

1. "Different moments occupy different positions in time, just as different places occupy different positions in space." - What are the shortcomings of that explanation when applied to our experience of the passage of time?

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In this question, there are three terms that need a precise definition. Those are the words position, place and moment.

Position seems to be the easy one: It really is a mathematical term that describes a location with regard to a reference system – such as coordinates in space or a time on a calendar or clock. It is something that is measured by numbers, but it is an abstract concept as there is no physical object required to define a position.

In common language a place is often used synonymously with position (in my dictionary: “a particular position or point in space”). But it makes no sense to say: “a position occupies a position” (an example of the ambiguity of our spoken language). Another use of the word place is the notion of “a portion of space”. That however implies that there is a size to it – measurable however small it might be. And consequently, the given question implies, that a purely abstract position (a point that defines a location) would suddenly have a physical size. And that is another conundrum.

A similar question arises when trying to define a moment in time. It is easy to say that on a time scale it is the dividing point between the future and the past – having no dimension in itself other than separating to consecutive periods of time. But again, the dictionary defines it as “a very brief period of time” (leaving aside different uses of the word in physics or statistics). And with that we have the same problem that something with a measurable dimension occupies a position, which has no dimension.

What can we do? One way would be to redefine “position” as something that indicates a location and a space occupied at that location and with that an orientation (i.e. a direction into which that space extends, however small it might be). And I think that is what common language generally tries to mean.

The other, more precise option would be to use the words “place” and “moment” purely to indicate a location in whatever space we operate and not assign any measurable dimension to it. That would be sort of like mathematics defines real numbers – as the “cutting” point between two adjacent intervals on the number scale. But then the term “occupy” would be wrong.

Regardless, whatever set of definitions we use, we can still describe one big difference between space and time, even if we combine them into the space-time concept of relativity theory:

Space is static, at least at the level that we experience. Once we define a reference system, a place in space will always occupy the same position with regard to that reference system. In a different reference system, our measurements will yield different values, but the principle is the same. We can be at a place, move away from it, and come back to it, and it's still in the same position. Space itself does not prevent us from moving back and forth in any direction to any place. Other factors probably do - like gravity, cost, obstacles, etc. (but these are not caused by the concept of “space” itself).

By contrast, we experience time as a continuous flow in one direction (the “Arrow of Time”). So – if we are in a flow, what is our reference system to define positions in time?

The classical way is to define a reference point like the begin of the Common Era (i.e. the birth of Christ), the unit of time (the second) and then measure the distance from the reference point. That makes us an observer of history from our own position that continuously moves away from the reference point – and any moment in history is defined by a “distance from the reference point” and represents a snapshot of all places in space at that time – not only what one single person may have experienced as a “moment in time”. This seems to be objective, precise and rather awkward with respect to what an individual person perceives as his/her moment in time.

Coming back to this last aspect, my reference point in time is the moment that we call “now”. It's the separating point between my past and my future – and yes it is correlated to the general history, but it is moving with respect to that framework. That is – we have two valid reference systems for measuring time – one of them is moving with respect to the other – moreover the movement is in one direction only (my “moment of now” always moves away from the historical reference point).

As a consequence, in my own reference system, I have no freedom to move. I am always at the “now” moment. The future is only defined by the continuous move of that “now” along the historical reference system – and so is the past a continuous trail of “now”-events deposited on the timeline of the historical reference system. It’s like sitting in a moving train – I am always in the train (the “now”), the future is wherever the train will take me, the past is along the rail that the train has left behind (and the train never reverses its direction). And the “moment in time”? – it’s position depends on what reference system one uses : Historically it occupies a well-defined location on the timeline. However for me subjectively it is always “now” – or by extension either an expectation of a future “now” or a memory of a previous “now” – funny to say: in my own reference system the “now” has no position, because I have no choice, but be at “now”.

Of course – there are inaccuracies in what I wrote: On the level of cosmology (the “very large”) and on the level of Quantum Physics (the “very small”), it seems that there are observations that do not exactly conform to this description (see Stephen Hawking’s results and speculations). But like Newton’s theory of gravity, for the level of the world that we normally experience, it seems to be an accurate enough description.