

How the influence of Einstein messed up Quantum mechanics so that it becomes as messed up as Special Relativity

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There was philosophic influence that spilled over from Einstein's relativity into the formation of Quantum mechanics.

Heisenberg inspired by his reading of Einstein's relativity, so based QM on the same mess as SR, i.e. of messing up what observers are observing. My comments highlighted by arrow ->

As Gerald Holton points out about Heisenberg[1]: "In his Gymnasium days, he read and loved Einstein's newly-published popular book on special and general relativity. He would have been not quite eighteen when he heard of the sensational November 1919 eclipse expedition results. At the University of Munich, where he studied under the guidance of Arnold Sommerfeld, he attended Sommerfeld's lectures on relativity. Heisenberg was also captivated by Herman Weyl's book, Raum-Zeit-Materie. To top it off, one of his closest friends in Munich was Wolfgang Pauli, who, while still a fellow student, was writing his Handbuch monograph on relativity theory. When Heisenberg moved to the University at Göttingen, he got more relativity theory from Max Born. In short, it came to him from all sides. Although Pauli wisely warned him to devote his future research to quantum physics instead of relativity, there was no way that Heisenberg could escape being fascinated by Einstein's work."

- ➔ So, Heisenberg was deeply influenced by Einstein's relativity, when at Gymnasium (i.e. High School). Heisenberg entered the Maximilians-Gymnasium in Munich in September 1911. He graduated at the top of his class nine years later and entered the University of Munich that same year, 1920. [2]
- ➔ According to Holton the main understanding of relativity that Heisenberg got was from his friend [1]:

Holton continues -> "Heisenberg was especially struck by a remark from his friend Otto Laporte, recalling it later as follows: We ought only to use such words and concepts as can be directly related to sense perception. . . . Such concepts can be understood without extensive explanation. It is precisely this return to what is observable that is Einstein's great merit. In his relativity theory, he quite rightly started with the commonplace statement that time is what you read on a clock. If you would keep to such commonplace meaning of words, you will have no difficulties with relativity theory. As soon as a theory allows us to predict correctly the result of observations, it gives us all the

understanding we need. This “instrumentalist” or “operational” view of Einstein’s method was quite common at that time, and for decades afterwards. As we shall see below, Laporte’s long remembered praise of it laid the groundwork for one of Heisenberg’s key insights many years later.”

- ➔ “instrumentalist” or “operational” philosophy -> the problem with that is -> the claim “time is what you read on a clock” is false -> “time” is not “clock readings” -> “clock readings” can record “time” but “time” is an abstract idea, so clocks showing what is called time dilation -> that’s not really an effect on “time” that is instead an effect on the “clocks” -> i.e. what is commonly called “time dilation” is better called “clock dilation” -> calling it “time dilation” has messed up the meaning of “time” with “clock”. But having messed up that the instrumentalist/operational philosophy is going to be used to mess up more in physics.

Holton -> “On 25 September 1925, Heisenberg published in Zeitschrift für Physik his brilliant breakthrough to quantum mechanics, “On the Quantum Theoretical Reinterpretation of Kinematic and Mechanical Relations.” From the beginning, the abstract of the paper announced Heisenberg’s fundamental guiding principle: “This work is an attempt to find foundations for a quantum-theoretical mechanics which is based exclusively on relations between quantities that are in principle measurable.” The paper restricted itself to the observable properties of a spectrum, eschewing models built on unobservables such as the position and periods of electrons in the atom. Heisenberg later observed that his crucial insight was an echo from the days when he had been struggling with relativity theory at the University in Munich. In his work leading up to that 1925 paper, he remembered “the philosophy presented as Einstein’s viewpoint by our friend Otto during our bicycle tour, to regard only the observable magnitudes as the indication of atomic phenomena.””

