R^{DM}(X^{DM}_{t=0}) \qquad V^{S}_{t=1} + I^{S}_{t=1} = X^{S}_{t=1}$$

Before we summarize the various steps we pay attention to the time notation of our last multiplication. The comprehensive form is therefore

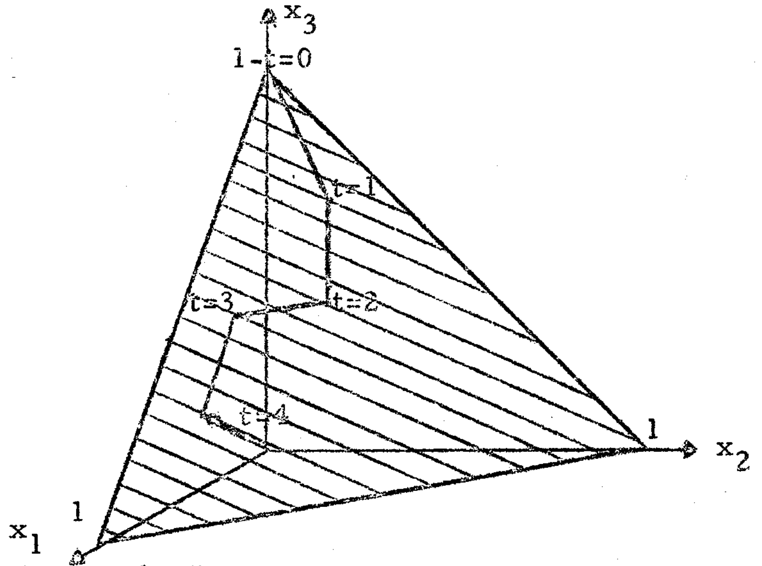
8.1.1. $$X^{S}_{t+1} = R^{DM}(I^{DM}_{t} + R^{S}X^{S}_{t}) + I^{S}_{t+1}$$

8.1.2. $$X^{DM}_{t+1} = R^{S}(I^{S}_{t+1} + R^{DM}X^{DM}_{t}) + I^{DM}_{t+1}$$

By these equations we are in the position to forecast the state of affairs for any time period, provided we know the amount of interference of any state. If, on the other hand, we had no knowledge of it but were only interested in the development after a certain initial stimulation we could forecast how the initial stimulus influences the state of affairs over time.

We might illustrate the development graphically (see Ill. 8.2.) and interpret the different stages of the vector as a "route of development" (which consists of discrete points only, because of our assumed restrictions.)

Ill. 8.2.



Ill. 8.2. demonstrates the "route of development" for one element in the three-dimensional case. It is entirely in the hatched triangle, which itself contains any possible vector (due to our assumption 9.3.1.) Mathematically spoken, one calls this set of vector points a "simplex". It should be mentioned that our results are not necessarily restricted to 3-dimensions. Hence the state of our political 2-element system is perfectly defined at any time by two vectors, X_t^{DM} and X_t^S (which are elements of two distinct simplexes).

(9) BEHAVIOR OF THE SYSTEM

The formulations of the last paragraph made it possible to predict where the system will be located within the "information space" (the triangle of Ill. 8.2.) at any time t provided that we are informed about the amount of interferences. Since we treat information about political actions, we are perfectly informed about what happens "within" our system at any time. This seems to be a fairly advanced state of development of our model, but it still fails to satisfy our curiosity entirely. What we still wish to know is: What happens to the system ? In order to find satisfying results for this problem we will have to clarify some new notions and concepts, which shall be done in this chapter.

9.1. Change and maintenance of systems

Observing certain political systems over a distinct period of time two different experiences can be won. One possible observation could be that the political process remains unchanged, i.e. that neither a significant alteration of government behavior takes place nor one on the society's part. In other words, the system maintains its present state.

On the other hand, we could expect the contrary as equally probable. Situations in which e.g. opposition parties win elections, coups d' etat take place, social unrest or riots appear, should thus be taken as indicators for change of the system.

Summarizing these possibilities we could say:

By observation of political systems we are convinced that the state of the political process remains unchanged for certain time periods. This state should be expected to be succeeded by periods of major alterations of the kind of political behavior and so forth. In terms of our model we will formulate the notion of change and maintenance in this way therefore: We say a political system maintains itself - or the elements of the system are compatible - if the ideology matrices of both the elements remain unchanged, i.e. the transformation process of the entire system will continue unaltered. The opposite version, i.e. change of the system, comes to bear as soon as at least one ideology matrix is going to be changed. In this case we agree to say that the elements are not compatible any more.

After the clarification of our concepts of change and maintenance we should not hesitate to ask for reasons which possibly could explain these phenomena.

9.2. "Evaluation" of the partner element

Most certainly one would intuitively accept the idea that the phenomena of change or maintenance of a system shall not be determined by the amount of political relevant information to which the system was exposed in the course of time (for some formal consequences of this notion see under 9.3.) On the other hand, it would not appear to be plausible to see change of political behavior entirely independent of the flow of information. So we have to ask in what respects information will be relevant for our problem. We imagine that exchange of information, the content of it and the way how it takes place form the basis of an "evaluation" of the partner element. The result of this evaluation will be expressed in "approval" or "disapproval" of the behavior of the partner.

The final result will either be the lending of more or less support or an effort to change the partner's behavior or maybe to exchange the partner. Following this line of thought we claim that information transformation processes should be considered to be at least one major factor which influences the life chances of political systems. The attempt to describe this influence will constitute the main subject of the rest of the paper, despite the fact that we are well aware that other phenomena's influence is no less negligible.

Concentrating our emphasis on this single subject we will proceed by illuminating the ways in which approval or disapproval come about and what consequences they entail. By proceeding carefully we will try to examine the situations for the two elements separately because we should expect different sets of possibilities for the two.

Focusing our attention on the S-element first we see two different kinds of effects of the "evaluation".

1. Extension or reduction of "support" of DM by S (Support will be restricted to "legitimacy" for reasons mentioned a little later).
2. Decrease or increase of "rejection" of the behavior of DM. "Rejection" shall be conceptualized as most closely related to "efforts" to change the behavior of DM (or not).
   (Later, when we will have formalized the concepts, we will introduce positive and negative values in order to include extension or reduction of support and rejection).

