



A World Without Time: The Forgotten Legacy of Gödel And Einstein

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In 1942, the logician Kurt Gödel and Albert Einstein became close friends; they walked to and from their offices every day, exchanging ideas about science, philosophy, politics, and the lost world of German science. By 1949, Gödel had produced a remarkable proof: *In any universe described by the Theory of Relativity, time cannot exist.* Einstein endorsed this result reluctantly but he could find no way to refute it, since then, neither has anyone else. Yet cosmologists and philosophers alike have proceeded as if this discovery was never made. In *A World Without Time*, Palle Yourgrau sets out to restore Gödel to his rightful place in history, telling the story of two magnificent minds put on the shelf by the scientific fashions of their day, and attempts to rescue the brilliant work they did together.

A World Without Time: The Forgotten Legacy of Gödel And Einstein Details

Date : Published February 14th 2006 by Basic Books (first published December 28th 2004)

ISBN : 9780465092949

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Format : Paperback 224 pages

Genre : Science, Physics, Nonfiction, Philosophy, History, Biography, Mathematics



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Carmen Booz says

Unless you have a fascination for either Einstein or Gödel, this is not the book for you. There are more things in this world than we can ever imagine.

Keith Akers says

I read this book and "Incompleteness" by Rebecca Goldstein at the same time. They are both quite good books and, as written by academic philosophers, generally mitigate my general negative opinion of academic philosophy. If you are interested in Gödel's ideas about "time travel" then this is your book. (It's actually not a "Star Trek" type concept, as Yourgrau makes clear.) If you are more interested in the proof itself, read Goldstein, who goes into more detail. But really you should read both, because unlike some philosophers from Austria that I could name (ahem! cough, cough!), they actually take the time to try to explain things to you.

I should say that it improves my opinion of academic philosophy, except for one problem -- both books make clear, this one even more than Goldstein's, that Gödel was rejected by most of academic philosophy, many of the members of which didn't even understand what Gödel was talking about.

There is an explanation of "Gödel's proof" of the incompleteness of mathematics (actually two proofs, as it turns out) which is quite accessible. You also get a good idea of how Gödel's mind worked, sometimes for the better and sometimes for the worse, and why his ideas about time are philosophically important. If time travel is possible, even if it is in a world with different properties (a rotating non-expanding universe or whatever), then the whole concept of time as experienced subjectively needs to be re-evaluated.

It is really astounding that this master logician, who should be the hero of all the "analytic" philosophers in the U. S. A. -- since he proved something really significant about logic and mathematics that rivals or exceeds Aristotle -- is hardly even regarded as a philosopher at all, a fact which reveals the shallowness of modern academic philosophy.

Manish Mishra says

This book is amazing. It gives an insight into the life of Kurt Gödel and his relationship with Albert Einstein. Gödel spent much of his later life unearthing the mysterious yet spectacular consequences of the theory of relativity. If you like reading books about the history of science and its pioneers, this should definitely be on your list.

Sander Almekinders says

First and foremost, this book is an attempt by the author to vindicate Gödel as an important philosopher of the 20th century. However, it is not until the final chapter of the book that Yourgrau finally gets around to this. It is a pity that he does not elaborate on the concept of a world without time as it occurs in a Gödel universe (and therefore also in our universe), or on Gödel's arguments. The explanation of the incompleteness theorem was very clear and well-written, whereas this lucidity was absent in the rest of the book. I think that Yourgrau loses the plot a little bit at the end of the book (especially in the final chapter), which makes this part not as interesting as it could have been. I mean, a discussion of whether Gödel was an important philosopher or not is a very valid one in itself, but not in the way it is presented now, in just one chapter at the end of a book that is supposedly about the concept of a world without time, which is difficult enough to grasp in itself. Such a discussion deserves a separate book. As it is now, in my opinion the author attempts to incorporate too many angles in this one book. On the other hand, Gödel may not 'deserve' an entire book about the philosopher he was, which then may indicate that the opponents of Gödel as a philosopher are right, and that Gödel was not a very important philosopher after all.

