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A Brief History of the Philosophy of Time

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The concept of time is one of the most written about topics in all of the philosophy of science. Yet, for all the hours spent and ink spilt working in the area, are we any closer to a consensus about the nature of time? Unfortunately, the answer is "No"! Why is it that an idea we are all intimately familiar with and bound up in resists a widely acceptable formulation? Perhaps, as some have argued, it is exactly because we are so bound up in it.[1] For my part, I will not attempt a formulation; instead, I want simply to focus on some of the attempts to construct an unobjectionable theory of the nature of time.

The debate about time hinges largely upon one aspect – direction. The direction of time, or lack thereof, is a major sticking point for arguments about time, and there are three ways we can divide philosophers and scientists on this point. The motivation for each of these camps is rather similar. They all argue for their conclusions based on some aspect of laws of nature or laws of physics (LOP), and I will discuss the arguments below. The differences of opinion only come into play when they value one idea over another.

Under nearly all interpretations, LOP are perfectly time symmetric, or time-reversal-invariant (TRI).[2] Without getting too technical, LOP are TRI if, and only if, whatever is permitted in one direction by LOP is also permitted in the reverse direction by LOP.[3] In the present state of physics all known fundamental processes are TRI.[4] Basically, TRI means that LOP do not distinguish a direction of time, and as such, if looking at the fundamental laws alone, there should be no direction of time. Commonsensically, however, we have an understanding of the world that suggests otherwise – we know more about the *past* than the *future*, we contemplate our *present* actions for *future* results, and, well, despite our best cosmetic efforts, we tend to age. This apparent tension provides the motivation for the split among each camp.

Given the symmetry of LOP, but the apparent asymmetry in the world of our everyday experiences, philosophers and scientists have responded in three distinct ways. Those who argue that time is symmetric base their arguments on the symmetry of LOP. Those who argue in contradistinction for the asymmetry of time point not only to the quotidian asymmetries named above, but also to the asymmetries of entropy and causality. And then there are those who argue that time is nonexistent. Each position has its own strong and weak points; alas, however, there is no consensus view. For the remainder of this paper, I will spell out the payoffs and shortcomings of each position.

The two most prominent arguments for the "no-time" view of time come from J.M.E. McTaggert's famous article "The Unreality of Time", and Julian Barbour's book *The End of Time*. Although each argues from a completely different point of view, their conclusions are the same – time does not exist. McTaggert argues from a purely logical position and reaches the conclusion that the only consistent view of time is also self-contraditory, and therefore time cannot exist. A rudimentary formulation of this logical argument is as follows:[5]

i. Change is a necessary for time
ii. There are two ways in which we discuss time: the changing A-series and the changeless B-series
iii. The B-series is changeless, and it cannot accommodate time[6]
iv. Only the A-series can potentially accommodate time
v. Every proposition in the A-series necessarily contains the predicates past, present, and future
vi. The predicates past, present, and future are mutually incompatible
vii. The A-series is self contradictory, and thus, non-existent

Therefore, time is non-existent.

This is a very strong argument and it paves the way, some seventy-five years earlier, for Barbour's argument to the same end. There is, however, a famous rebuttal to this argument which says that all McTaggert's argument proves is that tense (i.e. pastness, presentness, and futureness) is unreal;[7] time and tense are not the same, and we can keep time if we discard tense. Thus, the logical argument does not eliminate time, but the other prominent "no-time" argument uses a revolutionary version of LOP as its motivation.

Julian Barbour's book, *The End of Time*, proposes that by eliminating time from our physics we can reconcile quantum mechanics (QM) with the general theory of relativity (GTR), and eventually reach a theory of everything (TOE). This is noble goal, but does his proposal work? Barbour bases the entire force of his argument on the *timeless* Wheeler-DeWitt equation.[8] This equation is said to be timeless because its interpretation implies a static universe. Barbour believes that our normal intuitions about a timed universe are worth sacrificing if we can achieve a TOE. If this equation is sound and Barbour's conclusion from it is true, then apparently we must bite the bullet and admit that the universe is a block, static place. The question is, however, whether Barbour could actually be correct. Based on a recent review by Jeremy Butterfield, even if we grant Barbour everything he asks for,[9] his conclusion about the unreality of time does not necessarily follow. Butterfield's definitive claim on the subject is: "one can only conclude that quantum gravity [the field attempting to reconcile QM with GTR] gives no reason to believe Barbour's denial of time".[10] Thankfully, for all of us who own watches, time is safe; the nature thereof, however, we still need to clarify.

The two strongest proponents for the asymmetry of time are Ludwig Boltzman and Hans Reichenbach, and each attempts to reduce time to a physical process in nature. Boltzman's theory came to the fore with the publication of his *Lectures on Gas Theory*, 1896-1898, which argues that the arrow of time is reducible to the arrow of entropy. This is a powerful proposal for those in favor of the asymmetry of time, but does the reduction work? First, we must appreciate that entropy is a *statistical* measure of the disorder in a system, and as such the system's entropy *tends* to increase, but there is a statistical chance that entropy will decrease in any system. Thus, if a decrease in entropy does occur, and we are taking the reduction seriously, then we would have to say that the time order has reversed – we are now going toward the past. This is a major concern, and it certainly makes the arrow problematic; it is not, however, the biggest concern. The Kelvin-Loschmidt paradox asks how a system that is perfectly symmetrical at the micro-level, like the statistics that govern entropy,[11] can have an asymmetrical process, a reliable arrow in our case, emerge from it. There seems to be no definitive answer to this question, and as such, the reduction is invalid. Reichenbach, however, picks up Boltzman's line of argumentation and attempts to reformulate it.

