Time: Non-Western Views

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Time is a difficult notion, since time beliefs underlie a variety of seemingly unrelated areas like (1) scientific theory, (2) philosophy of science, (3) religious beliefs about the the nature of life after death, and consequently about the soul (4) human values (5) nature of language and logic, etc. These various time beliefs may or may not cohere with each other.

As a well-known example, the tense structure of the English language, unlike that of the Hopi language, presupposes that time and space are entirely separate entities, and this makes it hard to understand the intermingling of time and space in relativity theory. As another example, the Buddhist Dhamma is closely connected to the Buddha's concept of *paticca samuppāda*, or conditioned coorigination, the proper understanding of which require the concept of a *structured time*, in which the instants of time are not featureless geometrical points. This notion of a structured time is incompatible with the two-valued logic assumed in Western philosophical discourse. In Buddhist thought, seemingly contradictory properties may coexist, as in the quantum-mechanical Schrödinger's cat which is both alive and dead at a single instant of time. Thus, the attempt to understand one aspect of a non-Western view of time, such as the Buddhist notion of *paticca samuppāda*, can force us to reconsider fundamental issues like the logic underlying Western thought.

Hence, any attempt to provide an account of non-Western views of time is a very difficult enterprise, involving complex relationships across widely different areas of knowledge, and potential conflicts at a deep level with stock metaphysical assumptions underlying even the language and logic of Western discourse. This entire gamut of relationships between different pictures of time has been covered in the books *Time: Towards a Consistent Theory*, and *The Eleven Pictures of Time*, by this author, but is too complex to be covered in the span of this one article, which will focus on only a single aspect related to the Western stereotype of non-Western beliefs about time.

The Western stereotype: "linear" time versus "cyclic" time

Non-Western views of time have typically been represented in Western literature and scholarship by contrasting Western "linear" time with non-Western "cyclic" time. "Linear" time is endowed with a variety of positive properties: rationality, progress, "free will", etc. while "cyclic" time is attached to a variety of negative properties: spirituality, stasis, fatalism.

The first step needed to understand non-Western views of time is to get rid of this stereotype of "linear" versus "cyclic" time.

For example, the time beliefs underlying scientific theory are not the same as those underlying the philosophy of science, and the two do not cohere, but both can be classified as "linear" time. Thus, scientific theory is today presented in the form of differential equations, such as Newton's laws of motion, or the Hilbert-Einstein equations, or Schrödinger's equation etc. These equations fix the state of the cosmos at any time, once its initial state is known. However, all these equations involve the mathematical notion of a derivative with respect to time—for example, velocity, or the rate of change of position, is the time derivative of position, and acceleration is the rate of change of velocity or the time derivative of velocity. On the existing Western mathematical understanding of the calculus, these derivatives with respect to time force us to suppose that time is a continuum, which can be represented using real numbers. That is, current scientific theory necessarily presupposes that time is like the real line, or that time is *superlinear*.

On the other hand, our reasons for believing in this or that scientific theory are (or ought to be) based on experiments, and this presupposes the belief that one can perform various experiments, the outcomes of which were not all determined beforehand, by the state of the cosmos at some moment in the remote past. That is, the philosophy of science presupposes a *different* belief about time: namely, that the future of the cosmos is a consequence of *human* choices and actions, and not merely of its past state. One does not normally stop to think about such presuppositions because everyday human actions are premised on the same belief that human actions are powerless to change the past ("no use crying over spilt milk") but that they do bring about the future in some small way ("if I don't watch the milk it will boil over"). Thus, the philosophy of science subscribes to the belief in *mundane time*.

These two types of time, superlinear time and mundane time are both "linear", but they are nevertheless incompatible and in conflict with each other. This conflict is a serious matter: for its pits scientific theory against the reasons for regarding it as valid. How is this conflict to be resolved? This would naturally seem to require a correction in one or the other picture of time.

However, the slightest alteration in one's time beliefs can have profound consequences. Changing the picture of time in scientific theory fundamentally changes the *type* of equations used to formulate the models of physics. On the other hand, if one were to believe that the future of the cosmos has already been rigidly determined by its past, there would be little point to human action, and life itself would become meaningless, as in the theory of the Stoics, or in Nietzsche's thought.

Since there are different notions of "linear" time, such as superlinear time and mundane time, which do *not* cohere with each other, so the very category of "linear" time is not meaningful. The category of "cyclic" time is not meaningful for similar reasons.

