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On The Edge of Chaos:

A "New Vawe" Paradigm and Its Career in the Studies of International Relations

When anyone has a problem and needs to decide how to handle it, he looks about in his available experience for some analogy that might suggest a solution. That's why the world view and root metaphors that a practitioner holds will greatly impact how he views and interprets phenomena. The different fields of socials have been largely governed by classical world views and root metaphors. The present work suggests that, like the physical sciences, we should offer a greater deal of free scope for chaotic view in socials as it may be appropriate and even advantageous. Chaotic systems can be characterized by their obeying of rules, nonlinear interactions, and sensitivity to initial conditions. Using a chaotic world view, new tools and methods can be applied to existing and future research. In this paper, I will focus on its career in the studies of International Relations.

*I. What is chaos exactly?*²

As used in mathematics and the physical sciences, "chaos" is a property of a dynamical system. Chaos has been discussed widely in the past thirty years, both in the academic literature and popular press. A chaotic system has dynamics that are not periodic and not easily predicted, but also not formless or stochastic. In particular, chaotic systems are deterministic systems of interacting elements. The rules governing the interactions are nonlinear and this gives the system sensitivity to initial conditions. That is, two (or more) trajectories that begin very close to one another will quickly diverge.

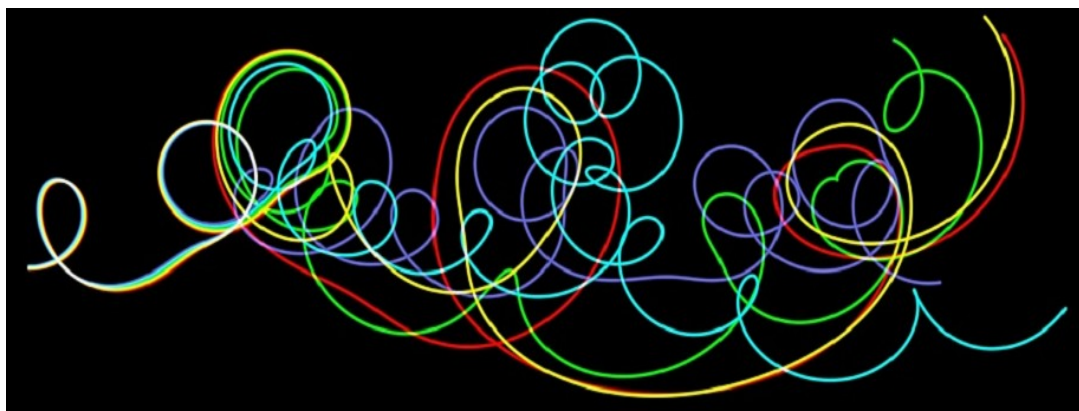


Figure 1. Illustration of five paths in a chaotic system

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² In my discussion about chaos theory in Section I and II I used two outstanding books: 1) James Gleick: *Chaos: Making a New Science*. New York, Penguin Books, 1988. 2) Nikosz Fokasz: *Káosz és fraktálok (Chaos and Fractals)*. Új Mandátum, Budapest, 2000. (In Hungarian)

In figure 1 the paths in space of five points in a "chaotic flow field" (e.g. smoke particles) are plotted; each path in a different colour. At the far left of the image, all five traces are together, indicating that the points begin at very similar locations. However, as the particles move generally to the right, their paths become less correlated until at the far right of the image, they bear scant resemblance to each other. However, chaotic trajectories are generally bounded and well characterized in the aggregate. As an example, consider the weather—the warm fronts, as well as temperature five weeks from today, can't be predicted exactly, but it can be placed within a limited range with great confidence.

Let's take another example. Population biologists are interested in predicting the fluctuations in wildlife populations. This may seem like an enormously complex task, but in actuality, one simple equation, called the logistics equation, approximates observed behaviour with great accuracy. At a conceptual level, this equation allows us to predict the variation in a population by basing on only two factors: 1) the average number of offspring per adult (a constant), and 2) the initial population. This is an iterative equation, meaning that having calculated one year's population, that value is input back into the equation to predict the next year's, and so on. The key aspect of the logistic equation is a feedback factor that depends only on the population value as it changes year to year. When the population becomes too big for the local ecosystem to support it, the feedback factor flattens the population. When it is smaller, the feedback "encourages" higher future populations. What is most important about this feedback factor is that it introduces nonlinearity into the system.

Nonlinearity in a system, by definition, means that the output is not directly or inversely proportional to the input. Linear equations contain only addition, subtraction, multiplication or division by constants. Nonlinear operations involve exponents, trigonometric functions, and logarithms. Nonlinear equations usually have more than one solution; the higher the nonlinearity, the greater the number of solutions. This means that new situations may emerge at any moment. Mathematically speaking, the system encounters a bifurcation point in such a case, at which it may branch off into an entirely new state. We will see below that the behaviour of the system at the bifurcation point (in other words, which one of several available new branches it will take) depends on the previous history of the system. In the nonlinear range, initial conditions are no longer "forgotten." One of the fundamental truths about chaos is all chaotic systems are nonlinear (though not all nonlinear systems are chaotic), and many chaotic systems become so because they are subject to this type of nonlinear feedback, which the system eventually cannot "compensate" for. In brief, feedback is a major factor in driving many systems into chaos, and the result is wild fluctuating characteristics of chaos.

