
THE *erratic* PULSE

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Chaos theory and the changing conception of law.

Chaos theory is a new scientific theory which could conceivably have an impact on our perception of the world around us and, hence, on our understanding of the concept of law. Chaos theory may prove a useful, although controversial, theory through which to understand law. In this article, I review the relationship between law and science and briefly re-examine the concepts of certainty and predictability in law in the light of chaos theory.

For many centuries scientists have developed and extended the application of universal laws, in particular Newton's laws, to all systems of the natural world, on the assumption that the universe operates with clockwork precision. The Shorter Oxford Dictionary defines system as: '(a) set or assemblage of things connected, associated, or interdependent, so as to form a complete unity'. There are, needless to say, important exceptions to this generalisation and, of course, discoveries in the early part of this century signalled the beginning of a number of new approaches to science. Quantum physicists, for example, turned their skills towards the study of sub-microscopic particles and developed valid laws inconsistent with the laws of classical (or Newtonian) physics. At the other end of the spectrum, relativists directed their energies to astrophysics where, again, valid laws have been developed which exhibit inconsistencies with the laws of classical physics. Yet the fact remains that the laws of classical physics continue to be essentially valid in the natural world around us. Their important feature is the provision of order: a point of reference from which we can make accurate predictions.

What does science mean to lawyers?

Of what significance could this be to the lawyer? At face value, possibly none at all; the disciplines of law and science are sufficiently remote from one another to suggest that, at least at a philosophical level, there is little need for a cross-pollination of ideas between them. There is no need for lawyers to construct theories of law based on models borrowed from other disciplines. Indeed, it may be argued that it is positively detrimental for lawyers to use the intuitions and metaphors of science in the understanding of legal and social issues – scientific models of criminal intent or human feelings have little place in law.

Despite these differences in concept, there may be areas of similarity between law and science, for it is important to remember that, while the laws of classical physics do not oblige us to embrace a particular philosophical position, they do provide an important theoretical unification of experience which, from a wider perspective, allows us to conceive of a world view which is ordered and structured; in which things, animate or inanimate, function according to a deterministic or predictable pattern. In short, they provide us with the paradigm of our time: our ability to detect and define, even to create, and sometimes imagine, order in the world around us, in our societies and communities, and even in the very arrangement of our thoughts.

This paradigm filters through to the concept of law, providing for

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lawyers a useful analogy to recognise and explain the relationships between legal institutions and legal rules, and the structures of law such relationships create – the legal system. It allows lawyers to justify the role of law in society – without the order inherent in law there would be chaos. Similarly, the notion of an ordered universe provides lawyers with an analogy for the good governance of society under the aegis of civil authorities. This is apparent, for example, in the constitution of the United States of America, which provides, almost in Newtonian form, for checks and balances between the various repositories of power. This is discussed in M. Kammen's work *A Machine That Would Go of Itself: the Constitution in American Culture*. To that extent, then, the law appears to be firmly rooted in the Newtonian concept of universal laws.

Similarly, the paradigm allows lawyers to explain their ability to predict or determine the judicial outcome of a particular set of juristic facts or events. This is perhaps best exemplified in the statement of the American Judge, O.W. Holmes, that 'the prophecies of what the courts will do in fact, and nothing more pretentious, are what I mean by law'.

As has already been mentioned, the scientific paradigm has been challenged by the relativists and quantum physicists. To the extent that these areas of science deal with things beyond the realm of everyday human experience, they have had little impact, other than introducing a small element of uncertainty in prediction and measurement. Yet, in the last decade or so, the paradigm has been strongly challenged by chaos theory, which has been described as 'a revolution that is affecting many different branches of science'; one requiring 'a new paradigm in scientific modelling'.¹ Should this new challenge succeed, it may mean that we will have to construct a new paradigm from this new theoretical unification of experience. It is therefore appropriate to briefly describe the theory.

