

## Time, Information, and Determinism in Psychology

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Time has long played a vital role in physics and philosophy, as evidenced by many of the chapters of this volume (e.g., Guignon, in press; Gustafson, in press; Primas, in press). However, psychologists have rarely acknowledged the important role of time in their own discipline. They have studied how people perceive and manage time, but they have rarely examined the assumptions of time in their own theories and practices (for exceptions see McGrath & Kelly, 1986; Slife, 1993; Slife, 1995a). The purpose of this chapter is to explicate the overlooked role of time in psychologists' understandings of determinism.

Here, conceptions of time in physics and philosophy are helpful, because relatively unexamined beliefs will, as Edwin Burt (1954) once put it, "share the ideas of [their] age" (p. 229). In this case, Isaac Newton and his followers dominated the age with Absolute Time, leading psychologists to adopt a singularly atomistic conception of time. Unfortunately, this temporal atomism has fostered a seemingly irresolvable dilemma of determinism and free will in psychology that has enfeebled and befuddled theoreticians and practitioners. Some psychologists assume these problems have been solved by the modern notions of information and the vaunted "information processor." However, it is argued here that this "solution" is a sham. Instead, a holistic conception of time is proposed that dissolves the determinism/free will dilemma and allows the notion of information to be truly meaningful.

### Newton and Absolute Time

As many historians have noted, Newton's popularity cannot be underestimated; he was truly a legend in his own time (Cohen, 1985; Koyre, 1965; Slife, 1995b; Thayer & Randall, 1953). At the point of psychology's conception, his physics had enjoyed almost two centuries of relatively unchallenged status. It seemed only natural for psychologists to copy the successful methods of Newton. However, the popularity of Newton's physics was the Trojan horse of his metaphysics. As Burt (1954) said it so eloquently, Newton made a "metaphysic out of his methods" (p. 229). Veneration for Newton's methods—thought to be without metaphysics, at Newton's own insistence—allowed an unrecognized metaphysic to be brought into psychology. My particular focus of this metaphysic today is Newton's conception of Absolute Time.

As Newton put it in his Principia, "absolute, true, and mathematical time, of itself, and from its own nature, flows equably without relation to anything external, and by another name is called duration" (Newton, 1687/1990, p.8). Newton's time is absolute, because it is independent of other natural entities -- "without relation to anything external," as he put it. Newton's time also "flows equably," as a continuum in which "all things are placed in time as to order of succession" (Newton 1687/1990, p. 10). This is the reason that subsequent scholars and "underlaborers" of Newton, as John Locke (1690/1990, p. 89) characterized himself, likened his conception of time to a Euclidian line (Whitrow, 1980). Time flows like a line or continuum, with the succession of its instants analogous to points on a line.<sup>i</sup> The present point on the line, then, is the point separating the points of the past from the points of the future.

Consider Newton's view of time as described by Whitrow (1980) and Burt (1954):

Newton regarded the moments of absolute time as forming a continuous sequence like that of the real numbers and believed that the rate at which these moments succeed each other is a variable which is independent of all particular events and processes (Whitrow, 1980, p. 35).

Time is a succession of discrete parts, or moments, no two of which are present simultaneously, and hence nothing exists or is present except the moment now. But the moment now is constantly passing into the past, and a future moment is becoming now. Hence, from this point of view time simmers down till it is contracted into a mathematical limit between the past and the future (Burt, 1954, p. 263).

From these descriptions, it is clear that Newton's conception of time was an extension of his atomistic or corpuscular understanding of the universe (Burt, 1954; Faulconer, 1995; Williams, 1995). The universe, for Newton, consisted of separable regions of time and space, each as independent corpuscles or atoms. Each region of space, at a particular time, was a self-contained cell, because each had its own qualities and characteristics inherent in it. That is, each region derived none of its qualities from its simultaneous relation to other regions or atoms of time and space. This atomism meant that Newton's conception of time was itself separable into self-contained instants or points, each with its own properties and qualities, independent of other instants and moments. Even sets of instants, such as the past, present, or future, were absolutely separate from one another. Although these points and these moments together form the

line and flow of time, they each have their own properties and qualities, separate from one another.<sup>ii</sup>