The second truth that we really need to understand is that chaos results from completely known, deterministic, conditions; chaos is not caused by random events and chaotic systems do not behave randomly. Before chaos theory, which is often referred to as *Laplacian determinism*, scientists thought deterministic conditions always produced completely predictable behaviour. In 1814, near the height of the great successes of Newtonian physics, Pierre-Simon de Laplace wrote as follows:

"If an intelligence, at a given instant, knew all the forces that animate nature and the position of each constituent being; if, moreover, this intelligence were sufficiently great to submit these data to analysis, it could embrace in the same

formula the movements of the greatest bodies in the universe and those of the smallest atoms: to this intelligence, nothing would be uncertain, and the future, as the past, would be present to its eyes.”³

Laplace was expressing a pre-chaos world view, which is often called determinism. Accordingly, there are two “options” available to a system: either 1) total predictability based on deterministic, characterizable conditions, or 2) disorder based on random, stochastic processes. Chaos theory, however, brings up a fundamentally new way of viewing reality. We no longer can say that reality is either random or completely predictable (Figure 2).

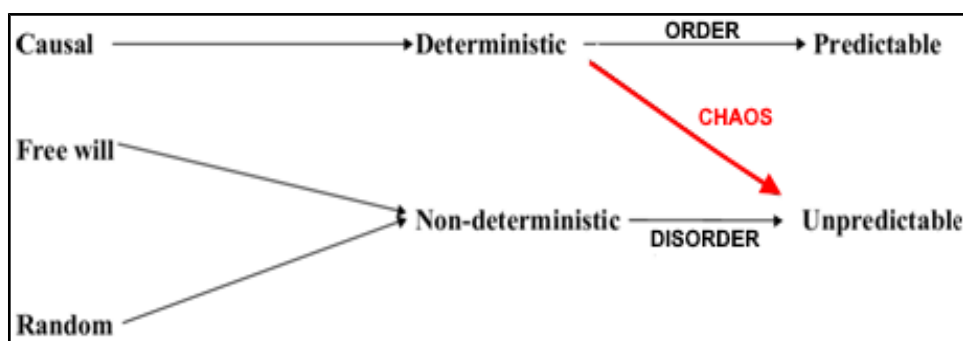


Figure 2. Illustration of Chaos World View

In sum, chaotic systems are deterministic, however, they produce unpredictable outcome as a result of their response to their input. Chaos frequently “sets-in” to systems that have only minor differences in the physical conditions or parameters, from completely predictable systems. These parameters are constants throughout the evolution of the system; they are out there, however, their significance in driving a system into chaos, or prevent chaos from occurring, depends on the environment of the chaotic systems and the interplaying of their elements, and how they are controlled.

II. Butterfly Effect and Black Swan Effect

In 1961, Edward Lorenz was running a numerical computer model to repeat a weather prediction from the middle of the previous run as a shortcut. He expected the computer to regenerate the remainder of the previous simulation and then carry it further. But rather than duplicating the end of the previous simulation, the result was a completely different weather scenario: the new one diverged wildly. He eventually realized the reason for this strange result, but it was totally against the thesis that numerical mathematicians and physicists thought to be true at that time. In the computer’s memory, the data were stored to six decimal places, but in the printout, they were quoted to only three. As a result, the data he had supplied were a tiny bit off. Earlier it was a common thesis among numerical mathematicians and physicists that tiny, random errors such as measurement errors or round-off errors cancel each other out for the long run—and it is really true for a great number of mathematical calculations, but not for all of them. What Lorenz found is nothing else than what we call the sensitivity to initial conditions.

³ Pierre-Simon de Laplace: *A Philosophical Essay*. New York, 1902, p. 4.

This sensitivity to initial condition is often referred to as the "Butterfly Effect." The popularized notion of the Butterfly Effect goes something like "if a butterfly flaps its wings in Texas, it can cause a hurricane in China." Though this notion is very expressive, not precise, and so is wrong by one important word: "cause." It is not the butterfly that causes the hurricane. The system must already have enough energy in it to produce a hurricane. The presence of the butterfly is just the element of the whole system, and it merely disturbs system, which is extremely sensitive to the smallest of changes, "driving" the system into a different direction than if the butterfly was not there. This makes it impossible to predict if a hurricane will occur. In fact, chaos theory shows some elegant mathematical models that sometimes the inevitable errors in calculations do not cancel each other out but they strengthen up their effects—and this occurs even if round-off is done only for the tenth digit after the dot. If this is the case, then a flapping of butterfly wings left out of account might as well turn the result of meteorological calculations into the opposite direction. However, it was not the butterfly that launched ("caused") the hurricane, but the nature of the weather that is sensitive to the initial conditions.

