

The Nature of Time and Intuition

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Did you ever know, just know, something is going to happen. Something wonderful, or perhaps frightening, it could be ‘the last thing anyone would expect’, but every fiber in your body tells you that this is the path your life will take. This feeling is your intuition at work. Pay attention to it. That intuition has its origin in your future.

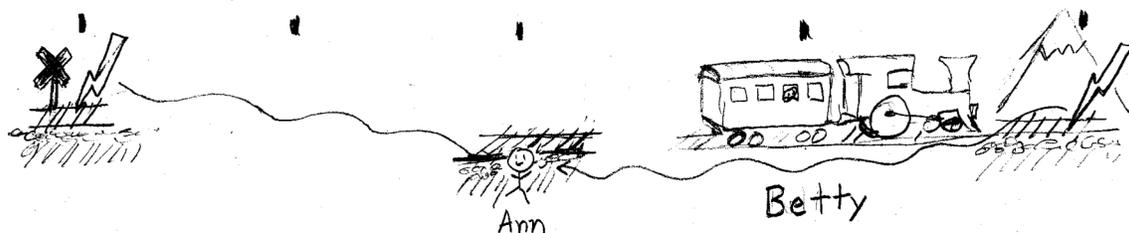
What do I mean by that statement? Your intuition has its origin in your future.

In this short series of sermons I am going to explore the relationship between modern science and our premonitions. I will begin with a discussion about the nature of time, and how it differs from our daily perception of ‘the flow’ of time. One startling possibility is that your premonitions may be connected with your actual future. A future that simultaneously co-exists with your past and your present. In this sermon my goal is to show you that both modern physics, and ancient philosophy point to our perception of time as, quoting Einstein “a stubbornly persistent illusion.”

PART 1: Time and Events

I will begin with a story. The story follows one of Albert Einstein’s famous ‘gedanken’, or thought, experiments. It is a story of a set of twins, Ann and Betty, who are planning to get together for lunch.

Betty and Ann live in different towns. One fine morning Betty boards the local train for the journey to her sister’s village. Ann is expecting to meet Betty at the train station just after noon, and being a good Unitarian, decides to walk to the station. She is walking along the footpath besides the tracks when the train carrying Betty passes by. At this point something unusual happens; two lightning bolts strike in the distance.



One strikes next to a mountain directly in front of the train. The second lightning bolt strikes next to a railroad crossing directly behind the train. The twins see both lightning

strikes, and since they grew up in the area, they also know that, coincidentally, they are exactly midway between two lightening strikes.

Given the scene I have just outlined, let's look through Einstein's eyes, at what each twin experiences. I will examine their experiences in a series of steps, phrased as three questions. Each step, in-and-of-itself, should seem simple, but be forewarned, my friends, at the end we will end up very far from where we started. To make the example more tractable, I am going to pretend that the speed of light is slower than it actually is. In fact I will pretend that it is only twice as fast as the train.

Question 1. Did the two lightening bolts strike the ground simultaneously?

First Ann's experience. Ann sees Betty's train go by and then she sees the light from both lightening bolts - at the same time. In her experience: *the lighting bolts struck simultaneously.*

Betty's experience is different. Since she is moving with the train toward the mountain, the light from the bolt in front of the train reaches her eye first. Betty thus concludes and in her experience: *the lightning strikes were NOT simultaneous, the one in front of the train struck first.*

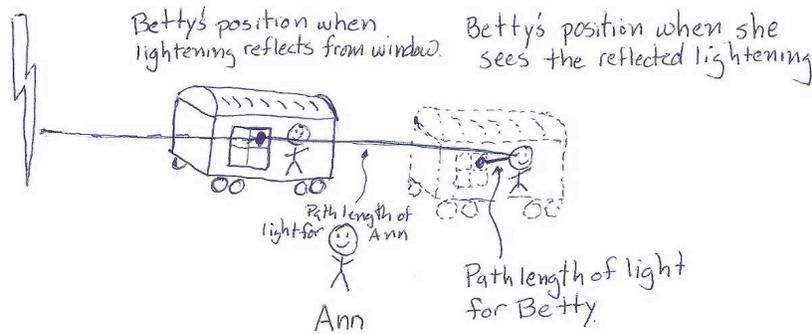
So who is right? Well, we are good Unitarians, so they are both right. Ann saw what Ann saw, that is her experience. Betty saw what Betty saw, that is her experience. Although by remembering that Betty is moving on the train they may be able to understand the other person's viewpoint, their actual experiences of this one event, what they actually saw, are forever different. This next sentence is fittingly Unitarian. There is no right answer here, just two different experiences of the same event. OK so far?

