The Journal of Mind and Behavior
Winter 1995, Volume 16, Number 1
Pages 9–20
ISSN 0271–0137

Waiting for Newton

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Argues that Newton's influence on psychology has been broad and profound, if not always acknowledged. From the Enlightenment onward, most philosophers and psychologists have tried to be "Newtons of the Mind," trying to do psychology as Newton did physics, stressing mathematics and mechanism. No Newton has arrived in psychology, but we go on waiting nonetheless. But Newton's influence has been deeper than this, because he defined the modern style in science and ushered in a revolutionary concept of the universe and humans' relation to it. Newton's great influence has tended, especially in English-speaking psychology, to crowd out or depreciate other visions of psychology such as Wittgenstein and hermeneutics that do not conform to the Newtonian ideal of science. It is suggested that Newton, like Beckett's Godot, may never arrive.

The influence of Isaac Newton on psychology — as on Western civilization generally — has been wide and deep. I wish to describe Newton's hold on psychology by taking as my stage Samuel Beckett's play *Waiting for Godot*. In *Waiting for Godot*, two men await the promised arrival of a third, Godot, who never arrives. As I read the play, those who wait are crippled by their faith, trapped by their own vain longings for Godot, unable to find themselves and their own ways in life. Similarly, psychology, along with the other social sciences, is kept from finding its own way by a vain hope for a scientific savior and could remain forever trapped within a tragically absurd universe of perpetually dashed expectations.

In my theatrical metaphor, Newton's influence on psychology may be viewed both as foreground and background. In the foreground are Newton's direct influences on psychology, those psychological doctrines taking Newton's model of the universe as a model of the mind. In the near background is the "Newtonian style" (Cohen, 1985) in science, and in the far

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background is Newtonian metaphysics (Burtt, 1963), the worldview of the scientific revolution. In the theater, it's the action in the foreground that captures our attention. I want to draw attention to the background against which the action of psychology is set. In the stage directions for *Waiting for Godot*, Beckett sets an austere, almost — but not quite — blighted landscape. Psychology's *Waiting for Newton* takes place on a similarly bleak stage, unremarked by psychology's players, who, like Beckett's, take it to be only natural. But before remarking on psychology's stage set, we need to ask: "Why should anyone wait for Newton?"

I. The Play's Producers: The Philosophers

Newton's Reputation

> Nature and nature's laws lay hid in night;
> God said, Let Newton be! and all was light.
> –Alexander Pope

Even in his own lifetime, Newton was revered as a demigod. Newton's friend, the astronomer Edmund Halley, whose legendary question about cometary orbits brought forth Newton's *Principia*, wrote in his "Isaac Newton, an Ode" that "Nearer the gods no mortal may approach." Visiting England shortly after Newton's death, the Marquis d'Hopital asked if Newton ate and slept like other mortals (Koyre, 1965, p. 18).

With the Enlightenment, Newton's reputation took the step forbade by Halley. As Peter Gay (1969, p. 128) has remarked, "The scientific revolution was a voyage into abstraction and specialization, but, fortunately, the philosophers [of the Enlightenment] found it possible to dramatize that revolution by deifying one of the revolutionaries." The American philosopher Thomas Jefferson was typical in keeping a portrait of Newton in his study. And the highest praise flowed from philosophers' pens. The dean of the philosophers, Voltaire, wrote: "Before Kepler, all men were blind, Kepler had one eye and Newton had two eyes." David Hume called him "the greatest and rarest genius that ever arose for the ornament and instruction of the species."

The Enlightenment undertook its project of remaking the human world in the spirit (and the shadow) of Newton's achievement. Newton had shown that the universe is not capricious, or even running down as pessimists feared, but was an orderly machine ruled by fixed and universal laws. Most importantly, Newton represented the triumph of human reason, because his intellect revealed the workings of the celestial clockwork and gave us power to turn nature to our own ends. And if the world machine could be mastered by reason, why not the springs of human behavior? Could not knowledge of

humans turn human nature to rational ends? As Crane Brinton (1950, p. 1181) wrote:

> Thanks to Newton and his predecessors, they understood the solar system, gravity, mass, and in fact in its broad lines all natural sciences; research was needed only to fill in the details. But as to human relations, though they knew enough to know that their unenlightened predecessors, under the influence of traditional Christianity, had been all wrong about human relations, had indeed built up a system of laws and institutions inadequate at best, vicious at worst, they had as yet not quite attained their Newton. He was, however, just around the corner, this Newton of social science, the man who would sum up our enlightened knowledge into a system of social science. Men had only to follow to ensure the real Golden Age, the real Eden — the one that lies ahead, not behind.

