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Ultimate Realities: Deterministic and Evolutionary

Roy A. Moxley
West Virginia University

References to ultimate reality commonly turn up in the behavioral literature as references to determinism. However, this determinism is often difficult to interpret. There are different kinds of determinisms as well as different kinds of ultimate realities for a behaviorist to consider. To clarify some of the issues involved, the views of ultimate realities are treated as falling along a continuum, with extreme views of complete indeterminism and complete determinism at either end and various mixes in between. Doing so brings into play evolutionary realities and the movement from indeterminism to determinism, as in Peirce's evolutionary cosmology. In addition, this framework helps to show how the views of determinism by B. F. Skinner and other behaviorists have shifted over time.

Key words: determinism, evolutionary cosmology, Peirce, philosophical determinism, Popper, scientific determinism, Skinner, Tipler

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Inasmuch as ultimate realities are highly speculative, a behavior analyst might reasonably think they are not of vital concern. Nevertheless, behaviorists have been presented as believing in determinism, one of these ultimate realities (e.g., Chiesa, 2003, p. 243; Neuringer, 1991a, p. 46; Rakos, 2006, p. 153; Watson, 1924/1970, p. 183). Rakos referred to "what unquestionably is the central philosophical and conceptual unifier among committed behavior analysts: a shared understanding of the deterministic nature of human behavior and its implications for cultural design" (p. 153). However, neither Skinner nor all other behavior analysts have consistently supported a shared understanding of determinism in any definite sense. Further, in his later years, Skinner appeared to advance an evolutionary reality without any reliance on determinism. To clarify these issues, the following outlines some ultimate realities—roughly along Popper's continuum, as explained below—as well as behavioral positions on them.

Although not a clear taxonomy for all determinisms (Honderich, 1988, p. 5), Popper's (1965/1979) organizational outline was vivid. He distinguished indeterminisms and determinisms along a clouds-to-clocks continuum. Popper's "clouds … represent physical systems which, like gases, are highly irregular, disorderly, and more or less unpredictable" (p. 207). He asked us to consider "a very disturbed or disorderly cloud … on the left [and] on the other extreme of our arrangement, on its right … a very reliable pendulum clock, a precision clock" (p. 207). Popper said that almost everybody thought, "The Newtonian revolution [had established] the following staggering proposition: *All clouds are clocks*—even the most cloudy of clouds. This proposition, 'All clouds are clocks,' may be taken as a brief formulation of the view which I shall call '*physical determinism*'" (p. 210). This scientific or "physical determinism … became the ruling faith among enlightened men" (p. 212). However, there were dissenters, including Newton:

> Newton himself may be counted among the dissenters, for he regarded even the solar system as *imperfect*, and consequently as likely to perish. Because of these views he was accused of impiety, of "casting a reflection upon the wisdom of the author of nature." (p. 212, note 11)

It was assumed that the universe designed by the author of nature would be as logically perfect as

Address correspondence to Roy A. Moxley, 884 E. Everly, Apt. 15, Morgantown, West Virginia 26506 (e-mail: rmoxley@wvu.edu).

humans thought it should be. Another dissenter was the pragmatist Peirce:

> Among the few dissenters was Charles Sanders Peirce, the great American mathematician and physicist and, I believe, one of the greatest philosophers of all time. … Peirce concluded that we were free to conjecture that there was a certain looseness or imperfection in all clocks, and that this allowed an *element of chance* to enter. … So far as I know Peirce was the first post-Newtonian physicist and philosopher who thus dared to adopt the view that to some degree all clocks are clouds. (pp. 212–213)

Peirce believed the universe has steadily been moving from more to less indeterminism.

The continuum can also include Earman's (1986) distinction: "I group random with stochastic or chancy, taking a random process to be one which does not operate wholly capriciously or haphazardly but in accord with stochastic or probabilistic laws" (p. 137). Random indeterminism would be on the left side but not on the extreme left. A wholly capricious or haphazard indeterminism would be on the extreme left. This still leaves ultimate realities that will not be addressed. For example, although religious revelations and teachings show a kind of ultimate reality, revelations require a special kind of interpretation and will not be considered here, nor will we consider all the variants of determinism and ultimate reality (e.g., Earman, 1986; Honderich, 1988).

DETERMINISTIC REALITY

Determinism in the sense of universal necessity has an ancient lineage. As Neuringer (2004, p. 891) pointed out, the idea of universal necessity goes back to the Greek atomist Leucippus: "Not one thing comes to be randomly, but all things from reason and by necessity" (Furley, 1987, p. 148); and the extent to which we believe we are governed by necessity has remained an issue into modern times. The dissolution of lawful necessity for mortals and immortals was a key theme in *The Ring of the Nibelung* by Richard Wagner (1853–1874/1976), whom Skinner listened to "notebook in hand" for recording "a significant thought" (Bjork, 1993, p. 218). One issue with necessity was whether it existed universally between absolutely exact events or whether it existed for the most part between events in general.

Philosophical or Psychological Determinism

Popper (1965/1979) thought philosophical (or psychological) determinism was vague: "For the thesis of philosophical determinism that 'Like effects have like causes' or that 'Every event has a cause' is so vague that it is perfectly compatible with physical indeterminism" (p. 220). Popper attributed this position to Hume (1739–1740/1969), who said, "Philosophers form a maxim, that the connexion betwixt all causes and effects is equally necessary, and that its seeming uncertainty in some instances proceeds from the secret opposition of contrary causes" (p. 183). Therefore, "Chance is nothing real in itself. … 'tis commonly allow'd by philosophers, that what the vulgar call chance is nothing but a secret and conceal'd cause" (pp. 175, 181). Applied to human actions, Hume held that "a spectator can commonly infer our actions from our motives and character; and even where he cannot, he concludes in general, that he might, were he perfectly acquainted with every circumstance of our situation and … disposition" (p. 456). The phrase "in general" along with "might" allows for interpretations of probabilistic causality: Every event has or needs at least a probabilistic cause. But undercutting necessity was resisted. The positivist Auguste Comte "opposed the mathematics of probability all his life" (Lenzer, 1998, p. lxvi). Proponents of philosophical determinism seemed to want necessity but had difficulty with wording that allowed for interpretations of probability, particularly in discussing experiences.