Chaos theory pays our attention to the fact that there are systems in the world, which are chaotic because of their structure. And sometimes they may produce an unpredictable outcome. This kind of outcome can also be called "Black Swan." In philosophy, this concept can be associated with the problem of induction. We generally think that the observations we make can justify some expectations or predictions about observations we have not made yet. Such inferences from the observed to the unobserved, or to general laws, are known as "inductive inferences". Now the problem of induction is just this: Does inductive reasoning, in which one's premises are viewed as supplying evidence for truth, lead to knowledge? In philosophy, from David Hume to Karl Popper, the reply is definitely "Nope". Let's see why. In the 17th century London, a "black swan" was a phrase that was equated with impossibility. For Europeans at that time, the idea of anything other than a white swan was totally absurd because they have never seen other colour of swans than white. Yet, it was in 1697 that a Dutch sea captain discovered a black swan while exploring the coastlines of Western Australia. Later, in the literature of philosophy, the bird became a metaphor to demonstrate the problem of induction: No amount of observations of white swans can allow the inference that all swans are white, but the observation of a single black swan is sufficient to refute that conclusion.

There is another aspect to the problem of induction, and that is when we look at a sequence of events that have always happened in the past and assume that they will happen in the future. Sometimes we have not too much reason for doubting in this induction. Hume famous example is that we are all convinced that the sun would rise tomorrow because it always has risen every day. We have a firm belief that it will rise in the future because it has risen in the past. If we are challenged as to why we believe that it will continue to rise as heretofore, we may appeal to the laws of motion. Of course, in the spirit of the problem of induction, we can repeat our doubts as to whether the laws of motion will remain in operation until tomorrow, and in fact, we cannot avoid an infinite regress in principle, but the whole matter seems nit-picking and too theoretic scenario.

However, in practice, we have no such strong belief like the laws of motion. Author Nassim Nicholas Taleb suggested in his book, *The Black Swan*⁴, in 2008 to use the term black swan to describe a highly improbable event with three principal characteristics: 1) it is unpredictable; it carries a massive impact; and after the fact, we concoct an explanation that makes the event appear less random, and more predictable, that it was. For Taleb, black swans underlie almost everything about our world, from the rise of religions to events in our personal life. For me, the main message of Taleb's is that we should be very careful in understanding and interpreting events in our world. After the event, a signal is always crystal clear; but before the event, it is obscure and engaged with conflicting meaning.

III. Towards a "Chaotic" Theory of the Past

As physicists have the pendulum to test chaos theory, social scientists can use history. You may have the feeling after your middle-school study in history that historians give an appearance of inevitability by dragging into prominence the forces which have triumphed and thrusting into the background those which they have swallowed up. It sounds a little bit just the opposite that Taleb's book sent us as a message—as if there were no contingency in history. This picture is not so simple, fortunately. In Historiography, which is the study of the methods of historians in developing history as an academic discipline, new approaches occur together with the traditional schools of the ninetieth century and the modern schools of the twentieth century. These new approaches are called postmodern historiography or, especially in the Anglophone countries, new cultural history. Though it is impossible to define them as a whole, we can give some main (and new) characteristics of theirs: to highlight the social-cultural role of language, collective memory, the history of gender, microhistory, historical anthropology, and historical fiction and counterfactual (virtual) history are strongly preferred.

From the perspective of our study, the counterfactual (virtual) history is extremely interesting, which can be seen as the most daring and the most groundbreaking approach in the new cultural history. Its prominent exponent is a British historian, Niall Ferguson, who says history is not determined by different "great forces" but by individuals. Nothing is predetermined; history can be interpreted neither as developed nor as decline. The fact if we live in a better or worse world always depends on individual choices and actions. He edited and published a book, titled *Virtual History: Alternatives and Counterfactuals*⁵, based upon a framework of the theoretic assumptions mentioned, whose each study discussed some periods of the history of humankind by asking the question "what might have happened, if only we had or had not ..." Ferguson's ninety-page introduction is a brilliant manifesto-like defense of the methodology of counterfactual history and offers a convincing justification of the whole enterprise. The title of the introduction is also instructive: "*Virtual History: Towards a 'chaotic' theory of the past.*"

In his own written book that is concerned with WWI, he deconstructed the ten "myths" of the conflict by using the same "what might have happened, if only we had or had not ..." method. In his counterfactual scenario, Ferguson makes that story likely that Germany had no offensive goals in 1914 but preventive ones, and the war was unleashed by British diplomacy.