For the part of the DM we will not use the concept of support, because we assume that at this end of the system support can only be expressed by the fact that DM is "doing its job", i.e. by producing acceptable responses which follow demands. We will consider one kind of effect only, namely

1. Decrease or increase of "rejection" of the behavior of S.

The concept of "rejection" shall again be related to efforts to change the behavior of the partner element. We herewith finish the discussion of consequences of the concept of "evaluation" for this chapter (for further treatment see paragraph 10., 11.) but have to mention a necessary restriction.

By talking of "support" and "efforts" one thinks immediately of availability and application of material resources as natural limitation of both. But, as the topic of material resources promises to be a highly complex and difficult matter, we prefer to treat this separately in another, independent research paper and assume for this time - quite unrealistically - that material resources are not restricted and that the proportion in which they are used is merely dependent on the strenght of the desire to induce the other element to change its ideology. The exclusion of material resources from our model offers interesting consequences for the concept of "support". Since we are not in the position to support DM by material resources we are restricted to "moral" support. Therefore we propose as a sensible alternative to talk about "legitimacy" rather than support during the rest of the paper.

Finally we find ourselves in the position to present the notion of change as a concept which is determined by our flow of information, - according to the formerly mentioned conversion process of information into evaluation (i.e. rejection and legitimacy) - where material resources will be applied in order to force the other element to change its ideology. Most likely, therefore, resources of the one element stand against those of the other and it can be assumed that the stronger one will get its will at least in the long run. Additionally we assume that the "long run" finds its natural end as soon as a certain treshold of differences in "strenght" has been passed. This is the point (in time) where the weaker element gives in and changes its ideology. Expressed in terms of our previous formulations, the point of incompatibility is reached and we should be ready to accept the existence of a "new" political system.

9.3. Some consequences concerning the information vectors and ideology matrices

A result of our previous considerations was that we agreed on the fact that information is of dominant importance for evaluation but of secondary importance for the further fate of the system itself. We concluded therefore that we might simplify our original proposals concerning the properties of input vectors and ideology matrices.

At first we will interpret the idea that information and its transformation is mainly relevant for evaluation, such that we suppose not the absolute quantities of our information categories to be of importance but the relative proportions of them. The mathematical formulations of this and the next two propositions will be presented under 9.3.1.-9.3.3.

Secondly, we deduce from the fact that not information as such but evaluation is of greater importance for maintenance and change of the system that an increase in the amount of information is irrelevant. In regard to what we mean by information it is clear that negative values of information do not make sense, furthermore we assume that an output of information presupposes an input stimulus, or in other words the system is not creative by itself.

For all these reasons we believe it to be a sensible undertaking to specify the qualities of input vectors and transformation matrices as follows in the subparagraphs below.

9.3.1. Normalization of the input vectors:

Since we are interested in comparing the behavior of our elements under different input conditions we will only look at proportions and not at the absolute figures. We normalize the input vectors so that the sum of the components equals 1, before multiplying the vectors with the ideology matrix, i.e. we calculate at a per cent rate[1].

Example:

$y_1 = 0,2$	$x_1 = 0,2/0,6$
$y_2 = 0,4$	$x_2 = 0,4/0,6$
$y_3 = 0,4$	$x_3 = 0$
$y_1+y_2 = 0,6$	$x_1+x_2+x_3 = 1$

9.3.2. Normalization of ideology matrices:

For the above reasons and because we postulated that no element will produce more outputs than there were inputs, we normalize the column vectors of the matrices in the same fashion as above.

Example:

$$T = \begin{pmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{pmatrix} \qquad \begin{aligned} a_{11}+a_{21}+a_{31} &= 1 \\ a_{12}+a_{22}+a_{32} &= 1 \\ a_{13}+a_{23}+a_{33} &= 1 \end{aligned}$$

Additionally we claim for $0 \leq aij \leq 1$.

9.3.3. Characteristic value of the ideology matrices:

In order to guarantee that information escalation will be avoided during an entire loop, we have to axamine the qualities of the characteristic value of the product matrices $R^{DM}R^S$ and R^SR^{DM}

Where

$R^{DM} = T^{DM}C$ and $R^S = C\ T^S$

as mentioned earlier.

If we are able to prove that the absolute values of the characteristic values $|\lambda| \leq 1$, we can be sure that our previous claim will be satisfied. We shall prove this for the first case ($R^{DM}R^S$) only, as the same operations would have to be performed for the second.

---

1) The case of the zero vector we shall exclude as trivial as it corresponds to the system being inactive.

Proof:

If

$$T^S = \begin{pmatrix} s_{11} & s_{12} & s_{13} \\ s_{21} & s_{22} & s_{23} \\ s_{31} & s_{32} & s_{33} \end{pmatrix} \qquad T^{DM} = \begin{pmatrix} d_{11} & d_{12} & d_{13} \\ d_{21} & d_{22} & d_{23} \\ d_{31} & d_{32} & d_{33} \end{pmatrix}$$

$$R^{DM} \cdot R^S = \begin{pmatrix} d_{11}s_{11}+d_{12}s_{21}, & d_{11}s_{12}+d_{12}s_{22}, & d_{11}s_{13}+d_{12}s_{23} \\ d_{21}s_{11}+d_{22}s_{21}, & d_{21}s_{12}+d_{22}s_{22}, & d_{21}s_{13}+d_{22}s_{23} \\ 0 & 0 & 0 \end{pmatrix}$$

Schur 's Theorem tells us that for every matrix **where**

$a_{ij} \geq 0$ and $\sum_i a_{ij} \leq 1$(for all j) $\Rightarrow |\lambda| \leq 1$. (for all λ)

Thus we have to prove that the sum of the components of each column vector is less than or equal to 1.

Proof:

$$\sum_i a_{ij} = s_{1j}(d_{11}+d_{21}) + s_{2j}(d_{12}+d_{22})$$

$$1 = d_{11}+d_{21}+d_{31}$$

$$d_{11}+d_{21} \leq 1; \quad d_{12}+d_{22} \leq 1$$

$$d_{21} \leq 1-d_{11}; \quad d_{22} \leq 1-d_{12}$$

$$s_{1j}(d_{11}+d_{21}) + s_{2j}(d_{12}+d_{22}) \leq s_{1j} + s_{2j} \leq 1$$

Hence

$$\sum_i a_{ij} \leq 1$$

Hence

$$|\lambda| \leq 1$$

Our result means that the length of our vector remains bounded. What we requested earlier, namely that no output should become greater than the input vector, is consequently true.

