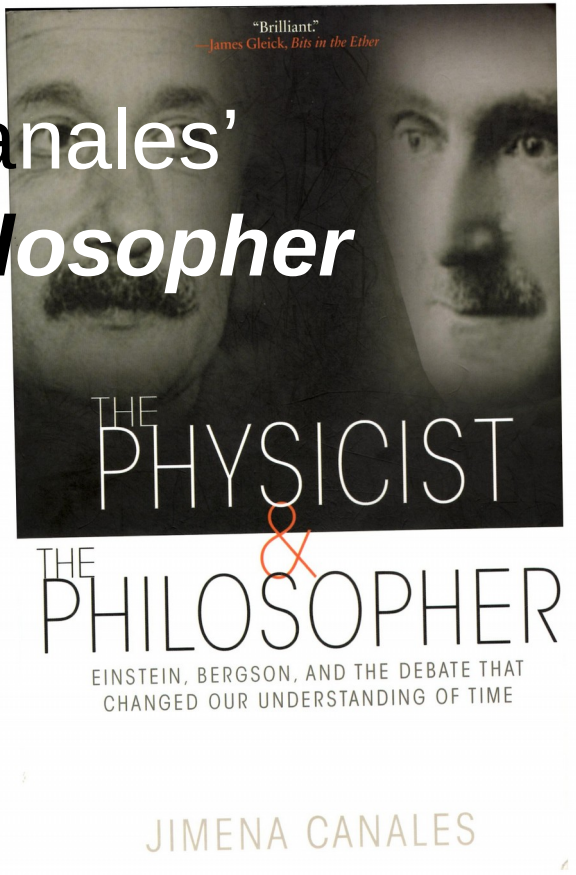
IT WAS ABOUT TIME

A book report of Jimena Canales'
The Physicist & the Philosopher

Episode 3: Finale



Leo Michelotti

January 18, 2019

Erratum

- Last time (December 7) I said that Edouard Le Roy had talked both Einstein and Bergson into their 1922 debate. According to page 131 in the book, Walther Rathenau was the one who finally convinced Einstein to accept the invitation and go to Paris.

- Rathenau was killed later that Summer.
  - “A band of men intent on assassinating prominent Jews shot him at close range and finished him off by throwing a hand grenade into his car. ... Einstein's work was [already] widely attacked, often because of blatant anti-Semitism. ... [After] his visit to Paris, [he and his supporters] would have to deal, in addition, with Bergson's objections and those of his numerous supporters.”

Opposition

- EINSTEIN
  - ***All physics invariant under Lorentz transformations.***
    - No preferred reference frame for any physical phenomenon.
  - Lorentz transformations are not “just” mathematics but express something real about the nature of space-time.
  - Simultaneity is not absolute. Temporal order of events outside each other’s light cones is ambiguous.
  - Time is what clocks measure! “Philosopher’s time” does not exist.
- BERGSON
  - Time is not space; they are not interchangeable.
  - Time is dynamic and irreversible, not static and reversible.
    - The elan vital, a “vital impulse” flowing through the universe
  - Time exists as ***duration***; there is no time "point."
  - Physical time of clocks is real but not complete. Philosopher’s Time exists too.

Opposition

THE BLOCK-UNIVERSE

– Consequence of the relativity of simultaneity
– Minkowski's space-time diagrams and world lines
– Following the logic and assuming that math models reality lead to the conclusion that past, present and future are all equally existent and "real."
– Our perception of the past being "gone" and the future being "not yet" is an illusion.
– This is what was meant by those who said that Einstein "killed time."

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Quantum theory: the other debate

- Seven Solvay Conferences on physics between 1911 and 1933, chaired by Hendrik Lorentz (Belgium), Paul Langevin (France), and others. ...+
- “During the [1927] Solvay Conference, Einstein started a notorious debate with ... Niels Bohr ... uttering his argument that God did not play dice with the universe.... From then on the Solvay Conferences 'took quite a dramatic turn' plagued by disputes pertaining to the relation between relativity and quantum mechanics....”
- “Defenders of Bohr and quantum mechanics increasingly turned to Bergson for support.” ...+

Quantum theory: the other debate

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Einstein and Poincaré met once: at the Solvay Conference in 1911. They discussed not relativity but thermodynamics and, presumably, its growing understanding in terms of statistical mechanics.

My bet: they talked mostly about entropy.

Poincaré died the next year from complications following prostate surgery.

Quantum theory: the other debate

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Quantum theory: the other debate

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“Some of those who followed these new debates saw in them, and in the triumph of quantum mechanics, the final vindication of Bergson's lifework.”

