THE EVOLUTION OF A SCIENCE

A Brief History of Behavior Analysis in the 20th Century

including Applications to Autism Treatment

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UMBC
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...AND AN ACKNOWLEDGMENT

This webinar is based upon a book in progress with Victor G. Laties. Circumstances now prevent him from continuing to contribute to it. We also wanted better representation of the role of applied behavior analysis in the evolution of our field. For that reason Nancy Neef has recently joined us as a co-author. (But neither bears responsibility for errors or omissions in this workshop. Those are on me.)
ANTECEDENTS:

- From the Big Bang through the origins and evolution of
  - our galaxy
  - our solar system
  - our planet
  - life on earth
  - hominids
- To human history in recent centuries.
From top to bottom: gradually zeroing in on our own time in the Holocene
ANTECEDENTS: Let us skip rapidly past 50,000 years of language evolution and 5,000 years of recorded history for a brief stop with the Greek philosophers:

• Plato (in translation, of course)
  …speaking is a kind of action, and naming is a kind of speaking.

• Aristotle (again, in translation)
  We are what we repeatedly do.
ANTECEDENTS:
And now more recent centuries, while recalling that just 7 consecutive human lifetimes of 75 or 80 years each would take us from 1492 to today (Fred Keller alone gets us back to 1899; more about him later):

- **15th:** da Vinci, Dante, Gutenberg
  - Geography, technology
- **16th:** Copernicus, Kepler, Vesalius, Shakespeare, Galileo
  - Earth as a planet
- **17th:** Descartes, Leeuwenhoek, Harvey, Newton
  - Organisms and mechanisms; the reflex
- **18th:** Galvani, Watt, Lavoisier, Linnaeus, von Humboldt
  - Animal magnetism, natural history, the industrial revolution
ANTECEDENTS: the 19th century

- Steamships and railroads
- Britain abolishes slavery (1833)
- The American Civil War (1861-1865)
- From the telegraph to the telephone
- The automobile
- The light bulb
- The gramophone
- Cameras and movies
- The flush toilet
- Fireplaces and iceboxes, but not yet the heating, refrigeration, and air conditioning that were to become 20th century commonplaces
ANTECEDENTS: the 19th century

- But primitive thinking still about what was to become eventually the practice of psychiatry
- Phrenology, mesmerism and other way-stations
- Bedlam, madhouses, lunatic asylums — diagnosis and treatment (such as it was) were typically overshadowed by custodial issues
ANTECEDENTS: Darwin and the 19th century

- His 1830s voyage on the HMS Beagle
- Artificial and Natural Selection
  - Sexual Selection
- Structure versus Function
- The Eclipse of Darwinism
ANTECEDENTS: the 19th century

- Mendel reports his genetic research (1865)
- Mendeleev organizes the periodic table of the elements (1869)
- Sechenov provides a prelude to Pavlov’s work on digestive glands (1897)
- Experimental Psychology: Wundt’s first laboratory in Leipzig (1879); William James
- American Psychological Association founded (1892), with G. Stanley Hall as first president
- Animal behavior: Romanes, Morgan, Lubbock
- Thorndike, Animal intelligence thesis (1898)
Thorndike puzzle box
Was Thorndike basic or applied?

• He left Harvard with some basic data and a 1897 MA to complete his PhD at Columbia in 1898. He spent almost all of his academic career at Teachers College of Columbia University, where he devoted much of his time to research on education.

• In a 2002 survey he was listed as the 9th most cited psychologist of the 20th century (Skinner was 1st, Piaget 2nd, and Freud 3rd; Watson was 17th and Pavlov was 24th).
EXPERIMENTAL STUDIES

OF THE

MENTAL PROCESSES OF THE RAT

Dedication presented to the Faculty of Clark University, Worcester, Mass., U. S. A., in partial fulfilment of the requirements for the Degree of Doctor of Philosophy and accepted upon the recommendation of E. C. Sanford.

BY

WILLARD S. SMALL

Reprinted from American Journal of Psychology
The straight alley (D) shows us roughly how Skinner got started.
From Skinner’s “Case history in scientific method” (1956)
But we’re jumping ahead of our story, though we’re getting close to where we want to be…

ANTECEDENTS: the 19th century
  • Fred Simmons Keller just misses the new century. He is born on February 2, 1899, in the little town of Rural Grove, New York.
The 1900s:
- the Wright brothers (1903)
- Einstein’s *Annus mirabilis* (1905): his four papers that transformed physics
  ‣ $e=mc^2$
  ‣ special relativity
  ‣ the photon
  ‣ Brownian movement and the atom
- The two psychologies of learning diverge: Animal learning, Ebbinghaus (1885) and British associationism
The 1900s: Behavior emerges as a subject matter in its own right.