All in all, I think this book is quite a good read, but could/should have been written better.

Gavin says

Slightly crankish popularisation of his work on a mathematical argument of Godel's which maybe demonstrates time's nonexistence (in an ideal system close to General Relativity).

Yourgrau argues this case using the overlooked friendship between E & G to stir up human interest. He beats the drum a bit hard, taking popularisation to mean "add superlatives and jibes" ("He was a German Jew among WASPS").

I get the feeling that Einstein's in the title more to boost sales / Godel's profile than because the men's relationship is all that critical to the proof Yourgrau thinks has been hushed up or ignored.

Ed Smiley says

In the annals of twentieth century physical and mathematical thought there were a series of crises, and as a result of those crises, in many cases some kind of limitative result was derived.

Two of the figures involved in these results became deep friends in their late years at Princeton: the voluble Einstein and the strange reclusive Gödel, and this book dwells on the development of their philosophical views and the outcomes of some of that thought in the late work of Kurt Gödel.

Gödel, it is to be remembered, demonstrated a general approach that separated the concept of truth from the concept of provability from a set of axioms: every completely formal mathematical system possesses at least one true statement that cannot be demonstrated by it, regardless of what modifications you attempt. Gödel was extremely dubious of logical positivism, and essentially deriving his outlook from Plato, regarded formal methods as merely a rigorous way of arriving at fundamental, preexisting, intuitions of truth.

Einstein, more familiar to most readers, produced a geometrical interpretation of space and time not existing independently, but wholly determined by measurement, matter and energy.

Gödel became extremely interested in the aspect of time as psychological time, time that flows, and asked the question as to whether the intuition of time was something that should prove as reliable and fundamental as the notion of truth. Or was Plato's hint to be followed that time was not truly to be taken as real?

Gödel in exploring Einstein's general relativity came to the conclusion that time was an illusion, at least in the sense that we intuit it. Or perhaps one might say, it lacked the power and generality to become a fundamental intuition. It is odd, in that in his master work, his Incompleteness Theorem, he rigorously demonstrated the generality of the intuition of truth; yet in his work on relativity, he demonstrated deep flaws in the intuition of time.

Background: Unlike special relativity, general relativity allows the large scale distribution of matter to determine "average" or in some sense privileged observers at any region of space and time, in which it could be said time is to pass.

Gödel proceeded to

1. artificially imagine a universe in which the large scale distribution of matter is rotating about an axis
2. demonstrate that an observer could follow a path in which they would end up eventually in their own path
3. argue that in such a world time in the sense of a linear flow that we can intuit is an invalid concept
4. argue that if time cannot be validly applied to *all possible worlds* it has no true validity in any.

It may be noted that Gödel invented a totally new and completely valid solution of Einstein's field equations, but with very odd conditions clearly not followed by our actual universe. The argument from complete necessity in all possible worlds, may strike the reader as odd, or may seem to recall strange resemble to the Ontological Proof of the existence of God (Gödel played with formalizing the Ontological Proof, but never published it.)

I gave 3 stars to this book because (I have read the monograph on the Incompleteness Theorem, so trust me on this) I thought some of the explanations for the general reader, especially the Incompleteness Theorem were a little poor. It did give a very brilliant portrayal of Gödel's philosophical concerns. I also note that this is the non-technical companion to a much more rigorous exploration of Gödel's war on time, also by Yourgrau.

Christopher says

The title is suggestive of pop-science, but it's misleading: the book is a mathematical-philosophy-heavy Gödel hagiography. It's not really about Einstein, either, except to the extent that he served as a sort of foil and inspiration for Gödel's later philosophical work.