4 Nassim Taleb: *The Black Swan*. Random House, New York, 2008.

5 Niall Ferguson (ed.): *Virtual History: Alternatives and Counterfactuals*. Basics Book, New York, 1997.

If Great Britain had been out of the war or had let her rival win, then a United of European states like the EU now would have formed even in the first part of the twentieth century under the dominance of the German Empire, without the terrible experience of communism and fascism in the world, or at least in Europe. Great Britain would have been better-off, as well, because she would have remained as an empire and the dominant fiscal and trade power of the world.⁶

However, the whole business of counterfactual (virtual) history seems very problematic. On a methodological course, we teach students that they should abstain from asking research questions that cannot be investigated at least in part empirically. Such research questions may be like these:

1. Would US president Franklin D. Roosevelt have decided to drop A-bombs on Japan had he still been in office in August 1945?
2. Was WW2 inevitable if the Parisian Peace Pact in 1919 had been more respectful for the Germans?

We can say these are examples of fallacies in framing research questions. The first question is problematic because it is a fictional one: there are no secure grounds on which to base a reply to it. We might be able to contrast the views of Roosevelt with those of his vice president, Harry Truman, who succeeded him and whose decision it was to use these weapons of mass destruction. Of course, it can be a challenging question itself with different historical and moral interpretations of why the United States did drop atomic bombs over Japan, and this is not the place where we enter into the discussions now. Instead, our focus is how we can know that, if Roosevelt had still been president, he would not have done precisely what Truman did. We encounter the same problems with the fallacy of metaphysical questions: these are questions that try to "resolve a non-empirical question by empirical means." The second question above belongs to this category. How can you answer a question about "inevitability" through empirical research? Using terms "inevitable," or "unavoidable," or "inescapable", or so, commits you to an argument that surely goes beyond what research can establish.

It is no wonder that historians thinking in classic terms of historic studies could never accept this kind of approach. In the dismissive phrase of Edward H. Carr, "counterfactual history" is a mere "parlour game", a "red herring".⁷ Geoffrey Elton urged the return to essentials of historiography in his book published shortly before his death. According to him, the highest form of historiography is the history of politics in its original sense, where historians should be concerned with "events" and not "conditions," since the traces of the facts in the past can be reconstructed. He refused all the new trends in historiography by labelling them as "destructive", "absurd", "heretic", and "nihilist"⁸.

However, Fergusson himself admitted in the introduction of *Virtual History*:

⁶Niall Ferguson: *The Pity of War: Explaining World War One*. Basics Book, New York, 1998.

⁷Edward H. Carr: *What is History?* London: Palgrave MacMillan, 2002. (Vintage Edition).

⁸Geoffrey Elton: *Return to Essentials. Some Reflection on the Present State of Historical Study*. Cambridge: CUP, 1991

“Why concern ourselves with what didn't happen? Just as there is no use crying over spilt milk”. And he replied to his own question: “[...] we constantly ask such 'counterfactual' questions in our daily lives. [...] It seems we cannot resist imagining the alternative scenarios: what might have happened, if only we had or had not ... We picture ourselves avoiding past blunders or committing blunders we narrowly avoided. Nor are such thoughts mere daydreams. Of course, we know perfectly well that we cannot travel back in time and do these things differently. But the business of imagining such counterfactuals is a vital part of the way in which we learn. Because decisions about the future are usually based on weighing up the potential consequences of alternative courses of action, it makes sense to compare the actual outcomes of what we did in the past with the conceivable outcomes of what we might have done.”⁹

The sources of disagreements among scholars in the academic sphere are not only about which researcher has wider knowledge about a topic, or who is more prepared, and so it is decidable who is right and who is mistaken. It is also important how to approach to phenomena. Science starts and ends with theories, and all theories have a set of assumptions, i.e., an untested starting point or belief that is necessary to build a theoretical explanation. All interpretations contain built-in assumptions, and thus they are at least in part subjective. However, we need to make a difference between subjectivity and bias in research methodology. Subjectivity is an integral part of the way of thinking that is conditioned by your educational background, discipline, philosophy, experience, and skills. In this regard, we are obliged to give up the original program of positivists that research should be value-natural and objective. All we would rather expect a researcher to have an intention to objectivity; in other words, to avoid bias, i.e., a deliberate attempt to either conceal or highlight something for some reasons.

As I see, though the methodological program of Fergusson and the counterfactual history is extraordinary in fact, but not objectionable. In history, the scholars consider the entities in course of time, and so they need to investigate the strings of cause and consequences, and they create causation. As long as the goal of the analysis of counterfactual history is to understand the conditions of events and to make an attempt to be responsive to historical evidence, this approach is vivid and remains plausible. The real challenge is to find the crucial fact in the chronology of events.

At this point, it is worth adding Thomas Kuhn's revolutionary contribution to this discussion by putting it into a more general context¹⁰. Kuhn's central claim is that a careful study of the history of science reveals that development in any scientific field happens via a series of phases. The first phase is the so-called "normal science." In this phase, a community of researchers who share a common intellectual framework — called a paradigm — engage in solving puzzles thrown up by anomalies between what the paradigm predicts and what is revealed by observation or experiment. Most of the time, the anomalies are resolved either by incremental changes to the paradigm or by uncovering observational or experimental error. The trouble is that over longer periods unresolved anomalies accumulate (this phase is called

⁹ Ibid., Fergusson, 1997, p.2.