Newton conceived of time in this atomistic manner to serve his view of motion, and thus change and causation. He regarded absolute time as the perfect measure of motion precisely because it was independent of all physical change (Adler, 1990, p. 713). If time were dependent on motion, then Newton would be left without any independent or objective means of gauging motion -- his cherished focus in the natural world. This independence is, of course, another important aspect of his corpuscular understanding of the universe. Each corpuscle -- in this case, motion and time -- is independent and autonomous from every other corpuscle. Change, in this sense, takes place across the three parts of time -- past, present, and future -- without change itself being connected to these parts. Causation, too, is ordered in this same temporal sequence, with self-contained cause separate (in time) from self-contained effect, and both cause and effect independent from time itself. This means not only that change takes place across time but also that the self-contained past is sufficient to cause the self-contained present -- Newton's primary conception of determinism.

Here, the issue of determinism is somewhat controversial. Newton's understanding of determinism is somewhat more complex than described thus far. James Faulconer (1995), for example, contends that Newton did not require the determinism of science to have these efficient causal properties. Although many of Newton's own physical explanations were atomistic, as described (above), this does not mean his general conception of science necessitates this atomistic style of explanation. Important

interpreters of Newton, such as Locke, may have "read," or rather misread, his conception too narrowly.

The Newtonian picture seems to be further complicated by the uses of "Newtonian" mechanics in contemporary physics. For example, the notion of a system's "state" is often considered to incorporate a memory of the past, as if the past is inherent, in some sense, to the present (e.g., Packard, Crutchfield, Farmer, & Shaw, 1980). Nevertheless, this modern sense of "Newtonian" physics must be distinguished from the historic sense of Newton's metaphysics. As the descriptions of Whitrow (1980) and Burt (1954) clearly evidence (above), Newton's own view of time was ultimately atomistic. Most importantly, the past and present, as parts of time, were viewed as independent of one another. This is to say nothing, of course, about the ways in which Newton (or Newtonians) tied these parts together (e.g., causation).

However, as important as Newton's original understanding of time is, the main issue for this chapter is psychology's understanding of Newtonian metaphysics. Here, there seems to be little doubt that psychology—through Locke and other Newtonian "underlaborers"—understood Newton's metaphysics in this atomistic manner. The prestige of his science figured prominently in psychology's adopting atomistic conceptions of time and causality (McGrath & Kelly, 1986; Slife, 1993). The problem is, psychologists never looked back to the natural sciences after they had their own project going.

If psychologists had looked back, only a few decades later, they would have noticed many influential criticisms of Newton's atomistic legacy. Einstein, for example, directly disputed Newton's "habit of treating time as an independent continuum" (Adler,

1990, p. 712). Time, for Einstein, was related to the inertial frame of reference of its observer, and thus was relational rather than absolute (Whitrow, 1980). Many other prominent physicists—including Heisenberg, Bohr, and more recently Bohm—have disputed the independence of physical time-space regions in this Newtonian sense, and along with it the atomism of time and causality.

### Atomistic Time and Determinism

Unfortunately, this atomism lives on in the social sciences, where not only the past, present, and future, but also cause and effect are thought to be sequentially ordered in self-contained and independent regions of time and space. The term “unfortunately” is used because this atomistic conception has fostered all manner of unacknowledged problems in the discipline of psychology (Slife, 1993). The two most important, for the purposes of our conference, are psychology’s free will/determinism dilemma (Slife & Fisher, 2000) and one of psychology’s most popular “solutions” to this dilemma—the mind as information processor (Slife, 1995b).

Let us begin with two implications of atomistic time in psychology. First, the sequential independence of moments of time implies that the past and present are themselves naturally separate. This implication is, of course, the common notion that the past is not in the present, and the present is not in the past. The second implication of this sequential atomism is, again, the prevalent conception—culturally and psychologically—that the past is unchangeable. Because the past and present are separate from one another, the past is not reachable from the present. All living beings supposedly reside in the present, from this perspective, so none of these beings can reach back to change the past. The past is passed.

Whether the past constantly reaches forward in time is the main point of contention between the free willists and the determinists of psychology. By far the most popular position is the deterministic one. Here, many theoretical and practical psychologists have argued forcefully that the past is important to understanding the present, however independent it might actually be from the present. Freud, of course, is a notable supporter of this thesis, but one could also summon the support of most behaviorists, humanists, and cognitivists. The point is, most psychologists believe they need some means of bridging the temporal separation between the past and the present. What could this bridge be?

