

The Mind's Direction of Time

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It seems that time has direction which points ahead from the past to the future. Traditionally, the main efforts to explain the arrow of time were carried out within the domain of physics, primarily utilizing statistical mechanics laws. Here, I attempt to explain how the forward direction of time is configured from the viewpoint of the mind. At first impression the concept of forward direction stems from the meeting of subjectivity with space and as such it is applied to time. However, I show that the forward direction of time has a unique temporal sense not derived from space. Later I relate phenomenological explanations of the flow of time to the direction of time.

Keywords: time, mind, direction

The arrow of time and the flow of time seem to not be mutually exclusive concepts. However, while the first is usually treated within the boundaries of physics and the philosophy of science, the second is addressed in phenomenological or psychological contexts. Nonetheless, my aim here is to elucidate the arrow of time from a mind related perspective.

The term “arrow of time” means that time has direction. According to mainstream physics this arrow points forward towards the future; however, it neither travels ahead nor symbolizes time as flowing (Davies, 2002; Grunbaum, 1973). Generally, physics views time as another frozen spatial dimension, which participates in composing a block universe, lacking the quality of the flux that is so obvious to our senses (Dainton, 2001; Elitzur, 1996; Penrose, 1990). At the same time physics also maintains that time is anisotropic; an asymmetry exists between the past and the future in respect to issues as causality, knowledge and entropy (Horwich, 1987). The following lines reflect such a stance:

To deny that time flows is not to claim that the designations “past” and “future” are without physical basis. Events in the world undeniably form a unidirectional sequence. For instance, an egg dropped on the floor will smash into pieces, whereas the reverse process — broken egg assembling itself into intact egg — is never witnessed. (Davies, 2002, p. 26)

The most common explanation of the arrow of time, albeit disputable, stems from the second law of thermodynamics which states that in isolated systems disorder increases with time (Boltzmann, 1898/1964). This is essentially a probabilistic reasoning. For example, we start with a highly ordered state when we put sugar and coffee grains together in a glass, forming nearly distinct piles of the different materials. If we, then, mix the sugar and the coffee together, we will very quickly find a highly disordered state where the sugar and the coffee are homogeneously distributed. The odds of reversing this process and returning to the starting point, or reaching any other orderly state by the continuation of the mixing action is almost annulled since there are so many more disordered states than ordered ones.

General direction. The statistical reasoning behind the second law applies not only to small scale systems but to the universe itself as well (Elitzur and Dolev, 1999). Mixing coffee grains and sugar in a cup, the odds that a certain state of affairs S_n would turn into S_{n+1} and then back to S_n are tiny. The odds for such a regression to occur while applying the second law’s reasoning to the universe as a whole are even smaller. However, the statistical *possibility* for reversal of the order of the events composing the universe, and thus a reversal of time still exists. In contrast, I intend to show here that the stubborn nature of the forward direction of time is forced upon the mind by its temporal nature; meaning that even in the case that the tiny statistical odds of reversal of the order of events in the world would materialize, the mind would still experience those events as facing ahead in time.

I begin with a thought experiment. Imagine a room divided into two adjacent parts. This room belongs to a girl named Jane. Suppose that Jane jumps from part A to part B and then back in the reverse order BA. Assuredly, Jane did not go back in time. One may ask, “What is really the reason for not saying that?” From an absolute perspective of time, the answer would be that time constantly flows ahead, regardless of the order of occurrences. From a relational standpoint, the answer would be that other events taking place in the world surrounding Jane’s room did not go in reverse. But what if, instead of Jane’s room, the whole world were to reverse its course? Even an absolutist would have difficulty denying that time moved backward. Yet, we never experience the world as coming back to its previous state. One may try to explain this irreversibility by arguing in lines akin to the second law: whereas a simple system may step back to its previous state — the world cannot — due to its immense complexity. Assuming that time progresses through the

constant passing of one complex state of the world to another, we might conclude that after one complex state is realized, the odds for repeating the previous state of the world are actually annulled relative to all other statistically possible states. Thus, if the world cannot actually go in reverse, it must constantly go forward. It may be worth mentioning that this kind of rationale is relational — it is based on the configuration of objects in describing a property of time. Thus if phenomena are organized in the reverse order, it indicates that time has changed its course. For an absolutist like Newton, time progresses ahead no matter what happens with occurrences inside it (Alexander, 1956).