- ➔ So, based on the instrumentalist/operational philosophy that Heisenberg thinks he sees Einstein’s relativity based on. (I think Heisenberg was going by Einstein 1905 philosophy which he formed special relativity upon, because Einstein appears to change philosophy for general relativity.) Because Einstein doesn’t approve ->

Holton -> “But if Heisenberg had any illusion that his article would be approved by Einstein, he was wrong. One of Heisenberg’s five surviving letters in the Einstein archive, dated November 30, 1925, is evidently a reply to a note from Einstein (now lost) that had contained many objections. In his response, Heisenberg tried to hold out the hope of an eventual peaceful bridging between Einstein’s theory of light quanta and what he called “our quantum mechanics.” Heisenberg also drew prominent attention to his having used only “observable magnitudes” in his theory. All to no avail.”

- ➔ So, Einstein does his 1905 paper on Photoelectric effect which is seen as forming part of the basis of Quantum mechanics, but then Einstein doesn’t like the direction Quantum mechanics is taken in by Heisenberg.

Holton -> “The following year, 1926, is one of high drama in this growing but troubled relationship. In April, Heisenberg gave a two-hour lecture on his matrix mechanics in von Laue’s famous physics colloquium at the University of Berlin.”

- ➔ Matrix mechanics was Quantum mechanics using matrices.

Holton -> “ In the audience, with a whole group of potentates, was Einstein. It was their second meeting. Einstein, interested and no doubt disturbed by the lecture, asked Heisenberg to walk home

with him (there is that walk again) and thus ensued a remarkable discussion, which Heisenberg first reported in print in 1969. In the discussion with Einstein, Heisenberg once more tried to draw attention to his having dealt not with unobservable electron orbits inside atoms, but rather with observable radiation. He said to Einstein: "Since it is acceptable to allow into a theory only directly observable magnitudes, I thought it more natural to restrict myself to these, bringing them in, as it were, as representatives of electron orbits." Einstein responded, "But you don't seriously believe that only observable magnitudes must go into a physical theory?" Heisenberg goes on, "In astonishment, I said, 'I thought that it was exactly you who had made this thought the foundation of your relativity theory. . . .' Einstein replied, 'Perhaps I used this sort of philosophy; but it is nevertheless nonsense.'" And then came Einstein's famous sentence: "Only the theory decides what one can observe.""

- ➔ So, note -> Einstein seems to think some of the philosophy that his relativity was based on was "nonsense" or may be accurately may be that-> interpreting his relativity from instrumentalist/operational philosophy was "nonsense". But as noted earlier (above) it was the instrumentalist/operational philosophy that was messing up "time" with "clock" -> which seems what Einstein was originally doing in his special relativity -> and was one of the early criticisms of relativity by critics that got ignored.
- ➔ Einstein statement -> "Only the theory decides what one can observe." -> often gets interpreted as if the facts don't fit the theory then change the facts -> when supposedly science should really operate by discard the theory if the facts don't fit it! -> "if the facts don't fit the theory then change the facts" seems to turn upside the approach "if the facts don't fit the theory then change the theory" -> and is another source of mess.

Holton -> "All this must have come to Heisenberg as a scathing attack on what he regarded as his fundamental orientation, derived from reading Einstein's early works, and being guided by them from the start, right through his most recent triumph. Einstein, whose development away from positivistic instrumentalism to a rational realism ..."

- ➔ i.e. Einstein's change in philosophic beliefs; and get from others sources that -> special relativity being based on positivistic instrumentalism and general relativity based on rational realism.

Holton -> "had escaped Heisenberg's notice, went on to explain at length how complicated any observation is in general, how it involves assumptions about phenomena that in turn are based on theories. For example, one almost unconsciously uses Maxwell's theory when interpreting experimental readings involving a beam of light."

- ➔ i.e. an example of imposing interpretation onto experiments.

Holton -> "Perhaps this discussion helped Heisenberg eventually to embark on his own epistemological pilgrimage, which ultimately ended with a kind of neo-Platonism in the description of nature through the contemplation of symmetries."

- ➔ So, philosophic differences between Einstein and Heisenberg. Heisenberg decides what philosophy he wants science/physics to be based on.

Holton -> "But in 1927, just before starting on his next breakthrough—later called the uncertainty principle paper—Heisenberg suddenly remembered Einstein's provocative statement, "Only the theory decides what one can observe.""

- ➔ Oh dear because now going to use that "provocative statement" to make a bigger mess ->

Holton -> "It was a key to Heisenberg's advance. As he later put it, "I just tried to turn the question around according to the example of Einstein.""