Efficient causation is clearly the most popular means of building this bridge. This form of causation is itself thought to be sequential—moving from the past to the present—where the cause (in the past) transfers its influence onto the effect (in the present). This causal bridge not only seems to make good conceptual sense, it also allows psychologists to discuss the predictability of human organisms and thus become real scientists. Practitioners, too, are often caught in this deterministic net, because they also sense the importance of the past. Understanding clients in therapy, for instance, seems to necessitate some contact with the past, and efficient causation seems the only, or at least the most scientific way to make this contact.

The difficulty is, the free willists of psychology believe they must resist this presumption of efficient causation (e.g., Rychlak, 1994). Free willists note that when the cause (in the past) transfers its causal influence onto the effect (in the present), this is a hard determinism. Because the past is unchangeable, the past's influence on the present is itself unchangeable. Unless the present has unique influences—influences that are

simultaneous with the present—then the present is completely determined by the unchangeable past. No mainstream theory in psychology postulates such simultaneous influences, so each theory assumes that the present is an extension of the past, and thus completely unchangeable.

The free willist knows too well the implications of this temporal and causal arrangement. Humans cannot be distinguished from any other natural object that is subject to this form of causal determinism. Whatever change is observed in the present is accounted for, and thus determined by, unchangeable causal laws acting from the past. Humans, in this sense, cannot be praised or blamed, experience any meaning, or participate in moral discourse—any more than a rock rolling down a mountain. If the rock rolls into a hiker, we cannot say “bad rock,” because the rock has no responsibility for the direction of its roll. Presumably, natural forces, acting through efficient causation, are responsible for this direction. What would a psychology be, protests the free willists, without morality and meaning?

Again, many practitioners are sympathetic with these issues. They see the significance of meaning and responsibility in their practices. Indeed, many practitioners attempt to empower their clients and facilitate meaning. How would this be possible if the clients were completely determined by a separate, unchangeable past? This impossibility is the reason many free willists have questioned the presumption of causation (e.g., Rychlak, 1994; Howard, 1994). Efficient causation transfers the unchangeable past to the present—in effect, making the present unchangeable as well. The free willist solution, then, is to eliminate the bridge between the past and present—sequential causation—and focus on the present where the free will is presumably located.

This elimination allows the present to be “free of” or independent of the past—as the word “free” would seem to imply. If choices were dependent on the past, they reason, these choices would be determined and thus not be choices in any meaningful sense.

A major problem with this independence of the past is that the present makes little sense without the past. This is the reason psychotherapists have traditionally had difficulty taking a purely free will perspective; it is difficult to understand a client's will without the client's past as a context for that will (Williams, 1992). Even the notion of "choice" cannot be understood without some sort of historic context in which to understand that a choice is required. Without the past, a choice would be arbitrary or random; it could not be based on information or consequences, because knowledge of these stems from past experiences.

Here, then, is the dilemma of modern psychology: Either we embrace the present only (for "free will" decisions) because the influence of the past must be denied, or we embrace the past only (for determinism) because the present must be an extension (via efficient causality) of the past (Slife & Fisher, 2000). The first position leads psychologists to assume that free will is chaotic and contextless—as Daniel Dennett (1984) puts it, a free will not worth having. The second leads to the lack of possibility, and thus precludes agency, responsibility, and meaning. The upshot is, we lose meaning either way. Either meaning is lost through the contextlessness of a present that has no past, or it is lost through the determinism of a present that is the extension of an immutable past.

#### Atomistic Time and Information

Obviously, neither alternative is very appealing. However, psychologists have not questioned the atomistic conception of time that leads to these unappealing options. They have questioned, instead, the need for meaning. Indeed, cognitive psychologists are progressively replacing the old-fashioned notion of meaning with another concept that seems to require neither possibility nor context—the concept of information. Part of the reason for the popularity of this replacement conception, as I have argued elsewhere (Slife, 1995b), is that it fits so nicely within the atomistic assumption of time. Cognitive models consider data from the environment to be transmitted to the brain across time and space. In this sense, information is distributed across some span of time and space. This means that atoms of the information--information bits--occur at separate points of time and space, and the mind must process or store each bit as it is received. The human mind is thus an information processor, not a meaning processor.