Relativity was the starting point for Gödel's inquiry into alternative relativistic spacetimes and their implications for our intuitive sense of time, and he concluded that time does not exist in any sense that resembles our intuition about it. Yourgrau seems to think that this discovery was revolutionary, or OUGHT to have been revolutionary, and bemoans the fact that philosophers have mostly dismissed Gödel's philosophizing as amateurish and inconsequential. And this is really the point of the book: to establish the significance of Gödel's philosophical work as something on the order of his accomplishments in math and

logic.

I'll freely admit that I don't understand the math well enough to judge his argument. Having had a look at mathematicians' reviews of Yourgrou's earlier work, though, I'm not sure he understands the math well enough, either. (Yourgrou is a philosopher.)

The plausibility and significance of Gödel's result concerning the non-existence of time hinges on a point of logic that isn't sufficiently explained in the book, and that I simply don't understand: why is the mathematically-/relativistically-possible existence of a rotating universe that includes closed, circular time-like paths – a universe that is plainly and empirically NOT the one we inhabit – significant and determinative for the reality of intuitive time in THIS universe? And why is it even necessary to establish the mathematical possibility of Gödel universes to demonstrate the non-existence of intuitive time, which is plainly a very different sort of time than the geometric spacetime of the expanding universe of general relativity that we DO live in?

Yourgrou spends a lot of time complaining that philosophers don't take Gödel seriously enough and not enough time showing the significance of Gödel's philosophical results. His explanations of the incompleteness theorem and the continuum problem may work for mathematicians and philosophers of science, but they are impenetrable to even a philosophically- and physically-inclined general reader; Wikipedia does a much better job in 10% of the space.

All of which by way of saying that you should probably stay away from this book if you're not a mathematician, a logician, or a philosopher. And if you're one of those, then you've probably already got your own ideas about Gödel's project (which is to say about the plausibility of Yourgrou's contentious case).

Rob says

when Kurt Godel died, he weighed 65 pounds. quite possibly the greatest genius ever had become super-crazy and basically starved himself to death due to extreme hypochondria and paranoia. the personal lives and struggles of geniuses are generally interesting to learn about, but come on, aren't their brilliant thoughts much more interesting?

i guess the author wrote a book in 1999 on the same subject, aimed at academic philosophers. then a publisher convinced him to take that book, hack out lots of the hard-boiled math/physics/philosophy, and add 100 pages of "human drama" where we learn about godel's wife's cooking, einstein's lustng after both his cousin and her daughter, wittgenstein's brother's dealings with nationalistic austrian musical conductors, and comments by bertrand russel which could be construed as anti-semitic. UGH! who gives a crap about that stuff?? you can feel, paragraph by paragraph, which parts scream "this is the point of the book!" and which scream "the publisher made me put this crap in!" the transition from good stuff to crap is often jarring and filled me with despair.

but even though i didn't care for the "human drama" elements interspersed throughout, plus the endless personal snarking at people who dismissed godel's philosophical arguments about time, i still really enjoyed the book for the 80 pages or so of serious matter. i can feel that i will think about it for the rest of my life. basically, godel proved that there could be universes with distributions of matter different from ours in which "time-travel" would be fairly straightforward. thus in these universes, governed by precisely the same physical laws (mainly at issue here being general relativity), time as we intuitively know it (this stuff which

lapses inexorably instant by instant, of which only one instant, the present, can be said to really exist) wouldn't really exist. a subtle argument is then made that it follows that time doesn't exist in our universe either. the ramifications for human existence (if any, really) are not spelled out, particularly, but it was shocking and thrilling nonetheless.

Robert A. Yaffee, Ph.D. says

I really enjoyed this book and had the opportunity to meet a number of the individuals mentioned in it. This is a book for those who really appreciate the philosophical debates at the time of the Vienna Circle and in the early 20th Century. For all of Godel's major contributions to the Intuitionistic School of mathematical logic, including his incompleteness theorems (that demonstrate that in formal logical systems of natural numbers, completeness is not possible), Yourgau focuses on the friendship between Einstein and Godel, and their debate about the nature of time (p.102). Einstein believed that time travel might be possible through a time loop (called an Einstein-Rosen Bridge) which was a form of traversible wormhole.