- Pavlov, Nobel Prize for work on gastric secretion (1904)
- Thorndike, continuing contributions
- Jennings, *The behavior of the lower organisms* (1906); Loeb, tropisms and animal conduct
- Sherrington, *Integrative action of the nervous system* (1906), and the synapse
- Yerkes, comparative psychology and discrimination learning (later picked up by Lashley)
● The 1900s: One more significant event before we leave this decade:

- Burrhus Frederic Skinner is born on March 20, 1904 in Susquehanna, Pennsylvania
The 1910s: an iceberg sinks the Titanic (1912); a U-boat sinks the Lusitania (1915); the Great War (1914-1918) precipitates the Russian revolution (1917) and defines the decade

- Einstein’s *General theory of relativity* (1916)
- Bertrand Russell, *Principia mathematica* with Whitehead (1910-1913), *The problems of philosophy* (1912); Russell’s paradox: “This sentence is a lie,” which helped set the stage for Gödel’s incompleteness theorems of the 1930s
- Morgan’s *The physical basis of heredity* (1919)
- Bleuler (1911) applies the term *autism* to the extreme social withdrawal within a cluster of psychiatric symptoms
• **The 1910s:** The formal debut of behaviorism
  - Pfungst and Clever Hans (1911)
  - Köhler on Tenerife during the Great War: insight and problem solving chimpanzees
  - Watson’s *Behaviorist Manifesto* (1913): at first well-received for his antiestablishment stance on women and racism, but soon criticized for its materialistic views
  - Fred Keller works for Western Union and learns Morse Code
Fred Keller (center) as Western Union delivery boy
The 1920s: The 19th Amendment granting American women the right to vote; Edwin Hubble, galaxies and an expanding universe; the Modern Synthesis in biology; the Wall Street Crash of 1929 initiating the Great Depression
- Pavlov’s *Conditioned Reflexes* translated to English (1927); were *bell* and *conditioned* mistranslated?
- The learning theorists: Clark Hull, Edwin R. Guthrie, Edward C. Tolman
- J. R. Kantor and interbehaviorism
- Physics, not biology, provides the model science
- Philosophy of science: logical positivism and the Vienna Circle; Wittgenstein’s *Tractatus Logico-Philosophicus* (1921); Bridgman and operational definition
- Symptoms resembling the autism classification begin to be described in neurological and psychiatric journals
- B. F. Skinner goes to Harvard and meets Fred Keller
Fig. 1. B. F. Skinner’s treasured picture of Ivan Petrovich Pavlov, taken by a photographer at the 1929 International Congress of Physiology, with Pavlov’s signature attached.
Pavlov sesquicentennial issue of *The Sechenov Physiological Journal*, which was founded by Pavlov
The Learning Theorists: Clark L. Hull, Edwin R. Guthrie, Edward Chase Tolman
Logical positivism, the Vienna Circle, 1923 - 1936

Moritz Schlick (1882-1936), 1932: Positivism and Realism

Otto Neurath (1882-1945)


Ludwig Wittgenstein (1889-1951)

Herbert Feigl (1902-1988)

Hans Reichenbach (1891-1953)

Rudolf Carnap (1891-1970)

Carl G. Hempel (1905-1997)
• The 1930s: Fred Keller & B. F. Skinner receive Harvard Ph.D.s; Hitler comes to power in Germany and war clouds gather; Hitler invades Poland (1939)
  - Keller takes a teaching position at Colgate (1931), from which he moves to Columbia University (1938)
  - Skinner becomes a Junior Fellow (1933-1936)
  - Whitehead and the Black Scorpion
  - the path to *The Behavior of Organisms* (1938)
  - Skinner moves to the University of Minnesota (1936-1945)
Keller and Skinner
THE BEHAVIOR OF ORGANISMS
An Experimental Analysis

BY
B. F. SKINNER
ASSISTANT PROFESSOR OF PSYCHOLOGY
UNIVERSITY OF MINNESOTA

APPLETON-CENTURY-CROFTS, INC.
New York
Experimental chambers designed for rat lever presses (left) or pigeon key pecks (right). (If someone called either a Skinner box, it was a reasonable bet that the person did not have an extensive background in behavior analysis.)
The Cumulative Recorder
The 1930s: Some issues that had to be resolved.