Question 2. At what time do Ann and Betty see the two lightening bolts?

To answer this question it is easiest to begin by arbitrarily assigning a time to the lightening strikes. Let's say that the two bolts struck at 12:00 noon on both Ann and Betty's watches. Since the speed of light is finite, and in our imaginary world it takes 2 minutes to travel from the spot of the lightening strike to where Ann is standing, Ann sees both bolts at 12:02.

Unfortunately, for Betty, the answer is not as simple as 12:01 for the first bolt and 12:03 for the second. If it was, Einstein would not be so famous and modern physics would not be so strange in many ways. I need to embellish my picture a little bit to clarify for you the nature of time when you are in motion.

Let's look at one of the lightening strikes, say the one behind the train. Suppose the light from that strike reflects from one of the windows in the railcar so that Betty sees both the original lightening bolt directly, and its reflected image in the window. I am going to draw the path of the light as observed by both Ann and Betty.



It is obvious that the path of the light looks longer to Ann than it does to Betty because Ann also has to account for the motion of the train.

Now one more fact about physics. Einstein's brilliant insight was to realize that a lot of physics experiments with somewhat unusual results, made a lot more sense if the speed of light is a constant in our universe. You will just have to accept my word on this fact of nature, or read my book where I recount both historical and modern experiments confirming it. If the speed of light is a constant, the same for both twins, but Ann sees a longer path than Betty: how could the light traverse a longer path in the same amount of time? Which is the correct path for the light?

So who is right? Well, we are good Unitarians, so they are both right. The only way out of this contradiction is to give up our cherished notion that the passing of time is set by a constant rhythm, the steady tick-tock, of a clock, and is thus the same for everyone in the Universe. Time, as this example illustrates, must pass at a different rates for the two twins.

In fact time passes about 15% slower for Betty, who is in motion relative to the two lightening bolts, than it does for Ann.ⁱ Thus for each minute or 60 seconds of Ann's life, Betty experiences the passage of only about 51 seconds. This is a physical fact. Everything occurs more slowly for Betty, chemical reactions, her brain waves, and the totality of her experience. Betty is literally aging more slowly than Ann. However, since all her references are traveling with her on the train there is nothing Betty can do within the railcar to determine how fast time passes. As far as Betty is concerned her time is the universal time. The exact same statements hold true for Ann. She is convinced that her time is the universal time. It is only by comparing their two experiences of an external event that a difference in the rate of the passage of time comes to light.

Now we can answer the question: when does Betty see the lightening bolts hit the track? She observes the bolt striking near the mountain at 12:00.51 and the one near the sign at 12:02.33.ⁱⁱ

Question 3. When does Betty think that her sister Ann sees the lightening bolts?

To answer this question we are going to ask Ann, to hold up a sign that says ‘lightening’, when she sees the lightening strikes. When does Betty see Ann hold up her sign? As we have already said, Betty sees the lightening at 12:02.33. She knows that it took 51 seconds for the light to propagate from Ann to her, and therefore she knows Ann saw the lightening at 12:01.42.

The train stops at the next station, Betty gets off, and the twins go to lunch. Their lunch conversation naturally turns to the unusual events they just witnessed. When it comes to the simultaneity of the lightening strikes, both twins recognized that although they each saw something different, since they were in relative motion their experiences of the same event would naturally differ. When it comes to the timing of when Ann saw the lightening bolts, however, an argument breaks out. Betty knows Ann saw the lightening strikes at 12:01.42. She saw Ann hold up the sign with her own eyes. As her time is perfectly accurate, there can be no mistake. Ann, on the other hand, insists that she saw the lightening strikes at exactly 12:02.00, and it was not until 12:02 that she held up her sign. As her time is perfectly accurate there can be no mistake. Betty could not have seen her hold up the sign any sooner.