“Bergson's work, which had long been considered a philosophical defense of indeterminism, was seen to bear directly on Heisenberg's principle of indeterminacy. ... [It was argued that he] had offered 'a remarkable anticipation of the principle of indeterminacy,' beating Heisenberg by twenty years.”

Quantum theory: the other debate

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“In his work on X-rays, the physicist Maurice de Broglie showed that the rays seemed to behave both as waves and as particles. His famous brother, Louis, would repeatedly associate these new insights from physics with Bergson's philosophy. ... De Broglie downplayed the importance of relativity theory when compared to these new scientific developments. ... [He] found that the philosopher's [earlier] work 'consequently antedates by forty years the ideas of Niels Bohr and Werner Heisenberg on the physical interpretation of wave mechanics.' In his view ... Einstein's work simply extended classical conceptions of space and time...: '[R]elativity physics seemed to be in flagrant opposition to Bergson's views, ... [and] is the *final development of classical physics*.' ” [emphasis mine]

Quantum theory: the other debate

- “Einstein was unable to attend the Solvay Conference of 1933. ... [The] tone of their discussions appeared increasingly unfit for scientists.... Bohr explained the urgency of having additional international scientific meetings so that participants would not leave with a negative impression of science. He had in mind Einstein's remarks about what God would or would not do: 'Utterances of this kind would naturally in many minds evoke the impression of an underlying mysticism foreign to the spirit of science.' ... Despite his best efforts, the International Congress for the Unity of Science (1936) was yet another display of disunity.”
- “The Einstein-Bergson debate was now entangled with the larger problem of how relativity could be reconciled with quantum mechanics.”

Structure and content

- Part One: The Debate (three chapters)
  - Starts from the 1922 meeting featuring Einstein and Bergson and proceeds to preliminary introductions of material to follow.
- Part Two: The Men (sixteen chapters)
  - Most of the major players in the subsequent discussions, with their repercussions for science and philosophy.
- Part Three: The Things (eight chapters)
  - Inventions, discoveries, and technologies that influenced the arguments: e.g. clocks, telecommunication, movies, recordings, trains, planes and automobiles, and atoms.
- Part Four: The Words (two chapters)
  - A few final (recorded) thoughts of Einstein and Bergson about each other and the argument they initiated.

Part Three: The Things

- Chapter titles:
  - Things
  - Clocks and Wristwatches
  - Telegraph, Telephone and Radio
  - Atoms and Molecules
  - Einstein’s Films: Reversible
  - Bergson’s Movies: Out of Control
  - Microbes and Ghosts
  - One New Point: Recording Devices
- This part is about the people behind “the things” and how “the things” affected the debaters.

Part Three: The Things

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“Einstein and Bergson played key roles in bequeathing us a world split by two irreconcilable theses, yet they themselves were led in particular directions by a variety of elements that surrounded them.... [They] disagreed about the meaning, use, and importance of all of these things.”

“[S]eemingly unimportant things played a prominent role in the unraveling of the larger conflict. Einstein and Bergson recede into the background.... They no doubt made history, but they did not make it as they pleased.”

Part Three: The Things

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“Einstein and Bergson held an extremely low opinion of technology – especially when compared to science. ... ‘What comes to the mind of a sensible person when hearing the word technology?’ asked Einstein. 'Avarice, exploitation, social divisions..., class hatred,' he responded. ... Bergson was similarly pessimistic. ... '[For] a long time it was taken for granted that industrialism and mechanization would bring happiness to mankind. ... Today one is ready to lay to their door all the ills from which we suffer.' ... In their view, technology was separate and inferior to science.”

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Microbes and Ghosts

Arguments about the boundary between real and fictitious experiments.

"[Scientists] and philosophers that evening [April 6, 1922] debated about who should draw the distinction [between what was real, what was conceptual, and what was fictional] and how. ... Would physicists be the ultimate arbiters about what was realistic and what was fantastical in our world?"

Does the nature of time depend on living beings' perception of time? Their size? Their brain function? Their dimensionality? Were these considerations less meaningful than Einstein's thought experiments?

Part Three: The Things

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Microbes and Ghosts

"[Bergson] accused Einstein and his followers of introducing into science fictional, fantastical scenarios and portraying them, uncritically, as real." "The objection that Einstein's definition of simultaneity assumed a human-sized observer was frequently brought up. ... 'Physical propagation velocities have nothing to do with the character of our sensory organs,' he retorted.…"

" 'Only ghosts,' Einstein argued, can hear the sounds of 'an eternally uniformly occuring tick-tock. … Ask an intelligent man who is not a scholar' what time is, Einstein continued, and you will see that he takes time to be this ghostly 'tick-tock.' The physicist quickly chased away these ghosts. 'There is no audible tick-tock everywhere in the world that could be considered as time,' he concluded."