On the other hand, there need not be any particular conflict between a locally superlinear time, and a globally recurrent cosmos. If the cosmos is restricted to a finite region, like a gas in a box, and evolves deterministically—according to Newtonian mechanics, say—

then the Poincaré recurrence theorem tells us that, with probability 1 every state of the cosmos *must* repeat to an arbitrary degree of precision, infinitely often. Recurrence would similarly take place even if the cosmos evolves probabilistically rather than deterministically, so long as the future state of the cosmos depends only on its present state, an assumption more precisely formulated in current mathematics as the Markovian assumption for the evolution of a stochastic process. These recurrence theorems assure us that a recurrent cosmos, instead of being in conflict with superlinear time, is a logical consequence of it, under some rather general conditions, such as finiteness. In the above situations of cosmic recurrence, it could be argued that time only *seems* superlinear because the time scale of cyclicity—the recurrence time—may be very large, just as the earth seems flat, although it is round, since it is very large. Thus, a "linear" picture of time, need not be in conflict with a "cyclic" picture of time.

This meaningless dichotomy of "linear" versus "cyclic" time has nevertheless been persistently used in the West to characterize non-Western thought about time. Hence, a non-Western historical perspective on the development of Western time-beliefs is helpful in understanding the origins of this incorrect (but widespread) stereotype about time, and its linkage to religious ideology.

Quasi-cyclic time and the soul

Early notions of the soul (in India, for example) were based on the belief that the cosmos went through recurrent cycles, or, equivalently, that time was *quasi-cyclic*. It was believed that each cycle of the cosmos lasted for an enormous duration of time—billions of years—and that each cycle of the cosmos was *approximately* like the preceding one. Events repeated in approximately similar ways in successive cycles of the cosmos: roughly the same people were reborn in successive cycles of the cosmos, and lived roughly the same lives, and died roughly the same death repeatedly, across cosmic cycles. This perceived state of affairs was described by saying that each individual has a soul, which persisted beyond death, and was repeatedly reborn (in successive cycles of the cosmos), until such time as it achieved deliverance.

The duration of a cycle of the cosmos is reckoned in the *Vishnu Purana* as a day and night of Brahma, and amounted to 8.64 billion years. (An ordinary day and night amount to 86400 seconds.)

This notion of a soul which persists across vast cosmic cycles is *not* a metaphysical notion, since it presupposes a cosmic state of affairs, which may or may not be the case. That is, this notion of the soul is a *physical* notion, since it involves a refutable, or falsifiable picture of the cosmos.

It is a common error to confound quasi-cyclic time with eternal recurrence. It was *not* generally believed that these cosmic cycles were exact or eternal. The whole possibility of deliverance—*moksa*, *nirvana*—was premised on the idea that these cycles were neither exact nor eternal. (However, the category of "cyclic" time encourages such an error by suggesting that various types of "cyclic" time are the same.)

In India, this was the traditional view of time and life after death held from before the time of the Buddha. The Lokāyata denied the belief in life after death as a fraud. An interesting feature of this denial is how Pāyāsi sought to establish the non-existence of the soul by performing some 37 *experiments* with dying men, and condemned felons. It is unlikely that such experiments were ever performed anywhere else.

The Buddhists did not deny this cosmic state of affairs. Indeed, popular stories like the *Jātaka* tales, clearly accepted what was then the prevalent common belief about the world. What Buddhists denied was only the *significance* of cosmic recurrence, for they denied the existence of a soul or any continuity between two similar individuals across two cycles of the cosmos. In fact, they denied also that anything essential persisted between two similar individuals across even two instants of time: they maintained that the seed in the granary is a distinct entity from the seed in the ground, which is bloated up etc. The seed in the granary cannot be the cause of a plant, because the seed in the granary remains a seed at the next instant. There is a similarity between the two seeds, and hence, due to the paucity of names, one gives the same name to both seeds. Therefore, in the Buddhist view it would not be proper to say that there is some essential sameness in an individual which persists even from birth to death: on the Buddhist view, a individual exists (unchanged) only for a single instant.

