On the Nature of Time and Simultaneity

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Abstract

What is time ? Which properties are emergent and which are intrinsic ? Time is discussed, with special emphasis on properly discriminating the hypothetical outside perspective from the time of a world itself. This leads to a single, relatively simple model of time which is thought to encompass all others. Applying it to simultaneity, a conjecture is made which could turn out to be of great importance to proper definition and discrimination of relativity of simultaneity and of absolute simultaneity. The author was unable to disprove the conjecture, but found strong indications pointing to it's truth.

Introduction

Considerable effort has gone from the scientific community into the investigation of time. Change or flow of time, arrow of time, past, present and future, causality, relativity of simultaneity and absolute simultaneity, cyclic time and circular time, perception of time, loops and time travel, beginning of time and end of time are among the investigated properties. Most of them could be either weakly emergent or fundamental. A valid first question about time is »Can there be change ?«, if answered negatively, a lot or even everything about time is defined away. This is not the method employed. Instead, change is at least taken as a valid possibility. Previous

attempts to describe time and relate it to the world, however, very often gave insufficient care to distinguish the model that attempts to explain time or defines »how a world might be generated« versus the temporal properties attributable to the world itself or to it's behavior, including those seen by an inside observer.

Quasi-presentistic model of time

I am presenting a very simple model of time, yet with proper discrimination of the above, it can explain all the possible temporal behavior of any world I could think of, including well-defined time travel. The name ›quasi-presentistic model of time‹ is found to be appropriate:

»The world has an initial state. Optionally there may be laws which modify the world's state.«

Elaborating on this, if the world was result of a pseudo-code BASIC program, this would look like the following:

```
10 set world to initial state
20 calculate new state from applying modification
function on current state
30 replace current state with new state
40 GOTO 20
```

The above pseudo-code basic program is for clarity and the natural sciences community. Philosophically strictly, I'd have to amend the validity by noting that it should modify the current state, instead of replacing it. The difference between modifying and replacing is based on proper discrimination between identity and equality. Modifying may retain (some

elements') identity, while replacing cannot. So the valid pseudo-code BASIC program for philosophy purposes is:

```
10 set world to initial state
20 read world state into modification function, save
output
30 apply modifications to current world
40 GOTO 20
```

Emergent and fundamental properties of time in the quasi-presentistic model

Temporal properties of a world:

- Time doesn't exist necessarily, a world may be static.
- If a world changes at all, it's appropriate to speak about past and future from an outside perspective, but there do not necessarily exist past or future for the world itself.
- The world's arrow of time is weakly emergent. There is nothing, in principle, that would stop the modification law from reversing the world's arrow of time's once a certain state is reached. A necessary condition is only, that the past exists in the world or that it can be reconstructed from the current state. This is necessary, at least, if we want an observer's present to move backwards along the same past which it originally went through.
- Discriminate this arrow of time of the world from what might be called the ›arrow of time of the model's generation of the world‹.
- If the world does possess an existing past, then it is weakly emergent – in such case the world has at least one additional quasi-temporal dimension where the past is recorded.

- The future may exist, too, in similar sense. Alternatively it could be deterministically determined, yet without existing. An indeterministic future is another option. Indeterminism that deterministically converges to certain events is possible – as with cyclic big bangs and big crunches. All of this is weakly emergent from the world and it's behavior.
- Flow of time with the meaning of paces, speed or rate may weakly emerge locally.
- Pace of change in regards to a world as a whole is thought to be inconsistent. Apparent pace emerges from an intelligent observers perception.
- Physical causality in the world is weakly emergent, dependent on it's definition.
- Time travel into the past could weakly emerge in a world from the presented model, too. This includes changing the past, branching and time lines, observers caught in loops or combinations thereof.
- A world may even be so chaotic as to have no recognizable arrows of time, at all.

Examples how quasi-presentistic time explains common scientifically considered universes with time:

- A typical non-branching growing block universe: Appears 3-space to the inside intelligent observer, but is 4-space. The world's past exists and is weakly emergent, as it's a result of the modification function's recording of 3-space slices in the 4-space.
- A Minkowski 4-dimensional space-time universe: Future and past are, if anything, weakly emergent, as they actually form one block. Set initial state to the 4D Minkowski space-time. If there is no change, then the modification laws do nothing.
- All »time doesn't exist« universes: It's a static steady-state universe, it's eternalistic. Initialize to it's state. Empty modification function.