Unfortunately, the problem of meaning does not go away that easily. The meaning of a particular message cannot be discerned from any combination of information bits. No cognitive scientist believes that the elements of information can simply be "added up" to produce the meaning. The elements themselves have an organization that is crucial to the understanding of the overall meaning of the input. How does the receiver discern this organization when the bits of data are received independently of one another? Meaning is a particular relationship between two or more referents, and the independence of these data bits as separate carriers of information would seem to obviate their original relationship or organization.

In other words, their dependence before transmission cannot be reconstructed after their reception, when the parts are independent by their very nature.

The point is, the relations among parts can never be represented with independent parts. The core of the problem is that form and content cannot be realistically separated (Slife, 1995b). Even if the "content" of a message can be coded into independent pieces, the original "form" of the content--as a simultaneous structure--cannot be coded into a sequential entity, such as the modern concept of information (Slife, 1993; Slife, 1995b). Oral and written communications may seem to occur sequentially, but in actuality they are experienced as nested meanings--simultaneous relationships among the words--rather than individual words, each with its own portion of the message (McClelland, Rumelhart, Hinton, 1988; Saussure, 1966). To read a sequence of words without this simultaneous relationship is to experience meaningless gibberish. All that is available at the end of this informational stream is the cumulative record of independent elements--as each element is received in atomistic time--and not the qualities of the elements that are derived from their relationship to one another in the original structure.

This is where the issue of atomistic time most visibly reveals its fundamental role in conceptions of information. Because most scientific processes are thought to be distributed along the sequence of temporal atoms, these processes can literally never exist as a whole at any moment in time. That is, if a process begins at Time 1, proceeds through Time 2, and

ultimately ends at Time 3, only a reduced portion of this process can be studied at any point in this sequence. Recording devices, such as a scientist's memory, permit each piece of the process to be "photographed" and compared to the next moment's piece until all the process is viewed at the same time. However, none of the pieces contain information about their original relationships, and so their original "meaning" is lost.

As applied to the sequence of information bits, we can never understand the meaning of each data piece (its relation to the whole) as we encounter it sequentially in time. Without the meaning of each piece, we cannot know the meaning of the whole, even if we "store" them for comparison. Once again, our atomistic conception of time is the crux of the problem. Just as it precluded meaningful conceptions of free will and determinism in psychology, it precludes meaningful conceptions of information. Information, in this sense, does not save us from the issues of meaning. If anything, it highlights these issues, and clarifies the need for an alternate conception of time.

#### An Alternate Conception of Time

The temporal holism of several hermeneutic philosophers is particularly helpful in this regard (Bergson, 1959; Fuller, 1990; Heidegger, 1962; Manning, 1993). Indeed, the hermeneutic contributions to this volume implicitly, if not explicitly, assume this holistic approach to time (Guignon, in press; Martin & Sugarman, in press; Richardson & Bishop, in press). Temporal holism is not particularly well known (as temporal conceptions go), forsaking, as it does, the better known atemporal (timeless) and atomistic (corpuscular)

conceptions. Temporal holism postulates a dynamic interplay among the three dimensions of time—past, present, and future—that does not assume these dimensions are wholly separate from one another.

Instead, the past, present, and future are considered to be simultaneous rather than sequential in nature. As Fuller (1990) characterizes temporal holism, "our life's temporal moments—alreadiness [past], present, future—are in active communication with one another at any given moment, reciprocally determining one another" (p. 184). Heidegger (1972) put it this way: "The unity of time's three dimensions consists in the interplay of each toward each" (p. 15). The point, for our purposes, is that the past, present, and future are thought to happen, as Manning (1993) wrote, "as synchrony, not as diachrony" (p. 85).

This synchrony may seem provocative. However, its provocative nature is not because it violates our experience, but rather because it violates a familiar intellectual abstraction—atomistic time. Just because many Western thinkers have been taught to organize time in this manner does not mean this organization is a person's experience of time. On the contrary, Heidegger (1962) and others (Bergson, 1959; Bohm, 1980; Lewin, 1935) claim that time, as experienced, is at least as much simultaneous as sequential.<sup>iii</sup> These thinkers do not deny that we experience a sequentiality of sorts, with some events happening—as a narrative—before other events. Holists merely want to affirm the experience we have of the simultaneity of time's dimensions.