This notion of quasi-cyclic time is incorporated in artistic or mythical representations, like the Wheel of Time, the Phoenix, or the Plumed Serpent of Central America, that are found from across the world, and certainly existed in Egypt prior to the Greek or Roman empire. And, as Herodotus informs us, numerous ideas, customs, and religious beliefs were transmitted from the Egyptians to the early Greeks. Therefore, it is not surprising that a similar notion of the soul is found in the works of Plato, and was subsequently developed by the Alexandrian "Neoplatonic" philosophers.

Indeed, it is little known that this belief in quasi-cyclic time was the anchor also of early Christianity, as enunciated by one of its greatest real (as opposed to mythical) teachers, Origen of Alexandria (3rd-4th c. CE). This early-Christian notion of "cyclic" time was remarkably similar to what is today known as the "Hindu" doctrine of *karma-samskāra*. According to this doctrine the actions (*karma*) in one cycle, determine the dispositions (*samskāra*) in the next cycle, and the objective of life is taken to be deliverance (*moksa*) from these repeated births and deaths.

Quasi-cyclic time, immanence and equity

Curiously, while "cyclic" time and *karma-samskāra* is today associated with casteism and inequity, in early Christianity, Origen argued in his *De Principis* that this notion demonstrated both equity and justice: equity, since God had created all souls equal, and justice, since souls were rewarded and punished in each cycle of the cosmos according to the merits or demerits they had earned from their good or bad actions in the preceding cycle. Origen's argument was not an isolated curiosity.

Thus, the notion of equity was related to immanence or the idea of divinity with man, and hence the importance of deep introspection. The discipline of Yoga (union) is not a physical exercise, but a technique of meditation or introspection to bring about the union of atman with Brhman, inside man, and thence lead to deliverance. Mathematics (geometry) was perceived by early Greeks to be a technique, exactly like Yoga, to achieve the same goal. Thus, in Plato's *Meno*, Socrates demonstrated the slave boy's prior knowledge of mathematics, in support of his theory that all learning was but reminiscence of the prior knowledge of the soul. Likewise, Proclus explained the etymology of mathematics (from *mathesiz* or learning) as the science of learning, or the science of the soul, since he thought mathematics related to eternal truths, and forced one into an introspective state, which hence aroused the immortal soul, and induced it to recollect its past knowledge, which it had forgotten since birth.

Immanence related to equity since all souls were regarded as being part of one God. This relation is well brought out by the following story. Sankara, was the founder of Advaita Vedanta, a philosophical system which, as it name suggests, asserts that atman and Brhman are "not two" (but one). Sankara was returning from his bath in the river, when he was accosted by a *candāla* (outcaste). By force of habit, Sankara shrank back. Upon this the *candāla* taunted him, asking how Sankara could maintain this distinction when both had an atman one with Brhman, hence equal to each other. Realizing his mistake, Sankara prostrated himself before the *cāndala*. Almost every theorem of "Euclid's" *Elements* is hence about equality (not congruence), and this was unambiguously related to political equality as in the mystery story that there is "no royal road to geometry". The connection to political equality was made quite explicit in subsequent Islamic rational theology (aql-i-kalam). The lasting impact this had on Islam is obvious from the fact that religious minded emperors like Aurangazeb, even though they ruled vast empires, hence worked to earn their livelihood—something observed with great astonishment by Europeans who had never known any ruler of this sort. In the early Christian version, Origen argued that not only were all souls created equal, but they would again become equal at the end of time, since all would ultimately achieve deliverance, as in *karma-samskāra*, and there would be a time when God would be all *in* all.

This notion of an immanent God was also essentially a celebration of the creativity of life. Man creates the future cosmos (at least a tiny part of it), just because God is *in* Man (and also other living creatures). All people are hence equal, just because all people are equally parts of one God. Since these notions involved a celebration of creativity, they notions were associated with what have been called "fertility cults", such as the worship of Bacchus or Dionysius. In India, various Tantric schools have many similar practices. The relation of equity to creativity is well brought out by the Lokayata festival, today known as Holi. On the one hand it is related to the harvest, hence a celebration of creativity. The custom of throwing color on people was intended to erase the social distinctions that are displayed by means of clothes, and in fact to erase all individuality. The custom of taking bhang (marijuana) was intended to further creativity by heightening sexual passion.

