What is Time?

Franklin T. Hu

19166 130th Ct. NE, Bothell, WA 98011

Email: franklinhu@yahoo.com

Time, it is such a common concept and we think we know what it is, but do we really? Is it something that always moves forward or is it something we can reverse and do time travel? Is it something that is infinitely divisible and is time different for one place or condition? Does time exist in a physical sense or is it just something that humans perceive? This paper will attempt to provide a concrete definition of time and explore the consequences of such a definition such as resolving the grandfather paradox if time travel is possible.

1. What is time?

The first question to ask is 'What is time'. What do we mean by 'time'. We refer to time in physics, so it should have something to do with something 'physical'. I think time is defined by "change" in a system. If a system can have different states and those states are spontaneously changing, then the system has the property of "time". If you have a system which is completely not changing, then this system cannot have a concept of time. A good way to understand this is by way of an analogy. If we can see how time operates in a closed system that we are completely familiar with and understand how it works, then we can see how time really operates.

2. Time in a computer

Consider your modern desktop computer. This is a complex system of many electrical components, but on the very inside of the microprocessor, you will find registers which contain bits which can only have a binary state of 1 or 0. Together, all the bits in the computer comprise a "state" and we can see that the state changes from moment to moment. Therefore, this system has "time". In the computer, there is also a master "clock" that controls when the bits can change. The fastest a bit can change from 1 to 0 is in one tick of that clock. In fact, all the bits have to change at the same time according to that clock. The microprocessor moves from one state to the next by every tick of the clock. So for the microprocessor, time is controlled by that clock.
If I were to stop the computer clock, then the state of the computer would stop changing and it could be said that I have "stopped time" for the computer. So in this way you can see that "time" can have a specific meaning for a particular system like a desktop computer. Now this doesn't mean that time has stopped for you or me, but it has stopped for the computer as far as its state is concerned because "time" is just a system which can change states. So it could be simply said that "time" is a property of a system that changes state and is measured by the number of state changes that happen. So let's see if "time" travel is possible within the context of a desktop computer.

3. Time travel inside a computer

If we wanted to travel backwards in time in the computer, this would mean we would want to run the computer backwards. In this way, starting from the present state, we would unwind all of the actions of the microprocessor and we could get back to each previous state of the computer. It is completely possible to do this and it would be an interesting experiment to build a "computer desktop" time machine. You would do this by replacing the "microcode" in the microprocessor which controls the action of

each instruction given to the microprocessor. You would code each instruction to do the reverse of its normal action. So if you had an instruction which said to add one, you would change it to subtract one. The microprocessor is completely deterministic, so you can reverse any action. So, let's say we create this new microcode and we go back in time. We would do this by stopping the clock, switch out the microcode to run the computer backwards then then restart the clock. Technically, the clock is still ticking into the future, but "time" for the computer would be running backwards. If it were displaying a digital clock, you would now see it running in reverse compared to what it normally does. The computer is travelling back in time. Now of course, this system would have to be completely closed so that there is no external keyboard or truly external random events being input into the computer in order for this to work. But you could start your computer and have it run the game of life and then reverse it in time. So for the computer, we can completely see how the concept of time works and that the computer can travel back in time. But this is only an analogy, how does this relate to our real world?

4. Is time in the real world like time in a computer?

Well, if we could somehow see our real universe as being like a huge computer driven by a master clock, then we too could travel back in time like a computer can. But how can that be? The solution lies in the "quantum" nature of space and time. By "quantum", I mean that space comes if fixed sized lumps and is granular like the grains of sand on a beach. This hasn't been proven by current science, but you can treat space as if it were a piece of graph paper where you can only be in one square or another. You cannot be between squares, you have to jump from square to square - this is the quantum nature of space. If you are a fundamental particle like an electron, you can only jump from one piece of space to the next. This jumping happens at the fastest possible speed. So the tiniest bit of "time" that can be defined in the real universe is the time it takes for a particle to jump the tiniest bit of space. In fact, all the particles in the universe are jumping at the fastest possible speed and the only way they can do that is if they are all jumping at the same time. No particle can jump faster or before any other particle in the universe. This jumping sets the universal "clock" for the real world, just like in the computer. So, theoretically, this is what "time" could mean for us in the real world. It is defined by amount of time it takes for a particle to move the smallest amount of space. This means that time is 'quantized', it comes in a smallest possible amount and is not infinitely divisible. This also means that time exists in a real 'physical' sense which depends on physics state transitions and is not dependent upon human perception. If time is gov-

erned by a master clock, then time must actually be the same everywhere in the universe. Now in a sense, "time" is still used in an absolute sense in that it is a quantity that could potentially be measured by an even faster clock outside of the universe that always ticks forward in time. The universe we see could be nothing but a grid of space filled with particles which have a state which can only change with the universe master clock - and this is exactly the same as our computer analogy.

5. Can we travel back in time?

So now we can ask the question, can "we" travel back in time? Well, with the computer, we were able to change the microcode to reverse all the actions of the microprocessor. Now, if we were given God like powers over the universe, it is not inconceivable that the rules of physics could be re-written to run in reverse. We could then stop the clock, reverse the rules of physics and cause the entire universe to run in reverse! If anyone was hoping to build a time machine, I don't think we'll be granted sufficient God like powers to accomplish this any time soon. So sorry if you were hoping to make a real time machine, however, theoretically, it is not impossible. If the universe is like a computer and the code running the universe can be reversed, then it should be possible. So I have shown that time travel is possible and shown how it can be done by analogy to a desktop computer.

6. Resolving the grandfather paradox.

I think the most significant result of this line of reasoning is that there is a clear resolution to the grandfather paradox. If I were able to build a time machine, then I would have to have access to a system outside of our universe that runs on a different clock which allows me to stop the universe clock and replace the laws of physics. The most I could do is unwind the events of the past and bring me to a place where I could kill my grandfather. I couldn't do the killing myself since I can only unwind previous events, so in this way it is impossible for me to kill my grandfather since I can't insert myself into the state of the universe after winding it back. So one major consequence of this view of time is that you can only travel back one moment at a time and it you have to go through all of it in reverse and it would take as much time going backwards as forwards. You could not simply jump from one moment in time to another, you would have to re-experience every moment. You could not arbitrarily alter the state of the world as you traveled backwards, you can only re-wind to exactly the state that existed before. However if I were still bent on killing my grandfather, then perhaps, I can alter the brain state of some other person existing at the time to kill my grandfather. So I do that and then I run the universe in forward mode. My grandfather is killed and in the future of the universe, I am never born and everything goes on as expected.

7. Rewinding time does not undo what has already happened

Even in this case, there is no contradiction. My being born and inventing a time machine has already occurred and exists in the context of the "past" in the time frame which exists outside of the universe. In a sense, there is always an absolute sense of time which exists outside of any "system" which always runs forward and can never be truly reversed. Running the laws of physics backwards to run time backwards in the context of a particular universe does not affect this timeline. This is like reversing time in the computer, it reverses for the computer but not for you.

So there you have it, I've explained what is time in concrete terms, determined that it is theoretically possible and that I can go back in time and kill my grandfather – not that I would.

8. For further reading

This work on the nature of time is part of my Theory of Everything which links virtually all the forces as being electrostatic and mediated by the poselectron sea. It is this poselectron sea which defines the smallest unit of space and time and quantizes both space and time.

http://franklinhu.com/theory.html

The idea that the universe is like a computer is further explored in the paper 'The God Computer':

https://www.academia.edu/6193444/The_God_Computer

I welcome your comments. Please send them to franklinhu@yahoo.com