General Book Notes

Einstein, His Life and Universe (Walter Isaacson)

The Light Beam Rider

- Einstein was not a standalone genuis. He was nurtured by the prevailing contrarian attitude of his time, with Joyce, Picasso, Stravinsky, Freud being the other greats of his time.
- It's interesting to think about what makes great people go down in history. No doubt, the fact that Einstein was eclectic, irreverent and free-spirited helped him look, outwardly, to be a genius who was also beautifully human—much like Steve Jobs. It may be in your interest to be eccentric if optimizing for going down in history—you're simply more memorable that way.

His Childhood

- Raised by scientist parents, a city of mathematicians, with a genetic contempt for authority. He would be very good at not just wondering deeply about simple things, but actually reconciling and finding unifying answers to those puzzling questions.
- His childhood circumstances sent ripples through his future. He was treated as an outsider growing up because of his religion, which made him come closer to Judaism than ever before. His parents nurtured his strong math skills by get him textbooks and tutors.
- Einstein had no clear cultural and religious identity. He termed himself a citizen of the world, and dropped out of high school at 16 to self-study before university. He left Germany to go to Italy then Switzerland, renouncing his citizenship having always felt like an outsider. He was bewitched by Italian wit, elegance and beauty—both in culture, upbringing and education—contrasted with the mechanized way Germans thought.

The Polytechnic

- Einstein was taught by, and in intimate contact with, legends of modern science—his lecturers and personal friends include Weber, Siemens, Minkowski, and more. He also collaborated with Riemann, Bohr, Heisenberg, and more. Greatness is often very concentrated in small pockets of society—constantly ask yourself where the people that will be remembered most by history are right now, and how you can work with them.
- Einstein is a real-life Kvothe. An outsider of ill-birth, prodigious at two things (math, music), contempt for authority, sharp wit and sarcasm along with striking looks that make him a womanizer, yet somehow spends lots of time alone, thinking, and has a quietly antisocial streak.

The Lovers

- He really struggled to get a job for years, resorting to tutoring. If he had sold his soul to engineering, he'd have been good, but not legendary. And he easily could have—one extra push here, or pull there, and he'd have become an engineer out of necessity. Small decisions can have important impacts on your life.
- He applied for, and was rejected from, an academic post with almost every physicist in Europe. His job as a patent attorney gave him 1) the close friend group that inspired his philosophy of physics 2) a job that encouraged him to find flaws in the reasoning of people that apply for patents 3) a job that meant he could go deep on certain topics, without being pressured to publish or conform in any way.
- He was an asshole in his personal life. He had multiple affairs, neglected his first child, left his wife feeling lonely, and more. This is not remembered in the annals of history, however.

The Miracle Year

- Einstein was a master at reading across topics (thermodynamics, relativity, quantum theory) and synthesizing insights he had from reading papers by different authors and meshing them into something new and interesting. This is where much of his success in thermo/atomic physics came from—just blending an approach one guy took in thermo to a problem someone else was having in stat mech.

Special Relativity

- Relativity came about because of a deep, intuitive discomfort Einstein had in reconciling Galilian relativity with Maxwell's equations. The equations derived the speed of light, but did not specify *relative to what*. While the rest of the world assumed that meant "the ether", Einstein threw away traditional beliefs and set the invariance of light as a postulate for a new theory for how the speed of light and relativity can be reconciled.
- "Intuition is merely the outcome of earlier intellectual experience"
- It's important to understand how much harder it is to come up with a new theory than to learn it. Einstein had to adventure down misleading dead-ends, spend years in fruitless thought, before he could get the crucial insight while talking to Besso.
- Because humans are so good at internalizing examples, his ability to weave confusing edge cases then reconcile how they worked gave him a very, very deep understanding of topics.
- Philosophy was important insofar as informing his view for how the world *should* be and how you should approach/*think about* physical problems—for example, disregarding anything that cannot be experienced by the senses was a Humian way of thinking, but that's what caused him to feel uncomfortable with the idea of absolute space and time.

The Happiest Thought

- Einstein had a bunch of close friends who were physicists interested in philosophy, and so spent much of his time drinking coffee while discussing physics and philosophy, playing the violin, sailing and reflecting on physics. A life of true scholarship and beauty.
- Einstein was characteristically bothered by analogous phenomena that are not explained by a general, unifying theory—conductors and coils' relative motion during SR, gravity and falling in an elevator.
- The equivalence principle states how flying in an accelerating rocket ship and being confined to earth in an identical gravitational field cannot be distinguished by the person involved, and therefore should, intuitively, be explained by the same underlying physical phenomenon. He wanted to generalize special relativity to reconcile invariance of the speed of light with accelerating reference frames, and this thought started him on his way.