(10) "POTENTIAL" OF THE ELEMENTS

compressing the ideas of the last paragraph we should draw the following conclusions:
The potential p_t of an element at time t should be defined as the invested effort of this element to change the other's ideology. The magnitude of the effort is dependent on the element's evaluation of the partner. The evaluation finally is determined by the amount of information the element receives, the way how it reacts or transforms it, and past experience, i.e. the evaluations of the past (or simply by time).
Expressing this idea in a little more formal way, we may write:

10.1. $p_t = g\ (\text{evaluation}) = f(X, Y, t)$

At this point, we should remind ourselves once more, that we previously accepted the unrealistic notion of unlimited resources. We are therefore in the position to agree if we write

10.2. $p_t = f\ (X, Y, p_{t-1})$

Thus the function f represents the conversion of informations (X, Y) into "evaluation" and in a second step into an effort to change the partner's ideology; which means that consequences remain unaltered by watching "evaluation" or "efforts" alternatively.

The next consequent step in our program is to look for possibilities which enable us to specify the very broad and undetermined relation 10.2.

We will do this by developing our concepts of rejection and legitimacy and by asking what kind of reactions to our three different information categories will increase or diminish them. This shall be done in the next subparagraphs, after having presented the formal expression for the potential.
If we assume linear relations again, we are ready to specify the relation 10.2. for the potential of each element.

10.1. Potential of the elements

Summarizing the former propositions we finally arrive at the following expressions:

10.1.1. Potential of DM

10.3. $p_t^{DM} = r_t^{DM} + p_{t-1}^{DM}$

10.1.2. Potential of S

10.4. $p_t^S = r_t^S - l_t + p_{t-1}^S$

Notation:

p_t^{DM} .... Pot. of DM at time t

p_t^S .... Pot. of S at time t

r_t^{DM} .... Rej. of S by DM

r_t^S .... Rej. of DM by S

l_t .... Leg. at time t

p_{t-1}^{DM} .... Pot. of DM at time t-1

p_{t-1}^S .... Pot. of S at time t-1

Accepting the above formulations we should consequently turn our attention towards the terms r_t (rejection) and l_t (legitimacy) and ask how they might be shaped by the standards of information process. We will do this within the next three subparagraphs 10.2.-10.4

10.2. Legitimacy (l_t):

We imagine that DM is capable to influence the potential of S by acting in a way which is accepted by S. On the other hand it may also reduce legitimacy by other acts. We suggest therefore the following functions for the gain of legitimacy at time t.

10.5. $l_t = a_1 s_{31} x_{1,t}^S - a_2 s_{11} x_{1,t}^S - a_3 s_{21} x_{1,t}^S - a_4 s_{12} x_{2,t}^S - a_5 s_{22} x_{2,t}^S + a_6 s_{32} x_{2,t}^S$.

Notation: s_{ij} ... Element of T^S (see paragraph 9.3.3.)

The idea is that l_t increases in proportion to the responses and authoritarian acts which leave the system via s_{31} and s_{32}. DM looses legitimacy in proportion to the responses and authoritarian acts which are fed back via new demands or discontent.

One might interpret the proportional factors a_i in a way similar to material constants in technology which implies that they would have to be found for each particular society. For this dependence on a specific subject and for the sake of simplicity we choose their value to be 1 for our further argumentations. Remembering that the sum of our column vector equals 1, we transform the equation and get

10.6. $l_t = x^S_{1,t} (2s_{31}-1) + x^S_{2,t} (2s_{32}-1)$

as the final function for legitimacy.

10.3. Rejection of S by DM:

We requested before, that DM should be capable to increase its potential by its own efforts. If we assume that the potential of DM increases proportionally to the amount of authoritarianism and is going to be lowered by reactions to "discontent" other than authoritarian acts, we propose the following function:

10.7. $r_t^{DM} = \beta_1 d_{21} x^{DM}_{1,t} + \beta_2 d_{22} x^{DM}_{2,t} + \beta_3 d_{23} x^{DM}_{3,t} - \beta_4 d_{12} x^{DM}_{2,t} - \beta_5 d_{32} x^{DM}_{2,t}$

Notation: d_{ij} ... Element of T^{DM} (see paragraph 9.3.3.)

We proceed with similar transformations as above and receive

10.8. $r_t^{DM} = d_{21} x^{DM}_{1,t} + (2d_{22}-1) x^{DM}_{2,t} + d_{32} x^{DM}_{3,t}$

as our final expression.

10.4. Rejection of DM by S:

Similar considerations as above lead us to formulate the analogous relation as below:

10.9. $r_t^S = \gamma_1 s_{11} x^S_{1,t} - \gamma_2 s_{12} x^S_{2,t} + \gamma_3 s_{21} x^S_{1,t} + \gamma_4 s_{22} x^S_{2,t} - \gamma_5 s_{32} x^S_{2,t}$

Proceeding with our familiar transformations we propose finally

10.10. $r_t^S = (1-s_{31}) x^S_{1,t} + (2s_{22}-1) x^S_{2,t}$

This relation demonstrates that r^S, while it is reduced by reactions upon authoritarian acts other than acts of discontent, is enriched by any feedback reaction upon responses and by any acts of discontent, the roots of which are authoritarian acts.

Concluding this chapter we will connect the different parts and write for the potentials

$$10.11. \quad p_t^{DM} = x_{1,t}^{DM}\, d_{21} + x_{2,t}^{DM}\,(2d_{22}-1) + x_{3,t}^{DM}\, d_{23}$$

$$10.12. \quad p_t^{S} = x_{1,t}^{S}\,(2-3s_{31}) + 2x_{2,t}^{S}\,(s_{22} - s_{32})$$

as the final relations.

(11) COMPATIBILITY OF ELEMENTS

Having defined the dimension and relations which allow us to determine the state of potentials at any time, we proceed by investigating the possibilities of the maintenance or change of the system.