Mill (1871), who judged "Comte as great as either [Descartes or Leibniz]" (p. 182), introduced Comte's positivism to England. Mill (1874) also presented universal cause and effect much as Hume had and presented a determinism in which exceptions could be made:

> The state of the whole universe at any instant, we believe to be the consequence of its state at the previous instant; insomuch that one who knew all the agents which exist as the present moment … could predict the whole subsequent history of the universe, at least unless some new volition of a power capable of controlling the universe should supervene. (p. 250)

In allowing a power that controls the universe to intervene, Mill conceded that necessity might be suspended. Otherwise, "To certain facts, certain facts always do, and, as we believe, will continue to, succeed. … The invariable antecedent is termed the cause, the invariable consequent, the effect" (pp. 236–237). The exact repetition of exact causes with exact effects, as well as the apodictic certainty of facts, can be questioned (e.g., Maxwell, cited in Menand, 2001, p. 222), but Mill did not do so.

For those who would organize stimulus and response on such a cause-and-effect model, Mill (1874) explained cause in a way that allowed the stimulus to represent a complex of many antecedents even though only one antecedent was singled out.

> It is seldom, if ever, between a consequent and a single antecedent, that this invariable sequence subsists. It is usually between a consequent and the sum of several antecedents; the concurrence of all of them being requisite to produce … the consequent. In such cases it is very common to single out one only of the antecedents under the denomination of Cause, calling the others merely Conditions. … [However,] we have … no right to give the name of cause to one of them, exclusively of the others. (p. 237)

Watson (1924/1970, p. 22) illustrates such a view of causality in psychology.

Mill (1874) also opposed any element of chance: "It was more rational to suppose that our inability to assign the causes of other phenomena arose from our ignorance" (p. 405). As with Hume, any apparent failure of uniformity would be explained by counteracting causes:

> For there is probably no one even of the best established laws of causation which is not sometimes counteracted … which would have necessarily and justly shaken the confidence of mankind in the universality of these laws, if inductive processes founded on the universal law had not enabled us to refer those exceptions to the agency of counteracting causes. (p. 403)

However, if "inductive processes" only support probability, as generally acknowledged today, necessary laws cannot be established empirically. Although more precise in some ways than Hume, Mill's determinism was less than certain in the exceptions he permitted and in the empirical evidence he offered.

Scientific or Physical Determinism

In the 19th century, the scientific determinism of Laplace (Berofsky, 1999; Earman, 1986; Popper, 1982) became the standard form of determinism. Earman said, "Laplacian determinism and its close relatives are to my knowledge, the only varieties which have received attention in the philosophical literature" (p. 17). Popper put the term *scientific* in quotes to mean "an *allegedly* 'scientific' doctrine … which owes its popularity, and its influence even among great scientists, to its apparently scientific character" (p. xxi). With no mention of supervening interventions that might suspend necessity, Laplace's

(1814/1951) determinism would be seen instantly by an omniscient being:

> We ought to regard the present state of the universe as the effect of its anterior state and as the cause of the one which is to follow. Given for one instant an intelligence which could comprehend all the forces by which nature is animated and the respective situation of the beings who compose it—an intelligence sufficiently vast to submit these data to analysis—it would embrace in the same formula the movements of the greatest bodies of the universe and those of the lightest atom; for it, nothing would be uncertain and the future, as the past, would be present to its eyes. (p. 4)

This determinism would show itself to us but for our ignorance:

> The regularity which astronomy shows us in the movements of the comets doubtless exists also in all phenomena.
>
> The curve described by a simple molecule of air or vapor is regulated in a manner as certain as the planetary orbits; the only difference between them is that which comes from our ignorance. (p. 6)

Du Bois-Reymond (1874), and other scientists, agreed:

> The whole process of the universe might be represented by one mathematical formula, by one infinite system of simultaneous differential equations, which should give the location, the direction of movement, and the velocity, of each atom in the universe at each instant. (p. 18)

Presumably, the predictability of individual atoms would be extended to individual subatomic particles. What seemed to work in the world of the very large was assumed to work in the world of the very small.

Huxley (1887) illustrated metaphysical determinism for the human observer by linking exact causality to the smallest details of observed experience: "The one act of faith in the convert to science, is the confession of the universality of order and of the absolute validity, in all times and under all circumstances, of the law if causation" (p. 200). To make his point, Huxley contrasted a believer in chance with a man of science watching a heavy gale from shore.

> Let him [the believer in chance] note the infinite variety of form and size of the tossing waves out at sea; or of the curves of their foam-crested breakers, as they dash against the rocks; Let him listen to the roar and scream of the shingle as it is cast up and torn down the beach; or look at the flakes of foam as they drive hither and thither before the wind; or note the play of colours, which answers a gleam of sunshine as it falls upon their myriad bubbles. Surely here, if anywhere, he will say that chance is supreme. … But the man of science knows that here, as everywhere, perfect order is manifested; that there is not a curve of the waves, not a note in the howling chorus, not a rainbow-glint on a bubble, which is other than a necessary consequence of the ascertained laws of nature; and that with a sufficient knowledge of the conditions, competent physico-mathematical skill could account for, and indeed predict, every one of these "chance" events. (pp. 200–201)

The scientist assumed this was the way things were even if no one had yet figured them out—a view consistent with a positivism that saw everything observed as determined or determinable with certainty.

Although reasoning by universal necessity may only seem suited to a deity, Comte's (1830/1988) advancement of positivism attempted to show how humans would approximate such capability in a deterministic universe:

> The fundamental character of the positive philosophy is to consider all phenomena as subject to invariable natural laws. The exact discovery of these laws and their reduction to the least possible number constitute the goal of all our efforts. … Thus … the Newtonian law of gravitation shows us all the immense variety of astronomical facts as only a single fact looked at from different points of view, that fact being the constant tendency of all molecules towards each other in direct proportion to their masses and inversely as the squares of their distances. (pp. 8–9)

This single fact extended to "the weight of a body at the earth's surface" (p. 9). Comte's single fact operated like Laplace's divine formula—to unite all reality—but with human observers in place of a supernatural intelligence; and it illustrated how Newton's work may have inspired Laplace's formula.

