**DECISION MAKING IN LARGE**

**COMMUNITIES**

**The disproportionate influence of minority**

**groupings on the decision making process.**

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**INTRODUCTION**

It is clear that events in the future are predicated on decisions or choices which are made in the present. It is also very clear that the outcomes of those choices could, in theory, have had very different outcomes had different choices been made at any particular moment in time . Furthermore it is apparent that the “quality” of future outcomes must depend on the “quality” of the choices or decisions which are made in the present. Clearly this situation can lead to outcomes or consequences which were not intended at the outset and this has been described as the law of Unintended Consequences.

Also it would seem to be clear that the intended consequences of a choice made in the present would be to produce a result in the future which mirrored the intentions of the choice makers. In other words, any future outcomes would be self-similar to the intentions of the choice makers.

It is very apparent that in the real world this is not always the case and that the best (or worst) of intentions do not always achieve their intended outcomes. The purpose here is to attempt to describe and quantify the mechanism of the process and outcome of choice making.

**CHAPTER 1**

When any choice or decision is made, it is clear that the decision has immediate consequences and further potential outcomes. Part of the task here is to quantify the number of outcomes and possibilities which may result from any particular choice or decision.

Probability and possibility patterns are related by a logarithmic function because the overall probability of an outcome is the product of the probabilities of independent choices. The outcome of decisions made at any one given moment in time is the sum of the choices or decisions made at that particular moment in time. Thus the logarithmic function converts the multiplicative property of probability into the additive property of choices made at any particular moment in time.

At any decision making point there are two and only two choices the future progression of a particular situation. That is to say a decision or choice is made as to whether to change the current direction of a particular course of action or to let the status quo remain. There is no alternative to this scenario, either the decision makers take one or another of two possible paths. Either the system changes or it remains in its present form and fails to change. As far as the decision makers are concerned, any grouping or population has but two choices and there is a finite probability that any group or population of decision makers will develop in one direction or another, the only certainty being that every decision maker will belong to one group or another i.e. the “change” grouping or the “non-change” grouping.

Generally we can say that the rate of change of decision making patterns increases with time . That is to say that the possibility space available to populations for making changes increases with time up to a maximum available number of possibilities which is theoretically infinite. Thus we can write that the possibility space is proportional to time i.e:-

where =possibility space and *T*= time. Thus represents the possibility space occupied up to and including the present epoch.

The rate of change of choice patterns i.e. can be written as :-

where *T* is the elapsed time of the opportunities for change to date and is the total time available to the change pattern in question and thus we can write

where and are the final and initial states respectively of the choice patterns.

The multiplicative qualities of possibility space can be converted into the additive process of decision making by becoming a function of the natural logarithm of the possibility space as follows:-

i.e. the possibility space increases over time. Developing the theme of possibility space further as a general rule we can write:-

where the change in possibility space is positive and *N* is the total number of possibilities and also we note that :-

where the change in possibility space is negative and again *N* is the total number of possibilities.

From the foregoing we can infer that as and converge, that is to say if is reduced in volume then will tend to zero at which point opportunities for change will cease to present themselves and thus we can write:-

And from which we can conclude that also tends to zero (here is a property of ).

This model description can be developed further as follows. The rate of reduction of possibility space at any given time is proportional to the number *N* of possibility spaces available at any one moment in time i.e. and we can write and since is negative it follows that decreases as T increases. The introduction of a constant (which we will call the space reduction constant) gives:-

Equ.1.

Now if there are possibility spaces existing at *T = 0* and a smaller number at a later time then we can integrate Equ.1. to give:-

Applying this principle to this model of possibility space we can say that the “half-life” of any decision making pattern is the time taken to reduce the number of original possibility spaces to one half of their original value i.e:-

and when then thus and we write:-

(This point will be referred to later).

**CHAPTER 2**

In any probabilistic situation the set of all possible outcomes is the possibility space. Possibility space can best be illustrated by the use of branching models. In the case of random decisions all possibilities are equally likely. For example in a system where there are two alternatives presented at every decision node, the tree diagram is structured as below where each decision node is numbered 1,2 or 3 etc:-

3

2

3 3 3

1

3

2

3

FIG.1

i.e. at the first decision node there is a possibility space of 2. At the second decision node there is a possibility space of 4 and at the third decision node the possibility space is 8 and so on. Thus we can say that the possibility space of a branching process is multiplicative and the process can be described as a progression of the form:-

1+2+4+8……..∞

In the foregoing case the probability of an event occurring is always the inverse of the total possibility space. For example in the case of two alternatives the probable outcome results in a geometric progression of the form:-

In this case the first term is 1 or  so that the first value that *‘r’* takes is zero in every case whatever the bias of the system.