In chapter 9 we proposed that an element must change its ideology matrix as soon as the difference of the two element's potential exceeds a fixed treshold τ . Mathematically expressed

$$11.1. \quad p_t^{S} - p_t^{DM} > \tau^{S} > 0$$

$$11.2. \quad p_t^{S} - p_t^{DM} < \tau^{DM} < 0$$

The first expression characterizes the case that S prevails and DM is exposed to change whereas the second one manifests the opposite fact.

If we substitute our previous equations we arrive at

$$11.3. \quad 0 < \tau^{S} > r_t^{S} - l_t - r_t^{DM} + p_t^{S} - p_t^{DM} > \tau^{DM} < 0$$

which is the criterion for the maintenance of the system. The elements are compatible. Examining our last term we easily find that the only possible gain of potential at time t entirely depends on the expression

$$11.4. \quad r_t^{S} - l_t - r_t^{DM} = G_t$$

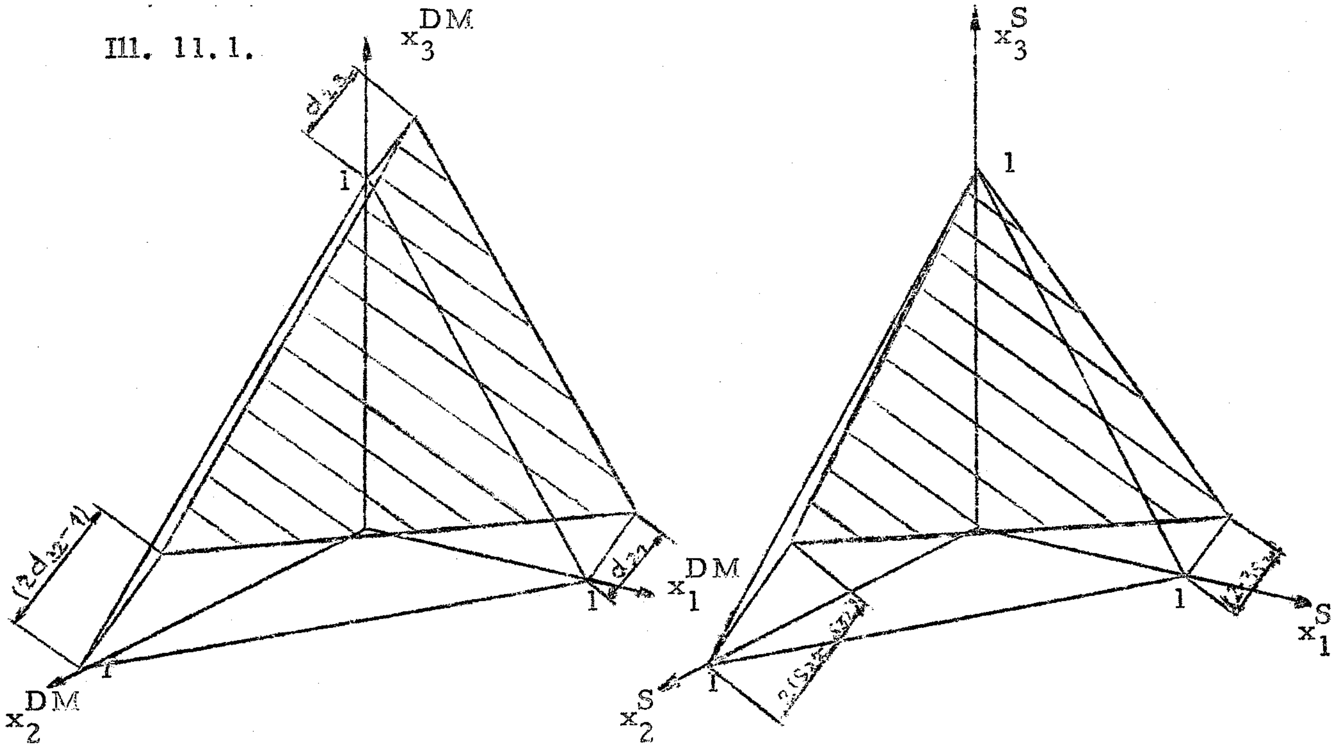
Thus it seems worthwhile to examine this formula a little more closely.

For this reason we transform it to read

$$11.5. \quad r_t^S - 1_t - r_t^{DM} = x_{1,t}^S(2-3s_{31}) + 2x_{2,t}^S(s_{22}-s_{32}) - x_{1,t}^{DM}d_{21} - x_{2,t}^{DM}(2d_{22}-1) - x_{3,t}^{DM}d_{23}$$

Apparently we deal with a function on ($x_1^{DM}, x_2^{DM}, x_3^{DM}$) and - if we add a term $(0 . x_3^S)$ - on (x_1^S, x_2^S, x_3^S). Recalling our graphical representation (8.1.) we are able to give a graphical presentation of the above expression as functions over the two simplexes of X^{DM}, X^S.

Ill. 11.1.



Since we are able to determine where the elements are located on their simplex at any time, as long as we know the amount of interference, we can readily see without difficulties by comparison which of the elements is favored - when and how much.

(12) DISCUSSION OF SOME INTERESTING CASES

12.1. Dominant systems

We agree to call an element "dominant" if for any condition of X its gain in potential is greater than that of the other element. This implies that a weaker element exists, which necessarily is bound to change its ideology or, in other words, that the elements are incompatible.

The mathematical condition for the situation of dominance is

12.1.1. $\text{Min}\{(\dot{d}_{2,1}), (2\dot{d}_{22}-1), (\dot{d}_{23})\} \geq \text{Max}\{(2-3\dot{s}_{31}), (2\dot{s}_{22}-2\dot{s}_{32})\}$

12.1.2. $\text{Max}\{(\dot{d}_{21}), (2\dot{d}_{22}-1), (\dot{d}_{23})\} \leq \text{Min.}\{(2-3\dot{s}_{31}), (2\dot{s}_{22}-2\dot{s}_{32})\}$

Thus the upper formula 11.1.1. represents the dominance of the DM element. The lower one 11.1.2. indicates dominance of S.
But we must make a serious limitation for the latter case viz. $x_3^S \equiv 0$.
In other words, we presume that a rising amount of interference on the S-side diminishes the increase of the potential and increases the probability of change of the S-ideology. This matter appears to be a very interesting by-product of our concepts of legitimacy and rejection because it means that major changes of the environment involve a change of the society's ideology.