Predictability and chaos

Chaos theory describes how even simple systems, with only one or two variable components, can behave in entirely unpredictable ways: it suggests that the natural world may be far more complex and random than was originally thought. In fact,

[I]t turns out that almost all dynamic systems possess a region of chaos. Conversely, systems having only regular dynamics are the exception.²

Chaos theory, therefore, implies that the current notions of certainty and predictability may be more a matter of chance than the successful application of known universal laws. From a layman's perspective, the most readable and understandable work on the subject is James Gleick's *Chaos: Making a New Science*.

It is based on two fundamental principles. The first, extreme sensitivity to initial conditions, establishes that minute initial differences in measurement are amplified and produce hugely varying results in a relatively short time. The effect is to ensure 'that the uncertainties will quickly overwhelm the ability to make predictions'.³ This can be summed up in the following verse:

For want of a nail, the shoe was lost
 For want of a shoe, the horse was lost
 For want of a horse, the rider was lost
 For want of a rider, the battle was lost
 For want of a battle, the kingdom was lost.

In more complex systems (with many components or variables), for instance a weather system, the opportunity for error

is greatly magnified. This, perhaps, helps to explain the apparent inconsistent ability of weather forecasters to predict the weather in the short term, let alone the long term.

The second principle is recursion: the feeding back of a result from a previous calculation into the following calculation, any number of times. This may be described as 'stretching and folding': a calculation 'stretches' the initial result, which is then 'folded' back in the next calculation. This can be illustrated 'by placing a drop of food colouring' in some dough and kneading it as would a baker. The dough is rolled out and then folded over on itself until the drop of dye 'has been stretched to more than a million times its original length, and its thickness has shrunk to the molecular level'.⁴

The two principles of chaos theory are best explained by its expression in what is called multi-dimensional geometry; abstract concepts called 'state-space diagrams', clearly showing in graphic form the amplification of initial errors, and the process of stretching and folding inherent in recursion.

Of crucial importance is that the unusual and sometimes aesthetic shapes produced by the graphic representations of chaos theory demonstrate that, while the behaviour of a system cannot be determined at a particular point in state-space, the apparently random behaviour of a system does follow an overall pattern that is determinable. It seems to hover around something which has become known as the 'strange attractor'. Therefore, the paradox of the theory lies in the fact that the apparent randomness ultimately follows a deterministic pattern.

Hence, it has been defined as '[s]tochastic [chaotic] behaviour occurring in a deterministic system'.⁵ The definition is strangely contradictory, for it suggests that there is irregular behaviour within an ordered and predictable system. The result is that:

[o]n one hand, it implies new fundamental limits on the ability to make predictions. On the other hand, the determinism inherent in chaos implies that many random phenomena are more predictable than had been thought. Random-looking information gathered in the past – and shelved because it was considered to be too complicated – can now be explained in terms of simple laws.⁶

The interesting point about chaos theory, then, is not so much the elements of complexity and randomness, but the fact that out of the apparent chaotic behaviour of systems, order emerges.⁷

An example of chaos theory is the experiment conducted by Shaw,⁸ known as the dripping faucet (or tap) experiment. Water dripping from a tap is a simple system with only a few variable components; yet it was found to be impossible to predict accurately the time of the next drip from the tap. When all the various time gaps between the drips were plotted on a state-space diagram, there was an overall graphic pattern which was consistent and predictable; hovering around a central point, or 'strange attractor'.⁹

The larger significance of chaos theory is that similar graphic patterns of strange attractors emerge in experiments involving such diverse subjects as a dripping tap, the beating of a chicken's heart, weather patterns, disease epidemics, the function of the brain and even economics. One consequence is the suggestion it may be more realistic to look at the natural world from a 'holistic' perspective, rather than a reductionist view. More importantly, it shows that chaotic or random behaviour has positive implications. Hence, biologists have demonstrated that chaotic behaviour is responsible for genetic variability, so important in evolution; the body's successful reaction to a virus is chaotic, as is the function of the brain.¹⁰ It seems that chaos

theory performs a very useful, but not yet fully understood, function in the process of life itself.