- The generic nature of stimulus and response classes
- The language of conditioning
- Respondent behavior and operant behavior
- Reflexes, pseudo-reflexes, and the transition to the free operant
The transition from
\[ S \rightarrow R^0 \rightarrow S^1 \cdot R^1 \]
to
\[ s.R^0 \rightarrow S^1 \cdot R^1 \]
to
\[ R^0 \rightarrow S^1 \cdot R^1 \]
to
\[ R^0 \rightarrow S^1 \]
took a long time.

(The first line contains all of the terms from the old conditioned reflex forms)
Differential Reinforcement
Operant Classes
The 1940s: Pearl Harbor and World War II, the post-war era, and a day of great illumination
- Keller teaches Morse Code to the troops
- Pigeons in a pelican: Guided missiles and shaping
- “Operational analysis of psychological terms” (1945); Baby in a Box (1945): The Air Crib
- Skinner moves to Indiana as Chair (1945-1947), delivers William James lectures at Harvard (1947) and returns there as Professor (1948)
- Conference on the Experimental Analysis of Behavior (1946)
- Walden Two (1948)
Keller teaching Morse Code with the code-voice method
A pigeon in a harness learning to navigate to a target
Baby in a Box

The machine age comes to the nursery: introduced

Seventeenth Summer: A Complete Novel by Maureen Daly
Aircrib on display at the Archives for the History of American Psychology, Univ of Akron
The CEAB meeting at Indiana University, 1946
INDIANA UNIVERSITY
BLOOMINGTON, INDIANA

Top Row
L to R: Jim Dinsmoor, Geo. Kline, Doug Ellser, Bill Daniel, Bunchus Skinnor, Bill Estes, Fred Trikk, Dave Anderson, Bill Jenkins, ?, me, ?, Ben Wyckoff, ? Wolin, Del Beier

Lawn from — Ray Durpam, Nat Schoenfeld, Ralph Hofferson, May 9, 1962

Prof. B. F. Skinner
Psychological Laboratories
Memorial Hall
Cambridge 38, Mass.

Dear Fred:

Fred Keller wrote to ask who the man at the extreme right, top, of the 1946 CHEB photo was. Said you wanted to identify him. If it is the one squatting down that you want, he is Del Beier. Or if it is the one above, leaning against the pillar, Wolin, I believe.

Regards,

Jim Dinsmoor
The 1940s: World War II and the introduction of autism as a diagnosis

- Kanner (1943) borrows the term *autism* from an early 20th century Swiss psychiatrist, Bleuler.
- Working in Nazi Vienna, Asperger (1944) identifies a syndrome.
- Behavior analysis made so much sense that it was assumed it would be applicable to human problems, but no one at that time knew how relevant it would become to these issues.
• The 1940s: World War II and the post-war era.
  - W. N. Schoenfeld earns a Ph.D. in social psychology at Columbia (1942), remains in the department and then is drawn to Fred Keller and to Skinner’s work; together they work on an undergraduate curriculum and on their textbook, *Principles of Psychology* (1950)
  - Ralph Hefferline comes to behavior analysis at Columbia via gestalt therapy
  - “Operant conditioning of a vegetative human organism” (Fuller, 1949)
  - The control of behavior: Controversy arises
• The 1950s: The Korean War, the Cold War, Sputnik; the fall of Dien Bien Phu; Watson & Crick and DNA; Rock & Roll and Elvis Presley; the Society for the Experimental Analysis of Behavior (SEAB).
  - Sidman completes a Ph.D. on avoidance at Columbia (1952); by the end of the decade he completes his *Tactics of scientific research* (1960)
  - Skinner’s *Science and Human Behavior* (1953) and *Verbal Behavior* (1957); Ferster & Skinner’s *Schedules of reinforcement* (1957)
  - The Skinner-Chomsky controversies
  - SEAB founds the *Journal of the Experimental Analysis of Behavior* (1958)
  - Wittgenstein’s *Philosophical investigations* (1953)
The 1950s: Behavior analysis establishes roots at Harvard and Columbia and begins to branch out.
- The pigeon lab produces a new generation: Blough on animal psychophysics, Morse and Herrnstein on schedules of reinforcement, Azrin on punishment
- Dews brings schedules to psychopharmacology
- Bachrach and ASU: Fort Skinner in the desert
- Oases at Indiana, Minnesota, Brown, UCLA, Washington, with Kansas, WMU, SIU and others to follow later (how many does it take to create a critical mass within an academic institution?)
THE COLUMBIA UNDERGRADUATE CURRICULUM