Thus the branching system is a geometric progression and is multiplicitive in nature. This being the case it now remains for us to convert this multiplicitive process into an additive process of cumulative behavioural change.

It is here that the significance of the “half-life” of the decision making process becomes apparent because the “half-life” would be the time taken to reverse any particular decision which in turn would quantify the consequences of reversing that decision.

The change in probability when *‘N’* behaviour patterns undergo a change of possibility space from  to  is:-



Where  and  are the final and initial states of the behaviour pattern in question and  and  are the initial and final volumes of possibility space respectively.

**CHAPTER 3**

The process of decision making falls into two main categories. The first category concerns the simple question of a yes/no alternative or zero-sum game and the long term outcomes of those decisions. The second category concerns the question of evaluating the opportunities which occur (or do not occur) for those decisions to be made.

As a preliminary to analysing the reasons for the outcomes of various decisions made by societies it is appropriate to examine the way in which collective decisions are made and the underlying forces which guide those processes.

The first process to be examined is that of simple decision making where two choices present themselves i.e. a zero sum game. To this end we can utilise some of those mathematical principles which underlie the some of the general processes to be found in nature. The first of these processes will be an adaptation of the Hardy-Weinberg theorem which can be interpreted as a probability theorem more commonly applied to the understanding of genetic processes.

For the purposes of this exercise I will describe the majority of the decision making population as the Dominant (D) tendency. That is to say that that percentage of the population outnumbers the percentage of the population which may be subject to the likelihood or possibility to change and I will describe that proportion of the population as the Recessive (r) tendency. These characteristics *'D'* and *'r'* occur in the following combinations.

First Second Frequency of

tendency tendency occurrence

*D D D x D = *

*D r D x r*

*=2Dr*

*r D r x D*

*r r r x r = *

Thus for example let us say that in any population of decision makers there is a 1/4 (25%) chance that an individual member of that population will belong to the *'DD'* dominant group which occurs with a probability of . Likewise there is 1/4 (25%) chance that an individual member of the population will make belong to the *'rr'* recessive group which occurs with a frequency of . It follows that 1/2(50%) of the population will be a mixture of *'D'* and *'r'* tendencies whose members will occur with a frequency of *2Dr.* The frequency of occurrence is in fact the same expression as that for the joint probability that any one choice tendency will dominate and the sum of these characteristic choice tendencies (or the joint probability) is then :-

*DD + 2Dr + rr = 1 (100%)*

Thus the principle equation representing decision making tendencies is:- 

This equation can be used to establish the probability of the choice tendency in any large population. For example take any population of 20,000 individuals. Let us say that the number of population members who belong to the recessive tendency  i.e. 1/20,000 or 0.00005 and the frequency of this group is.

Since all individuals must belong to one group or another then the frequency (probability) of both tendencies must be *1* since *D+r = 1.* From this we can calculate the frequency of the dominant tendency *'D'* as follows i.e:-

*D + r = 1*

*D = 1 - r*

*D = 1 - .007*

*D = .993*

The probability of the occurrence of the recessive tendency in the 'undecided' population i.e:-

*2Dr = 2 x .9937 x .0063 = .014*

That is to say 140 in 20,000 will have a probability of tendency towards recessive behaviour while only 1 in 20,000 will actively participate in the same recessive tendency.

Thus as soon as the proportion of the population aspiring to change reaches a total of 25% of the population, in this illustration 5000/20000 ( i.e. the value of *r* = .25 ), then the proportion of the population possessing a tendency towards behavioural change exceeds 50% of the population i.e:-

2Dr = 2 x .50 x .50 = 50%

Therefore at this point the tendency towards change exceeds dominant tendencies and it becomes very apparent how it is that the views of extremely small minorities can come to dominate the agenda of the majority whatever the merits or de-merits of that minority may be. Furthermore it is remarkable to note that once the value of ‘r’ reaches 0.25 in a population of 20000 it is probable (not just possible) that the majority of the population will tend towards a change to a recessive tendency. Thus as *2Dr* increases over time up to a total of 50% and then decreases over time, *D* decreases while increases proportionately.

Thus for we can calculate the probability of the tendency towards behavioural change at any point in any given large population.

Having established that it is possible to predict with some accuracy the tendency for certain modes of behaviour to change from a dominant to a recessive tendency in the total population, we can now establish that the underlying cause of this phenomenon is purely statistical in its nature.