As already described, many people have a strong experiential sense that their past pervades their present. After all, memories and information from the past exist in the present. Some holists even claim we have an intuitive feeling for the presentness of our

future. This future is not the unreachable future of the linear theorist. Goals and expectations are present images of the future. They do not exist except in the "now," affecting one's actions in the present and one's memory of the past. Indeed, neither the past nor the future can exist for us experientially, except in the present.

This holistic present is not the durationless instant of atomistic time. This present is a "lived now"—an experienced, practical present that requires the lived past and lived future as context.<sup>iv</sup> That is, the present is always "coming from" and "going to" somewhere (Heidegger's, 1926/1962). We are always in the midst of a story. Just as the understanding of any moment of a story requires knowing (in the present) what has happened before and anticipating (in the present) what is about to happen, so too any "now" of holistic time is considered to require both the synchronous past and co-occurring future. In this sense, then, the simultaneity of the three dimensions of time is not counterintuitive; it is thoroughly intuitive and experiential.

The "experiential" nature of temporal holism is itself a problem for many psychologists. Psychologists prefer, as Newton before them, a more "objective" conception of time than one based upon lived experience. However, holists note that atomistic time is not itself objective; it is not an object in any conventional sense and thus cannot be objectively observed. Clocks and watches may measure time, but they are not themselves the entity they presume to measure. Atomistic time is a social or intellectual construction that has itself been abandoned by many natural scientists (Slife, 1993). Unless scientists can somehow move outside their experience, it is the only source of knowledge we have (Slife & Williams, 1995).

### Determinism and Information

What implication does this holistic view of time have for the dilemmas related to determinism and information? First, the condition of simultaneity is crucial to any meaning. Meanings are parts of wholes, and wholes do not exist without the simultaneity of their parts. Holistic (and simultaneous) relationships must be recognized "first," at least logically, to endow the part with its partness, its meaning. As Heidegger (1962) puts it, "the totality of involvements which is constitutive of the context of significance is 'earlier' than any single item" (p. 116). Modern advocates of information reverse this order, assuming that a message begins with parts or information bits. These advocates hope that the aggregate of independent and discrete elements will be organized into a whole that is similar to the whole of which they were originally part. Unfortunately, atomistic time precludes any access to the simultaneous whole, because the parts of a whole must be distributed across the succession of time.

Holistic time, on the other hand, makes the relationship among parts accessible from the first. Information is not spread across a continuum of time. Information is the meaning of the lived "now" with all its interrelatedness. Heidegger, for example, argues that "things constantly step back into the referential totality, or, more properly stated, in the immediacy of everyday occupation they never even first step out of it. . . Things recede into relations" (Heidegger, 1985, p. 187). Similarly, Samuel Todes (1963,

1966) describes a field-structure of experience that is prior to the facts and implicitly determines their relevance and significance. For philosophers such as these, lived events are not experienced as isolated facts but as nested meanings within a simultaneity of contexts.

Crucial to this simultaneity is not only spatial context but also temporal context. No meaning is a meaning of the present only, such as an information bit. All meanings of the "now" necessarily involve meanings of the past and future. The past, for example, is not dead and gone, nor is this supposedly immutable entity stored for later retrieval. The past is a constant and dynamic presence in the present--in flux with respect to both our simultaneous spatial and simultaneous temporal contexts. Without this present past and present future, no meaning is possible. Indeed, the presentness of the past and future implies that the meaning of each dimension shifts in the light of our present reinterpretations, with these new past and future meanings affecting, in turn, our view of the present.

Perhaps surprisingly, recent empirical findings in psychology are supportive of this holistic understanding of time. Many researchers, for example, have concluded that memories are dynamic rather than static (Ashcraft, 1989, pp. 306-320). That is, the past as originally experienced is not stored but is constantly being reconstructed in light of present situations and future objectives. In this sense, it is as correct to hold that the present "causes" the meanings of the past (which are themselves in the present) as it

is to say that the past causes the meanings of the present.<sup>v</sup> A "childhood trauma," in this case, can be seen in retrospect (and in happier times) as a good lesson learned. The point is that the past in cognition is not a fixed and "dead" entity, as atomistic theorists have contended. The past is alive in the experiential present and constantly intermingled with the other two temporal dimensions.