Godel argued that there might be universes that would permit such time-travel if these universes resembled a shape of a letter, U, so a wormhole could extend from one side of the upward extension of a U shaped universe to the other. Time travel to the past might occur by accelerating from one point in spacetime through such a time loop to a previous position in spacetime (pp.129-130).

The problem with that kind of revisitiation implies that this time-travel would render that past, no longer the past, but a new contemporary present or even future. It required tying the arrow of time in knots. The essential order of time would be lost, leaving the concept of time meaningless (Ibid, p.134).

The problem was so essential to the understanding of wormholes that before Stephen Hawking could broach the subject he had to protect the nature of time from Godel. To do so, he formulated and adopted "the Chronology Protection Conjecture (pp. 135-136)."

However, if this were indeed the case, why would Richard Feynman, in his 1949 "Theory of Positrons" suggest that a positron is really an electron moving backwards in time?

Ami Iida says

It's only interesting the second chapter, almost boring, etc.

Danny Brynes says

I was so offended by how bad this book was I actually burnt it. I would not wish to inflict this book on anyone.

Let's start by getting some basic facts straight:

- 1) Both Godel and Einstein were geniuses who made very fundamental contributions at a rather young age.

Godel made one major contribution and Einstein made several contributions including his PhD which is one of the most cited papers in physics - it is the use of diffusion in hot liquids to measure a certain constant, but the technique developed into Brownian motion and stochastic calculus which is the basis of modern finance and also quantum field theory. That said by 1949 - when this paper Yourgrau makes such a big deal about - both of these people were well, well past their prime. Einstein wasted the more than the last decade of his life trying to disprove Quantum Field Theory - currently the most successful physical theory in history with absolute 100% agreement with every single experiment ever performed with an accuracy compared to measuring the width of the US with an error of a hairwidth. Godel tried to prove the "Continuum Hypothesis" which we know know is not provable. In between tilting at these windmills, Godel came up with one solution to General Relativity's equations.

2) We know for a fact that Godel's solution does not even remotely describe any part of our universe. We know - and have done for 50 years - that our universe is expanding in all directions. Godel's universe is static everywhere. Hence whilst Godel's solution maybe of theoretical interest it bears zero relevance to the real world. Hence it's neglect. Full Stop. No conspiracy.

3) We know for a fact that Yourgrau clearly hasn't the slightest clue about the subject on which he pontificates. Here are some howlers:

Whilst claiming it is "OK" not to be able to follow Godel's theorem, he make a completely wrong explanation of it that makes it clear HE doesn't follow it.

He makes some false historical claims - Church invented recursive functions not Godel.

He clearly doesn't understand the difference between acausal and non-causal. Acausal means there are no causes, non-causal means that a violation of causality. Godel's solution is acausal, not non-causal. We have in fact known for years that any solution to General Relativity cannot be non-causal.

So in the end this book is meant to be for people who admire the Emperor's wonderful new outfit. It is only good for people who will avoid like the plague anybody who has even a passing knowledge of this field, so unless you regularly only attend philosophy conferences I'd get a serious book on these topics written by someone with a clue.

If you buy it, then the sequel will be your fault.

José Luis says

Livro esotérico, destinado a um público bem restrito e que tenha conhecimento anterior (muito) em filosofia da ciência. Mesmo porque, apenas Einstein é conhecido pelos mais novos. Godel, aposto, raros ouviram falar dele. Dito isso, o livro é interessantíssimo e desafiador, pois examina a questão do tempo para nós, humanos. Tanto do ponto de vista filosófico quanto lógico, da ciência. É também um pouco biográfico, pois conta com detalhes a relação entre os dois filósofos-cientistas, a vida produtiva deles, seus maiores legados, e seu final em Princeton, no Instituto de Estudos Avançados, que gerou tanto legado para os fundamentos da matemática, da filosofia e da ciência. Enquanto o autor narra a vida na época, passa também pela ebulição científica ocorrida na Áustria, especialmente Viena, berço dos maiores filósofos da ciência da época, vindo até Karl Popper. O livro é uma viagem, tanto do ponto de vista cultural, quanto do ponto de vista filosófico. Sua leitura é um desafio, e mesmo eu já tendo sido exposto a tudo o que está nele desde a época do meu

