

Are God's Actions Hidden in Chaos?

Bruce Craven

Reader in Mathematics at Melbourne University until retirement. Still active in mathematical research and writing.

Based on a presentation to ISCAST(Vic) 'Fire in the Belly', 18 Feb. 2006

Abstract

Many physical systems are extremely sensitive to initial conditions, so that a small unobserved input can produce large consequences later, and moreover can behave in a seemingly random way. Perhaps God intervenes in His creation by such small inputs, without violating the regularities that we call physical laws. The world may be less deterministic, and more open to the future, than many suppose.

Keywords

Chaos, sensitivity, determinism, open to future, God's intervention, observable, freewill.

1. Chaos

Chaos is now a technical term, with a meaning different from 'without form and void'. The current meaning is described as follows. Note that a dynamical system is 'nonlinear' if output is not proportional to input. Some nonlinear dynamical systems show some or all of the following properties:

- a. Extreme sensitivity to initial conditions. A notable example, due to Lorenz (Lorenz 1963), is of a meteorological model described by three differential equations, which shows completely different behaviour after some lapse of time, when the initial conditions changed by only one part in a hundred thousand.
- b. The path may move into one region (called a 'strange attractor'), stay there for a long time, moving seemingly aimlessly to fill up the region (which may have a disk-like shape, as with Lorenz), then depart for another such region. These regions may be predictable, but the detailed paths within them are not, after some time interval (which depends on the particular system). More precisely, the behaviour is determined by the equations, but only predictable if the initial conditions are known to an extreme precision. When there are several 'strange attractors', the usual statistics of averages, etc. may mean very little.

- c. Some such systems have a 'self-similar' property, namely that small pieces of the system are very like bigger parts, differing only by the scale.

Systems having property (a) may be called 'chaotic'. Often properties (b) and (c) hold also. (See 'Chaos theory' in Wikipedia 2006.) The time interval, after which predictability is effectively lost, may be termed the 'prediction interval'. It depends on the particular system. Even for planetary orbits, computing the orbits of Jupiter and Saturn backwards in time for millions of years is claimed (Chown 2004, Ghil 2003) to lead eventually to chaotic orbits. If so, then perhaps some moderate external disturbance might push the present orbits into a chaotic state.

According to some theory, chaos does not happen at the quantum level. If so, the chaos must enter at some higher level of organization, though it is not yet clear at what level. (For a related discussion, see Selvam 2005.)

2. Determinism

Newton's laws of motion, combined with the inverse square law of gravitational attraction, give in principle a complete prediction of planetary motions, with only the initial conditions left that God may have influenced, and assuming no external disturbance. The later development by Laplace did not always need the initial conditions. Such a system is 'deterministic', meaning that its future is completely decided by its past history. The great success of Newton's theory led many to a 'deist' theology, according to which God set the universe running at the start, and thereafter left it alone. Many scientists (including, surprisingly, some Christians in the 'Intelligent Design' debate) reject strongly any divine intervention, except maybe on day one—effectively a deist position. Is God then a constitutional monarch, who leaves the world to run itself?

Quantum physics modified the Newtonian system greatly, by introducing a random element, though with statistical averages still deterministic. The question still remains, how autonomous is the physical universe?

To the extent that chaotic phenomena occur, even deterministic processes can only be predicted over a limited time interval. This 'prediction interval' can be quite short, e.g. a few days for weather forecasting, and may well be much shorter for microscopic systems. We cannot know that a deterministic law holds exactly. If the system being described happens to be chaotic, the observations from which the law was deduced would also be compatible with some small disturbances to the system, thus small enough to not be observable at the time, though having larger consequences later. It is supposed that the disturbances are not frequent enough, or always in the same direction, to show up as a statistical regularity. Two cases are possible. The resulting system could be deterministic, though unpredictable in practice after some 'prediction time' interval, or it might be indeterminate, thus to some extent unpredictable in principle, even if we had much more knowledge (and initial conditions to some impossible precision). There might be no way to distinguish these two cases by any experiment.

