[Mobile pdf] Does God Play Dice? The New Mathematics of Chaos

Does God Play Dice? The New Mathematics of Chaos

Ian Stewart
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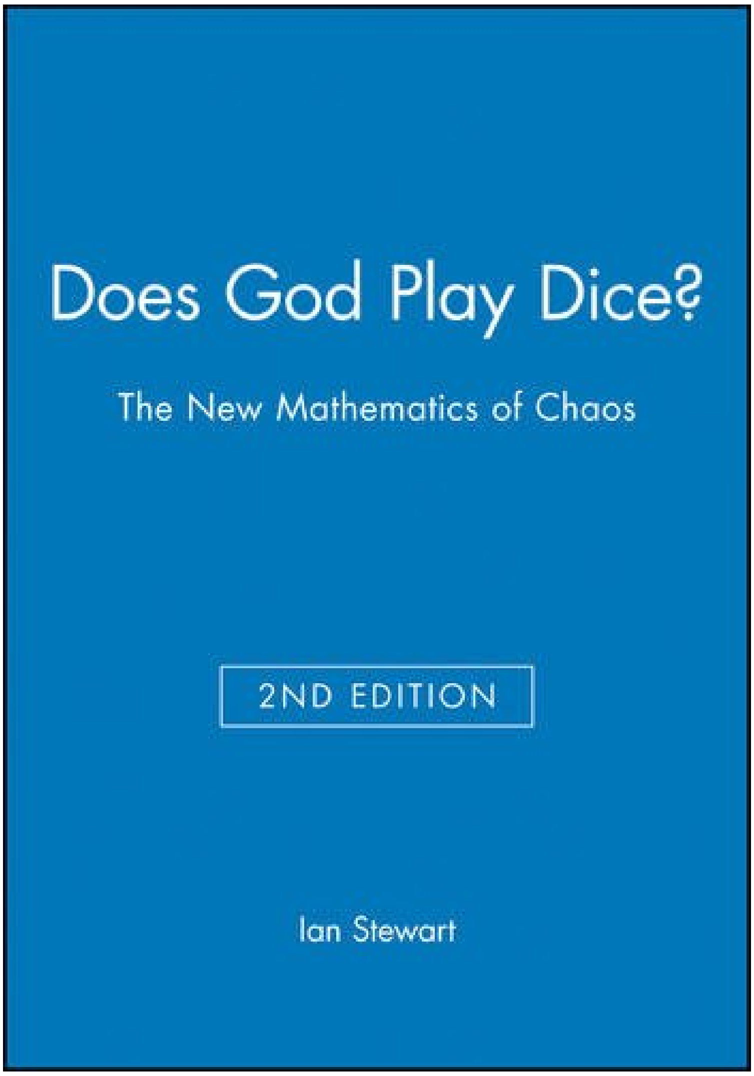

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Ian Stewart : Does God Play Dice? The New Mathematics of Chaos before purchasing it in order to gage whether or not it would be worth my time, and all praised Does God Play Dice? The New Mathematics of Chaos:

1 of 1 people found the following review helpful. Great book for the laymanBy BearThis book is insightful, clear and provides great analogies to understand chaos theory and it's applications. If you are not a math fiend this book will still make you interested and want to learn more. The writer does an excellent job making a seemingly complex theory relevant to our everyday lives. Written for the liberal arts crowd and is really helpful in conversations at parties with the little cocktail dogs.2 of 2 people found the following review helpful. If you cannot read this book within three weeks, I don't want to recommend it. (added in Dec 27, 2015)By I am falling in love with my lifeBefore reading this