12.1.1. Example: for dominance of S

Main types — Despotism — Revolutionary Society

$$T^{DM} = \begin{pmatrix} 0 & 0 & 0 \\ 1 & 1 & 1 \\ 0 & 0 & 0 \end{pmatrix} \qquad T^{S} = \begin{pmatrix} 0 & 0 & 0 \\ 1 & 1 & 1 \\ 0 & 0 & 0 \end{pmatrix}$$

$1 = \dot{d}_{21} < (2-3\dot{s}_{31}) = 2$

$1 = (2\dot{d}_{22}-1) < (2\dot{s}_{22}-2\dot{s}_{32}) = 2$

$1 = \dot{d}_{23} < 2$

We see that at least in our model a despotic ideology can be changed by society, assuming that S ignores interferences, i.e. $x_3^S \equiv 0$, (environment has a favorable influence). It should not remain unmentioned that even the main types of 'discontented' and 'content' societies are powerful enough to overcome "despotism" in its pure form.

12.?. <u>Stable systems:</u> (in system analytic terms: "indifferent systems")

We find it particularily interesting if the difference of the potential of the elements remains equal over time, independent of possible inputs (again the condition $s_3^S \equiv 0$ is met.) Formally we write then

$r_t^S - l_t - r_t^{DM} = 0$ or

$d_{21} = d_{23} = (d_{22} - 1) = (2 - 3s_{31}) = 2(s_{22} - s_{32})$

The obvious meaning is that a system fulfilling this assumption is compatible under any circumstances under the usual proviso $x_3^S \equiv 0$.

12.2.1. Example:

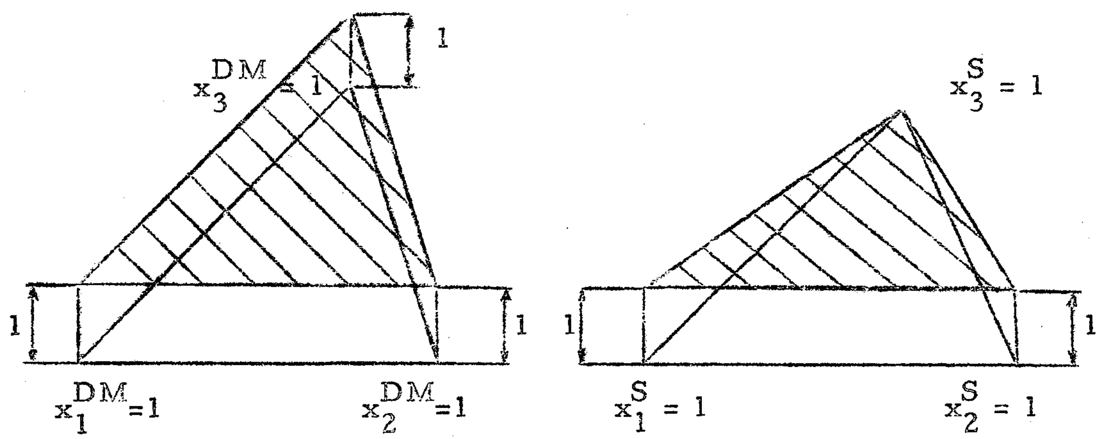
Despotism

$$T^{DM} = \begin{pmatrix} 0 & 0 & 0 \\ 1 & 1 & 1 \\ 0 & 0 & 0 \end{pmatrix}$$

examples for S-elements compatible with despotism

$$T^{S}1 = \begin{pmatrix} . & 0,1 & . \\ . & 0,7 & . \\ 1/3 & 0,2 & . \end{pmatrix} \qquad T^{S}2 = \begin{pmatrix} . & 0,5 & . \\ . & 0,5 & . \\ 1/3 & 0 & . \end{pmatrix}$$

Graphical illustration:
Ill. 12.1.



Of course we remain at $x_2^S = 1$ all the time in our example and receive $G_t = 0$ therefore, but x_1^{DM} and x_2^{DM} will change according to the distinct ideologies of S.

12.3. Unstable compatibility:

The previous systems were more or less special instances of the normal case. In the general situation the plane representing the G-function would no longer be parallel to the x_1, x_2, x_3 - simplex but rather be inclined towards it. In this case the condition for compatibility will be:

12.2. $$x^S_{1,t}(2-3s_{31}) + 2x^S_{2,t}(s_{22}-s_{32}) = \text{const} =$$

$$= x^{DM}_{1,t}\, d_{21} + x^{DM}_{2,t}(2d_{22}-1) + x^{DM}_{3,t}\, d_{23}$$

It is obvious that this condition will not be fulfilled in general. Hence it might be sensible to suggest for future work that under these premises the DM-element be regarded as changing its own ideology gradually at every time point t, in order to keep and manipulate an equilibrium. But nevertheless not even then is it granted that a system remains compatible, because the entire situation depends strongly on the interference components of the S-element, which has to be controlled by the DM-element.

12.4. Selfcontrolling systems:

So far we have not put great emphasis on the fact, that there are systems consisting of elements with the remarkable quality that one or both of them diminish their own potential. In other words their gain of potential is negative, i.e. "they are digging the grave of their own ideology". This certainly most interesting possibility shall be discussed below, but before doing so we should not forget to remark on combinations where positive as well as negative gain is possible. These structures offer the rare chance of a path whose potential remains unchanged at zero. The mathematical condition for that situation is easily deducable from 11.2. and 11.3.