• Keller’s Introductory Psychology course
  • 1st Semester: the rat lab
  • 2nd Semester: the human lab

• Schoenfeld’s Experimental Psychology
  • 1st Semester: Discrimination
  • 2nd Semester: Motivation

• Other courses: Behavior socialization (including behavior pathology), Seminars in teaching and in verbal behavior
Nat Schoenfeld and Fred Keller
Bill Cumming
...but other more important things were happening
…and meanwhile, in Cambridge, Massachusetts
Memorial Hall, 1962
A pigeon lab chamber
Pigeon lab relay racks and recorders
Pigeon lab relay racks and recorders
PSYCHOLOGICAL LABORATORIES
Memorial Hall, Harvard University

Upper Floor

Entrance →
Pigeon staff meeting: Bea Barrett, George Reynolds, Bill Morse
Another pigeon staff meeting:
Skinner at front right examining cumulative record
Skinner displays a pigeon
An early teaching machine
He pioneered behavioral work with pigeons, monkeys and "psychotic" children, and he might not have recognized or acknowledged a distinction between basic and applied research.
Murray and Rita Sidman
Vic Laties, Bernie Weiss and Peter Dews
• The 1950s: The Cold War, Sputnik, and language translation; the Arms Race continues and the Space Race begins; the French lose Dien Bien Phu.
  - Publishing hurdles: Harlow and cumulative records
  - the Society for the Experimental Analysis of Behavior (SEAB) is founded (1957) and launches the *Journal of the Experimental Analysis of Behavior* (1958)
  - Og Lindsley sends pigeon feathers to charter subscribers
  - Chomsky reviews Skinner’s *Verbal Behavior*
• The 1960s: More national and international history plays itself out.
  - A wall divides East and West Berlin (1961)
  - The Cuban Missile Crisis (1962)
  - The Civil Rights movement grows in the US while its entanglements grow in Vietnam
  - Assassination of John F. Kennedy (1963)
  - The Beatles come to the USA (1964)
  - Assassinations of Martin Luther King Jr and Robert Kennedy (1968)
  - Woodstock (1968)
  - The first moon landing (1969)
• The 1960s: Basic and applied research become more than one journal can handle, and SEAB founds the *Journal of Applied Behavior Analysis* (1968).
  - Behavior analysis becomes a division within the American Psychological Association (1964).
  - Skinner promotes teaching machines and introduces the distinction between verbally governed and contingency-shaped behavior.
  - Fred Keller visits Brazil.
  - Behavior analysis becomes more visible (but still “we happy few”?).
Don Baer, Mont Wolf and Todd Risley
The 1960s: New innovations, new controversies.
- The “superstition” superstitions
- Bijou, Baer, Wolf, Risley: modeling, prompting, fading….
- Ferster and a behavioral theory of autism
- The relativity of reinforcement: Premack develops a principle
- A new Harvard PhD cohort: Baum, Fantino, Hineline, Neuringer, Rachlin
- Contingencies as conditional probabilities
- Project Follow Through
- Signal detection: Nevin (1969)
- Goldiamond studies stuttering
- Timeout goes mainstream
- Lovaas, punishment and controversy
- MacCorquodale replies to Chomsky
- More controversy: constraints on learning (Bolles, Garcia, Seligman)
Ayllon & Azrin (JEAB, 1965)
“The measurement and reinforcement of behavior in psychotics”
The side-effects of extinction and their implications, reinterpreted with some help from psychopharmacology
ON THE EVOLUTION OF OUR VOCABULARY AND OUR GRAMMAR

Do you reinforce the organism or the response? If the organism, do you need to specify the response? If the response, do you need to say whose it is?