book, I've read the famous book, Chaos by J. Gleick. I really enjoyed the book. It gave me an intellectual shock. I can dare to say that my whole perspective on the world has changed. As a following-up book, I chose 'Does God Play Dice?' by I. Stewart. I think my choice was appropriate. It explains some important concepts, for example, Feigenbaum constant, in more detail while it also explains chaos from the basics as Gleick did. And it contains newer and more sophisticated results that are not included in Gleick's book. For example, this book deals with complexity theory in the final chapter. In that chapter, the part about 'ant country' was really fun!!! And the book contains a chapter on the problem of overcoming the probabilistic nature of quantum mechanics by applying the central characteristic of chaos, "deterministic but apparently random process" (It was also very fun, although I skipped many paragraphs). And this book features many helpful pictures and photos.The author is a specialist in Chaos theory although Gleick is a journalist, so this book can be more trusted. And he has wide (and exact, as far as I see) understanding on science including mathematics (he is a mathematician), physics, physiology, astronomy. And he is excellent at defining words concisely and very understandably. For example,(page 40) ... normal distribution. This is a bell-shaped curve that closely models the proportions of a population that have some particular characteristic.(page 90) Two flow lines are called the separatrices of the saddle. They're so named because they separate the way nearby points flow.(page 151) A bifurcation is any change in the qualitative form of the attractor of a dynamical system.(page 172) ... time-series: a list of numbers representing the value of the observed quantity at regular intervals of time.(page 184) Wilson's method was based upon the idea of self-similarity, the tendency of identical mathematical structure to recur on many levels.And the explanation of Julia sets and renormalization is also excellent although I don't still understand the renormalization.But the book has some disadvantages. I think if you are not so familiar with English but familiar only with academic science papers in English, you may have difficulty in reading the book. First of all, there are a lot of difficult words like muse, topsy-turvy, rejig, etc. I had to look up such words in a dictionary many times. Whenever I thought that I am spending too much time on the book, I skipped many passages. And more importantly, the author's writing style is somewhat rhetorical, contrary to directness. Reading the book, I thought that the book is like a detective novel. If you are a native English speaker, it would not be a problem, other than that, it would make the book more interesting. But if you are not, you may be confused. Another disadvantage of the book is the huge variation of the author's skill in explaining important theories and experiments. In some places, I felt that nothing can be better than this. Other places, I felt that I learned little things. For example, if somebody asked me to show chaos in front of him, I think I would have to tell the story about the logistic mapping (a mathematical function) with my pencils and papers. In fact, both of Gleick and Stewart do this. I can understand Gleick, but not Stewart. There are many places like that.1. Stewart shows that the irregular dynamics of Hyperion, a moon of Saturn, can be explained by chaos theory and he assigned many pages about that. But I could only understand a little part of them.2. The author deals with the Feigenbaum constant (a very important notion of chaos theory) more in detail than Gleick did. I couldn't understand well the Feigenbaum constant in Gleick's book, so when I come to the chapter on Feigenbaum constant, I desperately look forward to learning something. But after reading the chapter, I found that I still don't understand what Feigenbaum constant is and why the Feigenbaum constant is universal in a kind of functions. The exact same feelings are applied to the Smale's achievement.As a whole, the book has valuable informations about chaos, but considering the above disadvantages, if you need more than three weeks to read the book, I don't recommend the book, because you may be able to get the informations from other books and sources more easily.--

(added in Dec 27, 2015)This is an addition of my previous review on 'Does God Play Dice?' by I. Stewart. I gave only three stars in the review. There, I said that regarding the two important concepts, the Feigenbaum constant and renormalization, his explanation was insufficient for non-specialists. These days, I am reading the chapters about chaos in Nonlinear Dynamics and Chaos by S. Strogatz. I am obtaining clearer understandings about chaos, especially about the Feigenbaum constant and renormalization. After more carefully rereading the mentioned parts of Stewart's book, I found that my review was not fair to the author. Here, I want to summarize what I know now.1. What is renormalization (or renormalization group)? Renormalization is a technique in quantum field theory that is used to cancel infinity in calculations of physical quantities. It has been used since the mid 20th century.2. What is K. Wilson's work? K. Wilson solved a long standing problem by applying renormalization to phase transition (like an ice melting into water) (1970s). By this, he won the 1982 Nobel Prize in Physics. Wilson's method was based upon the idea of self-similarity, the tendency of identical mathematical structure to recur on many levels (p184).3. What is Feigenbaum's work? Turbulence had been a big old problem in physics. Feigenbaum was interested in the problem. Phase transition and turbulence only differ in that turbulence is a transition in a flow-pattern rather than in the physical structure of a substance (p184). Some physicists believed that Wilson's renormalization method might apply to turbulence. Feigenbaum was one of such physicists. Turbulence is a nonlinear phenomenon. Nonlinear equations are mathematically extremely difficult, so he chose a simple nonlinear equation (maybe being able to reflect some essence of turbulence) and decided to study it. What he chose was the logistic mappings $y = r x(1-x)$ where r is a parameter such that a real number from 0 to 4 (for each r, the equation is defined explicitly as you see). He obtained the number 4.669... for a sequence related to the family of them (i.e. the family of logistic maps for all r). I will explain about the sequence later.What was amazing was that this number 4.669... pops up for the same kind of sequence related to the another family of maps like, y = r sin x (and many other family of maps), but there seemed to be no reason that the same number happens. For such coincidence, Feigenbaum could see self-similarity, and he wrote a paper in 1979 explaining the coincidence by using the idea of Wilson's renormalization. This coincidence is called the Feigenbaum's universality and the number 4.669... is called the Feigenbaum constant. Feigenbaum's claim was (mathematically) rigorously proved in later years.4. What is the relation between chaos and Feigenbaum's work? For example, in the logistic mapping, depending on the value of r, the corresponding logistic mapping shows a chaotic behaviour or not. Say, start with r=1. The logistic map y= x(1-x) does not show a chaotic behaviour (we will call it regular behaviour). This regularity continues until r= 3.57.... After r=3.57..., the map shows a chaotic behaviour. When we increase r from 1 to 3.57..., for some values of r, like r=3, r=3.449, r= 3.54409..., the behaviour of the corresponding maps change qualitatively while retaining regularity. The number 4.669... is a number concerning the increases of the sequence of such r's. The famous mathematician S. Smale pointed out that to understand chaos, it would be helpful to understand the sequence of r because chaotic behaviour starts from 3.57... where the sequence converges.5. What do I want to study in the future? As the first step, I want to study renormalization and next, I want to study Feigenbaum's work, that is, how he showed that the constant is universal using renormalization. The reason Feigenbaum succeeded was that he could see the scaling phenomenon in the mentioned sequence. Scaling phenomenon is very general and it is one of characteristics of chaos. As I quoted that, for scaling phenomenon, renormalization is ready for use. So, the second step is clear to me. I want to research my specialty, group theory, looking for some scaling phenomenon. If there is, I will check if I can apply renormalization. Renormalization is such a powerful method that it had Wilson win the Nobel Prize and Feigenbaum win the Wolf Prize.2 of 2 people found the following review helpful. Excellent Work on ChaosBy Randolph EckThis is the second book I read from Ian Steward. I was looking for another book on the subject of chaos, and having been impressed by a book of his called "The Mathematics of Life," I decided to read this one. I wasn't disappointed.He begins with the Greeks, Eudoxus, Ptolemy, and others and moves through time to Copernicus, Kepler, and Galilei showing how the foundations of mathematics were developed. Later we learn of the works of Euler, Lagrange and his generalized coordinates, Hamilton's work on the state of dynamical systems, and Galton's contributions to the normal distribution. As the 20th century came to a close, statistical methodology took its place alongside deterministic modeling as an equal partner.By chapter six, we are into strange attractors and flows in a plane such as sinks, sources, saddles, and limit cycles. Then there is quasiperiodicity, suspensions, solenoids, and Poincar sections which can give us interesting pictures of the dynamical behavior. Any text on chaos is, of course, going to cover logistic mapping and bifurcation diagrams, as well - so does Steward. Chapter ten introduces Mitchell Feigenbaum and the Feigenvalue - a value of 4.669 - the rate at which successive period doublings accumulate faster and faster. Chapter eleven gets into fractals, Julia sets and the infamous Mandelbrot set.I found chapter sixteen very interesting. I'll just quote Steward here, "The central thrust of the chapter is the possibility of changing the theoretical framework of quantum mechanics altogether, replacing quantum uncertainty by deterministic chaos as Einstein would have liked." As Steward delves into concepts such as quanta; wave functions; spin; eigenfunctions; decoherence; the Einstein, Podolsky, and Rosen paradox and other concepts, he exposes what he feels are some loopholes in the arguments - all very fascinating. His alternate explanation of "spooky action at a distance" or quantum entanglement eliminates the need for information to travel at speeds exceeding the speed of light. I found his argument convincing - too lengthy to describe here. In the last chapter, the discussion turns to complexity theory and how it relates to chaos.Steward presents here for us, I feel, an interesting introduction to the world of chaos - the world we live in incidentally. This is an in depth discussion of the subject, but I feel that Steward did a remarkable job of "translating" the obtuse mathematics and concepts to an understandable level for someone not expert in the field. Certainly an excellent book, and I highly recommend it.By the way, as Steward says in the Epilogue, "If God played dice ... he'd win."