A system which should satisfy the former assumption (negative gain in any case) is bound by the following constraints:

12.3. $d_{21} = 0 \qquad d_{22} < 0,5 \qquad d_{23} = 0$

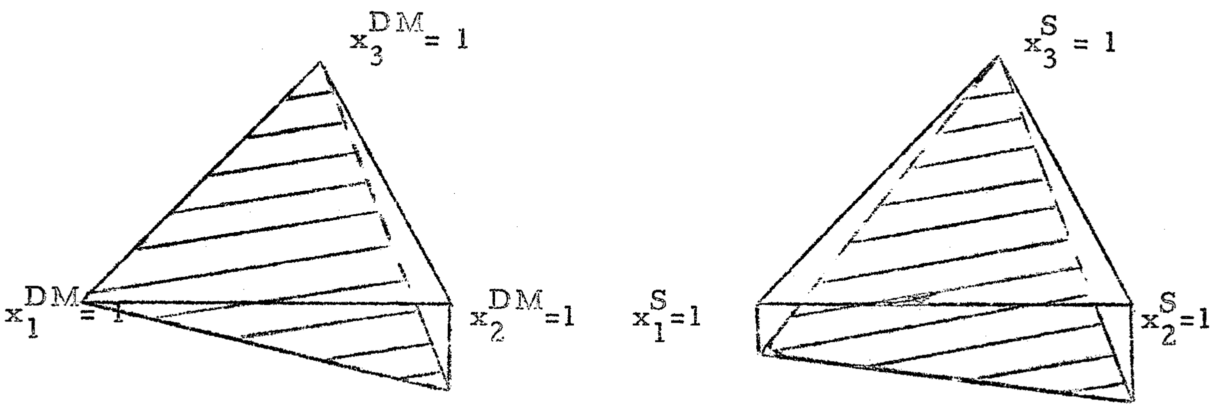
$s_{31} > 2/3 \qquad s_{22} < s_{32}$

Systems which obey these restrictions might properly be labelled "Systems based on consent". They have the lowest percentage of authoritarian acts and discontent of all systems considered. S accepts the main proportion of responses, at least 2/3 and even a certain number of authoritarian acts. On the other hand DM avoids suppressive actions almost entirely. But, and that appears to be an other very interesting point, DM and S tend permanently towards self destruction of their ideologies. This type of system keeps working only if the respective elements minimize their own potentials and if interference or disturbance from outside is kept low.

Intuitively it seems worthwhile for the partner element to adopt this pattern of behavior since any other could only worsen its position. An analysis of this process would have to add concepts like costs and material resources to the model - which will be done in a future paper.

Concluding this subparagraph we should like to emphasize the fact that it is precisely this very interesting type which has no chance of being stable (see chap. 11.2.), because of $d_{21} = 0$.

Ill. 12.2.



(Simplex and G-function (hatched) of a "selfcontrolling system")

(13) APPLICATIONS AND CONCLUSIONS

In order to demonstrate the concepts of the last paragraphs more vividly, we will try to observe the behavior of our systems by means of computing a few simple, invented examples. We will learn that even these invented demonstrations give rise to some interesting interpretations.

13.1. An argument for curtains of iron or other materials:

We imagine a system, the elements of which shall be characterized by the ideologies T^S, T^{DM}.

$$T^S = \begin{pmatrix} 0,3 & 0,3 & 0,6 \\ 0,1 & 0,4 & 0,4 \\ 0,6 & 0,3 & 0 \end{pmatrix} \qquad T^{DM} = \begin{pmatrix} 0,2 & 0,1 & 0,8 \\ 0,2 & 0,6 & 0,2 \\ 0,6 & 0,3 & 0 \end{pmatrix}$$

We assume that both the elements are exposed to a very high level of interference, i.e. information coming from outside. (For computation we took a 100 times higher proportion of outside information, compared to inside information; i.e. we added at every loop an interference component $x_3 = 100$ to the output vectors, before normalization.) For description of the behavior we have to examine formula 11.3., which transforms for this special situation to

$$p_t^S - p_t^{DM} = 0,2\ (x_{1,t}^S + x_{2,t}^S - x_{1,t}^{DM} - x_{2,t}^{DM} - x_{3,t}^{DM}) + p_{t-1}^S - p_{t-1}^{DM}$$

Doing the computation for every loop (t=1, 2, ...), we finally get the results for the series of differences of potentials as demonstrated by diagram 13.1, version 1. Watching this graph one easily finds that under any circumstances and for any proposed treshold τ S will change its ideology, i.e. the system will change.

If we assume now that DM dislikes the change of the situation for some reasons (probably because it would not appreciate the view of being possibly forced to change its own ideology in a second turn) we should offer to DM the advice to cut down the level of outside information, i.e. interference $x_3^S = 0$, radically to zero. We computed this case too, the result of which is demonstrated in diagram 13.1., version 2. As one sees the difference of the potentials remains constant, the system will maintain its state for ever.

Moral: Under the assumption that change of the system is anticipated as somewhat horrifying and that DM wants urgently to keep its ideology unaltered and pure for ever, we should say it pays to cut off society and erect an information curtain, maybe of iron or bamboo.

13.2. "Well-informed" societies need nonauthoritarian governments:

Again we imagine a political system which is characterized by the ideology of S and the fact that S is exposed to a very high information level ($x_3^S = 100$ again). What we want to know is what qualities the other ideology should have so that the system maintains itself.

Given:

$$T^S = \begin{pmatrix} 0,3 & 0,1 & 0,5 \\ 0,2 & 0,6 & 0,5 \\ 0,5 & 0,3 & 0 \end{pmatrix}$$

Alternatives for T^{DM}

Version 1

$$\begin{pmatrix} 0,4 & 0,2 & 0,3 \\ 0,5 & 0,8 & 0,4 \\ 0,1 & 0 & 0,3 \end{pmatrix} = T^{DM}$$

Version 2

$$\begin{pmatrix} 0,8 & 0,5 & 0,5 \\ 0,1 & 0,5 & 0,1 \\ 0,1 & 0 & 0,4 \end{pmatrix} = T^{DM}$$

If we calculate the development of the difference of potentials for both versions we get the results demonstrated by diagram 13.2. We easily find that in version 2 there is hardly a tendency to overstep a given treshold soon (in contrast to version 1). It appears to be interesting now to elaborate the differences between the two ideologies. Examining the ideologies one easily finds that in version 2 DM reacts with much less authoritarianism than in version 1.

Moral: If DM wants to maintain a system where S receives a high amount of information from outside and DM is not capable or willing to suppress this flow of information, DM should take care to choose an ideology where reactions on the authoritarian basis hardly occur. In other words, well-informed societies need non-authoritarian governments if the system should remain unchanged.