The scientific adoption of this determinism, which fit well with religious and authoritarian political views, met little resistance. Huxley (1886/1929), for example, said that belief in an omniscient deity demanded a belief in determinism:

> If physical science, in strengthening our belief in the universality of causation and abolishing chance as an absurdity, leads to the conclusions of determinism, it does no more than follow the track of consistent and logical thinkers in philosophy and theology. … Whoever accepts the existence of an omniscient Deity as a dogma of theology, affirms that the order of things is fixed from eternity to eternity; for the fore-knowledge of an occurrence means that the occurrence will certainly happen; and the certainty of an event happening is what is meant by its being fixed or fated. (pp. 141–142)

Determinism satisfied religion and those in authority. If an omniscience of complete determinism seemed attractive for a deity, it was especially attractive for those in authority who spoke for a deity. How could one argue, other than with great difficulty, against those who knew how an infallible and omniscient being thought? Determinism also satisfied science. Popper (1982) could say that scientific determinism was "held by physicists, practically without exception, until 1927" (p. 2).

In his interpretation of scientific determinism, Popper said that it implied an extraordinary claim of exactness, one difficult to imagine as ever fulfilled:

> *Every* event in the world is predetermined: if at least one (future) event is not predetermined, determinism is to be rejected, and *indeterminism* is true. In terms of what I call "*scientific*" determinism, this means that if at least one future event in the world could not in principle be predicted by way of calculation from natural laws and data concerning the present or the past state of the world, then "scientific" determinism would have to be rejected. [Moreover] if every event is to be *predictable, it must be predictable with any desired degree of precision*: For even the most minute difference in measurement may be claimed to distinguish between *different* events. (p. 6)

However, Earman (1986) did not think determinism and prediction always needed to go together.

> Determinism and prediction need not work in tandem; for the evolution of the system may be such that some future states are not predictable (at least not under Popper's strictures) although any future complement than the one fixed from eternity is impossible. (p. 9)

Nevertheless, as Dupré (1993) said, "Evidence for determinism will tend to come precisely from our ability to predict the course of events" (p. 175). Popper's interpretation may not be completely accurate, but it indicated the hurdle for finding empirical evidence of determinism.

Doubts about scientific determinism arose with the acceptance of quantum theory and indeterminism for the very small. The logical positivist Schlick (1936/1949) said, "Modern science must … be satisfied with predictions that have probability. Science is thus no longer deterministic in character" (pp. 69–70). Scientific determinism became looked upon as a characteristic of times past.

> Newtonian certainty … gave [scientists] a sense of Scientific Predestination, of unalterable processes leading inexorably from one event to the next. … Twentieth-century science … is much more humble: chance is back, probability is perfectly respectable, and indeterminacy is not a confession of faltering. (Ritchie-Calder, 1973, p. 215)

Scientific determinism seemed even less likely with the acceptance of the big bang theory of the origin of the universe. The physicist Wheeler (cited in Dyson, 2004) said, "We know the universe began with a big bang. The laws must have come into being. Therefore they could not have been always a hundred per cent accurate" (p. 73).

Although the acceptance of scientific determinism has waned, it is not thought that determinism, or indeterminism, can be empirically refuted (e.g., Earman, 1986, p. 137; Suppes, 1993, p. 254). Earman said, "We must be prepared to find that chaos or caprice at one level of description gives way to order and design at another level, or vice versa" (p. 137). Even though complete determinism cannot be refuted, it was seen to need modification. Honderich (1993) thought *near-determinism*, an accommodation for quantum theory, is "perhaps more widely accepted than determinism" (p. 4). Near-determinism is the "view that although there is indeterminism at the micro-level, the level of small particles, there is still determinism at the macro-level, which includes neural events and everything with which we are ordinarily familiar" (p. 140). However, a determinism that is deterministic at one level but not another needs to explain the interaction, or lack of interaction, between levels, which is not easily done (Earman, pp. 13–14).

A complete determinism may still be maintained by interpreting quantum theory as merely apparent indeterminism. Such alternatives hold that "Quantum Theory is incomplete and that there do exist 'hidden variables,' items not taken into account by it, which make for full explanations of all events at the micro-level" (Honderich, 1993, p. 65). This adjustment allows a complete determinism to survive in considerations of ultimate reality.

However, at this point we are a long way from contact with scientific experience. Honderich (1993) found alternatives like the above "are inconsistent with Quantum Theory and cannot be said to have got much support from orthodox physicists" (p. 65). Even though a belief in determinism need not assume that determinism has effects that make contact with experience, believers in determinism often expect such contact, in one way or another.

EVOLUTIONARY REALITY

Opposing determinisms, Peirce (1931–1958) offered an evolutionary reality as ultimate reality; and Tipler (1994) offered a more precise, scientific version of an ultimate evolutionary reality.

Peirce's Rejection of Determinism

Peirce (1893/1992) did not think much of the "the sham-science of Mill" (p. 359). Regarding Mill's universal law of uniformity, Peirce (1869/1992) said,

> The usual reply is that nature is everywhere regular; as things have been, so they will be; as one part of nature is, so is every other. But this explanation will not do. Nature is not regular. No disorder would be less orderly than the existing arrangement. It is true that the special laws and the regularities are innumerable; but nobody thinks of the irregularities, which are infinitely more frequent. (p. 75)

Peirce (1891/1992) found it was not the irregularities but the regularities that needed explanation.

> Uniformities are precisely the sort of facts that need to be accounted for. That a pitched coin should sometimes turn up heads and sometimes tails calls for no particular explanation; but if it shows heads every time, we wish to know how this result has been brought about. Law is *par excellence* the thing that wants a reason. (p. 288)

Although we may look for the one thing that went wrong in a commonly experienced combination of events, as when a car breaks down, we assume a background in which we are able in principle to understand why everything in the machine had previously gone right.