From this research, cognitive theorists have become aware of the past as a simultaneous context for the present. Unfortunately, their only option for bringing the past into the present, given their atomistic view of time, is atomistic causality. This popular notion of causality, however, destroys time in any meaningful sense (Slife, 1993). The present is lost because it is at the mercy of the immediately preceding event. As a mere "effect" of this causal event, the present cannot make its own contribution to meaning. This, of course, is the objection of the free willist. However, mainstream cognitivists seem to welcome the determinism of past information in their explanations, because it seems so scientific (read Newtonian). The problem is, the past is also lost in this deterministic framework. The past as a totality--as a simultaneous whole--is not involved in determining the present with atomistic causality. What is involved in this determinism is the most recent, ending event of the past and not the past as a whole.

The upshot is that atomistic causality cannot bring temporal context to events of the present. The present--where all people supposedly reside in this

framework--remains fundamentally contextless. Similar to the information bit, the present is a discrete event, independent from other present moments that have now passed away. The fundamental difficulty with this framework is that humans do not experience the world in this manner. Even if a person experiences a sequence of events (e.g., words on a page or sights on a trip), these events are not experienced as atoms of reality. We do not experience present moments only, divorced from related past memories and future anticipations. We experience wholes and meanings, full-blown and alive with possibility.

With this conception of time, the free will/determinism dilemma of psychology falls away. The present is no longer contextless, nor is it merely an extension of the past, because the past and present are always and already connected. The concerns of the determinist are assuaged because the past influences the present (though this is not mechanical necessity). The concerns of the free willist are assuaged because possibility is permitted. The past underdetermines the present, and the past itself is dynamic rather than immutable.

The issue of meaning is also addressed for the notion of information. Currently, the mind and its environment are portrayed as residing in separate, Newtonian time and space regions (cf. Slife, 1995b). The environment must traverse the space and time distance between these regions to reach the mind with its information. The radical contextuality of temporal holism challenges this information processing model. No

informational flow is necessary because the mind and its environment communicate with one another by virtue of their relation as parts of a superordinate gestalt--what Heidegger has called Dasein.

When I see a new bloom on a Bavarian tree, for example, I am not merely receiving, and thus being determined by, stimuli or information from one time-space region which I then must represent mentally in another region of time and space.<sup>vi</sup> If I am situated and embodied in the holist sense, I am part of the same region of time and space as the tree, the same life world as the tree. The new bloom I see has a direct and immediate impact on me, because the bloom and I are parts of the same Dasein, parts of the same whole. As with any whole, a change in a part (the bloom on the tree) can have a simultaneous impact on the gestalt of the whole (the world) and thus the qualities of all other parts (my perception of the tree).

### Conclusion

Only the notions of atomistic time--with their sequencing of past, present, and future--can make this simultaneous change appear to occur in a sequence. Temporal holism, by contrast, not only prevents the tree and the mind from being distributed along the line of atomistic time, it also disallows atomistic causality, and thus a prevalent form of determinism, from assuming a privileged status. Indeed, it allows the mind and tree to exist in the same dynamic world, a world of context and possibilities. From this

perspective, the free will/determinism dilemma dissolves and atomistic conceptions of information are no longer needed.

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<sup>i</sup> “The order of the parts of time are immutable” (Newton, 1687/1990, p. 10).

<sup>ii</sup> Although there is some question about whether Newton believed in the indivisibility of temporal instants (Whitrow, 1980), I wish to avoid this question and use atomism here to refer to the self-containment of these instants, no matter how divisible they might be. That is, their qualities are inherent in them and do not stem from their relation to other instants and points of time.

<sup>iii</sup>It is important to note here that no one, including scientists, get outside their experiences. Our experience of the world--and hence ~~are our~~ interpretation of it--is thus crucial for understanding how it is that we conduct and undergo investigations.

<sup>iv</sup>Heidegger (1962) shifts the meaning of the present from that in which something occurs to the actual carrying out of an action. Ontologically conceived, the present is making present (Gelven, 1989).

<sup>v</sup>The use of "cause" here may seem problematic. From an atomistic perspective, causal processes are considered to be distributed across atomistic time, and thus causes are thought to have to precede effects.

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As others have shown, however, this notion of antecedence is not a formal property of causality (Bunge, 1959, p. 63; cf. 1963, p. 189). Cause and effect work just fine as simultaneous events.

<sup>vi</sup>Dennett (1991) seems to have a similar concern when he criticizes the "Cartesian Theatre" of many cognitive models (p. 253). His remedy to this concern, however, is quite different from the one offered here.