However, the above relational explanation does not suffice when taking the mind into consideration. Even if we hypothesize a world reversing its course, time would still maintain its forward direction for the human mind.

Imagine now that Jane's room is the world itself. Again, Jane jumps from A to B, and back from B to A. As spectators, we may believe that time reverses its course for Jane, since after coming back to A, her world returns to the same exact state as before. However, this conclusion is incorrect. The order of events that Jane experiences is ABA, which means that the second time Jane gets to A comes after B. Jane feels that time flows ahead as usual, not in reverse. Jane's memory participates in the constitution of the forward direction of time. On arriving at B, Jane remembers that she had previously been at A, and on arriving at A again, she remembers that she has previously been at B, to which she was previously jumping after A; thus the order of the sequence ABA is built into her by memory. Metaphorically speaking, memory stands behind and pushes the wagon of time ahead (see also Mellor, 1998, for a relevant discussion).

For the temporal mind, forward direction possesses an inherent priority over the backward direction. The temporal order of the mind dictates that going backward must be superseded by going forward; if BA is the reverse of AB, examining BA by its own accord shows that B happens prior to A. The fact that AB antecedes BA does not hinder A to come after B at BA.

An example is the notion of travel into the past. In order to get to her destination, the year 1789, the time traveler should use the time machine's reverse device. When this step is accomplished, she operates the forward device in order to experience the French Revolution events as they occurred. From an external viewpoint we would say that she is situated in the past. But from a subjective viewpoint she may ask herself, "I am *now* in the past, so am I in the present or in the past? Furthermore, it seems that those events I currently experience come after my ordinary life in the future, which I remember. In other words, is that which is considered to be the future, the past for me? So, is the forward direction of time preserved, regardless of the historical point in chronological time in which I am found?" One can argue that the

memories of the future this time traveler has may be folded backward or erased while going to the past, but this will create a strange notion of time travel wherein the traveler is not aware of her precedent future; from her point of view it would not be time travel.

The general reasoning behind the ascendancy of the forward over the backward is almost too obvious for expression: for the mind, going forward is a necessary condition for going backward. BA could not be created without the formation of AB. The opposite is not true: AB is not conditioned by BA. Moving through space in time, a certain amount of distance must be passed before we can step back on our footprints — or the other way around: we cannot go back prior to the beginning of a movement. While time is involved, under any circumstances, going forward comes before going backward.

Moving forward. In multi-dimensional spaces, there is potentially an infinite number of directions. However, I will not discuss here the concept of direction in general, but only the forward and the backward, which are relevant to time. Although it seems interesting to ask why we could not, for example, progress diagonally in time, I take for granted that it is impossible or meaningless.

I suspect that we implicitly assume that the concept of “forward” is primarily spatial and independent of time, and by analyzing the nature of time we would understand why this spatial quality should be attributed to time more than its inverse spatial quality. I believe this attitude is mistaken. I will try to demonstrate that the meaning of the forward direction of time is inherently temporal and that it is not derived out of the static nature of space but from the quality of change.

Bare space is said to be isotropic; neither forward nor backward, nor any other direction, holds a predetermined priority. But what if we confront subjectivity with space? Let us, for example, place a standing human being in a three-dimensional space. In such a condition we typically use the word “forward” to designate the direction that our eyes are looking and “back” to the opposite direction.

Following this description we may think that “moving forward” means to follow the static arrow dictated by the direction in which our eyes are pointed. However, consider, for example, a conscious spider, which owns eight eyes (as spiders often do), symmetrically distributed around its body. For this creature a look at the environment should not create any preferred direction. The spider’s gaze is indifferent to any specific direction relative to the ground on which it stands; but what if it begins to move? What would the direction of the movement be then? Due to its symmetric sight the spider could not determine direction a priori — it must start moving to do so. As the spider begins its movement, a forward direction is determined by the change of positions created by the movement. If the spider moves from M to

N we would say that MN is the forward direction and NM is the backward direction.