Film (aka movies)

- “Einstein and Bergson were situated in radically different places with respect to the visual culture of their time. Their use and experience with images … drew them farther and farther apart…. [C]ertain kinds of films furnished clear evidence in favor of one man, but other kinds … proved exactly the contrary.
- Einstein complained of films that showed distant events as occurring simultaneously.

Film (aka movies)

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Bertrand Russell imagined “a film camera operating with an infinite number of frames. 'A cinematograph in which there are an infinite number of [frames], and in which there is never a next [frame] because an infinite number come between any two will perfectly represent continuous motion.' ... Russell 'suggested' that ‘the cinema is a better metaphysician than common sense, physics, or philosophy.’ ... For Russell there were not 'real' entities to contrast against those 'on screen' --- both were constituted in similar ways.”

Film (aka movies)

- “[To Bergson, cinematography] was a pervasive, constraining, and infirm approach used to pass off illusory movement as if it was real. ... The passing of time, he insisted, involved the creation of the new and the unforeseeable. Time was uncontainable. Every instant [sic] bit into the future.”
- “Einstein explained ... why the subjective feeling of time flowing was just an illusion by asking him to consider playing a movie of Brownian particles in reverse. ... 'The shrewdest man in the world would not be able to find the arrow of time from that material.’ ”
- “From Brownian motion to a movie of diver [sic] jumping into the water to the same image in reverse, cinematography was much more than an applied technique of representation. It played a central role in a world divided into two irreconcilable theories of time.”
- “Increasingly, scientists felt the need to consider entropy in terms of the transfer of information in addition to energy.”

Film (aka movies)

- Nobel laureate Alexis Carrel and Pierre Lecomte du Nouy “developed the concept of biological time in the interwar years and considered it a vindication of Bergson's work. ... 'Cinematographic films of cell cultures have revealed totally unknown and unforeseen facts....' ... 'Everything occurs as if sidereal time flowed four times faster for a man of fifty than for a child of ten.' ”
- Quoting Du Nouy: “ 'Bergson ... disengaged very clearly the necessary but vague notion of physical time from the more precise notion of duration.' ... 'All that we can say at present is that our crude language, lacking appropriate words, translates this knowledge into improper, inadequate expressions such as: "There are two species of time," or "Physiological time does not flow uniformly like physical time." ' ”

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Nobel Prize: Albert Einstein

- Received in 1922 “for his services to Theoretical Physics, and especially for his discovery of the law of the photoelectric effect.”
- From presentation: “There is probably no physicist living today whose name has become so widely known as that of Albert Einstein. Most discussion centers on his theory of relativity. ***This pertains essentially to epistemology*** and has therefore been the subject of lively debate in philosophical circles. It will be no secret that ***the famous philosopher Bergson in Paris has challenged this theory, while other philosophers have acclaimed it*** wholeheartedly. The theory in question also has astrophysical implications which are being rigorously examined at the present time.”
- Proceeds to talk of Brownian motion, photo-luminescence, and the photoelectric effect.

Part Four::The Words: Einstein

- In his final years, Einstein reflected back on his greatest discoveries. He wrote in 1953,
  - "[The] special theory of relativity ... was ripe for discovery in 1905. Lorentz had already recognized that the transformations named after him are essential for the analysis of Maxwell's equations, and Poincaré deepened this insight still further. ... [But] my work of 1905 was independent. ... The new feature of it was the realization of the fact that ***the bearing of the Lorentz transformation transcended its connection with Maxwell's equations and was concerned with the nature of space and time in general.*** ... *'Lorentz invariance' is a general condition for any physical theory.*"

Part Four::The Words: Einstein

- Northrop explained to Einstein Whitehead explaining Bergson: "All the paradoxes of relativity ... consisted in maintaining a strict difference between the local and the distant. ... [Einstein replied] 'Oh! Is that what he [Bergson] means? ... That would be wonderful! So many problems would be solved were it true!' But on second thought 'after a moment's silent reflections,' he remained unconvinced: 'Unfortunately, it is a fairy tale. Our world is not as simple as that.' "

Part Four::The Words: Einstein

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"Once Einstein said that … the experience of the Now means something special for man, something essentially different from the past and the future, but that this important difference does not and cannot occur within physics. That this experience cannot be grasped by science seemed to him a matter of painful but inevitable resignation. ... I remarked that all that occurs objectively can be described in science, on the one hand the temporal sequence of events is described in physics; and, on the other hand, the peculiarities of man's experiences with respect to time, including his different attitude towards past, present, and future, can be described and (in principle) explained in psychology."