The revised and updated edition includes three completely new chapters on the prediction and control of chaotic systems. It also incorporates new information regarding the solar system and an account of complexity theory. This witty, lucid and engaging book makes the complex mathematics of chaos accessible and entertaining. Presents complex mathematics in an accessible style. Includes three new chapters on prediction in chaotic systems, control of chaotic systems, and on the concept of chaos. Provides a discussion of complexity theory.

.com We'd better get used to chaos because it certainly isn't going anywhere. Mathematician Ian Stewart--who is also a very talented writer--shares his insights into the history and nature of the highly complex in Does God Play Dice: The New Mathematics of Chaos. While his delightful phrasings will draw in nearly every reader, those with a strong aversion to figures and formulae should understand that it will be slow going. Chaos math suffuses everything from dreaming to the motion of the planets, and Stewart's words can never match the precision of his numbers. Persistence pays off, though; there are so many "aha" moments of insight herein that it almost qualifies as a religious text. The second edition has been partially revised in the wake of 1990s research, and three exciting new chapters report on prediction and other applications of chaos mathematics. --Rob Lightner "A book well worth reading and a valuable contribution to the literature on chaos" (New Scientist) "For those who have even rudimentary mathematical knowledge, for teachers and for lively-minded school and university students, Stewart give a valuable insight into the innards of chaos" (The Times Higher Education Supplement) "A fine introduction to a complex subject" (Daily Telegraph)From the Back Cover"You believe in a God who plays dice, and I in complete law and order." Albert Einstein The science of chaos is forcing scientists to rethink Einstein's fundamental assumptions regarding the way the universe behaves. Chaos theory has already shown that simple systems, obeying precise laws, can nevertheless act in a random manner. Perhaps God plays dice within a cosmic game of complete law and order. Does God Play Dice? reveals a strange universe in which nothing may be as it seems. Familiar geometrical shapes such as circles and ellipses give way to infinitely complex structures known as fractals, the fluttering of a butterfly's wings can change the weather, and the gravitational attraction of a creature in a distant galaxy can change the fate of the solar system. This revised and updated edition includes three chapters on the prediction and control of chaotic systems. New information regarding the solar system and an account of complexity theory is also incorporated. It is a lucid and witty book which makes the complex mathematics of chaos accessible and entertaining.