13.3. How to change "backwoodish" societies:

The preceding examples were mainly concerned with the problem of how to maintain a system. Now we inverse the question and ask what DM should do if it wants to ensure that S changes and that its own ideology remains unaltered.

We represent the system by

$$T^S = \begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 0 & 0 \end{pmatrix} \qquad T^{DM} = \begin{pmatrix} 0,3 & 0,1 & 1 \\ 0,5 & 0,9 & 0 \\ 0,2 & 0 & 0 \end{pmatrix}$$

(T^S is type 2.1. of table 7.2. and called "Feudal Society")

Calculating again two versions which only differ by the fact that version 1 assumes $x_3^S = 0$, version 2 $x_3^S = 100$, we receive results as presented in diagram 13.3. For both versions we assumed $x_3^{DM} = 1$. It is obvious that version 1 ensures that DM must change, version 2 guarantees the same for S.

If we agree to call such societies "backwoodish" as information-channels to the outside are entirely lacking, we can state the following

Moral: In order to guarantee that a "backwoodish" society will change its ideology, we should expose it to high information-stimuli and confront it at the same time with a fairly authoritarian government. (otherwise it could appear that DM changes)

13.4. Two "selfcontrolling" systems: (unintended change of the partner's ideology)

This example should present two versions of 'selfcontrolling' systems where each of two possible results will appear, namely change of S (version 1) and change of DM (version 2).

Assumptions:

Version 1

$$T^S = \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 1 & 1 & 0 \end{pmatrix} \qquad T^{DM} = \begin{pmatrix} 1 & 1 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}$$

$$x_3^S = 1 \qquad x_3^{DM} = 1$$

(T^S represents type 2.2. in table 7.2. "suppressed society".)
(T^{DM} represents type 1.1. in table 7.1. "ideal government".)

Version 2:

$$T^S = \begin{pmatrix} 0 & 0,3 & 1 \\ 0,1 & 0,3 & 0 \\ 0,9 & 0,4 & 0 \end{pmatrix} \qquad T^{DM} = \begin{pmatrix} 1 & 1 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}$$

$$x_3^S = 100 \qquad x_3^{DM} = 100$$

$$p_t^S - p_t^{DM} = -0,7x_{1,t}^S - 0,2x_{2,t}^S + x_{2,t}^{DM} + p_{t-1}^S - p_{t-1}^{DM}$$

The results are presented by diagram 13.4.

13.5. Examples of systems with positive and negative values of their elements' potential:

Here we offer two systems for discussion where each of the elements may gain positive or negative values of their potentials.

Version 1:

$$T^S = \begin{pmatrix} 0 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \end{pmatrix} \qquad T^{DM} = \begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 0 & 0 \end{pmatrix}$$

$$x_3^S = 1 \qquad x_3^{DM} = 1$$

(T^S is type 1.5. of table 7.1. "Content Society")
(T^{DM} is type 2.1. of table 7.2. "weak despotism")

$$p_t^S - p_t^{DM} = -x_{1,t}^S + 2x_{2,t}^S - x_{1,t}^{DM} + x_{2,t}^{DM} - x_{3,t}^{DM} + p_{t-1}^S - p_{t-1}^{DM}$$

Version 2:

$$T^S = \begin{pmatrix} 0 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \end{pmatrix} \qquad T^{DM} = \begin{pmatrix} 0,5 & 0,7 & 0 \\ 0,5 & 0,3 & 1 \\ 0 & 0 & 0 \end{pmatrix}$$

$$x_3^S = 1 \qquad x_3^{DM} = 1$$

$$p_t^S - p_t^{DM} = -x_{1,t}^S + 2x_{2,t}^S - 0,5x_{1,t}^{DM} + 0,4x_{2,t}^{DM} - x_{3,t}^{DM} + p_{t-1}^S - p_{t-1}^{DM}$$

The results are presented by diagram 13.5. and examplify for version 1 a situation where S is weaker than DM for the first 7 time-periods, but slowly grows stronger afterwards. Finally, S appears to be the stronger one of the two in the long run. Version 2 demonstrates a rather constant situation, where DM appears to have a minor advantage.

For everyone of the calculated cases we assumed the interference component to be constant for each element and every loop. This should of course not be taken to be a necessary condition. Normally, the magnitude will vary over time probably in a random and a systematic fashion.

Diagram 13.1.

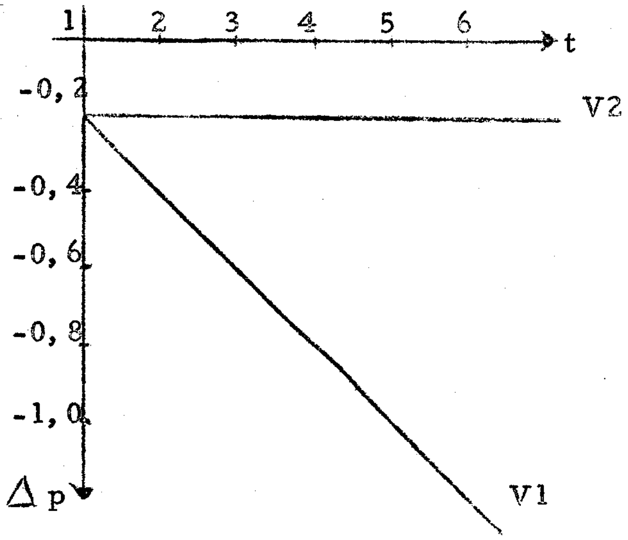


Diagram 13.2.

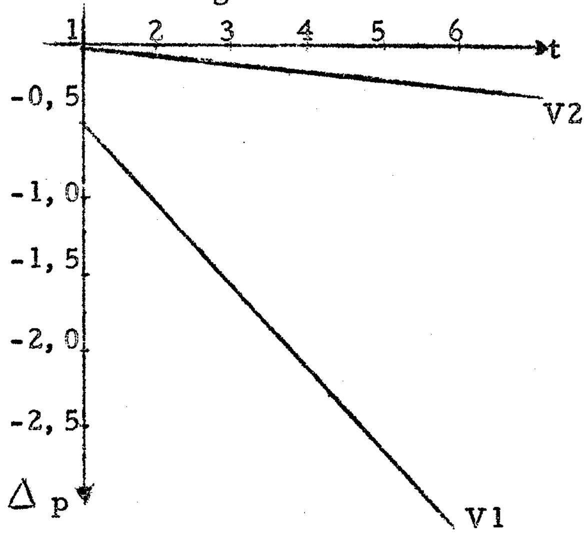


Diagram 13.3.

