

TIME[§]

Attempts to characterise time seem to throw up paradox at every turn. Some of the most famous of the paradoxes are also the oldest—those due to Aristotle (384–322 BC) and Zeno (b. c. 488 BC), as described in Aristotle’s *Physics*. For example, Zeno argued that in order to traverse any distance, one must always first traverse half that distance; but since this half is itself a distance to be traversed, one must in turn first traverse half of the half, and so on *ad infinitum*. Since it is impossible to traverse an infinite number of distances in a finite time, all motion must be impossible—indeed, incoherent. A similar argument can be used to show that a line cannot be composed of a set of points, a problem which was only satisfactorily resolved with the development of the modern mathematics of infinity. A central question for the philosophy of time, then, becomes whether (and how) the mathematics of infinity applies to time.

Zeno was a student of Parmenides (b. c. 510 BC), and his paradoxes were designed to support the Parmenidean doctrine that reality itself is unchanging. Parmenides in turn had written largely in response to Heraclitus (c. 500 BC), who had proposed that reality was permanently in flux. Contemporary issues in the philosophy of time have turned out to be continuous in many ways with this presocratic concern with the reality of temporal change. The dispute can be framed in terms of where to locate the flow of time, metaphysically speaking—is it located in the world, or is it located in our experience of the world? We can refer to the former as the *Heraclitean* view of time and the latter the *Parmenidean* view of time.

A recent and influential Zeno-like argument in the Parmenidean tradition is due to John McTaggart (1866–1925). McTaggart began by distinguishing two ways in which times may be ordered. Firstly, times may be ordered with respect to the present: *one day ago*, *now*, and *one day from now*, for example, into what McTaggart called the *A-series*. Secondly, times may be ordered with respect to other times: *one day before*, *simultaneous with*, and *one day later than*, for example, into the *B-series*. McTaggart argued that the *A-series* is incoherent—each time must at some point be each of past, present, and future; and yet, these properties are incompatible with each other, since no time can be at once past, present and future. McTaggart further argued for a kind of *error-theory* about time: since notions of the present and of change are constitutive of our very concept of time, and since only the (incoherent) *A-series* contains these notions, time itself does not exist.

A simpler argument against the Heraclitean view is that if time flows, it must flow at some particular rate. But this also seems incoherent—rates are

[§] Forthcoming in Martin Cohen (Ed), *Essentials of Philosophy and Ethics*, Hodder Arnold, London, 2005.

standardly defined with respect to times, and it seems as unmotivated to say that time flows at 1 second per second as it does to say that space flows at 1 metre per metre. Alternatively, to appeal to some other dimension in which time flows leads both to vicious regress and to questions of how this might be measured.

A different kind of challenge to the Heraclitean view of time is raised by the special theory of relativity in physics. According to that theory, simultaneity is defined relative to inertial reference frames, and moreover there seems no natural candidate for a privileged reference frame for the purposes of defining a unique global present. Relativity marks the first significant break between the scientific conception of time and our everyday experience of time, since without a uniquely defined notion of simultaneity we lose the objectivity of the present, and with it any objective distinction between the past and the future.

These difficulties with the Heraclitean view all suggest that the passage of time is an aspect of our experience of time rather than of the world itself. This leads naturally to a view according to which both the unique past and unique future exist *simpliciter* in what has been called the *block universe* of spacetime, a view sometimes referred to as *eternalism*, or *four-dimensionalism*, and to which Parmenides is the earliest adherent. Opposed to this view are *presentism*, according to which only the (flowing) present exists *simpliciter*, and the *growing block universe*, according to which the past and (flowing) present exist *simpliciter*, with the block growing ever larger. It has also been argued that there is no untensed notion of “existence *simpliciter*” available on which to found this debate (it is unclear where to place the deliberately paradoxical Heraclitean cosmology in this scheme).

A further set of questions regarding time concerns the relation between the various *temporal asymmetries*—the crucial respects in which time differs from space. We have already noted the directed *flow* of time and the alleged asymmetry of temporal *existence* on the growing block view. Probably the most discussed asymmetry apart from flow has been the fact that the past seems *fixed* or *determinate* while the future seems *open* or *indeterminate*; in addition there are the closely related asymmetries of *causation*, *explanation*, and *counterfactuals* (causes precede their effects, explain their effects, and license past to future counterfactuals), of *memory* (we remember the past but not the future), of *knowledge* (we have greater knowledge of the past than the future, and different means of acquiring such knowledge), of *action* or *agency* (we deliberate on the basis of past information for the purpose of acting in the future), and numerous physical asymmetries including most notably the *thermodynamic asymmetry* (entropy tends to increase in closed systems) and various *cosmological asymmetries* (for example, the universe was in an extremely low entropy state in the distant past, and is expanding towards the future).

A complete theory of time should answer the metaphysical questions with which we began, and also trace the connections between these various asymmetries. And there are further mysteries: Does time have a beginning? Does it have an end? Is it discrete or continuous? Can time be analysed in terms of something more fundamental, for example causation? Could there be time without change? Is time travel possible? The vast array of open questions concerning the nature of time show that this old philosophical quarry remains elusive.

Brad Weslake
Centre for Time, University Of Sydney