Peirce particularly objected to assuming that exactness, which would support determinism, existed in nature, "We observe that phenomena approach very closely to satisfying general laws; but we have not the smallest reason for supposing that they satisfy them precisely" (1931–1958, Vol. 1, para. 133); "Whenever we attempt to verify the accordance of fact with law, we find discrepancies which we rightly enough attribute to errors of observation. But we cannot be sure that there are not similar, though much smaller, aberrations in the events themselves" (1886/1992, p. 243; also see 1893/1998, p. 2); and he (1904/1998) opposed the idea that chance was merely a name for ignorance: "I know that writer has copied writer in the feeble analysis of chance as consisting in our ignorance. But the calculus of probabilities is pure nonsense unless it affords assurance in the long run" (p. 314).

Peirce's Universal Evolution

Peirce (1883–1884/1992) said of his views, "My opinion is only Darwinism analyzed, generalized, and brought into the realm of Ontology" (p. 222). As Peirce (1891/1992) understood natural selection, "Broadly and philosophically conceived, Darwinian evolution is evolution by the operation of chance, and the destruction of bad results" (p. 290); and he (1893/1992) saw that "Natural selection, as conceived by Darwin, is a mode of evolution in which the only positive agent of change … is fortuitous variation" (p. 358). On this understanding, Peirce supported natural selection in opposition to theories that assumed universal necessity: "Diametrically opposed to evolution by chance are those theories which attribute all progress to an inward necessary principle, or other form of necessity" (p. 359). For Peirce (1997), "From the moment that the Idea of Evolution took possession of the minds of men the pure Corpuscular [or mechanistic] Philosophy … had [its] doom pronounced" (p. 164).

Understandably, *The Origin of Species* could not easily be understood or welcomed by those who accepted determinism and the nonexistence of chance. Addressing this conflict, Mayr (1991) said,

> The physicists at that time were strict determinists; prediction was not only possible but was the very test of the validity of theories. Evolutionary processes, by contrast, involved a considerable chance element: they were probabilistic, and hence they did not permit absolute prediction. … The deterministic spirit of science at his time was in complete conflict with Darwin's findings. (pp. 48–49)

Put another way, "Darwinism was a scandal to many Laplaceans. In the Laplacean worldview, randomness is only appearance; in the Darwinian, it is closer to a fact of nature—in some respects it is *the* fact of nature" (Menand, 2001, p. 199).

Contributing to this scandal, Darwin (1859/1958) often used the term *chance* in his explanations even though he was apologetic about doing so in *The Origin of Species*.

> I have hitherto spoken as if the variations—so common and multiform with organic beings under domestication, and in a lesser degree with those under nature—were due to chance. This, of course, is a wholly incorrect expression, but it serves to acknowledge plainly our ignorance of the cause of each particular variation. (p. 131)

Darwin knew that chance was not a respectable word in many scientific circles although he used it without apology in his personal correspondence, for example, in letters to Lyell of October 25, 1959 (Burkhardt, 1991, p. 358) and September 1, 1860 (Burkhardt, 1993, p. 340).

Noting that Aristotle and Epicurus had accepted a role for chance in ancient times, Peirce (1892/1992, pp. 298–299) had no a priori prohibition against accepting chance, not so much to use it as a bald explanation but to "make use of chance chiefly to make room for a principle of generalization, or tendency to form habits, which I hold has produced all regularities" (p. 310). Peirce (1887/1992) also noted that Darwin was not the first scientist in recent years to make use of chance.

> Mr. Darwin proposed to apply the statistical method to biology. The same thing had been done in a widely different branch of science, the theory of gases. Though unable to say what the movements of any particular molecule of gas would be on a certain hypothesis

regarding the constitution of this class of bodies, Clausius and Maxwell were yet able, by the application of the doctrine of probabilities … to deduce certain properties of gases. … Darwin, while unable to say what the operation of variation and natural selection in any individual case will be, demonstrates that in the long run they will adapt animals to their circumstances. (p. 111)

Peirce (1893/1992) saw that physics and biology had both demonstrated that chance begat order:

> The idea that chance begets order, which is one of the corner-stones of modern physics … was at that time put into its clearest light. … The statistical method had … been applied with brilliant success to molecular physics. … In the very summer preceding Darwin's publication, Maxwell had read before the British Association the first and most important of his researches on this subject. The consequence was … the idea that fortuitous events may result in a physical law. … It was inevitable that the *Origin of Species*, whose teaching was simply the application of the same principle to the explanation of another "non-conservative" action, that of organic development, should be hailed and welcomed. (p. 358)

Peirce came to Darwin's natural selection with a mind open to accepting chance from his knowledge of philosophical precedent, mathematics, and Maxwell's research.

From this background, Peirce arrived at a general formula for selection and a theory of universal evolution. He (1871/1992) saw natural selection as analogous to "the law of supply and demand" (p. 105; also see Schweber, 1977, pp. 278n–279n); and he (1880/1986) saw a close parallel between habit and natural selection: "Habit plays somewhat the same part in the history of the individual that natural selection does in that of the species; namely, it causes actions to be directed toward ends" (p. 46). He saw such a process as accounting for what we find everywhere in the universe.

> The only possible way of accounting for the laws of nature and for uniformity in general is to suppose them results of evolution. This supposes them not to be absolute, not to be obeyed precisely. It makes an element of indeterminacy, spontaneity, or absolute chance in nature. (p. 288)

The following presents Peirce's formula for selection and his universal evolution in more detail.

In one of his accounts of natural selection, Peirce (1931–1958) said, "The theory of natural selection is that nature proceeds … to adapt a stock of animals or plants precisely to its environment, and to keep it in adaptation to the slowly changing environment" (Vol. 2 para. 86). In this process, Peirce saw three key concepts: the slowly changing environment (A), the stock of animals or plants that vary (B), and selection (C). Peirce cast these concepts in a three-term probabilistic arrangement and generalized this formula across the discovery of the laws of nature, the improvement of inventions, and natural selection. In effect this was an AB-because-of-C formulation: "So we now meet with a Rational Threeness which consists in A and B being really paired by virtue of a third object, C" (Vol. 2 para. 86). Skinner's operant in which the relation between the antecedent (A) condition and behavior (B) is because of consequences (C) illustrates this formulation. Peirce contrasted his formulation with an AB formulation in which "a real pairedness consists in a fact being true of A which would be nonsense if B were not there" (Vol. 2 para. 86). For Peirce, "Purely mechanical actions take place between pairs of particles" (Vol. 2 para. 86); and he described the relation as one of brute force or reaction, "The idea of brute force is little more than that of reaction; and this is pure binarity" (Vol. 2 para. 84). An S-R formulation (if-the-stimulus-then-the-response) illustrated the brute force of a mechanical reaction.