- ➔ i.e. turning the statement "Only the theory decides what one can observe." Around is probably leading to such beliefs as -> if the facts don't fit the theory then change the facts; which have commented on earlier.

Holton -> "At this point I should pause briefly to return to the unfinished story of my own encounter with Heisenberg in 1965. After giving his lecture, Heisenberg came over to tell me in detail about that 1926 meeting with Einstein, and what it had meant for him. Indeed, as if to make sure I had it straight, Heisenberg followed up by sending me a letter in January 1966, in which he repeated the story, and added a rather striking conclusion: While the theory determines what can be observed, the uncertainty principle showed him that a theory also determines what cannot be observed."

- ➔ Which makes things worse because now deeming theory should deem certain observations are not allowed and be dismissed as unobservable.

Holton -> "Ironically, Einstein, through his 1926 conversation, had provided Heisenberg with some genetic material for the creation of the uncertainty principle article of 1927."

- ➔ Yes "ironic" -> Einstein tried to stop Heisenberg messing up philosophy upon which Heisenberg was basing Quantum mechanics -> but Heisenberg found that as encouragement to carry on with it and mess things up further.

Holton -> "We can now follow the effect of Einstein on Heisenberg along two diverging tracks. Both start at a high level, but descend eventually into terrifying terrain below. One track is the scientific one. Despite all his misgivings, Einstein of course realized the brilliance of Heisenberg's work. He nominated Heisenberg for a Nobel Prize for three years before Heisenberg was so recognized, even though Einstein to the end believed that Heisenberg's way of doing physics would ultimately turn out not to be true to the thoughts of the "Old One," the Creator."

- ➔ The split of Einstein from mainstream physics, when mainstream physics took the path of Quantum mechanics based on philosophic point-of-view that Einstein didn't like, while he did unified field theory research. The "Old One" refers to the comment by Einstein of God does not play dice with the universe; Jim Baggott [3] describes it as: "'The theory produces a good deal but hardly brings us closer to the secret of the Old One,' wrote Albert Einstein in December 1926. 'I am at all events convinced that *He* does not play dice.'"

Holton -> "The third meeting of the two men took place in October 1927, at the six-day Solvay Congress in Brussels. That conference was the scene of famous debates, mainly between Einstein and Schrödinger on one side and Bohr, Heisenberg, and their "Copenhagen" colleagues on the other. It soon became clear that the Copenhagen spirit had triumphed."

- ➔ That "Copenhagen spirit had triumphed" just meant that too many people were on that side of the argument. The majority point-of-view need not necessarily be right, sometimes the minority are right.

Holton -> "Day after day, Einstein presented ingenious arguments, which Bohr then answered before nightfall, until Paul Ehrenfest finally said, according to Heisenberg, "Einstein, I am ashamed for you." Heisenberg in a later interview added a shrewd point: "I would say that a change had taken place, which I can only express in terms of lawsuits. That is, the burden of proof was reversed. . . . That made a complete change of view among the younger generation.""

- ➔ Saying "the burden of proof was reversed" -> must mean that suddenly the "burden of proof" that those who supported the "Copenhagen spirit" no longer had to prove that they were right, had been switched to having Einstein having to prove them wrong. That is completely illogical and illegal move to do something like that! ->How many times does a person in normal life get away with saying "prove me wrong, and if you can't then it means I am right" -> because that is the tactic that the "Copenhagen spirit" supporters used on Einstein! It's the appeal to ignorance fallacy. Richard Nordquist[4] explains it as -> "The appeal to ignorance is a fallacy based on the assumption that a statement must be true if it cannot be proven false — or false if it cannot be proven true. Also known as argumentum ad ignorantiam and the argument from ignorance."
- ➔ These physicists creating logical fallacies in their thinking start then making the mess in modern physics bigger.

Holton -> "Ironically, the same kind of reversal of fortunes had happened long before, in the triumph of Einstein's relativity over its opponents."

- ➔ If you look at early days of Einstein's relativity when it became more well-known, the critics of it were just ignored; so the "triumph" was a farce, like the "triumph" that Heisenberg+co had over Einstein with Quantum mechanics was also a farce.