I believe that the meaning of direction created by the movement itself and not by the a priori direction of gaze, or by tracking the direction of the gaze, is much closer to the meaning of the mind's direction of time than that of a static spatial arrow. Let me call this the *posteriori* meaning of the forward direction.

How is the *posteriori* forward direction created during movement in space? When the spider moves from point M to adjacent point N it changes places. It leaves one point behind in order to move to the next point. In other words, the spider's presence at the previous location M is annihilated for its presence at the new location N to be created. The continuous combination of the cessation of being at one place and the appearance at a consecutive place defines the *posteriori* meaning of moving forward.

One may ask: "Suppose that the spider closes six eyes leaving two adjacent eyes open and now it moves in the direction opposite of the direction in which its opened eyes are looking. In this case the change of positions occurs while moving backward, in contrast to your claim." This voice may raise an additional difficulty: "After the open eyed spider arrives at N it could go back by changing positions from N to M. This state of affairs, once more, opposes your argument."

However, these descriptions miss the point put forward by the *posteriori* sense of the forward direction. Indeed it is true that a change of positions can take place in directions other than forward, provided that those directions are a priori established. But in this case the change of positions only occurs relative to given directions, it does not construct them. The *posteriori* movement itself is independent of pre-established directions; whether the change of positions occurs relative to fixed directions or relative to a void, the only direction it could *generate* is forward. The essence of the *posteriori* movement is in forming a direction, rather than in following or going against an existing one.

Change. If the *posteriori* meaning of forward direction captures the essence of the mind's direction of time, it is because it expresses the nature of change — not a stationary differentiation between adjacent units of space that may be considered also as change, but the dynamic alterations of experience. It is difficult to imagine how time could be perceived without any change whatsoever, even if such claims exist (Shoemaker, 1969). If we imagine everything in the external environment as frozen, the clock could still be ticking as we experience this frozen world; however, if we could also stop this internal perception, time must totally halt and vanish.

Change could not occur without stability. We can say about an object that it changes only if it is keeping its identity during the change. Change has

two facets which are conditional to each other: creation and annihilation. When an object changes its color, one color of an enduring object vanishes and a new color takes its place. Change, thus, is constituted by the complementary action of this coupling. Annihilation and creation should not be considered as separate. They do not come one after the other, but each serves as a necessary condition for the other. Overtly, change may be seen as a sequential perception of disappearance following appearance (or vice versa) of different qualities, but covertly, change might reflect a conditional structure of annihilation-creation embedded in the mind which itself is non-temporal, but enables the forward direction of temporal experience.

The meaning of the posteriori forward direction was demonstrated by focusing on movement, or in other words, in the continuous *change* of places through space. But as previously stated, the essence of change does not lie in space. Take for example a mother expecting her young son to return home late at night. She might feel worry (W) at the beginning of the evening and this emotion might fade when her son returns; it is then replaced by anger (A) which weakens while forgiveness (F) is created. Thus, the successive creation and annihilation of these feelings determine an emotional forward direction WAF which is not related to space, but to the constitution of the forward direction of time. We do not need an act of looking forward into a given linearity to understand why time is perceived as facing ahead. The meaning of sheer change is adequate enough.

Change could not occur backward. Whether a change is realized by units of space, by emotions, or by any other substance, all are carried by units of time, i.e., instants. While the units of space co-exist, instants vanish as they are created. In space, for example, it is possible to go from A to B and then come back to A, since A remains as is, lying side by side with B. Yet, if A and B are units of time, coming back to A would be impossible. A could only be retrospectively viewed but not reached, since while arriving at B, A had already vanished.