Darwin's (1859/1958) three terms —*conditions of life*, *variation*, and *selection*—fit Peirce's AB-because-of-C formula: "Natural *Selection* [italics added], or the Survival of the Fittest … implies only the preservations of such *variations* as arise and are beneficial to the being under its *conditions of life* [italics added]" (p. 88). In other words, the relation between the conditions of life (A) and the variations of organisms (B) adapted to it exists because of selection by consequences (C) for previous AB (conditions of life/variations) relations. Darwin (1877/1984) might vary these terms; for example, "If the species were exposed to new conditions of life, and the structure of the several parts varied ever so little, the smallest details of structure might readily be acquired through natural selection" (p. 287). But the three basic concepts, (A) conditions of life, (B) variations, and (C) selection remained. When Darwin simplified this reference in terms of variation and selection, the conditions of life was understood. This formula was embraced within a comprehensive evolutionary account. Peirce (1886/1992) said,

> We must … suppose an element of absolute chance, sporting, spontaneity, originality, freedom, in nature. We must further suppose that this element in the ages of the past was indefinitely more prominent than now, and that the present almost exact conformity of nature to law is something that has been gradually brought about…If the universe is thus progressing from a state of all but pure chance to a state of all but complete determination by law, we must suppose that there is an original, elemental tendency of things to acquire determinate properties, to take habits. (p. 243)

And he (ca 1890/1992) extended this disposition to take on habits to atoms and molecules:

> All things have a tendency to take habits. For atoms and their parts, molecules and groups of molecules, and in short every conceivable real object, there is a greater probability of acting as on a former like occasion than otherwise. (p. 277)

This was a thorough evolutionism in which some levels had a longer history of acquiring habits than others and were more deterministic in their habits. Adopting behavioral terminology, we might say Peirce was proposing an operant universe.

What his evolutionary cosmology would lead to was far from clear. At one point Peirce (1891/1992) said, "At any time, however, an element of pure chance survives and will remain until the world becomes an absolutely perfect, rational, and symmetrical system, in which mind is at last crystallised in the infinitely distant future" (p. 297). But he (1931–1958) also said,

> Now, you and I—what are we? Mere cells of the social organism. … the very first command that is laid upon you, your quite highest business and duty, becomes, as everybody knows, to recognize a higher business than your business … a generalized conception of duty which completes your personality by melting it into the neighboring parts of the universal cosmos. (Vol. 1 para. 673)

Peirce joined this view to religious values, "The supreme commandment of the Buddhistochristian religion is, to generalize, to complete the whole system even until continuity results and the distinct individuals melt together … become welded into the universal continuum" (Vol. 1 para. 673).

Peirce lacked a sustained university affiliation, which partially accounted for his views not being widely known and sometimes incorrectly presented. In an apparent misreading of Peirce, Wiener (1949/1972) said, "As late as 1893, Peirce still regarded Darwin's theory as unworthy of much scientific respect" (p. 77); and he justified this interpretation by Peirce's (1893/1992) statement that Darwin's hypothesis "did not appear, at first, at all near to being proved; and to a sober mind its case looks less hopeful now than it did twenty years ago" (p. 359). However, the wider context of this passage shows that Peirce was speaking for the views of the scientific community at large rather than for himself.

Earlier in that same paragraph, Peirce had said, "The real science that Darwin was leading men to was sure some day to give a death-blow to the sham-science of Mill" (p. 359), which hardly indicates that he "regarded Darwin's theory as unworthy of much scientific respect." In the following paragraph on that same page, Peirce also said, "Diametrically opposed to evolution by chance are those theories which attribute all progress to an inward necessary principle, or other form of necessity" (p. 359), and he referred to Weismann, who,

> though he calls himself a Darwinian, holds that nothing is due to chance, but that all forms are simple mechanical resultants of the heredity from two parents. It is very noticeable that all these different sectaries seek to import into their science a mechanical necessity to which the facts that come under their observation do not point. (pp. 359–360)

Peirce was referring, not to his own regard for natural selection, but to those in the scientific community who did not accept Darwin's theory. As Mayr (1991) pointed out, "The opposition to natural selection continued unabated for some eighty years after the publication of the *Origin*" (p. 132). The opposition even increased: "When the fiftieth anniversary of the publication of the *Origin of Species* was celebrated in 1909 … natural selection at that time was at the lowest point of its scientific acceptance" (p. 127). Moreover, "Natural selection as the mechanism of evolutionary change was not universally adopted by biologists until the period of the evolutionary synthesis (1930s–40s)" (p. 97). Peirce was commenting on the status of natural selection in the scientific community at large. He himself was an early and steadfast supporter of natural selection.

Tipler's Evolutionary Reality

The physicist F. J. Tipler (1994) proposed an evolutionary account for a superorganism in comparative detail.

> This book is a description of the Omega Point Theory, which is a testable physical theory for an omnipresent, omniscient, omnipotent God who will one day in the far future resurrect every one of us to live forever in an abode which is in all essentials the Judeo-Christian Heaven. Every single term in the theory … will be introduced as pure physics concepts. In this book I shall make no appeal, anywhere, to revelation. I shall appeal instead to the solid results of modern physical science; the only appeal will be to the reader's reason. (p. 1)

In other words, Tipler offered his theory as a possibility to be tested by science, not a certainty to be accepted by faith. The omega point theory was "not deterministic" (p. 189). Although "The traditional cosmos was static; the Omega Point cosmos is dynamic and evolutionary" (p. 216). Tipler traced his ideas to Bernal through Dyson, and the term *omega point* was taken from Teilhard de Chardin (1975) although "the term is Teilhard's only scientific contribution to this book" (p. 110).