doutorado, quando tivemos que entender profundamente o alcance do seu teorema da incompletude em sistemas formais. De quebra, entendendo também consistência de sistemas formais, são dois conceitos indissociáveis. Oportunidade para pensar muito no fato inconteste de que o ser humano ainda é muito pequeno e incapaz de entender e explicar o universo que nos cerca. E para ter mais certeza de que a filosofia é indispensável como suporte para a nossa própria vida. Recomendo a leitura, mas não se enganem, um livro de poucas páginas, mas de um conteúdo explosivo em conhecimento.

Jeremy says

This is a very interesting description of Godel's life with Einstein, together at the Institute for Advanced Study in Princeton, how they both got there, and their final years. This book is a little more about Godel than Einstein. I really liked how the writer was able to talk at length about the Vienna Circle and each thinker's place in it, how they dealt with WWII, how they interacted with each other and why, and the crux of each one's theories. You don't often get this kind of context, even in history books.

But I also liked how the book goes over the logical and philosophical theories and their ramifications. I really don't understand how other reviewers can call this book badly written. I'm very sensitive to bad writing, I often stop reading books because of it, and personally believe that no one cares about good writing anymore...and I thought this was well written.

So what didn't I like and why only four stars? The end of the book is devoted to illustrating why Godel's latter work, a foray into philosophy, was unappreciated and dismissed unfairly. Godel sought to show that Einstein's relativity determined that time is an illusion. Pretty cool concept. However, I don't think the writer does a good job showing why the criticism was unfair. He says eminent philosophers and professors said Godel's contribution to philosophy was nothing....but he doesn't elaborate on why. He doesn't give the other side's arguments. He just says that Godel was an outsider so therefore he was dismissed. It's possible, but as the reader I'd really like hear all the arguments and then come to my own conclusions.

80% of the book is really interesting about the history of these people's lives and their monumental theories. The last part is really interesting about the concept of time not existing. But the latter pages and pages of author opinion was really out of place and takes away from the book.

Alex says

This was an amusing and fairly light read. It aims to be a kind of popularization, presenting the intellectual and personal connections between Einstein and Godel. Its main substantive focus is Godel's argument for the conclusion that Einstein's physical theory implies a kind of idealism about time. Yourgrau aims at a rehabilitation of Godel's post-incompleteness intellectual labor. The substantive discussion is good -- though somewhat incomplete. (For a more strictly theoretical discussion consult Yourgrau's book *The Disappearance of Time* , which is likely to be a good read.)

More problematically, however, Yourgrau's efforts as a popularizer here involve some not very interesting biographical details. (Would you like to know the addresses at which Godel lived in Princeton, NJ? Look

here!) Of course, some of the biographical details are interesting. But, your mileage may vary with respect to biographical trivia. Yourgrau is clearly a more talented philosopher (and expositor of arguments and positions) than biographer. All-in-all, though, I would recommend this to anyone who'd like a low-impact review of (i) 20th century theory of time, (ii) positivism, and (iii) Godel's incompleteness results (and their historical context).

PS: It also has a Very Nice discussion of what might be called Frege's Functionalism and the connection between it and Phenomenology.

Isabelle says

Absolutely phenomenal look at Godel's influence on modern science and his response to Einstein's SR and GR (which contain his theories on SR and GR not allowing for an intuitive notion of flowing time). Amazing insight into the logical positivist movement and Godel's incompleteness theorem, which Yourgrau explains in succinctly (as succinct as it can possibly get) and clearly. Also is a wonderful look at both Godel and Einstein as men and their friendship. Highly recommend it to anyone who questions formal systems of math and science.