So who is right? Did Betty see an event happen 18 seconds before Ann insists that it happened? Here comes the pop quiz. I’ll bet you didn’t know there was going to be a pop quiz. I’ll give you the question again: So who is right? The answer is: we are good Unitarians, so they are both right!

To get out of this apparent contradiction I am going to ask you to give up your cherished notion of the *flow* of time. Betty was able to see the event of Ann raising her ‘lightening’ sign before Ann thinks she did so because that event, Ann raising her sign, is always there in the fabric of the universe to be seen by Betty. I will say it again because it is a startling conclusion. The act of Ann raising her sign that says ‘lightening’ is part of the universe at any and all times for any observer to see in their own timeframe.

It is the simultaneous co-existence of all things. That co-existence includes all events that will ever happen, have ever happened, and are happening, from your viewpoint, because all events, . . . all events, . . . co-exists in our universe. Physicists call this phenomena *block time* and it is one of the most amazing implications of Einstein’s Theory of Relativity.

Most of us are comfortable with the idea that the past is fully determined. Whatever has happened: has happened. We remember it, took a video, or something like that. However, if all events co-exist and are to be treated equally, then this ontological certainty must also extend to the future. In a sense then, the future has already happened, just like the past. It is just that in your journey through the universe you have not yet encountered it. This fact is what Einstein meant when he called “the distinction between past, present and future just a stubbornly persistent illusion.”ⁱⁱⁱ

The same thing is true for you. Your future exists right now, and I do not mean some abstract future in the sense that we all have karma. I mean what will happen to you next week, or next month, like what you are going to eat for lunch next Tuesday, already exists in the fabric of the Universe.

So do the words past, present, and future lose their meaning in the world of modern physics? Certainly not. They are very useful for indicating *relative* directions in time, just as we use the words north and south to indicate *relative* directions in space. Relative to whom? Well relative to you.

Vancouver International Airport is to the south of where I am standing now. My breakfast this morning is in my past, and the sermon I plan to deliver next Sunday is in my future. The main UBC campus is to my west. If I go over to Wreck Beach later today, the main campus will be to my east; just as two weeks from now, next Sunday's sermon will have moved from my future to my past. There is no absolute future and no absolute past, just as there is no absolute north and no absolute south.

Nor do the words north, south, past or future imply anything about existence. That is a separate topic. I would venture that no one in this room would seriously assert that the UBC campus doesn't exist just because it is to the west of us and we have not yet journeyed west today. I hope that you can make the conceptual leap and put time on the same footing, so that after this sermon you will not assert that your future does not exist, just because you have not yet journeyed there.

As I told you my friends, we have come very far from where we started.

PART 2 – Saints and Sages

Albert Einstein formalized the mathematical description of our universe that led to the idea of block time in around 1905. His revelations about the relative nature of time were a direct challenge to the prevailing view of the 'clockwork' universe established by Newton and his followers in the 17th century. Newton's clockwork universe is a view that many if not most of us share today; the idea that time is somehow independent or disconnected from human experience. The idea that, as Newton wrote, "absolute, true, and mathematical time, of itself, and from its own nature, flows equably without relation to anything external."^{iv} The only problem with Newton's view of time is, as we have seen, he was wrong.

The idea of block time, however, is much older than either Einstein or Newton. Although it has been called by a different names in different eras, it is an ancient idea that goes back to the origins of humanity. Somehow, though logic, meditation, or religious inspiration, ideas similar to block time have emerged as part of the gnosis of humanity.

For the ancient Greeks, the idea of block time grew out of their logical analysis of the world around them. Parmenides of Elea was a 6th century B.C.E. priest of Apollo, and

one of the most important pre-Socratic philosophers. His ideas strongly influenced Plato, and through him Aristotle and the whole of western philosophy.

His surviving idea is summarized in the statement from one of his poems: “For never shall this prevail, that things that are not, are.”^v For him and his pupils, movement and change are simply appearances of a static, eternal, reality. The poem continues:

Nor was [it] once, nor will [it] be, since [it] is, now, all together.
One, continuous; for what coming-to-be of it will you seek?