The idea of god created in the future is not that new. Almost 200 years ago, DeQuincey (1827/1966) said, "Some of this school have affirmed that it is not so true to say of God that he *is*, as that he *will be* hereafter" (p. 225). The concept of a god that will evolve according to the concepts of physical science that can be tested along the way is more recent. Whether such a god will eventually be considered strictly as a possible future existence, as existing in the past once future existence is established, or as existing and evolving since the beginning of time remains to be seen.

Previously, Tipler (Barrow & Tipler, 1986) had coauthored *The Anthropic Cosmological Principle* with J. D. Barrow, professor of mathematical sciences at the University of Cambridge, which pointed out that life would be impossible if the values of the constants of nature were much different. Amassing considerable scientific evidence and argument, Tipler (1994) presented a theory with the advantage that "Science can now offer precisely the consolations in facing death that religion once offered" (p. 339). Although much in Tipler's physics must turn out right for his theory to be validated—just as the constants of nature must turn out right for life to evolve—and we might well expect a need for future modifications of the original theory, Tipler concluded,

> The Omega Point Theory allows the key concept of the Judeo-Christian-Islamic tradition now to be modern physics concepts: theology is nothing but physical cosmology based on the assumption that life as a whole is immortal. A consequence of this assumption is the resurrection of everyone who has ever lived to eternal life. Physics has now absorbed theology; the divorce between science and religion, between reason and emotion, is over. … Religion is now part of science. (pp. 338–339)

In other words, science and religion may now have much the same ends although the means differ.

Working Toward an Ultimate Reality

In evolutionary realities, we need to consider the possibility that human actions may affect the outcomes and make them more or less likely to occur. As Skinner (1957) said in his opening sentence to *Verbal Behavior*, "MEN ACT upon the world, and change it, and are changed in turn by the consequences of their action" (p. 1). What the ultimate reality of a long series of these changes will be is highly unpredictable in any detail. Nevertheless, inspired by the philosopher E. A. Singer, Jr., Ackoff and Emery (1972) suggested that the broad outlines of the ultimate reality we desire already has common assent to it and that we can work toward it. According to Singer (1948, p. 12), all desires—by the very concept of desire—entail a desire for the power to attain them. The issue is the nature of this power and how to advance it. For example, personal power for all cannot be attained if personal power for one must come at the cost of personal power for another. Cooperative relations need to be advanced to the point at which this does not occur. Following Singer, Ackoff and Emery proposed conditions for harmoniously producing such power. They saw these conditions as having precedents in the classical concepts of truth (information or knowledge), goodness (cooperative relations), and beauty (creativity). They also added a fourth condition of plenty (access to resources or prosperity). More information and more accurate information, more cooperative relations, more creativity, and more prosperity are conditions we can work to improve, and various signs might be taken as evidence of improvements in these conditions, although such improvements need not be necessary or continuous.

Lest it seem as if conceptions of evolutionary realities lead inevitably to postulating a deity, note that such a being is absent in the early evolutionary speculations of Eliot (1879/1994), Lytton (1874/1973), and Wells (1895/2003), which were more pessimistic than optimistic. And it is not uncommon to assign a pessimistic outcome to the world's evolution. Skinner (Bjork, 1993, pp. 229–230) said, "I can't imagine anything that will prevent the sheer destruction of the world as a planet long before it needs to be destroyed" (p. 230). However, predictions depend on assumptions, and other assumptions can be made.

If we acquire an increasing control of our environment that avoids a destructive outcome, we may hope for optimistic outcomes in the long run. We may also play a role in bringing them about. Given enough time, it may be rash to rule out any eventuality. The appropriate question for ultimate speculation might well be, What would you have reality evolve into?

BEHAVIORIST POSITIONS ON ULTIMATE REALITIES

A belief in determinism was clearly a commitment of Watson's, and it seems reasonable to assume it was also a belief of Skinner's for a time. However, Skinner's views diverged from Watson's, and that divergence extended to Watson's determinism.

Watson

Watson (1924/1970)—who was aligned with positivism (Buckley, 1989, pp. 80–81, 183; Lattal & Laipple, 2003, p. 43)—said, "The behaviorist is a strict determinist—*the child or adult has to do what he does do*" (p. 183). Watson also said, "Behavioristic psychology has as its goal *to be able, given the stimulus, to predict the response*—or, *seeing the reaction take place to state what the stimulus is that has called out the reaction*" (pp. 17–18); and, "We can throw all of our psychological problems and their solutions into terms of stimulus and response. Let us use the abbreviations S for *Stimulus* (or the more complex *situation*) and *R* for *response*" (p. 22). All behavior was to be cast in a universal cause and effect, or stimulus and response, formulation. Further, in allowing the stimulus to stand for either an event within the situation or for the entire situation, Watson was consistent with the distinction Mill (1874, p. 237) made for considering the cause as either one antecedent or a sum of antecedents for the effect. However, this leaves the cause rather ambiguous, and problems were seen with the validity of classical behaviorism by the early 1930s (Moore, 2005, p. 138).

Skinner

Although Skinner (1979/1984) said in his thesis that "every movement of the organism is in response to a stimulus" (p. 102) and also said, "I was convinced that the concept of the reflex embraced the whole field of psychology" (p. 70), he came to reject a pervasive stimulus and response model. Skinner (1971) said, "The stimulus-response model was never very convincing" (p. 18) and that he should have abandoned the reflex framework for operant behavior sooner (e.g., 1977/1978, p. 119). Skinner also deviated from Watson's determinism in seemingly pursuing scientific determinism before abandoning it.