Thus we note that the existence of any tendency towards behavioural change must produce a greater proportion of potential behavioural change in the population at large and it is remarkable to note that once the value of ‘*r*’ reaches .50 it is probable (not just possible) that the majority of the population will tend towards behavioural change. The potential consequences of this situation are not difficult to imagine! But why should this be the case and what should be done about it? The probability function can only exist if choice exists. More particularly we can say that, if the opportunity for behavioural change is removed, then the probability towards change will cease to exist. But as soon as the opportunity for behavioural change is present for the whole of the population, then the tendency towards behavioural change for the whole of the population must increase dramatically. The most probable behavioural state is the one for which the number of choices is at a maximum.

This then establishes the possible outcome which may result from any political or administrative decision which is made or indeed any particular fashionable viewpoint which may be prevalent and may as a result, affect the future behaviour of large swathes of the population.

Uncomfortable as it may be, the principal conclusion that can be drawn from demonstrating the Hardy-Weinberg theorem in this way is to illustrate how it is that a small minority can exercise an influence on majorities in any collective group. It is also clear that this minority can very easily set the agenda for the majority by the sheer weight of numbers whether or not the agenda of that minority has any credence either morally or factually.

**CHAPTER 4**

So far the foregoing has been a description of potential long term possible outcomes resulting from any decisions and choices that are made . The Hardy- Weinberg theorem describes the actual process of decision making and illustrates how it is possible for seemingly small minorities of opinion to gain acceptance and hold sway over the greater majority of the population. Thus we may conclude that as possibility space increases so does the likelihood of wrong or dis-advantageous decisions being made. From this it follows that the opportunity to correct mistakes decreases over time or put another way the opportunity to make “correct” decisions decreases over time.

Returning to the branching system as previously described, while it is true that the number of possibilities or possibility spaces doubles at each decision node it should be noted that any decision made at any node automatically cuts off the potential number of choices actually available by one half.

It has previously been noted that possibility space increases over time and at the same time we have noted that the probability of an event occurring is always the inverse of the total possibility space. From this it follows that possibility and probability are always increasing in tandem towards a system of ever more complexity. Here we ask ourselves-What has happened to our original intended course of action?. It would be reasonable to say that the decision makers at point 1 on the branching diagram were seeking to achieve an outcome compatible with their own intentions or expectations. In other words they were hoping to achieve a self-similar outcome. A self-similar system is one which looks largely similar on any scale and therefore this description is ideally suited to the objectives of the original decision makers. Self-similarity is expressed as;-

where where *N* and *s* possess self-similar qualities and *d* is the power law scaling factor.

The difficulty experienced by decision makers seeking to maintain self-similarity over time is that the number of possibilities increases over time which leads to a state of increasing un-predictability and uncertainty. In other words uncertainty increases over time as shown by;-

Here *U*= the level of uncertainty at any given moment in time.

In any system uncertainty can result in unpredictability. However the fact that a system is unpredictable does not mean that it is unstable. In the case of the Hardy-Weinberg theorem it can be easily shown that the self-similarity equality applies. That is to say that by making equal to *N* and by making the sum of and equal to *s* then the expression for self-similarity is consistent throughout the system. For example taking our original value we have:-

where

Letting and the sum of then and this remains consistent throughout the system then it is clear that as soon as N and s converge the equation for self- similarity becomes and at the point of convergence and afterwards the *s* tendency dominates to the expense of the *N* tendency. Since the *s* tendency consists largely of undecided and recidivistic tendencies i.e. then the volume of possibility space increases for this group to the point where predictability becomes totally uncertain and chaos has arisen from a simple system (Gleick) and the possibility space becomes infinite. In other words the system is moving towards a state to which it naturally aspires.

**CONCLUSION**

From the foregoing it is apparent that very fundamental changes in an organisation can occur as the result of very simple changes of direction for any collective grouping. Furthermore it is very apparent that any system can move from order to unpredictability to chaos over a comparatively short time span. Thus it is easy to see how it is that very small minorities of opinion can hold sway over much larger communities as their opinions come to dominate the agenda of a largely undecided section of society. It is also easy to see how it is that holders of unpleasant or deviant tendencies can find their views accepted by the majority of the population.

The principle objective of this paper has been to establish the fact that communities and societies in general are structured by and function according to the general laws of nature which in turn are governed by the laws of mathematics. This fact will no doubt be difficult to accept especially by those who great store by notions of free will. Nor will it be easily accepted by those who imagine that systems of government or political theories which do not conform to the laws of physics and mathematics and the laws of nature in general can succeed in the long term.

**END**