¹⁰ Thomas Kuhn: *The Structure of Scientific Revolutions*. Chicago: University of Chicago Press, 1996.

model drift) and eventually enough significant anomalies have occurred against a current paradigm, the scientific discipline is thrown into a new state of crisis, which is called as "revolutionary" phase, a contrast to the phase of "normal science." During this crisis, new ideas, perhaps ones previously discarded, are tried. Eventually, a new paradigm is formed, which gains its own new followers, and an intellectual battle takes place between the followers of the new paradigm and the holdouts of the old paradigm. This is the paradigm shift of modern parlance and after it has happened, the scientific field returns to normal science, based on the new framework. And so, it goes on forever.

Kuhn's version of how science develops differed dramatically from the traditional view before him. Where the traditional account saw steady, cumulative "progress", following a direct path from past to present, adding at each point to the achievements of earlier generations, Kuhn saw episodic development—that is, different kinds of science occur at different times. Kuhn pointed out the central weakness of the traditional view of science. For example, by the standards of present-day physics, Aristotle looks like an idiot. And yet we know he wasn't. Kuhn's blinding insight came from the sudden realization that if one is about to understand Aristotelian science, one must know about the intellectual tradition within which Aristotle worked. Or, to put it in more general terms, to understand an academic stance, one must understand the intellectual frameworks within which the scholars work.

Kuhn's discussion can be relevant here for two reasons. First, to understand the business of counterfactual history: in complex systems (the world) among which we live, we should expect that minor factors (events or personal decisions) that are out there sometimes cause incidents (black swans) or prevent chaos from occurring. Second, to understand how it is possible to be able to use competing theories existing side by side. Besides the standard interpretation, chaos theory especially convenient to have a way of effective problem-solving: to consider scenarios in changing conditions with alternative outcomes, we will be aware of viewing the subject in the discussion in a more general fashion and gives the opportunity to work our findings out in a more complex form.

IV. Putting It All Together

The aim of these exercises, let's call them simulations, is to create those conceptual frameworks through which associations, sometimes correlations, and implications are realized and interpreted in a manner that was not evident earlier. In the studies of International Relations Theory (IRT), which is a modern and substantially interdisciplinary field, such efforts can be especially fruitful.

The pioneering work of Lewis Richardson set the stage for subsequent attempts to analyze quantitatively many questions of strategic military and economic competition between and among nations.¹¹ Some of his insights came from his work on the weather as a classic chaotic system. He has already anticipated many developments which only were realized decades later when fast computers became available. Many phenomena that are exhibited by chaotic systems appear to have striking parallels in the interaction of human societies. Richardson wanted to model the escalation to war, e.g. how WWI could have erupted even if no one seemed to want to go to war. In IRT this problem is based on the so-called security dilemma:

11 Lewis F. Richardson: *Arms and Insecurity*. Pittsburgh: Boxwood, 1960.

as states acquire capabilities to make themselves secure, they make others more insecure—without trust that may lead to a cycle of arms races and growing instability.

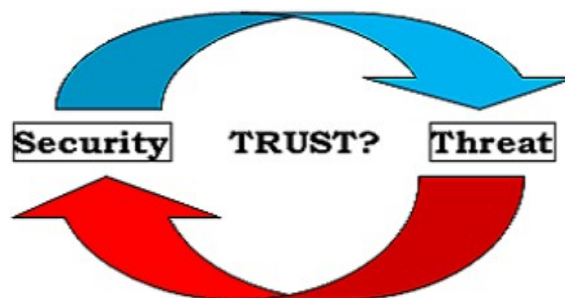


Figure 3. Security dilemma as a "vicious circle"

And the challenging question is how to tame down the vicious circle that appeared in the security dilemma. In Richardson's model, opposing sides scale their arms purchases in proportion to their opponent's total stocks. In Richardson's view, the degree of escalation is a predictor of the likelihood of war. The more states are involved in the discussion, the more impenetrable can be the occurring outcome. We hit the realm of chaos, indeed.

Mayer-Kress constructed an algorithm for a three-nation nonlinear Richardson Model in which nations set their armament levels by their national factors, external threats, and economic constraints. Alliances form when one of the nations becomes stronger in terms of arms expenditures than any of the other nations (collective security).¹² A computer program is also made to the algorithm; a result of a scenario can be seen in Figure 4.