Skinner on determinism. Pointing to similarities in "Jonathan Edwards," "predestination," and "a deterministic system of behavior," Skinner (1983/1984) said, "Much of my scientific position seems to have begun as Presbyterian theology, not too far removed from the Congregational of Jonathan Edwards" (pp. 402–403). Skinner's religious upbringing and his initial scientific position both supported a belief in determinism. Later, in an apparent assent to scientific determinism, Skinner (1947) said, "We must … postulate that human behavior … is completely determined" (p. 23). The modifier "completely" does not admit of exceptions for instances. Skinner spoke as though he expected to find empirical evidence of this determinism:

> A proper theory at this stage would characterize the behavior of an individual in such a way that measurement would be feasible if he were the only individual on earth. This would be done by determining the values of certain constants in equations describing his behavior. (p. 39)

Further, Skinner (1977) said he had thought a completely predictive science of behavior "might be possible in the laboratory" (p. 1008). Skinner's phrasing indicated that he had once expected, or hoped to find, empirical contact for determinism but that he no longer did.

In addition, Skinner has been criticized for how he had presented indeterminism–determinism in 1953.

Responding to Skinner's (1953/1965, p. 6) idea that if human actions are not determined they are merely spontaneous or random occurrences, Earman (1986) observed, "The reader will immediately recognize that we are being presented with a false dichotomy: determinism vs. non-lawful behavior or determinism vs. spontaneity and randomness" (p. 243). Instead,

> We have seen not the slightest reason to think that the science of physics would be impossible without determinism, and from the many examples studied we know that denying determinism does not push us over the edge of the lawful and into the abyss of the utterly chaotic and non-lawful. (p. 243)

In fact, determinism was never needed for scientific explanation, which does not work with mathematical formulas that are completely exact empirically (Cartwright, 1983; Giere, 1999, pp. 5–6). In the models-based view advanced by Giere (also see De Waal, 2005, pp. 285–286, for similar views by Peirce), "The empirical question—the question of realism—is how well the resulting model fits the intended aspect of the real world. And here my central claim is that the fit is always partial and imperfect" (p. 6).

Skinner (1983/1984) also reported that Bridgman had criticized his account of indeterminism–determinism in 1953:

> I had learned my operationism from Percy Bridgman, but evidently not well enough. When he saw the manuscript of *Science and Human Behavior*, he caught me up on two subtle points. He wrote:
> *I think it would be better in discussing the principle of indeterminacy to say that relevant information does not exist than to say we cannot put ourselves in possession of it. And I would not like to say, as seems implied, that science has to assume that the universe is lawful and determined, but rather that science proceeds by exploiting those lawfulnesses that it can discover. Anything smacking of faith I think we can get along without*. (p. 60)

Bridgman's point was that indeterminism does not need to assume, as Skinner implied, that the relevant information existed. Skinner did not argue with Bridgman's assessment, and the phrase "caught me up"—without any objection or defense—suggests that he accepted it.

Skinner (1974) still affirmed a complete determinism: "We cannot prove, of course, that human behavior as a whole is fully determined but the proposition becomes more plausible as facts accumulate" (p. 189). But Skinner (1955–1956/1999) did not explain how the range of "sentences about nature"—from "highly probable 'facts' to sheer guesses" (p. 6)—add up to an inference of certainty, particularly when we are affected by but cannot know reality directly (e.g., Leigland, 2004; Skinner, 1974, p. 127). Skinner wanted empirical manifestations of determinism, but he could offer no convincing evidence.

Skinner on indeterminism and evolutionary reality. In his early work, Skinner (1935) expressed an indeterminism regarding the instances of a response class, "The responses which contribute to this total … are not identical. They are selected at random from the whole class" (p. 45). Neuringer (2004, pp. 892–893) said that such a view was consistent with placing Skinner as a determinist in regard to general laws but not instances. Such determinism would not be absolute, exact, or complete and did not fit the model of either scientific determinism or philosophical determinism, although it would be similar to near-determinism. We may wonder if Skinner would have distinguished an indeterminism of instances and a determinism of classes for other events besides the actions of organisms. Or was he simply commenting on the here-and-now reality he faced with behavior?

Further, Skinner (1937) had early assumed chance was operating in order to explain how operant behavior began, an explanation he kept after discarding the paired S-R formulation of the original operant. Instead of having a stimulus initiate an operant response, the behavior occurred spontaneously (at random or by chance) without a previous initiating cause: "There is also a kind of response which occurs spontaneously in the absence of any stimulation with which it may be specifically correlated … although discriminative stimuli are practically inevitable after conditioning" (p. 274). With conditioning, the operant became a habit, with antecedent stimuli from the setting functioning as discriminative stimuli. Instead of treating this explanation of chance origins apologetically as due to his ignorance, "Skinner … made the spontaneity and 'random' origins of operant behavior a virtue" by arguing that "organisms that engaged in such uncommitted behavior had some sort of survival advantage … because there was much greater opportunity for consequences to select effective behavior" (Moore, 2005, p. 115). Skinner accepted randomness and spontaneity for here-and-now reality in his three-term contingency of antecedent conditions, behavior, and consequences while accepting complete determinism for ultimate reality, a troublesome discordance.

The strain between Skinner's probabilistic facts and deterministic metaphysics was resolved when he placed any eternal verity, such as determinism, beyond the realm of acceptance. Skinner (1979/1984) said, "Accept no eternal verity" (p. 346), which might have been suggested during his studies of Wagner's *Ring*. In addition, Skinner (1990b) spoke against the high predictability he had forecast in 1947: "Too much of what will happen depends upon unforeseen variations and adventitious contingencies of selection. The future is largely a matter of chance" (p. 197). And Skinner insisted, "The origin of human behavior, like the origin of species, has got to be interpreted in terms of randomness and accident" (Trudeau, 1990, p. 2). Discussing natural selection, operant conditioning, and cultural evolution, Skinner (1990a) said the "variations are random and contingencies of selection accidental" (p. 1207) and that "if there is freedom, it is to be found in the randomness of variations" (p. 1208). In his final positions, Skinner showed no support for scientific determinism or for any other form of determinism. Although his advice against accepting eternal verities precluded accepting ultimate evolutionary realities as well as ultimate deterministic realities, the reality he proposed in the here and now was evolutionary.