In Reichenbach's landmark work, *The Direction of Time*, he proposes a reformulation of the entropy reduction.[12] In Reichenbach's system we need not worry about the entropy of the whole universe for our arrow of time, we can simply focus on the entropy in the majority of systems in the universe, and base our arrow of time on this majority, which will, by the statistics, have increasing entropy. This is a very rough summary, but the point is clear; in Reichenbach's reduction he believes that since the majority of systems will tend to have increasing entropy, those areas with decreasing entropy need not worry us because we can map the majority arrow onto the universe as a whole. For my part, this seems both too convenient and naïve. We may doubt our ability to know the entropy in the majority of the systems in the universe, and as such, we would have no grounds for postulating an overall arrow. Moreover, even if we could postulate such an arrow, and the entropy in our galaxy (a near isolated system) suddenly began to decrease, how could we reconcile our entropy decrease with some hypothetical overall arrow of increase? Wouldn't we simply be traveling back in time in our system, only to come out, when our entropy began to increase again, in our past, but the further future of the rest of the universe? Something is amiss in this proposal, and I do not believe it is sound. Thus, it seems we are back were we started; we know that time exists, but we do not know its nature.

Against these monumental figures of science and philosophy, Huw Price, in his book *Time's Arrow and Archimedes'* Point, gives the most powerful proposal in favor of the symmetry of time. Basically, Price takes what everyone agrees upon,[13] the fundamental symmetry of LOP, and argues that if we take the symmetry seriously and adopt a proper viewpoint, the view from "no-when", then the apparent asymmetries are either explainable, or they simply disappear. As he writes most succinctly in the conclusion of his book: [14]

> In particular, I have been trying to correct of variety of common mistakes and misconceptions about time in contemporary physics – mistakes and misconceptions whose origins lie in our own ordinary temporal perspective, and especially of the time asymmetry in *that* perspective.

Thus, he explains our misconceptions about causation as "objectively subjective"; they are objective insofar we cannot change our perspective,[15] but subjective insofar as causation is non-sensical without acting sentient agents like ourselves.[16] And most importantly for contemporary philosophers and scientists, Price's purely symmetrical view has huge payoffs in quantum mechanics; namely, we can keep quantum mechanics local *and* reconcile it with relativity.[17]

From an indisputable foundation (the symmetry of LOP), Price builds a system that gives us a strong defensible position with huge payoffs. As such, he also gives us a clear glimpse at the nature of time. In conclusion, then, time is fundamentally symmetric, even if we ourselves are asymmetrical beings.[18]

ENDNOTES

1. Much of Price (1996) concerns our internal assumptions about time; moreover, St. Augustine (1991) put it best when he wrote, "What then is time? Provided that no one asks me, I know. If I want to explain it to an inquirer, I do not know" (230).

2. Penrose (1989), esp. pp. 458-64, offers an argument that quantum mechanics is actually time-asymmetric, although he seems to be alone in this proposal.

3. I take a more precise definition from Callender (1995), "A process evolving from state I to state F is TRI iff it is dynamically possible according to the laws of nature for the image of F to evolve to the image of I after a temporal reflection that maps t: t -> -t" (332).

4. Price (1996) notes one exception, "the neutral kaon appears to distinguish between past and future – an effect which remains deeply mysterious" (18).

5. McTaggert, (1927).

6. Here is a *reductio* that demonstrates why B-series cannot accommodate time (also from McTaggert):

   Suppose: (§) B-series statements can accommodate the way we perceive time.

   i. We perceive change in time
   ii. The truth-value of B-series statements cannot change
   iii. Since the truth-value of B-series statements cannot change, change cannot actually occur in B-series time

   Therefore, (§) is false.

7. D.H. Mellor (1981), offers the best objection and counter argument to McTaggert's thesis.

8. see Barbour (1999), esp. Chap. 3, for his explanation of the equation.

9. Whether or not we should grant Barbour everything he asks for seems questionable given his own candid admission:

   It [the Wheeler-DeWitt equation] is controversial in at least three respects. First, many experts believe that the very derivation is flawed...Second, the equation is not yet even properly defined...And third, the experts argue interminably over what meaning it might have and whether it can ever be promoted to the status of a bona fide equation" (38-9).

10. Butterfield (1999), pp. 328.
11. Boltzman used Newtonian mechanics, which are perfectly TRI, for the individual collisions to derive his mechanics; therefore, the mechanics are perfectly symmetrical at the micro-level.
12. Reichenbach (1984), see esp. Chapter 3.
13. see note 2.
14. Price (1996), pp. 261, my italics.
15. As to why we have an asymmetric perspective, we can offer an evolutionary answer which suggests that agents with such a perspective have a better chance for survival. Why they have a better chance will need to be formulated.
16. As Price (1996) writes, understanding the causal asymmetry is inside of us gives us "the same sort of progress we make in seeing why we needn't treat taste and color as natural categories" (170).
17. This has been a huge concern ever since Bell's Theorem seemed to debunk the EPR experiments, and Price's reconciliation comes at very little cost.
18. Reconciling time's symmetry with our asymmetry is another task that needs to be undertaken, and it is a worthwhile one at that, but it is certainly not a task that will undermine this conclusion.

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