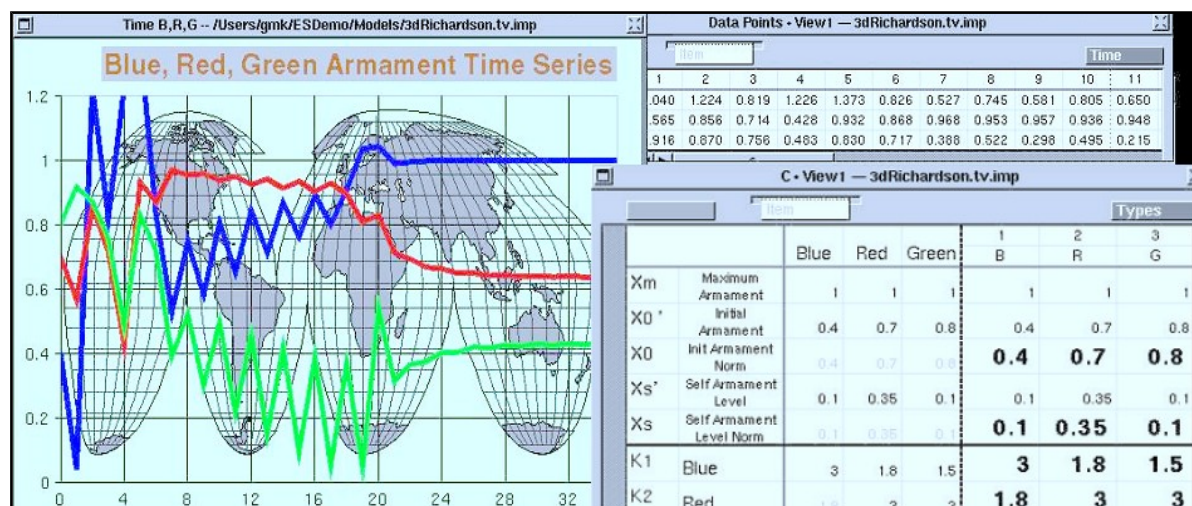


Figure 4. A display of graphical time series output

Another version of the Richardson model is presented by Alvin Saperstein.¹³ His main critics of the Richardson model is it assumes predictability in all cases of two-state scenarios because

¹² Gottfried Mayer-Kress: *Nonlinear Dynamics and Chaos in Arms Race Models*. Proc. Third Woodward Conference: "Modelling Complex Systems", (Lui Lam, Ed.), San Jose, 1991

¹³ Alvin Saperstein: *War and Chaos*. American Scientist, Vol. 83, No. 6, 1995, p. 548-58.

of the applied linear equations in the original model, which is not lifelike. In Saperstein's nonlinear version of the Richardson model, a state's fair of its opponent's arms stocks diminishes as the size of those stocks approaches the maximum sustainable by that opponent. Hence, the arms procurement of one state is less tightly linked to the size of the competitor's arms stocks than it would be in the Richardson model; simply to say, procurement grows at a lesser rate with increasing stock size. And the result is a nonlinear relation between procurement and stocks that can lead to an unpredictable variation of both, with fluctuations over the full range of possibilities.

In another work, Saperstein uses two famous theories to test the chaotic model in IRT. The first is known as Democratic Peace Theory going back to Immanuel Kant, but there exist different versions of the theory today. The gist of the theory is the idea that states with democratic regimes are not fighting each other. The second is the theory of John Mearsheimer and the neorealists (or structural realists) who claim that a bipolar world is more stable than a multipolar structure. Let's review first the two theories very briefly. Bruce Russett summarizes some hypotheses that explain the causal mechanism of Democratic Peace Theory and explains that the reason for peace is rooted in democracy.¹⁴ The first hypothesis is that transnational and international institutions make peace because their aim is to protect common interests between the member states. The European Union is an example of such institutions that protect (previously hostile) member states, so they do not fight one another. The second hypothesis is alliances make peace; the allies choose each other, and that makes the war unlikely. The third is that wealth makes pace, and democracies are more often wealthy states than autocracies. The wealthy states support political stability, and the costs of war are more than the benefits.

The second theory that Saperstein tests is the neorealist thesis that a bipolar structure benefits stability and so, as Mearsheimer states, the end of the Cold War could destabilize the whole world. He argues that "the prospects for major crises and war in Europe are likely to increase markedly if the Cold War ends [...] this pessimistic conclusion rests on the argument that the distribution and character of military power are the root causes of war and peace."¹⁵ The three main factors that provide stability in the bipolar system are i) the existence of only two great powers encourages each to maintain the bipolar system; ii) the existence of only two great powers reduces the chances of miscalculation and makes it easier to operate an effective system of deterrence; iii) power relationships are more stable as each bloc is forced to rely on inner (economic and military) resources, external (alliances with other states or blocs) means of expanding power not being available.

All in all, with the help of chaos theory, Saperstein points out that democratic nations are more stable than autocracies and that a tripolar world is less stable, indeed. He uses different ranges of parameters, different algebraic forms, and he checks which inputs lead to stable

14 Bruce Russett et al.: *Grasping the Democratic Peace: Principles for a Post-Cold War World*. New Jersey: Princeton University Press, 1993, Chapter 2, p. 24-42.

15 John J. Mearsheimer: *Back to the Future: Instability in Europe After the Cold War*. International Security, 15, Vol. 1, 1990, p. 6.

solutions and which lead to unstable solutions.¹⁶ As we can see here Chaos Theory can be considered as a quantitative research method of IRT.