The Wandering Professor

- The Solvay conference was organized by a chemist of the same name to figure out the "quantum problem". It brought together over 10 Nobel laureates into the same room to hash ideas out. He really was surrounded by some of the smartest people in history.
- He had a rough, nomadic personal life, having an affair on his wife with his cousin, having his first marriage break down into a business affair then divorce, crying over losing his children, and moving between Germany, the Czech Republic, Austria several times for different academic posts. He escaped emotional turmoil by turning to science.

General Relativity

- The holes in SR included that the speed of light as a speed limit contradicted Newton's formulation of instant gravitational affect, and it applied to constant-velocity frames of reference. The equivalence principle was importance because it hinted that when he reconciled one of those inconsistencies, the other would fix itself. One first leap was realizing that the equivalence principle implied that strong gravitational fields curved light because light entering one side of an accelerating space ship would leave at a lower point because of the intermediate motion of the ship, giving it a curved path.
- This curving of light reminded him of the shortest path through a curved surface, hinting that his theory may need non-Euclidean geometry, so he turned to Grossman, a childhood friend, who taught him Riemannian geometry.
- He approached developing the theory from both a purely mathematically formal, and physically intuitive perspective, with the latter initially leading him astray, and the formal eventually causing him to succeed, after a race with David Hilbert, which led to the most intense, scientifically creative and productive 4 weeks of his life, at age 36.
- He did all this despite the overwhelming anti-Semitism of his time, which caused World War I and made all other German scientists become used in the pro-war effort, like Planck and Haber, his personal friends.

- He cried and mourned the fact that “his children were being turned against him” by his wife and that he didn’t get to see or mentor them as they grew up into young men.

The Divorce

- Einstein was an asshole to his “first family” and used his second wife (whose daughter he considered marrying) as an instrument of logistical convenience. Not a loving, considerate, generous or deeply kind person at all—not that history will remember that.
- This man lived, ate, breathed physics, for decades on end. Part of the reason he could contribute so much was because he “worked” so damn much. Literally almost all of every day from late teens to old age was spent reflecting, brooding, intensely grappling with questions of physics, whether that’s while having coffee with physicist friends, going on hikes, sailing, or even eating meals with his family.

Einstein’s Universe

- GR has profound implications for, and indeed birthed, cosmology, since we now had the mathematical basis for studying the nature of space and time, in extreme conditions. It predicted black holes, and was verified by Eddington’s eclipse experiment testing the bending of light. While Einstein was well known in European scientific circles before this, afterwards he became an international celebrity by overthrowing Newton.

Fame

- The reason for his huge success was a combination of his genius, his showmanship, the circumstance in which he succeeded (end of a World War, where everyone wanted good news bringing people together).
- His physics changed the world’s intellectual atmosphere, sparking relativism and the populations’ philosophy at large, since many people misunderstood what he said. His contributions coincided with the magnum opuses of James Joyce, Stravinsky, Freud, and other intellectual giants of the time, all of whom he came to know and meet due to his fame.

The Wandering Zionist

- In the midst of rising anti-semitism in Germany after WWI, some tried to assimilate, but Einstein was pushed into vocal Zionism, feeling like a Jew, through and through, when shunned as an outsider because of his heritage. Part of his celebrity in the US came from the strong Jewish community who clamored over the opportunity to meet him, almost as if they were Catholics about to meet the Pope, not entirely from his science.

The Nobel Laureate

- Einstein had a very powerful ability to concentrate deeply, even in chaotic situations.
- The Nobel was for the photoelectric effect because relativity, at the time, was seen as more philosophical than physical, and the committee was comprised of experimentalists.
- Philosophy is important to theoreticians because it determines the beliefs they have about what physical theories are correct and complete, as well as how they approach problems. Einstein reading Mach and Hume made him want to do away with absolute space and time, since they couldn’t be physically observed.

Unified Field Theories

- Einstein hated QM because it didn’t mesh with his deterministic, local, realist philosophies of how God would have constructed the universe, and spent his whole life trying to poke holes in it and pursue unification in other ways, making no significant headway.
- Einstein’s physics lost intuition as he got older, and became a lot more about the mathematical formalism that led him to complete GR.

Turning Fifty

- Throughout his life, indeed continuing until he was older than 60, he was a playboy. Despite being in marriages, he would have “companions”—ranging from secretaries to daughters of women he knew. His wives always suspected, but accepted it as part and parcel of being with a famous genius.
- As he aged, his mission became just as much about activism, political advocacy and philosophy as it did about physics. Part of the reason he was so famous was because he had strong opinions on politics and war that he voiced, making him relatable to millions.

- He strongly advocated pacifism and refusal of military service. If even 2% of the public refuse to conscript, they can't jail them all, and wars will cease to exist. This opinion of his changed when Hitler came to power, where he acknowledged the European need to re-arm, and his opinion on Machian philosophy also changed over time. He was good at adapting his opinions in the face of new evidence.