...
Thus [it] must either be completely or not at all.^{vi}

The three Abrahamic religions, Judaism, Christianity and Islam, share the idea that God transcends time. He has no beginning and no end. As such God is simultaneously present at all events and in all time, and able to know them by inspection. Saint Thomas Aquinas eloquently summarizes this aspect of God’s knowledge in his writings:

“Verbs of different tenses are used of God, not as though he varied from present to past to future, but because His eternity comprehends all phases of time.”^{vii}

“Eternity is called whole, not because it has parts, but because nothing is lacking to it.”^{viii}

The ancient Greeks and Abrahamic religions, however, are not the only ones to develop the notion of block time.

I am using Einstein’s elegant theory to say what the Tibetan monk Lama Govinda says:

“The temporal sequence is converted into a simultaneous co-existence, the side-by-side existence of things into a state of mutual interpenetration . . . a living continuum in which time and space are integrated.”^{ix}

I am using Einstein’s elegant theory to say what the 13th century Zen Buddhist Abbot Do(bar)gen Zenji wrote for his followers”

“all existences, and all worlds, are present in each and every moment.^x . . . it is believed by most that time passes however, in actual fact, it stays where it is: this idea of passing may be called time but it is an incorrect one, for since one only sees it as passing, one cannot understand that it stays just where it is. . . what we say is yesterday and today is one and the same thing in the same way as when looking at mountains, we see many peaks with only one glance.”^{xi}

So if you don’t believe me, or Einstein, then believe almost four thousand years of human history. Believe saints and sages whose experiences span every culture the world has known; who span human history and who are in touch with humanities ancient knowledge. Einstein may have put some mathematical formalism around the idea, but the concept of block time, the idea that your future actually exists at this very moment, is ancient knowledge. Part of the gnosis of human understanding of our Universe.

PART 3: Predestination

“Hey – wait a minute.” came the exclamation from my old friend Professor Steve Pollock, “Don’t you go tak’in away my free will!”

Almost everyone, from physics professor, to poet, to my treasured wife, when they are first exposed to the idea of block time jump to the conclusion that it is an argument in favor of predestination. It is natural to think that somehow, because your future already exists in the fabric of the Universe, and is available to be seen ‘by inspection’, then you can have no hand in shaping it.^{xii}

This line of reasoning is fallacious. The concepts of block time and free will can, and do, happily co-exist. One particularly straightforward argument in favor of free will is given by John Polkinghorne, a Theoretical Physicist, Anglican Bishop, and President of Cambridge University in England. Professor Polkinghorne writes: “to equate an atemporal world with determinism is to make a category mistake, . . . No unique pattern of causal relationship is demanded by the events of the block universe, and what those connections might actually be is a question quite separate from that of the undifferentiated existence of past, present and future.”^{xiii} In other words, each choice we make is a moment of free will. Several alternatives are available.

Let me bring this home for you with an example that we can all participate in. It involves our church.

This is a beautiful sanctuary. Look around and take it all in, admire it. You can know every part of this room, by inspection. In fact you know the outcome of every choice the architect had to make, and every choice the builder made: what color to put here or there, how high to make the ceiling, on and on, a myriad choices. You can see the outcomes of these choices all around you. Does the fact that you can observe this room and know it by inspection take away the free will of the architect who designed it, or the builders who built it?

But . . . but . . . I can hear the objections already. But the church was completed in 1964 and architect died in 1991. But if you say that you are thinking temporally. You sitting here, taking in this space, existed when the architect was designing it. You sitting here, taking in this space, existed when the builders were building it. And now, . . . right now, . . . in our universe, the architect is designing this space, and the builders are building this space all while we are sitting here admiring it. It is the simultaneous co-existence of all things.

You seeing this room, in its entirety, does not take away the architects free will in designing it, nor it does obviate the choices the builder had to make when building it. These are real choices made by real people with real freedom of action. Just because the outcome of those choices has been *recorded* in the universe does not make them any less real.

There is also a deeper message here, a message of hope. A message that you are a part of eternity. Even after your death, your life is forever being acted out in the universe. You have eternal life in the universe because you always exist there. But perhaps I should leave that topic for a separate sermon.

If your future actually exists, might not this future be the source for your premonitions? I am going to tempt you with this thought. For more on why this might be the case, stay tuned for next Sunday's sermon.