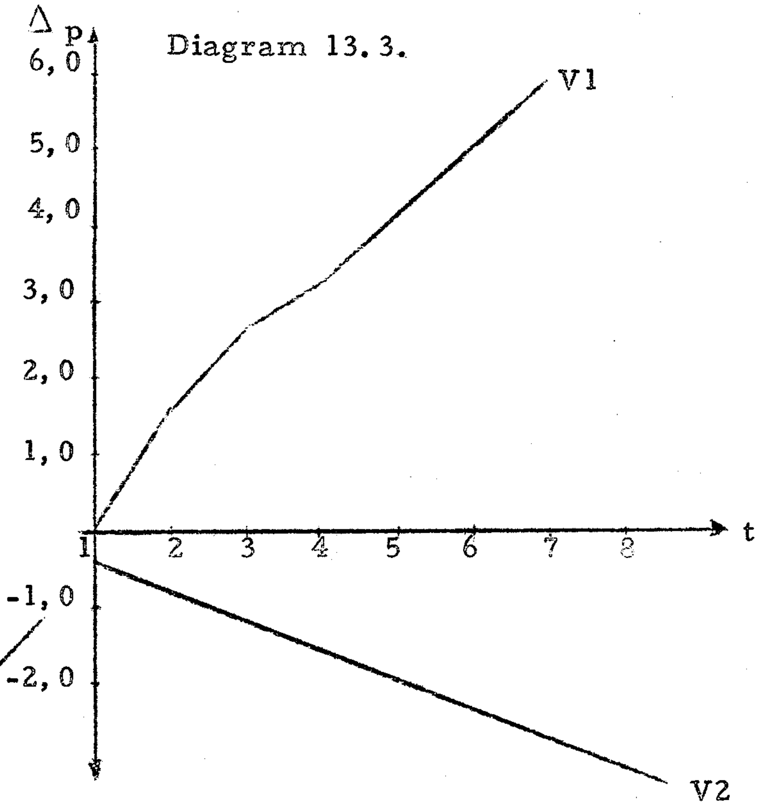


Diagram 13.4.

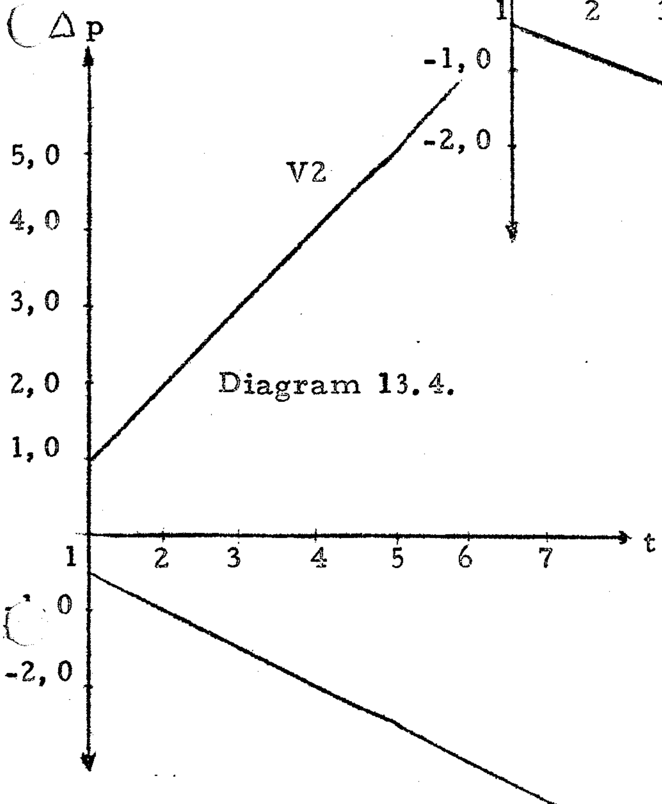
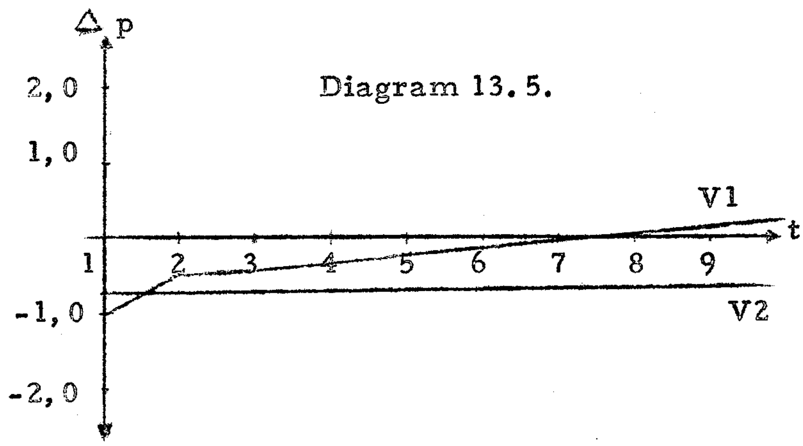


Diagram 13.5.



V... Version

(14) CONCLUDING REMARKS

In this paper an attempt has been made to do two things:

1) To show that system analysis concepts and techniques can profitably be applied to problems in political science where they can yield information and insight hardly attainable by purely verbal arguments.
2) To give precise definitions of the notions of ideology, change and stability, which although widely used, are at the moment hardly a sound basis for explications.

I am aware of the fact that the entire approach is reduced to the most radical simplifications, concerning linearity of the relations, the dichotomization of the system and the reduction to three vectors components only. Concerning the dimensions and the numbers of system elements, it should be obvious that giving up the imposed restrictions (which would have to be done in any empirical application of the model) only increases the computational burden, while not changing anything in the basic ideas.

Removing the linearity assumption would be far more critical since a nonlinear model might be expected to show strongly differing behavior patterns.

Current work on models of change of ideology and change of demands will provide a sequel to this paper.