Finally, there also exists the chaos view as a stand-alone interpretation of IRT in the literature. This outstanding achievement and discussion are due to James N. Rosenau.¹⁷ The square one of his idea is the modern society we live in and the modern technology using more and more widely generate turbulences, i.e., there appear situations where environments in which people live are marked by high degrees of complexity and dynamism. The extensive degrees of interdependences among actors create environments dense with causal layers. Such turbulence, in turn, transforms long-standing parameters of acting. Rosenau postulates that a multi-centric world has emerged with the coexistence of the long-standing state-centric international system with an ever more dynamic, decentralized, multi-centric system. The crux is that the norms, structures, and processes in these two systems are mutually exclusive, adding high complexity to the world system. As a result, we can perceive a dialectical relationship between globalization and localization:

„The best way to understand world affairs today requires viewing them as an endless series of distant proximities in which the forces pressing for greater globalization and those inducing greater localization interactively play themselves out [...Globalization is] one component of the transformative dynamics that underlie the emergence of a new epoch in the human condition.”¹⁸

In focussing on the dynamics of the shrinking of social and geographic distances in ways that render the environments of people, organization, and communities both distant and proximate, Rosenau introduces a special term “*fragemegration*” by which we can capture the pervasive interaction between fragmenting and integrating dynamics unfolding in all aspects of contemporary life. Rosenau’s main hypothesis is that the traditional framework of modern politics, which is based on sovereign states (the Westphalian System) and universal human rights (the Enlightenment), cannot hold up the parameters giving the bounds of the political order any more. Turbulences, anomalies have emerged especially after the Cold War. Rosenau postulates that the values, identities, capacities, strategies, and interests of individuals become key variables that can aggregate into substantial consequences for macrostructures, which interact with collectivities and communities. Central to these “*fragemegration processes*” is the proliferation of organizational networks, "a trend so pervasive that many networks are linked to each other and thus add further to the density of nongovernmental collectivities."¹⁹

16 Alvin M. Saperstein: *The Prediction of Unpredictability: Applications of the New Paradigm of Chaos in Dynamical Systems to Old Problem of Stability of a System of Hostile Nations*. In Douglas Kiel—Euel W. Elliott (ed.): “Chaos Theory in the Social Sciences.” Ann Arbor: The University of Michigan, 1996.

17 Two books are worthy of attention by the author:

- James N. Rosenau: *Turbulence in world politics: a theory of change and continuity*. Princeton, N.J.: Princeton University Press, 1990.
- James N. Rosenau: *Distant proximities: Dynamics beyond Globalization*. Princeton, NJ: Princeton University Press, 2003.

18 Ibid. Rosenau 2003, p. 3 and 8.

19 Ibid. Rosenau 2003, p. 58.

V. The Assessment of Chaos Theory as a Paradigm

Though I respect Rosenau's effort to use chaos view as a general framework to understand the dynamics of international relations and our modern ages, in my mind this is not the way of as we should apply Chaos Theory. Instead, Chaos Theory is a technique similar to Game Theory that is also from applied mathematics, and now it is used as an effective tool in Rational Choice as a mainstream paradigm in Political Science as well as in IRT.

Game theory is a model for rational decision-making in situations of social interaction. Social interaction, here, is to be understood in Max Weber's sense: as action that involves two or more intentional actors, and that is guided by mutual expectations about how the other (partner or opponent) will behave. Hence, Game Theory provides a model for an ideal type of reasoning about what to do. This is the reason why we can create and apply game-theoretic models in situational analysis in IRT. In describing the nature of the international system mainstream contemporary theorists tend to think in terms of "anarchical" and/or in terms of "interdependent." The notion of chaos gives a third alternative that can explain much of the actor behaviour in the international system, the recurrence of certain behaviours, and the emergence of new behaviours. Similar to Game Theory, Chaos Theory is also a situational base approach, which is sensitive to seemingly insignificant inputs and beyond discussions of order and disorder. The main difference, however, is that Game Theory usually backs up the mainstream interpretation of the situation, whilst the aim of Chaos Theory is just to open an alternative way of interpretations by investigating the conditions of the situation. To illustrate this, I will present two case studies now, which are worthy of attention, both separately and in comparisons, owing to the chaos approach.

Case Study N° 1: The Outbreak of WW1

In the outbreak of WW1, the standard explanation places great emphasis on the machinations and interests of state actors in Europe in the first years of the twentieth century. This account is something like this: "Austria-Hungary drawn into conflict with Serbia; Russia mobilizing to assist Serbia; Germany moving to support Austria; France, bound by treaty to Russia, moving to counter Germany; and Britain moving to support neutral Belgium and, in some interpretations, France."²⁰

A cartoon published in the contemporary *Times* or Wilson's 14 points reflects this standard account.

20 Dylan Kissane: *The Balkan Bullet with Butterfly Wings*. CEU Journal of Political Science, 2006. 1(4), p. 85-106, p. 97.