Thus does our play, *Waiting for Newton*, opened in the eighteenth century.[1]

II. The Foreground: The Newtons of the Mind

Newtonian Psychology

Unsurprisingly, there were thinkers ready to claim the mantle of the Newton of the social sciences, thinkers who hoped to emulate Newton's achievements in natural sciences with their own mental sciences: Peter Gay calls them "Newtons of the mind."

The first was Newton's contemporary John Locke, praised by no less than Voltaire for rewriting the "romance of the soul" into its modest history. Locke, writes Voltaire, "everywhere takes the light of Newton's physics for his guide" (quoted by Vartanian, 1953). Locke admired — though he did not fully understand mathematically — Newton's *Principia*, and seems to have influenced Newton's own philosophical thinking (Rogers, 1982). Indeed, the "scientific creed of the eighteenth century" was Newtonianism "in a curious mingling with Locke's philosophy" (Koyre, 1965, p. 18). The influence of Newton became more precise in the next generation of philosophers, especially through David Hume and David Hartley.

Hume, as is well known, was foremost among those philosophers who regarded psychology, or the study of human nature, as foundational, and not just to the social sciences, but to the natural sciences as well. He is thus a *soi-disant* Newton of the mind. His view of the universe of the mind hews closely to Newton's view of the universe of things. The Newtonian world-machine is composed of discrete particles held together by gravity; Hume's (1962/1977) mind-machine is composed of unitary sensations and ideas held together by associations, "really *to us* cement of the universe."

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[1]The play opened on the natural sciences' stages, too. Cuvier complained in 1812 that "should not natural history also one day have its Newton," and as late as 1930 Otto Warburg stated that the Newton of chemistry "had not arrived" (Cohen, 1985).

Hartley, who, according to Gay (1969) was the first to use the word psychology in its modern sense, was even more Newtonian than Hume. Independently of Hume, Hartley developed an associative psychology erected squarely upon Newton's views on sensation, perception, and cognition as expressed in the *Optics*, and throughout, Hartley consciously modelled himself on Newton. Hartley's follower, chemist Joseph Priestley, gave Hartley the greatest praise one philosopher could then bestow on another: Hartley, he said, has "thrown more useful light upon the theory of the mind than Newton did upon the theory of the natural world" (quoted in Gay, 1969, p. 185).

Hume and Hartley pointed the way toward psychology's Newtonian future. Although their associative conception of the mind fell short of the Newtonian ideal by its lack of quantitative treatment, later psychologists, from Thorndike to Rescorla, would strive to make up the lack.

Moral philosophy, too, could be done in the Newtonian spirit. Although often counted among Hume's enemies, the Scottish commonsense philosophers agreed that psychology was the foundational science. Dugald Stewart wrote that "general psychology [is] the center whence the thinker goes outward to the circumference of human knowledge" (quoted in Gay, 1969). For the Scots, the central problem of the Enlightenment was rescuing morality from the moral relativism, and the political order from the reliance on a tyrant's power, from Thomas Hobbes' atheist and mechanical conception of human nature. Against Hobbes, they deployed a Newtonian argument. Newton, they said, had shown two things: first, that nature is not chaotic, but is governed by principles; and second, that the human mind is endowed by God with intellectual faculties capable of comprehending those principles. By analogy, the Scots argued that human life is ordered, too, by moral principles, and humankind has been endowed with the faculties to comprehend the moral order of the human universe as well as the natural order of the physical universe. In this respect, the central mental faculty posited by the Scots was *moral sense*, capable of discerning the right or wrong of an actual or contemplated action. Thus the Scots envisaged the creation of a moral science (or family of moral sciences) of human behavior and society along Newtonian lines. Later, the German romantics would sharply contrast natural science with moral science, but, in origin, both have Newtonian roots.

With such a powerful launching of psychology by the Enlightenment's *soi-disant* Newtons of the mind, the influence of Newtonian psychology, added to Newton's broader reputation, could not be other than tremendous. Even if associationism were the only psychological fruit of the Newtonian program in psychology, it would still be counted as psychology's greatest influence — so pervasive is the idea of association in psychology past and present. However, more important still is the influence of the Newtonian style.

III. The Near Background: Theory Junkies[2]

The Newtonian Style

According to I. Bernard Cohen (1985), a large part of the scientific revolution was the creation and acceptance of the Newtonian style in science. Cohen describes Newton's style as the construction of an abstract and general mathematical model of the universe, comparing it to observation and continuing in this fashion, shuttling between model and observation, refining the model into a satisfactory state. The Newtonian style was well known to the philosophers. Hartley writes: "The proper method of philosophizing [is] to discover and establish the general law of action, affecting the subject under consideration, from certain select, well-defined, and well-attested phenomena, and then to explain and predict the other phenomena by these laws. [This] is the method of analysis and synthesis recommended and followed by Sir Isaac Newton" (quoted in Gay, p. 181).