Inequity as the basis of "linear" time

However, after Constantine, this belief in the equity of all souls stood in the way of the political goals of the church, which now viewed the world from the imperial perspective of the Roman state: if all souls would anyway be saved what was the advantage to be gained by turning Christian? If God was within man, where was the need to fear God, and be obedient to the priest? Hence, theologians like Augustine proposed to erase equity and erect a transcendent God who would judge people and establish a simplistic moral division between good (Christians) and bad (non-Christians). In the revised picture proposed by state Christianity, all souls were NOT equal, so not all souls were eventually saved; instead God established a permanent inequity in the world, sending some souls (those of good Christians) to heaven (for ever), and other souls (non-Christians) to hell, as described in gory detail by Dante, for example. Reincarnation was accordingly changed to resurrection—life after death, just once.

Because the earlier notion of soul depended upon a view of life after death deriving from the belief in quasi-cyclic time, *time beliefs were also compelled to change with this changed notion of the soul* and of life after death. Time beliefs changed from qausi-cyclic time to "linear" *apocalyptic* time: the world, as conceived by Augustine, began a few thousand years ago, and would soon come to an end. The notion of the soul became metaphysical.

Thus, the question of "linear" versus "cyclic" time is an issue that lies at the very foundation of Western Christianity (and the related historical notion of the "West", as in Toynbee's classification, used more recently by Huntington). Rejection of that view of (apocalyptic) "linear" time would amount to a denial of the entire religious ideology of state-Chistianity, as it is understood today. This explains the significance and importance to the West of the competitive stereotype of "linear" time versus "cyclic", directed as much against early Christianity as it is directed against non-Western views of time.

The Western misrepresentation of quasi-cyclic time as supercyclic

Augustine argued against Origen's view, by misrepresenting "cyclic" time as eternal recurrence or a state of affairs where deliverance was available to none. He asserted that the cosmos would recur exactly, so that even Jesus Christ would be repeatedly reborn and repeatedly crucified, so that no one could be saved: "Heaven forbid that we believe this, for Christ having died once for our sins, rising again, dies no more." Augustine then rejected this state of affairs on the grounds of "fatalism" (which, he quibbled, was different from "determinism").

This was certainly a misrepresentation of non-Western views, where deliverance from the cycle of birth-death-rebirth was not only held to be possible, it was regarded as the ultimate aim of life. This was also a misrepresentation of Origen who explicitly stated:

"And now I do not understand by what proofs they can maintain their position, who assert that worlds sometimes come into existence which are…in all respects equal. For…

then it will come to pass that Adam and Eve will do the same things which they did before: there will be a second time the same deluge…. So therefore it seems to me…that a diversity of worlds may exist with changes of no unimportant kind…in that age [world] which preceded this, Christ did not suffer….” (*De Principis*, Book II, chp. III.4-5)

Augustine's misrepresentation of “cyclic” time may be presented thus: time was thought to be quasi-cyclic, whether in *karma-samskāra* or in Origen's teachings; however, Augustine misrepresented quasi-cyclic time as *supercyclic* time—a situation (of “eternal and exact recurrence”) where no change is possible in the cosmos, which repeats mindlessly like a stuck record (this “repetition” being in some implicitly assumed notion of increasing time, external to the cosmos, perhaps in the mind of God). Most Western thinkers have fallen into the same Augustinian trap of confounding “cyclic” time with “eternal recurrence” because they lacked even the words required to make a distinction between different varieties of “cyclic” time.

Therefore, Augustine's misrepresentation of Origen's notion of “cyclic” time has confused a long line of Western thinkers, like Nietzsche who founded an entire philosophy on this misunderstanding of “cyclic” time as supercyclic time or “eternal recurrence of the same. The same confusion between quasi-cyclic time and eternal recurrence can be found in T. S. Eliot, or in Mircea Eliade' *The Myth of the Eternal Return*.

Starting from Newton, the same confusion about “cyclic” time persists in scientific theory to this day. For example, Stephen Hawking and G. F. R. Ellis, in their *Large Scale Structure of Spacetime* argue against closed time loops (a third variety of partially “cyclic” time, distinct from quasi-cyclic time and super-cyclic time) repeating exactly Augustine's mistaken arguments. The first step of the argument confounds any sort of cyclicity with eternal recurrence, and the second step rejects eternal recurrence on grounds of fatalism. More recently, arguments in the scientific literature related to the Grandfather paradox of time travel, which involves a loop in time, have again endlessly repeated Augustine's wrong arguments. The confusion between quasi-cyclic time and eternal recurrence seems to reverberate eternally in Western thought: “cyclic” time represents “eternal recurrence” hence fatalism, and should hence be rejected. On the contrary, as this author has pointed out, such closed loops in time, being causally inexplicable from the past, are the way to have spontaneity, or creativity, within the frame of current physical theory.