Believe in your intuition, your premonitions, believe in your future, and go forth boldly into it with praise and affirmation. The gift of knowing that future is one of the greatest blessings of your life. May it be so.

NOTES and REFERENCES

ⁱThe correct statement in physics is that the time between events occurring at the *same place* in any reference frame is called the *proper time*. The time interval measured in any other reference frame moving relative to the first one, is *always longer* than the proper time. This phenomenon is called *time dilation*. For those interested in the details, and perhaps deriving the formula, you have to be very careful about who is moving relative to which frame of reference. In the example with the lightning reflected off the window of the railcar, both the window and Betty herself are in the railcar. Thus Betty is not moving relative to this experiment. It is Ann, standing on the railroad embankment, who is actually the moving observer relative to this experimental apparatus. That is why Ann's path length for the light is longer than Betty's and Ann's measured time will be also longer. In the case of the lightning bolts, however, they strike the earth in Ann's frame of reference. Ann, in this case, is the fixed observer and Betty is the moving observer relative to the lightning. So now those up for the math challenge will find that time dilation is given by the formula $\Delta t_{moving} = \Delta t_{stationary} / \sqrt{1 - v^2 / c^2}$ where v denotes the velocity of the moving observer and c denotes the speed of light. In the example given since Betty is moving at half the speed of light (whatever its speed turns out to matter) then $v = 0.5 c$ so $v^2 / c^2 = .25$ and $\Delta t_{moving} = 0.86 \Delta t_{stationary}$.

ⁱⁱ For those really paying attention, you might ask how can a light beam that takes one minute to cover a given distance for Ann take only 51 seconds to cover the same distance for Betty when the speed of light is a constant? The answer is that the distances are not the same for Ann and Betty. In addition to time dilation, there is a phenomenon called length contraction in special relativity that modifies distance measurements so that the speed of light indeed remains constant. The formula for length contraction is quite similar to the one for time dilation. $L_{moving} = L_{stationary} \sqrt{1 - v^2 / c^2}$. So Betty is actually covering a shorter distance than Ann, which is why the light from the lightning bolt arrives sooner even though it is traveling at exactly the same speed for both Ann and Betty.

ⁱⁱⁱ Einstein, Albert, in a letter of condolence to the Besso family, March 21, 1955. Taken from *The New Quotable Einstein*, collected and edited by Alice Calaprice, Princeton University Press (Princeton 2005). p. 73.

^{iv} Newton, Issac, Scholium to the Definitions in *Philosophiae Naturalis Principia Mathematica*, Book 1 (1689); translated by Andrew Motte (1729); revised by Florian Cajori, University of California Press (Berkeley 1934) p. 6 Available from the Stanford Encyclopedia of Philosophy "Supplement to Newton's Views on Space, Time and Motion", Robert Rynasiewicz (2004)

^v <http://en.wikipedia.org/wiki/Parmenides> accessed October 29, 2009

^{vi} Ibid.

^{vii} Aquinas, Thomas Saint. *Summa Theologiae: Volume 1 The Existence of God*, Question 10 Article 2, Thomas Gilby, O.P., general editor, Image Books (New York 1969). p. 147.

^{viii} Ibid Question 10 Article 1.

^{ix} Govinda, Anagarika, Lama, *Foundations of Tibetan Mysticism* Samuel Weiser (New York 1969) as quoted in Davies, Paul *About Time*, Simon & Schuster (New York 2005) p. 25.

^x Do(bar)gen Zenji, “Uji – The Theory of Time” translated by Ro(bar)shi P.T.N.H. Jiyu-Kennett in *Zen is Eternal Life*, Shasta Abbey Press, (Mount Shasta 1999) p. 200.

^{xi} Ibid pp. 201-202.

^{xii} The question is, in a sense, the same as asking: “If there is an omniscient God who has all knowledge of past present and future can there be any free-will?” This question has been pondered for centuries by some of the greatest minds on our planet. Most philosophers and thinkers come down firmly on the side favoring human free will.

^{xiii} Polkinghorne, John C., *Exploring Reality: The Intertwining of Science and Religion*, Yale University Press (New Haven and London 2005) p117-118.