The success of the Newtonian style in physics was made possible by the fact that the physical universe can be described or modeled as a collection of spatio-temporal identical objects subject to spatio-temporal universal laws. However, so great was Newton's hold on subsequent thought that the basis of Newton's success — the nature of physical reality — became a presupposition of the social sciences. Hartley, Hume, and the Enlightenment philosophers generally, presupposed without argument that there is a universal human nature whose operations can be described as following universal mathematical laws (Gay, 1969). Michael Scriven (1980, p. 69) calls this attitude the "Newtonian fantasy": "the fantasy that underlying overt behavior, thought, or phenomenology there lies a theoretical structure which awaits discovery, and will yield precision, prediction, and power." Such a conception of human nature was essential to the Enlightenment's project of political reform and moral liberation. Without a scientifically knowable and controllable human nature reason would have nothing with which to replace local custom and historically unique traditions.

No one in modern psychology was more in the grip of the Newtonian fantasy than Clark Hull. Hull wanted very badly to be the Newton of behavior. Newton's *Principia,* Laurence Smith (1986, p. 178) writes, "became a kind of Bible for Hull. Several hours, he admonished [his graduate students], devoted to a perusal of this great classic would scarcely be wasted, even by a social scientist. The purpose of reading Newton was 'not to understand the details of the mathematics [cf. Locke], but to observe his *procedure,*'" that is, to absorb the Newtonian style. Hull wanted an axiomatic, mathematically pre-

[2]The term is that of Scriven (1980).

cise, and species-universal theory of behavior and would tolerate nothing less. He once complained to Kenneth Spence that Max Wertheimer had been "unable to give either the number of postulates or the number of theorems in his system" (quoted by Smith, 1986, p. 177, note).

Hull and his theory helped create the Yale branch of the Enlightenment project of using social science to effect social reform. During the Depression, Yale created the Institute of Human Relations (IHR) as a base from which social scientists might mount an assault on the social problems of the day. However, the Institute floundered until it was virtually taken over by Hull and his seminars (Smith, 1986). Just as Hull thought the laws of psychology could be deduced from physics, so, echoing Hume, he thought the laws of the social sciences could be deduced from psychology, creating "a very tight integration far up and down the hierarchy of the social sciences" and providing a formula for coordinating activity at the IHR (Smith, p. 181).

Hull became, for a time, what he wanted to be: the Newton of behavior. His first book, *Mathematico–Deductive Theory of Rote Learning*, was praised by Ernest Hilgard (1940) as giving "a foretaste of what psychology will be like when it reaches systematic, quantitative precision" (p. 185). The young Sigmund Koch (1944, pp. 269; 286) praised *Principles of Behavior* as "one of the most important books published in psychology," a book that would perform "radical surgery" on the "withering *corpus* of social science." Although today we (especially Sigmund Koch) would not regard Hull so highly, the Newtonian ideal — or fantasy — of psychology as a tightly unified and quantitative science, lives on. Behind the Newtonian fantasy lies the deep background of Newtonian metaphysics.

IV. The Far Background: Romance, Tragedy, or Irony? Newton's Metaphysics

> Two worlds: This means two truths. Or no truth at all. This is the tragedy of the modern mind which "solved the riddle of the universe" but only to replace it by another riddle: the riddle itself. — Alexander Koyre (1965)
>
> The history of modern science ought to be written not as Romance or Tragedy, but as Irony. — Stephen Straker (1985)

I have come to believe that the deepest philosophical problem facing psychology is deciding what phenomena we need to explain, with what bedrock principles, or as Stephen Toulmin (1961) calls them, ideals of natural order. Every science takes some principles and concepts as ideals which cannot themselves be explained. For example, in Newtonian physics, objects move rectilinearly unless acted on by some outside force. Such infinite straight line

motion is never observed — hence it is an ideal — and is used to give order to phenomena that are observed. However, what to take as bedrock and what to take as problematical, in need of explanation, is not always clear. The origin of psychology's difficulty lies in the scientific revolution.