Other Behaviorist Views of Determinism

Two different assessments of how behaviorists view determinism occur in Chiesa (2003) and Galuska (2003). Chiesa said, "Determinism is a metaphysical position … about how the world *is*" (pp. 250–251). Chiesa is correct in that this is the traditional meaning of determinism. But note that such determinism is an "eternal verity," which Skinner (1979/1984, p. 346) said *not* to accept. Chiesa also described what are commonly given as two advantages for accepting determinism. The first was motivation to search for controlling variables because determinism assures us they are there to be found. However, probabilistic causality is all we ever discover, and this causality would tend to function somewhat intermittently, like a gambler's ratio of reinforcement, which would have the advantage of encouraging persistence in the face of delay in finding controlling variables. The second was encouragement for people "to judge themselves and others less harshly than they might have been taught by their culture" (p. 255). However, it is difficult to see how a belief that our environment (including genetic and personal histories) conditions us to act according to probability entails a harsher self-judgment than a belief that we act according to determinism.

In contrast, Galuska (2003) did not find that all behaviorists subscribed to a metaphysical determinism:

> Some behaviorists have abandoned metaphysical determinism in favor of *metaphysical probabilism* or *probabilistic determinism*. … This philosophical position stems from viewing behavior as a stochastic system incorporating random events. In practice, both metaphysical determinism and probabilistic determinism can only couch predictions in terms of probability. (p. 263)

Metaphysical probabilism or *probabilistic determinism* indicates some element of indeterminism.

Dissent from complete determinism and the value of believing in determinism appeared in Vorsteg (1974), who presented a view that may have been similar to Skinner's final conclusion:

> Phenomena accounted for in terms of probabilistic laws are not, or need not be, deterministic. The laws of behavior specified in terms of operant conditions are probabilistic. Although these are quite different from the probabilistic laws of quantum mechanics, they bear one important similarity to the latter in that both are logically indifferent to the issue of determinism. (p. 118)

Citing Vorsteg, Begelman, and Day, Marr (1982) thought abandoning mechanistic determinism would be liberating for behaviorists:

> The radical behaviorist position on the issues of determinism and causality has been a matter of debate. … The abandonment of mechanistic determinism should not be viewed by behaviorists with despair, but rather be looked upon as liberating (as it has been for physics). (pp. 205, 207)

And Neuringer (1991b) said his research "has caused me to question the omnipresence of behavioral determinism" (p. 46). The various positions indicated for behaviorists in respect to determinism do not indicate a shared understanding and acceptance.

CONCLUSION

The span of speculations for ultimate reality is wide—from determinism to the omega point theory—and wider still if all suggested scenarios are included (e.g., parallel worlds, Kaku, 2006; morphic resonance, Sheldrake, 1981, 1988, 1995). A reasonable position might side with the famous fragment of Protagoras:

> Concerning the gods [or ultimate realities] I am unable to know, whether they exist or whether they do not exist or what they are like in form. For there are many hindrances to knowledge, the obscurity of the subject and the brevity of human life. (Schiappa, 1991, pp. 141–142)

Indicating the highly speculative ground we have been covering, it can even be doubted whether anyone has been convinced that either extreme of indeterminism–determinism existed. Has anyone ever existed who was convinced the world is thoroughly and enduringly capricious in all its aspects? At the other extreme, Berlin (2001) quoted John Austin to say,

> They all talk about determinism and say they believe in it. I've never met a determinist in my life, I mean a man who really did believe in it as you and I believe that men are mortal. Have you? (p. 143)

Presumably, Austin was speaking of complete or scientific determinism.

Both extremes seem difficult to accept, and the more recent behavioral positions seem to fall between the extremes. In Chiesa's (2003) definition, "Determinism is the view that all natural phenomena are products of interrelated antecedent processes" (p. 243). Such a broadly encompassing definition does not exclude an interpretation that probabilistic processes are ultimately at work. Galuska's (2003) finding that some behaviorists favor "*metaphysical probabilism* or *probabilistic de-*

terminism" (p. 263) also suggests that behaviorists fall between the extremes. And we have seen some movement among behaviorists along this continuum from right to left—from determinism to indeterminism. Both Chiesa's and Galuska's statements and Neuringer's (1991b) statement that his research has caused him "to question the omnipresence of behavioral determinism" (p. 46) indicate a shift to the left, away from the determinism of Watson and away from complete determinism.

As partial justification for a shift away from complete determinism, it seems gratuitous to propose that a completely deterministic process exists somewhere. All empirical investigations eventually encounter uncertainty, and we can never justify an empirical prediction of absolute necessity and certainty. Ultimate realities with some indeterminism are closer to processes we experience. An evolutionary cosmology, for example, that has the entire universe taking on habits is simply an extended generalization of Darwin's natural selection and Skinner's operant behavior. Darwin proposed selective processes for all living beings. Generalizing from human habits, Peirce (ca 1890/1992) proposed an expanded range of selective processes from the very small and, in effect, to the very large, including "atoms and their parts, molecules and groups of molecules, and every conceivable real object" (p. 277). Skinner (1981) saw selective processes "in living things [and] in machines made by living things" (p. 501) as well as in three selective processes for human behavior: "(i) the contingencies of survival responsible for the natural selection of the species … (ii) the contingencies of reinforcement responsible for the repertoires acquired by its members … [and] (iii) the special contingencies maintained by an evolved social environment" (p. 502). Although Peirce's evolutionary cosmology has gaps where particulars remain to be discovered, a never-seen conceptual process, such as a completely exact determinism, is not introduced as an explanation.

In early behaviorism, a belief in determinism was aligned with the mainstream heritage of science and philosophy at the time. Darwin's natural selection had yet to attain "the period of the evolutionary synthesis (1930s–40s)" (Mayr, 1991, p. 97) and was not firmly established in that heritage. Skinner, for example, did not even use the term *evolution* in his early publications (Morris, Lazo, & Smith, 2004, p. 158). Today, the radical behaviorism that Skinner developed is widely seen as having more in common with Darwin and pragmatism than with Watson and positivism. If a behaviorist wants to believe in—or hope for—an ultimate reality, an evolutionary or selectionist reality seems more consistent with Darwin, pragmatism, and radical behaviorism.

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