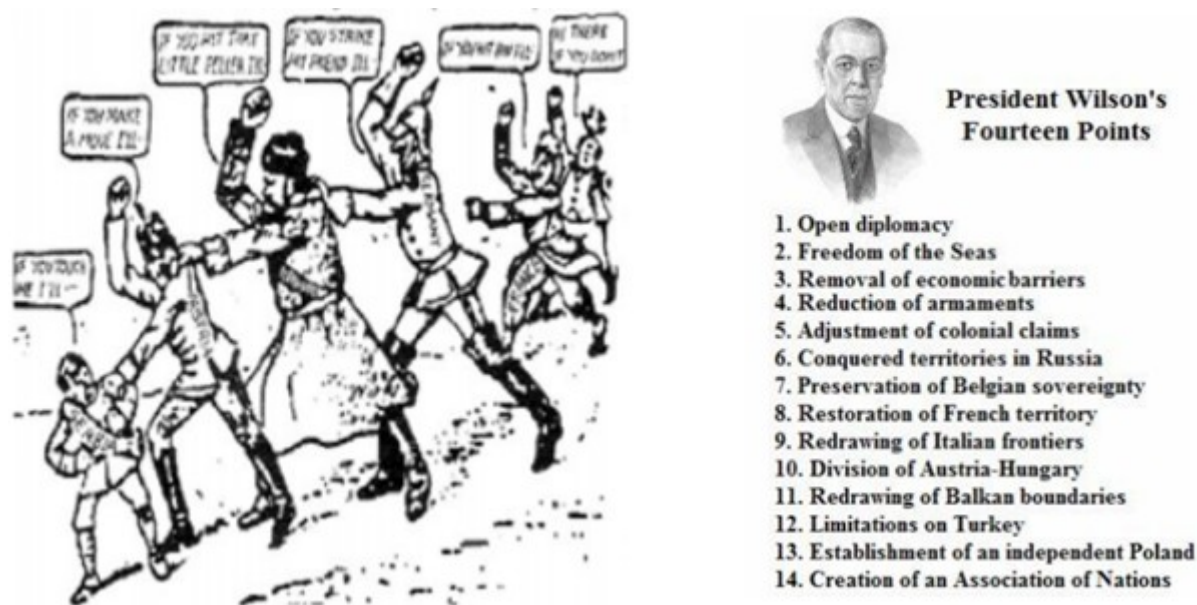


Figure 5. The “big picture”: The standard interpretation of the outbreak of WW1

Using game-theoretic models in which we consider the interests of the different sides in terms of willingness either to cooperate or to defect, the models point out defection as the ideal type of reasoning based upon the current interests of all the concerned parties. That means, in turn, that the war was in fact inevitable. Such an account certainly explains the order of the rush to war and offers reasons why major state actors became involved in the conflict. Let's call this account the “big picture.”

What the chaos approach may add to this analysis is to find the butterfly effect; we have learnt the lesson of chaos view: big movements of change have often started with minor events or personal decisions that ended up affecting the history of our world. And in this situation, it is easy to find it: more than one attempt to make an assassination against the Archduke of Austria-Hungary in Sarajevo in 1914.

Case Study N° 2: The Cuban Missile Crisis

This was the pivot point of the Cold War in 1962. The “big picture” is as follows: the relations between Cuban communist leader, F. Castro, and the US were increasingly strained, and Cuba moved closer to the Soviet Union. In 1961 an invasion of Cuban exiles with US support was defeated at the Bay of Pigs. In 1962, the USA's U-2 spy planes detected Soviet missiles in Cuba. From Cuba, these missiles could be used to attack US cities with very little warning. President Kennedy ordered a naval blockade of Cuba and put pressure on Soviet leader Khrushchev. The world was on the brink of nuclear war... Some experts who were asked to give suggestions to the Kennedy administration, just by using game-theoretic considerations, pointed out the situation is a game of chicken, and recommended Kennedy to remain insistent. In the end, Khrushchev made a deal to remove the missiles from Cuba and

ordered his ships to turn around. In exchange, the US lifted the blockade, promised to not invade Cuba.

So far, so good. However, to complete the story, it turned out an important butterfly effect. During the conflict, there were soviet submarines armed with a nuclear weapon in the region. A B-59 submarine has lost the radio connection with the world; however, an American destroyer began to drop depth charges on the B-59, intended as warning shots to force the B-59 to surface. The exhausted captain, V. Savitsky assumed that his submarine was doomed and that WW3 had broken out. He ordered a nuclear torpedo to be prepared for firing.



Figure 6. The “butterfly effect”: Vasily Arkhipov, a Soviet Hero

Vasily Arkhipov as the third commander eventually persuaded Savitsky and the second commander to surface and await orders from Moscow. What if there had not been Arkhipov on the board?

In conclusion, one thing is important to understand and to think over: “a few small changes in the historical, cultural, or social realities of the time would have seen either a completely different series of events lead up to the war or, perhaps and more interestingly, the war not occur at all.”²¹

21 Ibid. Kissane, 2006, p. 100.