In the pre-Newtonian worldview, the universe was an inherently meaningful place, full of purpose, capable of intuitive penetration by consciousness. The Newtonian world-machine, however, is lifeless and meaningless, knowable not in its essence — Newton's *hypotheses non fingo* — but only by mathematical rules and mathematical models. E.A. Burtt (1963) eloquently contrasts the medieval world and the scientific world:

> The gloriously romantic universe of Dante and Milton . . . had now been swept away . . . . The world that people had thought themselves living in — a world rich with colour and joy, redolent with fragrance, filled with gladness, love and beauty, speaking everywhere of purposive harmony and creative ideals — was crowded now into minute corners in the brains of scattered organic beings. The really important world outside was a world hard, cold, colorless, silent, and dead; a world of quantity, an world of mathematically computable motions in mechanical regularity. The world of qualities as immediately perceived by man became just a curious and quite minor effect of the infinite machine beyond. (p. 230)

As Koyre (1965, p. 23) has remarked, modern science split our world in two. On the one hand is the world of science: "the world of quantity, of reified geometry." This is the real world. On the other hand is the human world: "our world of quality and sense perception, the world in which we live, and love, and die." This is the subjective world, which, Koyre says, "science has been unable to explain." The science that has been assigned the difficult, perhaps impossible, task of explaining the subjective world is psychology.

Following Newton, psychology has assumed that the physical world, the "real world" of science, is primary and unproblematical, while the subjective world of consciousness, meaning, purpose, and morality is problematic, and in need of explaining. Thus psychologists have accepted the task of explaining consciousness, meaning, purpose, and morality with principles that do not contain reference to any of them.

Consciousness disappeared in a historical process that interestingly recapitulated the disappearance of God from the Newtonian universe. For Newton and his immediate followers, the Newtonian celestial clockwork implied the existence of a celestial clockmaker, God, whose continuing existence was needed to tend and repair the mechanism. However, as Newtonian science advanced, and mathematics explained more and more, God became superfluous. Asked by Napoleon about God's place in his system, Laplace replied, "I do not need that hypothesis." Newton's style had slain Newton's God.

In psychology, we can tell this tale again, with William James playing the part of Newton, consciousness the part of God, and Hull the parts of

Napoleon and Laplace. Although James accepted much of the Newtonian world-machine, he never accepted the automaton hypothesis that people are mere machines. He gave consciousness — a very subjective consciousness, too — a vital role to play in organic life; consciousness was necessary in order for living organisms to adjust themselves to a changing environment. Just as the Newtonian God intervened to adjust the movement of the world-machine, so Jamesian consciousness intervened to adjust behavior. But, as mechanistic psychology advanced, research in Pavlovian and instrumental conditioning suggested that consciousness was superfluous to the adjustment of behavior. Ultimately, in 1936, Hull rhetorically inquired at the end of his APA Presidential Address, "But what of consciousness?" He answered himself as Laplace had Napoleon: "I have ignored consciousness for the simple reason that no theorem has been found as yet whose deduction would be facilitated in any way by including reference to it . . . . Moreover," Hull continued, no "other scientific system of behavior . . . has found consciousness necessary." Finally, Hull correctly located faith in the importance of consciousness in the pre-Newtonian worldview, persistence of which he dismissed as being "in the thrall of the middle ages," a "lifeless tradition" whose "shackles" we should "throw off" (Hull, 1937, pp. 31–32).

Hull's theory may be dead, but the Newtonian–Hullian impulse toward the automaton theory of behavior lives on, most notably in artificial intelligence and cognitive science. Consider the claim that "the very fact that a machine solves problems men solve is evidence that what is going on inside it is similar to what goes on inside human problem solvers. Workers in artificial intelligence cognitive science seem to agree that no watertight barriers separate them" (Levin, 1979, quoted in Straker, 1985, p. 247). Certainly artificial intelligence is waiting for Newton: Edward Keigenbaum once said that "We're still waiting for our Newtons and Einsteins in artificial intelligence. But we've had our Galileo, and he was Newell and Simon" (quoted by Waldrop, 1987, p. 29).

Hull and the later neobehaviorists pretty well ousted consciousness from scientific psychology, and artificial intelligence has pretty well ousted purpose and is aggressively attacking meaning. The concept of informational feedback provided a more plausible analysis of purpose and James' linking of purpose to consciousness than Hull's own excessively clockwork theory. Feedback reconciled purpose and automata.

Meaning has proved to be a tougher nut to crack, and, if thinkers like John Searle and Hubert Dreyfus are correct, it may prove uncrackable by cognitive science, at least as currently conceived. Nevertheless, artificial intelligence cognitive science hopes to finesse or dissolve the problem of meaning. Traditional artificial intelligence tries to finesse meaning with the physical symbol system hypothesis of its Galileo [Newell and Simon] by viewing

thinking as computing with formally defined rules on formally, that is, syntactically, not semantically, defined symbols. As Jerry Fodor (1980) states, if you take care of the syntax, the semantics takes care of itself. Or, as Daniel Dennett (1987) has it, neither computers nor people really have meanings (intentionality); it is just useful (so far) to treat them as if they do. Connectionism (and its close ally, neurophysiological reductionism) seeks to dissolve meaning in a subsymbolic level of processing that does not directly map onto symbolic meanings (Smolensky, 1988). Both approaches work within the Newtonian metaphysics in which meaning is not part of the world, but is problematical and in need of explanation or even elimination (Churchland, 1985).