Holton -> "Heisenberg's last surviving letter to Einstein, written a few months before the Brussels meeting, already showed the cocky self-confidence of the victors in that new struggle. Heisenberg writes that while in the new quantum mechanics Einstein's beloved causality principle is baseless, "We can console ourselves that the dear Lord God would know the position of the particles, and thus He could let the causality principle continue to have validity." Heisenberg once more sought out Einstein in 1954, a year before Einstein's death, and the final meeting between the two men took place in Princeton. Heisenberg found that Einstein's view had not changed since the 1927 Solvay Congress. Despite all Heisenberg's persuasive skills, Einstein just said, "No, that's nothing. That's not the thing I am after. I don't like your kind of physics. I think you are all right with the experiments . . . but I don't like it.""

- ➔ i.e. Einstein never changed his mind about rejecting that type of physics.

Holton-> "The second track that follows the later relation between the two men concerns the full emergence in 1933 of what in Germany had been foaming from the mouth of the Beast since the early 1920s. For a time, Heisenberg continued to mention Einstein in his lectures and publications. But the scene was now dominated by demons, including the raving articles published by Johannes Stark, branding Heisenberg in 1935 the "spirit of Einstein's spirit." The published attacks on Heisenberg, and on theoretical physics as such, culminated on 15 July 1937 with an article in the official journal of the SS, Das Schwarze Korps. That article, endorsed by Stark, called Heisenberg a "white Jew," and dismissed relativity and quantum theory as non-German, Jewish thinking. There followed a one-year attempt by Heisenberg to obtain exoneration from Heinrich Himmler, head of the SS, who was a family acquaintance. That effort finally succeeded, but Heisenberg was ordered to, in the future, "clearly separate for your audiences, in the acknowledgment of scientific research

results, the personal and political characteristic of the researcher.” Privately, Himmler had his eye on Heisenberg as a possible researcher on Himmler’s own crazy “World Ice Theory,” of which I will spare you the details here. But any future playwright dealing with a version of the Heisenberg–Einstein relation will not be able, as Copenhagen does, to avoid including the cries, offstage and ever more distant, of the unmentioned millions who had also loved their homeland but had no way to make a deal with Himmler, or to bribe an SS man bent on murder. Despite Nazi condemnations of relativity theory, the use of the equation $E = mc^2$ continued to be quite permissible* for German scientists. Indeed, putting that equation to use remained their Holy Grail from the very beginning of the Uranium Club, and they had been called into action by the German government well before the Allies got going in an organized way on their research.”

→ Nazis are a diversion, skipping to next bit.

→ * seems typo error -> article had “permissible” amended to “permissible”

Holton -> “Heisenberg gave a second attack on Einstein in June 1974, when he spoke, of all places, in the so-called Einstein house in Ulm, Germany. (Part of the Volkshochschule in Einstein’s birthplace, this building was dedicated in 1968 as a living memorial to Einstein.) As in 1955, he began with a generous survey of Einstein’s work on relativity; he then repeated some of the points made in earlier publications, including an account of Einstein’s rejections of the theories of Heisenberg. Heisenberg then said that he would have to add something, “in order not to leave the portrait of Einstein all too incomplete.” Einstein, he said, “wrote three letters to President Roosevelt, and thereby contributed decisively to setting in motion the atom bomb project in the United States. And he also collaborated actively, on occasion, in the work on this project.” If there is to be someday a play based on the relation between these two men, the playwright will perhaps note that these astonishing exaggerations, uttered in Einstein’s birth town, were part of a Heisenberg lecture with the title “Encounters and Conversations with Albert Einstein.” In that last talk, Heisenberg, two years before his death, had his final encounter with the person whom he had once called his Vorbild, his model; the person who for good and ill had unknowingly been the cause both of deep insights and of fierce insults throughout Heisenberg’s scientific and personal life; and whose acceptance Heisenberg had sought again and again, always in vain.”

→ In other words Heisenberg’s physics was influenced by Heisenberg having Einstein as his role model. Even though Einstein didn’t like Heisenberg’s physics it had arisen because of his influence.