Thus, the Western stereotype of non-Western views of time involves involves a very deep-seated and long-standing confusion about the nature of time within Western thought, starting from Augustine and stretching down to people like Newton, Einstein, Hawking etc.

There are a few other aspects of non-Western views of time that deserve at least a brief mention.

Discrete versus continuous time

First, consider the issue of discrete versus continuous time. The belief that time is a continuum is forced in present-day physics, as we have seen, only by the Western understanding of the calculus, based on an idealistic understanding of mathematics. However, the calculus, as it developed in India, over a couple of centuries before Newton, incorporated a different understanding of mathematics, that could be called a realistic understanding. The difference between the two may be explained with reference to the Buddhist denial of the existence of the soul. The Buddhists (especially followers of Nagarjuna's *sunyavāda*) maintain that between two instants of time, an individual changes, and there is nothing "essential" in the individual that remains the same. In common parlance, and for practical purposes, we neglect or zero the differences as inconsequential, or non-representable, due to a paucity of names.

Let us now apply this understanding to a number like π, which symbol denotes the ratio of the circumference of a circle to its diameter. No matter how we try to express this number, it cannot be specified—that would require a supertask. In idealist (formal) mathematics, it is asserted that there really is such a number, although any actual representation of it will always only be approximate or erroneous. In realistic mathematics it would be asserted that calculations can only be done with an actual representation, and not an idealized one. There is a paucity of names, and therefore we use a representation appropriate for a given practical purpose, zeroing certain things treated as non-representable. The subtle difference between the two positions is brought out very clearly in the representation of such numbers on a computer; the actual numbers (floating point numbers) do not follow the same rules or "laws", such as the associative law for addition, that the ideal "real" numbers are supposed to obey.

This leads to a fundamentally different understanding of "infinitesimals" (as non-representable quantities discarded in a calculation), which presented such a problem for Newton and Leibniz. However, all practical conclusions drawn from the calculus, use realistic mathematics, and computation, rather than idealistic mathematics. Therefore, the idealistic point of view, which forces time to be continuum in physics, involves the superposition of "extra baggage" from Western metaphysics, and there is no real need to believe that: time may well be regarded as discrete or atomic, provided one does the calculus with a different philosophy of mathematics. The point here is not to argue that time is, in fact, discrete, but rather that the discreteness or continuity of time should not be fixed purely from mathematical and metaphysical considerations, since these metaphysical considerations could be fundamentally different in the non-West.

Atomically structured time and quasi truth-functional logic

The second question concerns the link between time beliefs and logic. Time may be related to logic through Wittgenstein's notion of logical worlds: the state of the physical world at an instant of time can be specified by specifying all the statements that are true at that instant of time. In the West it has been believed that if A is true at an instant of

time, then its negation ~A cannot be true at that very instant. Certainly there are schools of thought in the non-West which also subscribe to this belief, but it is not universal. Buddhist and Jaina logics permit both A and ~A to be true at an instant of time. This involves the concept of an atomically *structured time*. The classical way to explain this would be to think of an instant of time as a microcosm. However, a modern explanation for this state of affairs can be provided using *microphysical* loops in time.

Imagine that one has a time machine, and that one puts Schrödinger's cat (now dead) on board the time machine and sends it back to the time of Schrödinger. The events here described from a future perspective would actually have been observed by Schrödinger somewhat differently: for Schrödinger, the "observed" sequence of events would have been that time spontaneously and inexplicably splits into two streams (both part of this world), in one of which the cat is alive, and in the other it is dead. (At the microphysical level, one can actually "see" a somewhat analogous phenomenon of a photon or a particle of light splitting into an electron-positron pair, which may later recombine to produce back a photon. The positron has exactly the properties of an electron travelling back in time, so the process can also be described as an electron executing a closed circuit in time.) These two streams of time, witnessed (or rather inferred) by Schrödinger, are NOT "parallel" worlds, for the two worlds do meet, and the two cats would coalesce back into a single cat at the time we put the cat into the time machine.