3. Intervention?

Such small disturbances, hidden in chaos (which may appear to us as randomness) offer a possible way by which God might intervene, from time to time, in his creation, without violating the regularities that we call scientific laws. However, many scientists would apply Occam's razor, and some Christians would agree. On the other hand, many devout Christians see God intervening frequently. How autonomous is the world?

Is this a 'God of the gaps'? Yes, but these gaps are there in principle, not to be filled in by increasing knowledge. Polkinghorne comments as follows:

The view I am proposing has been criticized ... as being a return to the discredited notion of a God of the gaps. I disagree. ... If there is any free action (human or divine) it seems to me that there will have to be 'gaps' or open systems in physical processes, as it is described from the bottom up ... the gaps to which we are now referring are intrinsic.

(Polkinghorne 1991)

The present article suggests that chaotic physical systems provide exactly this sort of 'openness to the future'.

From a very different viewpoint, discussing human societies, Popper (Popper 1995) also postulates an element of openness to the future. Popper (Popper 1982) argues that, while a theory may be deterministic, it can only approximate the world by something simpler, and the world need not be deterministic.

4. Observable?

Can we prove that God is acting in this way? This seems unlikely, from the previous discussion. Scientific discoveries are consistent with God's existence, and indeed strongly suggest it, but do not offer a 'knock down proof'. If a number of physical quantities differed only very slightly from their existing values, then planetary formation, or life on earth, could never have happened. From this, the 'anthropic principle' infers that this 'fine tuning' was not coincidental.

Perhaps God does not want his activity to be shown so obviously? Jesus quoted 'do not put God to the test' (Matt. 4:7). Polkinghorne remarks:

...Perhaps his [God's] acts will be veiled within the unpredictability of complex process. They may be discernable by faith but they will not be demonstrable by experiment.

(Polkinghorne 1991)

Of course, it is not implied that God's activity is restricted to this mode. But the present discussion does show that the regularities, which we call scientific laws, are consistent with a continued activity of God in the world.

5. Free will?

The suggestion of small disturbances hidden in chaos also offers a place for free will, in a world which is, perhaps, less deterministic than many have thought. In order to outline this possibility, suppose initially that the human brain is at least a computer, and possibly (Penrose 1994) much more. If the ideas in section 2 are valid, then the brain may not be completely deterministic, and the mind (however conceived) likewise. Could the brain produce large changes in its environment, by small unobservable disturbances?

6. Prospects

Some Christians, who are concerned with science, may be content to put their religion and science in separate boxes, which do not conflict because they never interact. Others, for whom such a 'house divided' cannot stand, may come nearer to consistency by the approach proposed here. It comes at the price of modifying some traditional interpretations in both religion and science. The world, including ourselves, may be more autonomous than theology supposes, and less deterministic than scientific laws prescribe.

However, many scientists will never be persuaded that the 'small disturbances' exist at all, if they are not experimentally observable. This need not deter a Christian, or anyone who seeks a world view in which ethics and beauty, as well as physics and biology, find their place. The mathematical question of which dynamical systems are chaotic, and how much disturbance would be hidden in chaos, might be investigated.

References

- Anon 2006, Chaos Theory, Wikipedia, viewed 28 June 2006, <http://www.wikipedia.com>
- Chown, M 2004, 'Chaotic heavens', *New Scientist*, 25 Feb. 2004, pp. 32–35.
- Ghil, M 2003, 'Did celestial chaos kill the dinosaurs?' *The Observatory* vol. 123, pp. 328–337.
- Lorenz, EN 1963, 'Deterministic nonperiodic flow', *Journal of Atmospheric Science* vol. 20, pp. 130–141.
- Polkinghorne, J 1991, *Reason and reality*, SPCK, London.
- Penrose, R 1994, *Shadows of the mind, a search for the missing science of consciousness*, Oxford University Press, Oxford.
- Popper, K 1982, 'On theories as nets', *New Scientist*, 29 July 1982, pp. 319–320.
- Popper, K 1995, *The open society and its enemies*, Routledge, London.
- Selvam, AM 2005, 'A general system theory for chaos, quantum mechanics and gravity for dynamical systems of all space-time scales', viewed 28 June 2006, <http://arxiv.org/pdf/physics/0503028>.