Assessing the chaos in law

How this new theoretical unification of experience, which chaos theory purports to be, will change our view of law remains to be seen. It is clear it will provide new perspectives through which to analyse and assess law. Similarly, it presents us with the opportunity of creating new theories of law rooted in our own time, rather than in the time of Newton.

An interesting exercise would be to view the judgments of the courts from the perspective of chaos theory. From chaos theory we know that prediction is virtually impossible in a simple system such as a dripping tap. If this is extended into law as a metaphor, is it not reasonable to suggest that judgments of the courts, an infinitely more complex system, are completely indeterminable?

But this is not necessarily so. Most judicial decisions consist of the routine application of existing rules: the alignment of the facts of each case with well established categories and principles of law, producing relatively predictable results. This process may, broadly speaking, be referred to as precedent: the application of a principle of law derived from a previous judgment (*Fellner v Minister of the Interior* 1954(4) SA 523 (A) 538A). The predictability inherent in precedent allows us to conduct our affairs in an orderly manner: to plan our lives in the knowledge that there is reasonable certainty and predictability in the law (*Fellner v Minister of the Interior* at 538-539).

In more difficult decisions, those where there is no established category and principle of law, courts tend to apply a process of legal reasoning which, to some extent, allows itself to be analysed in terms of a logical construction – a series of stages beginning with the descriptive, proceeding through the inductive and deductive, to the axiomatic from which 'rights' can be deduced. It is these axioms, or 'rights', which are applied in future judgments and provide a conformity or concurrency of opinion.

It therefore seems that the judgments of the courts may be characterised as an evolving spiral of rationality and, unlike the dripping tap, regarded as largely predictable. If the two principles of chaos theory are applied to the judicial process, a different picture emerges.

The first principle – extreme sensitivity to initial conditions – suggests that a judgment of the court is the product of a process of trial in a particular set of circumstances and results from a choice as between the arguments presented by both parties to the case. Factors such as the skill and inventiveness of those presenting the case, the predilections and prejudices of the judge and the surrounding circumstances of the decision make for considerable uncertainty in the argument that one decision would be like another. This perhaps explains why, when one actually looks at the law reports, the pattern of legal reasoning that emerges seems somewhat confusing. It appears to operate in narrow, relatively watertight, compartments; there are sudden movements from, for example, the deductive stage in one particular area of law to a descriptive stage; forcing, in that particular and narrow area, the partial or complete abandonment of a principle or axiom. Such movements are quite clear, for instance, within the area of delictual liability for negligence. It becomes impossible to assert, despite a long progression from descriptive towards the axiomatic stage, that there is an axiomatic principle that people who suffer loss through the negligence of another have the right to be compensated.¹¹ Of

course, this may be as a result of the courts' use of the tools of empirical reasoning such as 'policy' and 'proximity'.

The second principle, namely recursion, is similar to the mode of repetition inherent in precedent: taking the result of one decision and applying it to the next. Chaos theory suggests, as a result of chance or fortune, accident or nature, each event in life is unique and that nothing is produced or happens like another. It suggests, in terms of legal theory, that the facts of an existing case before the court will never be identical to those of the previous judgment from which the precedent is drawn. Furthermore, it suggests a principle of law, namely that emerging from the original decision, by being applied again through successive cases could become completely distorted, as occurs in recursion.

Normal erratic legal reasoning

It seems the process of legal reasoning should not be regarded as an evolving spiral of rationality. It is perhaps better to conclude it be characterised as an erratic pulsation explicable in terms of the two principles of chaos theory. This tends to suggest that judgments follow a 'chaotic' pattern and may, therefore, be regarded as unpredictable.