In place of imaginary time machines, one can construct a more realistic desktop model involving parallel computing, although understanding this requires a little more technical knowledge. In parallel computing, a single process executing on parallel processors may be in multiple states at a "single instant" of time. Needless to say, "parallel" is a bit of a misnomer, since it is an essential feature of parallel computing that the processors (logical worlds, in the Wittgensteinian sense) and processes communicate with each other, and that they branch and collapse. Time, so to say acquires a structure, and it is necessary to take into account this structure to understand the semantics of formal parallel computing languages.

Microphysical closed time loops enable us to understand how an atom of time can nevertheless have a structure, in the sense that multiple logical worlds are attached to a single instant of time. This structure is manifested not by further subdivision of the atomic instant, but by a change of logic. In such a situation of an atomically structured time, it is perfectly possible to have both A and not-A valid at a single instant of time that cannot be further decomposed.

This notion of an atomically structured time or a structured instant is the basic unit of reality in Buddhism. It leads to the alternative notion of "causality" in Buddhism, called *paticca samuppāda*, or "conditioned co-origination". The present is not the cause of the future, but the future cooriginates, conditioned by the past. *paticca samuppāda* is identified by the Buddha as the key to his Dhamma. Thus, the use of a logic of four alternatives in Buddhism is not incidental to Buddhism but is integrally linked to its world-view, for it is only through an understanding of the "causes" of *dukha* that one can remove it.

Ontically broken time

The common terminology of the "laws" of physics—for example, Newton's laws of motion—is related to the theological idea that creation was a one-time process, and that subsequent states of the cosmos were controlled by God using "laws". This idea of a clockwork cosmos is denied in many non-Western systems of thought. Al *Ghazālī* , argued from a different perspective, where the world is continuously created by God. In this situation, any "causal" connection becomes a restraint on the powers of God, hence the existence of "causal" connections was denied by al Ghazālī . He, of course, conceded that there are observed regularities in the cosmos, but explained them as arising from force of habit: God habitually creates smoke with fire, he is not obliged to do so. Of course, one does not know on what time scale God changes habits, but it could be imagined that the cosmos is such that not only would physical theories change, but physics itself would change, over a time scale of, say, a thousand years.

More to the point, this helps us to see the historical evolution of the idea of the "laws of God". Thus, al Ghazālī was speaking about an immanent God, the apparent restrictions on whose powers were all too obvious. When this was taken over in the West, as by John Scotus Duns, it created a problem, because it was supposed (at least by the opponents of this point of view) that this description concerned a transcendent God. Under those circumstances, God would become a terrible tyrant, since one would never know what to expect next. Accordingly, God's intervention was toned down, and his role limited to instituting laws. This led eventually to superlinear time.

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The relation of cosmic recurrence to early beliefs about the soul is explained in "Life after death" chp. 1 in *The Eleven Pictures of Time*. The glossary of this book also contains a definition of the term "West" in terms of religious beliefs, according to the classification proposed by Arnold Toynbee and used by Samuel Huntington. Origen's argument relating cosmic recurrence to equity and justice is in Origen, *De Principiis*, Book II, chap. 9. Frederick Crombie, trans., *The Writings of Origen*, vol. X in *Ante Nicene Christian Library*, ed. Alexander Roberts and James Donaldson, T&T Clark, Edinburgh, 1895, p. 136. The quote from Origen (which shows that Origen believed in quasi-recurrence, and not exact or eternal recurrence, as Augustine maintained) can also be found in the online text of *De Principiis*, chapter on "On the Beginning of theWorld and its Causes". This chapter is numbered somewhat differently in the different online versions. It is IV-5 in the New Advent version at http://www.newadvent.org/fathers/04122.htm, while it is II.3.5 according to the *Catholic Encyclopaedia*. Augustine's argument against Origen is in XI.3 *et seq.* of Augustine, *The City of God*, in *Augustine*, trans. Marcus Dods, vol. 18 in Great Books of the Western World, ed. R. M. Hutchins, Encyclopaedia Britannica, Chicago, 1952. For a discussion of this argument, and its relation to the Hawking's chronology condition, see C. K. Raju, "The curse on 'cyclic' time", chp. 2 in *The Eleven Pictures of Time.* For the relation of this curse to current resolutions of the grandfather paradox of time travel, and for an alternative resolution, see C. K. Raju, "Time travel and the reality of spontaneity", *Found. Phys.* July 2006 (to appear), draft at http://philsci-archive.pitt.edu/archive/00002416/01/Time_Travel_and_the_Reality_of_Spontaneity.pdf.

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