- Deterministic circular time with 3-space, future, past and arrow of time exist: Is there any change ? If not, treat like static universe above. Otherwise it can be explained, too, but this may depend a lot on the chosen definitions of, for example, regarding an observer.
- Deterministic circular time with 3-space, with arrow of time, future and past don't exist: Initialize to a state of the loop. Modification functions is such, that the state of the world repeats itself from an outside perspective examination of it's behavior.

Introduction to the controversy of simultaneity

Consider a logical truth table for the Special Theory of Relativity and the experimentally equivalent Lorentz Ether Theory with it's underlying absolute simultaneity:

- STR and LET might both be false. Not very relevant.
- It's impossible to empirically determine just one theory to be true, without depending on other theories, because STR and LET make the same predictions on all experiments.
- Both can't be true, since they contradict each other.

With continued neglect of other theories, the axiomatic difference between STR and LET with their experimental equivalence about the world they describe leads to conclude:

A world described only by the STR is necessarily compatible with absolute simultaneity.
But also to: A world described only by LET is necessarily compatible with relativity of simultaneity.

If we prefer STR as the true theory, then the world described by STR is still necessarily compatible with absolute simultaneity.
Or should we prefer LET as the true theory, then the world described by it still necessarily compatible with relativity of simultaneity.

The above consideration probably doesn't directly lead to anything too significant.

The conjecture

Benjamin Palan's conjecture (assuming no one made it before):

»Every possible world can be ascribed to an underlying reality of quasi-presentistic time.«

A special case of the conjecture applicable to the simultaneity problem is given further below.

One very important property of time which was consciously omitted in the chapter discussing my model of time is that of simultaneity. The model can explain highly chaotic worlds with time flowing in reverse, arrows of time changing directions, even with no definable arrows of time, with backwards-causation or time travel in various definitions. The property of simultaneity, however, is simple: There is always just one state of the world, the present one. There is absolute simultaneity and it's as intrinsic and basic a property as it can get.

The special case of the conjecture for simultaneity:

»Every possible world described by a theory with relativity of simultaneity can be ascribed to an underlying reality of quasi-presentistic time.«

The reverse, that every possible world with absolute simultaneity could reasonably be ascribed to a world with relativity of simultaneity, seems obviously false to me. With truth of the conjecture, this gives:
Let A be the set of all worlds with absolute simultaneity.
Let B be the set of all worlds with relativity of simultaneity.
B is a strict subset of A.

Then relativity of simultaneity would have no added explanative authority over the quasi-presentistic model. Can the conjecture be disproved ? If it must be considered true, then ›relativity of simultaneity‹, as a result of being entirely encompassed by absolute simultaneity, would stand revealed as mere ›undetectability of simultaneity‹ on it's absolutely simultaneous basis.

Almost-proof of the conjecture

The quasi-presentistic model of time can be thought of as running on a Turing machine. The machine makes calculations and outputs the state of the world and then another state of the world to replace the old one and another etc. . Turing machines operation is a good example of the most simple time that admits change. It runs absolutely simultaneous with itself – there's always a single present state of the machine at which the machine could be stopped and that particular state analyzed. A Turing machine can compute everything that modern computers can compute, including future quantum computers. It can compute everything that is algorithmically computable at all.

Defense of relativity

So how what's possibly left to save relativity of simultaneity ? Maybe it could possess a property that allows it to act as a hypercomputer. This would be the case, if it could solve the Turing machine halting problem, for example. An explanation or justification would be required, however, why or how this is property should be exclusive to relativity of simultaneity. Why couldn't a universe of quasi-presentistic time be allowed to be calculated by a Turing machine which has access to oracle machines as well ?

It appears to the author, that about the only defense of relativity would involve denying that change could possibly occur to the world. This can conserve Einstein's theories while effectively admitting defeat on simultaneity – A ›static steady-state‹ , ›eternalistic‹ or ›fixed block‹ universe is the ultimate example of absolute simultaneity.