Such a conclusion has serious implications, for it suggests the law is far more uncertain than we would like to imagine. It means that the decision of a court is not a final interpretation, but a provisional one: which may be followed or supplemented, ignored or reversed as the courts respond in a chaotic fashion. It means law is contingent in its application. This is not a new or novel conclusion: it has been recognised for some years. Damaska noted:

there is a point beyond which increased complexity of law, especially in loosely ordered normative systems, objectively increases rather than decreases the decision-makers' freedom. Contradictory views can plausibly be held, and support found for almost any position.¹²

One consequence of inferring a chaotic pattern in the decisions of the court is litigation must now be regarded as more of a risk than was previously thought. The expenditure involved in litigation, in terms of time and resources, increases as the probabilities of predicting a result decline. In simple terms, this means litigation becomes more expensive the more complex the legal system.

The picture painted is one which indicates law is a somewhat erratic and contingent system. This is not necessarily unfortunate. It reflects, if anything, the two principles of chaos theory – extreme sensitivity to initial conditions and recursion. It shows the legal system is dynamic rather than static; dynamic systems are healthy, whereas stable or predictable systems wither and die. Furthermore, chaos theory demonstrates law's evolution, even in a haphazard manner, is nothing unusual in the natural world. All that is important is there must be some overall pattern to the evolution: while each decision of the courts may not be entirely predictable, it is important that the decisions follow an overall pattern, revolving around a strange attractor, which, in the case of law, could be an unknown abstract concept which we may tentatively refer to as 'justice'. This suggests lawyers should not be overly concerned with the correctness or otherwise of each particular decision of the courts, but rather with the predictability of the overall pattern which emerges from the judgments of the courts.

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conciliation and disciplinary role. The Commission has yet to commence operating but it may also serve as a model.

Generally there has been a move towards the placement of lay members on registration boards to protect the wider public interest and to provide a balanced perspective. The claim is frequently made that such members merely become captives of the interests of the dominant position on the board or defend those with expertise.

It may well happen that lay members simply defer to the 'modality-expert' on a particular board. I see this as a risk worth taking given the value of lay participation.

The criteria for registering a particular health group

The scope of practice of a health group should be clearly defined. While different approaches are possible within one health group, generally a group should be united by one tenet or approach. Furthermore, to obtain registration, clinical legitimacy should be established together with a high degree of consensus about appropriate skills and measures of competence.

The difficulty is to separate groups such as acupuncture and naturopathy from others which may be less genuine such as pyramid treatment, gem treatment or the Bulgarian School of Suggestology. The problem is compounded in that charlatans may exploit the holistic label to gain credibility. It is up to the group concerned, which has a vested interest in any official recognition, to prove the validity of its professional skill by any criteria or paradigm it seeks to put forward. Measures or standards of incompetence must be clearly ascertainable. Such a requirement would act as a litmus test to put the onus on a group to establish its own professional organisation and professional fitness.

As regards the 'professionalism' of a health group it should be a requirement for each group to demonstrate there is some degree of professional organisation and coherence supporting the modality. While complete agreement could not be expected in any group or class of persons, strong factional divisions would detract from the professional standards and ethics of a health group. It is not the role of a government department to use its resources to police the turf between various factions of a group to establish which group is the majority or which subgroup has the most effective treatment.

Conclusion

On balance, the most persuasive and only credible economic argument is that regulation protects the customer against asymmetry of information. I do not believe the arguments about standardisation of health care or that registration legitimises a group are sufficiently strong to hinder registration.

Further, the claim made on behalf of a group seeking registration that the public should be protected against the possible effects of non-registered activities or practices, must be weighed against the possible clinical legitimacy test. Legislators should thus be cautious of claims of harm by practitioners of a group seeking registration which is relatively uncommon or is in reality a claim for a professional monopoly of an occupational territory.

The strongest argument for extending registration to other groups is to encourage a plurality of health services and to prevent alternative groups from taking over the perspective of traditional medicine to the detriment of their own paradigm.

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