Holton -> “Niels Bohr, to his death in 1962, was also deeply saddened by Einstein’s constant refusal to accept his interpretation and program. And as to Einstein himself, he often cursed the quantum he himself had set loose, only to have it haunt him in the form of a physics that he could not accept, initiated largely by Bohr and Heisenberg. It all had started so well. But in that future play, as the curtain falls on these three extraordinary men, even the evil spirit that has been watching them from the wings of the stage, and that had haunted that whole terrible century, will, in the end, shed a tear for humanity.”

→ And that’s how quantum physics got messed up.

Problem persists today, as for example -> “Quantum mechanics may contradict itself when applied to big objects” New Scientist 18 September 2018 by Anil Ananthaswamy says: “The theory of quantum mechanics can give contradictory answers when applied to large objects like people and quantum computers, suggesting it may not be a valid description of how nature works at all levels.”

- when look at foundations of QM (Quantum mechanics) it becomes a mess of what different observers are saying about the other person's observation, and contradictory where QM predicts both a certain observation and the opposite observation simultaneously.

As per article: "The thought experiment [of the New Scientist article] is very provocative, says Robert Spekkens of the Perimeter Institute of Theoretical Physics in Ontario, Canada. "There's been this long tradition in the field of the foundations of quantum mechanics to talk about what quantum theory predicts about one observer ought to describe another observer," he says...."

- Same problem is in SR (special relativity): what SR predicts about one observer ought to describe another observer. I say things have been left unclear/ambiguous in SR about that.
- In SR (as it is usually portrayed; although I now think it is a mistake by the relativists) - it is about the constancy of lightspeed in vacuum for inertial observers. So, given two inertial observers A and B with A saying that B is moving at non-zero velocity v with respect to him. Presumably we have based on usual portray of SR:
 - A says that lightspeed is c relative to himself
 - B says that lightspeed is c relative to himself
 - Presumably, A is able to send a message to B saying that he A has measured lightspeed as c , and B similarly can tell A that he B has measured lightspeed as c relative to himself.
 - BUT—when A measures lightspeed as c relative to himself and B tells him that he B has measured lightspeed as c relative to himself as well, does A say: yes according to my calculation you should have c as well OR does A say that according to his calculation that B should not have c ?
 - NOWHERE AFAIK (as far as I know) in the relativity literature is it making it clear as to whether A works from his calculation for what he thinks B should measure is the same as what B says he measures!
 - AND the same thing has been taken over from SR into QM; does A agree with B's measurements or not?
 - By Newtonian physics (NP) presumably A would disagree with B's measurement, but what is SR supposed to be saying about that (?) Because presumably from SR we do relativistic velocity addition calculation where A would then agree with B's measurement.
 - So, we have contradiction that by calculation based on NP – A disagrees with B's measurement, while from calculation based on SR A agrees with B's measurement.
 - But how do we know which type of calculation A is supposed to make?
 - If A is working from NP he is surprised by what B says, but if works from SR then has made an adjustment away from NP.
 - -we are left with unanswered questions as to what A can and cannot do (i.e. can A be allowed to work from NP and be surprised what B tells him, or not?) !
 - Is A saying according to my NP calculation B should not measure c , and when B says to A that c has been measured, then A makes an adjustment to work from SR (?) Because if that is happening there is no mention of experiment where A is actually doing that.
- The above were old thoughts about relativity based on what mainstream says. My latest position at 30 July 2021 is that Einstein's relativity has been misunderstood by the mainstream -> so "they" are saying things that are wrong and "they" have not even properly translated Einstein from German.

References

[1] Werner Heisenberg and Albert Einstein, Gerald Holton, Citation: Physics Today 53, 7, 38 (2000); doi: 10.1063/1.1292474 <https://physicstoday.scitation.org/doi/10.1063/1.1292474>

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[3] What Einstein meant by 'God does not play dice', Jim Baggott <https://aeon.co/ideas/what-einstein-meant-by-god-does-not-play-dice>

[4] What Is an Appeal to Ignorance (Fallacy)? Richard Nordquist
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My comments c.RJAnderton31July2021