While it lies a bit outside the scope of my article — scientific psychology — a few words are in order about the influence of Newtonian metaphysics on morality. Alisdair MacIntyre (1981) has recently excoriated the Enlightenment project of reconstructing morality on rational grounds, which failed — as was inevitable — and was replaced by emotivism, a nonrational ethics whose discourse is in decadent disarray. With the background I've developed here, I think we can spot the moment when the moral disarray described by MacIntyre began. We have already seen how meaning and purpose were purged from the universe by the scientific revolution and imprisoned in the "minute corners of the brains of organic beings" (Burtt, 1963, p. 239). Scottish moral sense theory, while attempting to rescue morality by making Newtonian arguments against Newtonian metaphysics, had the same effect on ethics. Because by making morality depend upon human moral sense, ethical judgments, like judgments of beauty or purpose, became subjective, locked in the corners of human heads. Moreover, since in the Scottish scheme the guide to moral life was the feelings of conscience, ethics based on moral sense was an important step toward emotivism.

What rescued Scottish moral sense theory from emotivist relativism was their and Newton's still living Christian God. Since God makes us in His image, it follows that He would implant in us a universally valid set of moral judgments. But when, in the nineteenth century, Newton's God was banished by the Newtonian science, ethics fell into the hands of the geometers of the mind, the positivists, who hoped to make morality, too, a matter of mathematics and deductive logic. Even John Stuart Mill, otherwise generally sympathetic to the Enlightenment project, felt a shudder of horror at positivist ethics:

> They deduce politics like mathematics from a set of axioms and definitions, forgetting that in mathematics there is no danger of partial views: a proposition is either true or it is not, and if it is true, we may safely apply it to every case which the proposition comprehends in its terms: but in politics and social science, this is so far from being the case that error seldom arises from our assuming propositions which are not true, but generally from overlooking other truths which limit and modify the effect of the former . . . . (They insist) upon only seeing one thing when there are many. (quoted in Himmelfarb, 1990, pp. 9–10)

V. Waiting for the Reviews

Should *Waiting for Newton* Close?

> Psychologists are scientific in the manner that evangelized savages are Christian—G. Politizer (quoted in Straker, 1985)

So, we see that, directly and indirectly, Newton has had more influence on psychology than perhaps anyone else who has ever lived. In evaluating that influence, I would like to begin with Mill's criticism of the positivists for seeing things only *one* way, recalling William Blake's prayer against "single vision and Newton's sleep." The worst effect of waiting for Newton has been the assumption that Newtonian science is the only kind of science. In criticism, one might here invoke Vico, Herder, Dilthey, the whole counter-enlightenment (Berlin, 1980), the distinction between *Naturwissenschaft* and *Geissteswissenschaft*, and the revival of hermeneutics. One might also cite Ernst Mayr's (1982) distinction between proximate causal physics and physiology, and ultimate causal evolutionary biology, or B.F. Skinner's (1981) similar distinction between sciences of causes and sciences of consequences.

But sticking with Mill's point, I would like to counterpoise Newton with Wittgenstein. Central to the Newtonian style (and behind it, Newtonian metaphysics) is a concern for — even an obsession with — generality. The whole aim of the Newtonian enterprise is general knowledge of spatio-temporally universal objects. But in the case of human beings, this runs roughshod over local "other truths," spatio-temporally specific cultures, spatio-temporally local traditions. From the Newtonian perspective, local tradition is so much error variance to be factored out, noise to be purged so we may see human truth with Kepler's and Newton's eyes. In sum, human meaning and purpose are problematical to be explained or eliminated.

But we might take another, Wittgensteinian view. Meaning is a human creation, playing the central role in human forms of life. The universe of meaning is a created social world apart from the given world of physics. Thus meaning cannot be reduced to physical functions, nor can it be eliminated without abolishing humankind — precisely Koyre's (1965, p. 25) fear in reading science as tragedy — how the play *Waiting for Godot* really ends, continuing a vain wait for a savior who never comes. It may become an enduring irony, as Straker suggests, viewed by historians outside the play unable to change it. Or it might end in Romantic triumph, as ordinary humans assert the primacy of human forms of life against the imperial claims of the Newtonian style.

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