- from *Intellectual Autobiography,* by Rudolf Carnap as quoted in *Time Reborn* by Lee Smolin

Part Four::The Words: Einstein

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"[In 1954, Einstein] realized that his [current] views did not agree with the extreme proposition that all science should be exclusively based on direct sense impressions or data from some machinery facilitating the sense impressions. He gave the example of the system of natural numbers…. The mathematician Peano based the natural number system on axioms and derived … theorems that certainly cannot be obtained from raw sensory material. Thus, Einstein concluded that in order to do science we need to use elements other than the raw sensory material. … Einstein thus justified his use of space-time as an additional element of reality also philosophically, by saying in essence that we need to go beyond raw sense impressions if we wish to scientifically understand the world and the universe."

- from *Einstein was Right!* by Karl Hess

Part Four::The Words: Einstein

- Final correspondence with “old friend” Michele Besso.
  - Worked together in patent office during youth.
  - Corresponded throughout Einstein’s life. ...+
  - Attempted to “explain” Bergson to Einstein.
  - Died within two months of each other (Besso first) in 1955.

Part Four::The Words: Einstein

Edouard Guillaume: Einstein's other "old friend"

- also from patent office days.
- in opposition to Einstein, championed reality of "universal time," the "unique time" physicists had always believed in and used
- mutual affinity with Bergson, with differences (e.g. "duration")
- participated in debate with Einstein on April 5, 1922, one day before Einstein's confrontation with Bergson
  – left abruptly after "imperious interruption launched by someone in the audience."
- for the rest of his life, argued in correspondence with Einstein.
  – at some period, only through an intermediary: Marcel Grossman.
- Einstein eventually lost patience and disengaged.
- partial reconciliation; final direct correspondence c.1948.

Part Four::The Words: Einstein

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Part Four::The Words: Einstein

- Final correspondence with “old friend” Michele

"[Besso suggested,] 'Bergson's desire [was] to turn subjective time into something objective.' … [Einstein countered] The 'forced passage of time presents itself to us in an imperative fashion.' But this sense of time passing by was due to a subjective 'baggage of consciousness,' which scientists could correct for."

"[Einstein noted] that the difference between how we experienced the past, present, and future was due to our limited, subjective perspective. 'This is was [sic] what bothered Bergson the most. ... 'You [Besso] cannot get used to the idea that subjective time with its own "now" should not have any objective meaning. … For us, physicists of faith, the separation between past, present and future holds nothing more than the value of an illusion....' For Einstein, their youth (and old age), their births (and deaths) were simply ... slices of time that ... had always been there.... The sequence of events which they had experience [sic] was an effect arising from their own limitations ... that could be overcome when they thought and acted as physicists 'of faith.' "

Nobel Prize: Henri Bergson

- Nobel Prize in Literature 1927, announced in November, 1928, “in recognition of his rich and vitalizing ideas and the brilliant skill with which they have been presented.”
- From presentation: “[In his book Creative Evolution], Henri Bergson has declared that the most lasting and most fruitful of all philosophical systems are those which originate in intuition. ... [T]ime is conceived not as something abstract or formal but as a reality, ***indissolubly connected with life and the human self. He gives it the name "duration," a concept that can be interpreted as "living time," by analogy with the life force.*** ... What we usually call time, the time which is measured by the movement of a clock or the revolutions of the sun, is something quite different. It is only a form created by and for the mind and action. ... Bergson concludes that it is nothing but an application of the form of space. Mathematical precision, certitude, and limitation prevail in its domain; cause is distinguished from effect and ***hence rises that edifice, a creation of the mind, whose intelligence has encircled the world, raising a wall around the most intimate aspirations of our minds toward freedom.***”

Part Four::The Words: Bergson

- 1934: Last presentation of his argument made in a long footnote in his final book, *La Pensee et le mouvant*.
- Bergson wrote: “ ‘With regard to Time attached to Space, to a fourth dimension of Space-Time, it has no existence...other than on paper.’ For the very last time he argued that time could never be measured completely and that reality should not be confused with measurement. … Time on paper...was not time itself.”