I have used the concept of movement to demonstrate how change produces forward direction. However, while movement is change, change is not necessarily a movement. Movement is change that occurs through units of space that co-exist, so one could move in different directions as well as forward and backward. In order to extract the meaning of the mind's direction of time from the concept of change, we should shed the spatial metaphor as much as possible. The essence of change constituting the direction of time is not reflected by walking along a given line; in fact, it is not about moving at all. It is about the sense of formation constituting the front of our perception of time, combined with the sense of the continuing obliteration of this front which marks a back border we cannot actually cross.

An extended conclusion. The concept of change is the key for understanding the mind's forward direction of time, but not its flow. From this perspective change is not involved in projecting (neither forward nor backward) a one-dimensional spatial-like thread which binds the instants of time.

Emphasizing that spatiality is not needed, or even interferes, with the understanding of the forward direction of time, I have ignored the experience of the *flow* of time. However, human beings still feel that they are *moving* in time, not just living the experience of pure change momentarily, lacking any feeling of temporal extension.

To have this sense of movement, one should build some kind of mental bridge passing through the creation and annihilation of the successive moments. Such a bridge was described by writers like James (1890), Bergson (1896/1913, 1950) and Husserl (1964). Among other issues of temporality, James emphasized the concept of the specious present which is more than an instant but rather a perception of an extended unit of time:

In short, the practically cognized present is no knife edge, but a saddle-back, with a certain breadth of its own on which we sit perched, and from which we look in two directions into time. The unit of composition of our perception of time is duration, with a bow and a stern, as it were — a reward — and a forward-looking end. (James, 1890, p. 609)

Our consciousness of the past and the future constitutes the linkage between successive moments of time, creating duration. For Bergson, memory, which is almost a breathing entity together with expectation, revives and constructs the continuous feeling of lived duration and perception.

Perception is never a mere contact of the mind with the object present; it is impregnated with memory-images which complete it as they interpret it. (1896/1913, p. 170)

The psychological state, then, that I call "my present," must be both perception of the immediate past, and the determination of the immediate future. Now the immediate past, in so far as it is perceived, is, as we shall see, sensation, since every sensation translates a very long succession of elementary vibrations; and the immediate future as it is being determined is action and movement. (p. 177)

And finally Deleuze citing and explaining Bergson:

At each instant, our perception contracts "an incalculable multitude of rememorized elements"; at each instant, our present infinitely contracts our past: "The two terms which had been separated to begin with cohere closely together." (1988, p. 74)

But it was probably Husserl (see Michalski, 1997) who best described the human experience of time. According to him, the continuing, yet fleeting

experience of the present is combined from protention (the consciousness of the immediate temporal onward horizon) and retention (the consciousness of the immediate past). The experience of the flow is formed by successive retentions, each one penetrating and modifying the next one, thus forming a descending trail of past experiences still shaping, together with expectations of the close future, the present perception.

In the continuous line of advance, we find something remarkable, namely, that every subsequent phase of running-off is itself a continuity, and one constantly expanding, a continuity of the past. The continuity of the modes of running-off of the duration of the Object we contrast to the continuity of the modes of running-off of the duration which obviously is enclosed in the continuity of the first modes of running-off . . . (Husserl, 1964, p. 49)

For the mind, the arrow of time is pointing ahead. We can remember the past but probably not to experience it backward. As demonstrated above, such an attempt would be perceived by the mind as still moving forward. This process is comprehended by change — the constant alteration of moment by another moment. However, the explanation of the forward direction of time does not fully account for the human experience of *flowing* ahead. The concept of flow needs, also, a binding line that passes through the successive moments. Time is felt in the transition between moments, rather than in any one of them in isolation. This transition is made possible since living memory, as the consciousness of the very recent past, weaves a continuous thread through the succession of moments by keeping moment t_n and the following moment t_{n+1} together in mind while they are being actually disconnected. Take, for example, the gradual sensation of warming water while soaking in a bath, as an illustration of the forward flowing of time. Throughout the constant creation of “warmer moments” at the expense of “colder” ones, something must tie the successive moments together to create the continuous feeling of warming. That thing is the immediate memory which, together with expectation, forms a bridge throughout the process of creation of the warmer moments and the annihilation of the colder ones.

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