Einstein's God

- Einstein was critical of atheists' unfounded arrogance, and believed in Spinoza's God—terming the sense of wonder and awe he had about the elegance and complexity of the universe as "religious", but not believing in any supernatural being concerned with mankind.
- He was a determinist, who didn't believe in free will. "Man can do as he wills, but not as he wills he wills", he said.

The Refugee

- Einstein thought that Americans were materialistic and lacked depth of thought, but lauded their freedom of expression and individuality, and cherished the revolutionary thinkers who called the country home.
- As the Nazis came to power, Einstein fled, holding visiting professorships at Caltech, Princeton, and Oxford, before settling down at IAS.

America

- He lived unpretentiously, enjoying the quiet of sailing, and entertaining everyone from little girls struggling with math homework to Nobel laureates in his Princeton home. He genuinely didn't need much in life.
- The US took advantage of an intellectual arbitrage opportunity. When Germany shunned the best scientists in the world because of their Jewish nature, American welcomed them (and indeed actively recruited them), working well to their war advantage when Einstein, amongst others, helped build the atom (fission) bomb. Perhaps diversity in tech is a similar arbitrage opportunity?

Entanglement, The Bomb

- Einstein launched the atomic bomb project when Szilard showed him it was possible, worrying that the Germans had moved in that direction already. Funnily, the FBI didn't let him take part because enemies he had made earlier had incorrectly suggested he was a Commie, and the government didn't want to take any risks. He lamented his decision to help launch the project when the bombs were dropped on Japan.

One World

- He strongly advocated for one central, armed and authoritative, world government, perhaps informed by his nomadic lifestyle making him think of himself as an internationalist. Like the LoN, but with much more power than it actually has, and in a position above countries and in a position that has authoritative rather than advisory power.
- The Civil War is a nice structural analogy to how difficult it is to integrate geographically and culturally disparate states under the United States, but equally, the dangers of not doing so and the proof that it is possible at all.

Landmark

- Einstein was mainly an individual contributor, not a leader, a landmark, but not a beacon.
- The triplet queen intellectual achievements of the 20th century were all German—Einstein's relativity, Heisenberg's uncertainty, and Gödel's incompleteness, each intensely mathematical, but also deeply philosophical about what they told us about the universe. The first told us that time and distances are relative, the second that there is no underlying reality until we measure it, the third that there is a lot we will never be able to know about the universe.
- Gödel was a close friend of Einstein. The ability to become close to intensely introverted logicians and also be a womanizer is rare, and it has to do with being able to be generous with your time/attention, and understand what people have to give the world.

- Einstein took on a moral duty to “wastefully” spend time searching for a grand unified theory, as well as making controversial political statements, because a younger, less-established scientists wasn’t afforded this luxury, and so Einstein took it upon himself.
- In short, Einstein was generous, gentle, and charismatic to all those around him, but still silently distant, and would wall off people who tried to get too close, constrict him, or cause him emotional pain, like Mileva and even his own son, Eduard.

Red Scare

- In the midst of the cold war, he took objectively moderate stands calling out for the preservation of intellectual liberty, which made him unpopular amongst the public. He was worried American hatred towards people with socialist bents would remember 1932 Germany where there was a witch-hunt for the Jews.

The End

- Einstein was wholly devoted to both his physics and his lovers quite literally, until his last days. He was seeing women at the age of 76 (he was with Konenkova, a USSR spy, after Elsa’s death), and scribbling equations when on his deathbed. He chose and modified his philosophical principles very thoughtfully and rigorously, and then stuck to them stubbornly. He chose not to get an operation that would extend his life because “it is tasteless to prolong life artificially. My time has come, and I will go elegantly”.
- Even in the end, days would be marked by, alongside his mathematical assistant, pursuing certain avenues of theory, hitting a dead end, modifying the approach, trying another approach, hitting a dead end, and repeating.
- He describes how at the end of life, you start to feel less immersed with day-to-day happenings, and at once more reflective about what has been, and are “one” with the universe, where you get a little perspective on the beauty of life, more generally.

Einstein’s Brain and Mind

- We extracted and kept his brain for study, but nothing useful came of it as the doctor distributed extracts poorly, stored it poorly so DNA couldn’t be extracted, and we had no points of comparison age-wise or genius-wise, and also couldn’t tell which parts of the brain were important in cause or effect of his genius.
- In the end, his brilliance came not just from his biological advantage, but from his ability to recognize the wonder all around us, and to relentlessly persist at grappling with problems until he understood it. Most of us walk around everything hiding behind abstractions, knowing that ideas break down if you push them too hard, whereas he wanted to figure out why, and what the real truth was, abstractions aside. In short, curiosity, nonconformity, and humility were the cornerstones of his intellectual approach. Poincare and Lorentz came close to SR before him, and Hilbert with GR, but none of them had the audacity to overthrow Newtonian physics easily like Einstein.