Part Four::The Words: Bergson

- 1937: Last writings about Albert Einstein himself in a letter sent to the Descartes Congress.
  - Described Einstein as brilliant, savvy and ambitious, “a man who had ‘practiced *grand tourism*, first as a soldier [for science] and then for his own pleasure...’ ”
  - “It provided an image of Einstein that differed markedly from the one the physicist promoted of himself.”
  - Written in great pain from arthritic rheumatism.
- “[[In 1933]], Einstein described scientists as pure, isolated thinkers. … [But] Einstein was hardly isolated.”
  - “The … address vaunting the virtues of a lonely scientific existence was delivered at the Royal Albert Hall in front of some 10,000 people and recorded so that it could be used as a soundtrack for a newsreel.”

Part Four::The Words: Bergson

- One paragraph on Bergson's death:

  "Bergson's health declined sharply. Living conditions in Paris worsened rapidly. … [T]he philosopher did not use his fame or reputation to obtain special privileges…, refusing to ask Vichy officials for special treatment. Renouncing all privileges, he decided to wait his turn in line in the street in inclement December weather and register with other French Jews. … [H]e wore a simple robe over his pajamas. His feet were covered only with slippers. He died in early January 1941…. He was eighty-one years old. 'When they came to get the coffin,' recounted the poet Paul Valery, 'we said our last goodbye to the greatest philosopher of our time.' "

And in closing ...

- Do I recommend the book?
  - Yes! A window into a fascinating, important, yet all but forgotten part of the history of physics. Scholarly research written as an asynchronous, non-sequential narrative.
- Final sentences:
  - *“What happens if we … no longer accept the binary terms associated with Einstein and Bergson as self-evident and inevitable? … Instead of simply siding with one over the other, we can consider our universe filled with clocks, equations, and science as much as with dreams, memories, and laughter.”*
    - *This seems like a splendid ending, but I dislike it a little for a few reasons, which I will now explain ...*

And in closing ...

- Do I recommend the book?
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  - *"What happens if we … no longer accept the binary terms associated with Einstein and Bergson as self-evident and inevitable? … Instead of simply siding with one over the other, we can consider our universe filled with clocks, equations, and science as much as with dreams, memories, and laughter."*
    - *This seems like a splendid ending, but I dislike it a little for a few reasons, which I will now explain ...*

(a) This is just a matter of taste, but it sounds too "cheerful" or "optimistic." For balance, we could add "nightmares, regrets and agonized screams" to "dreams, memories, and laughter" without altering its meaning.

And in closing ...

- Do I recommend the book?
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(b) There seems to be the hint of a suggestion here that both positions can be considered "true." While every physical theory has had limits to its validity, those of relativity – if and when they are ever found – will be established within physics. (Challengers, such as Brans-Dicke theory, have been proposed in the past.) Meanwhile, to use binary terms, simultaneity either can or cannot be given an absolute meaning; there either is or is not more to time than what is expressed in general relativity; and it *fundamentally* is either reversible or irreversible. Not both.

And in closing ...

- Do I recommend the book?
  - Y… …ll but fo… …research w… …tive.
- Fina…
  - *"W… as… in… …ther, we ca… …d science as…*
    - … *for a few*

(c) Dreams, memories and maybe even laughter are not excluded from the domain of "clocks, equations and science." Pleasure resides in appreciating the elegance (and beauty?) of the Weinberg-Salam-Glashow model, or Pais and Gell-Mann's resolution of the "tau-theta" puzzle, or C.-S. Wu's experiment on parity violation, or the principle of least action, or the laser. And we simpler mortals can only imagine the moment of joy that must have been experienced by those who either discovered or devised these things.

And in closing ...

- Do I recommend the book?
  - Y… but fo… search w… e.
- Fina…
  - *"W… as… in… r, we can consider our universe filled with clocks, equations, and science as much as with dreams, memories, and laughter."*
    - *This seems like a splendid ending, but I dislike it a little for a few reasons, which I will now explain ...*

Favorite sentence:

"Has time ever advanced clockwise?"

Brilliant word play in a short question that encapsulates the argument.

And in closing ...

- Did Bergson have any valid points?
  - “Valid” here means interpretable and perhaps worth considering by physicists .
  - Possibly, yes, I think so, one or two, maybe …
    - There is no time “point”; time exists as duration.
    - Our experience of time is ***not*** just illusion, and relativity’s block-universe does not take it into account.
    - Some physicists are rethinking time: e.g. Lee Smolin and his ~~conspirators~~ collaborators, and Roger Penrose.
  - On the other hand, based only on what is in Canales’ book – never having read his writings – he was (IMHO) wrong about other things.
    - esp. associating time with an “*elan vital”*

And in closing ...

“That’s all I have to say about that.”

– Forrest Gump