And what about the stimulus control? Does the organism discriminate or does the response?
Contingencies as conditional probabilities
Fred Keller in Brazil
Basic and Applied

Ayllon & Azrin: Token economies on psychiatric wards
Barrett: Reduction of tics; teaching
Bijou, Baer & colleagues: Child development, disabilities
Brady: Chimpanzees and the space program
Dews: Psychopharmacology
Ferster: Autism ("psychotic children"); depression
Goldiamond: Stuttering
Holland: Vigilance
Keller: Personalized System of Instruction (PSI)
Lindsley: Psychiatric patients
Skinner: Teaching machines
Schuster/Thompson: Drug self-administration (addiction)
Verhave: Quality control
• The 1970s: National and international developments become increasingly complex.
  - the Yom Kippur War (1973)
  - the World Trade Center built in NYC (1973)
  - the Vietnam War ends (1975)
  - the Khmer Rouge and Cambodian genocide (1975-1978)
  - the Camp David accords (1978)
  - Ayatollah Khomeini brings the Islamic revolution to Iran (1979)
  - the USSR invades Afghanistan (1979)
• The 1970s: The Midwest Association for Behavior Analysis, soon to become the Association for Behavior Analysis International (ABAI), is founded with Nate Azrin as its first President (1974)
  - Sidman introduces equivalence classes
  - Discrete trial instruction
  - Willard Day founds Behaviorism (1972)
  - Azrin & Foxx’s Toilet training in less than a day (1974)
  - Jaynes The origins of consciousness in the breakdown of the bicameral mind (1976)
  - The Society for the Quantitative Analysis of Behavior (SQAB) is founded by Commons & Nevin SQAB (1978)
  - Behavior management in organizations: Gilbert, Human competence (1978); Aubrey Daniels
Fred Keller at Skinner Festschrift dinner circa 1970
Jack Michael and Fred Keller
• The 1970s: The Midwest Association for Behavior Analysis, soon to become the Association for Behavior Analysis International (ABAI), is founded with N. H. Azrin as its first President (1974)
  - The Golden Fleece: Hutchinson vs Proxmire
  - Chomsky (1971) takes on *Beyond freedom and dignity* as fascism
  - Lepper and Greene on hidden costs of reward (1973, 1978) set the stage for Alfie Kohn
  - Weiner argues that contingencies don’t work for humans based on human vs nonhuman schedule performances
  - The ape intelligence controversies, over decades: the Gardeners; Terrace; Premack; Savage-Rumbaugh
  - Ed Taub and PETA in the early 1980s
Schedule performances
• The 1980s: More global developments
  - the Iran-Iraq War (1980-1988)
  - Britain defeats Argentina in the Falklands (1982)
  - the Marcos regime collapses in the Philippines (1986)
  - Chernobyl (1986); Gorbachev initiates *perestroika* and *glasnost* in the Soviet Union (1988)
  - Lech Walesa co-founds the Solidarity movement in Poland (1988-1989)
  - Islamic fundamentalists seize Sudan (1989)
  - the Berlin Wall is dismantled (1989)
• The 1980s:
  - ...and Dustin Hoffman stars as a autistic savant in the movie Rain Man (1988)
• **The 1980s:** Data analyses and theoretical extensions abound:
  - Maximizing, matching, generalized matching, melioration, activation and coupling, self-control and procrastination, volition, molar versus molecular and behavior extended over time, equivalences and frames, satisficing, optimizing, adduction, reinforcer specificity and reinforcer classes, fluency, discounting, emergence, correspondence, joint attention, joint control, function-altering stimuli, resonance, verbal governance….
• The 1980s: Applications abound. Things get harder to keep up with.
  - Autism treatment comes of age
  - Expansion of functional analysis (Iwata) and functional communication training (Carr) in treatment of problem behavior
  - Founding of the Cambridge Center for Behavioral Studies (1981)
  - *The Analysis of Verbal Behavior* begins publication (Sundberg, 1982)
  - Pryor’s *Don’t shoot the dog* (1985) and clickers
  - Hayes draws away from behavior analysis with relational frame theory (RFT)
The Fred Keller School
(Doug Greer at right rear)
Fred Keller and Ellie Reese
Fred Keller and Deisy de Souza
The two Freds put on one of their shows at ABA
Nat Schoenfeld, Emilio Ribes and Fred Keller
Japanese ABA group, including Masaya Sato (center, touching glasses), Koichi Ono (on right)
• The 1980s draw to a close:
  - B. F. Skinner is diagnosed with leukemia and discusses it on NPR
The 1990s: The end of a century and a millennium.
- Iraq invades Kuwait, sparking the Gulf War (1990)
- East and West Germany reunite (1990)
- Nelson Mandela is released from prison (1990) and is elected South African president (1994)
- the USSR collapses (1991)
- the Rwandan genocide (1994)
- Taliban takeovers in Afghanistan impose Islamic rule (1996)
- India and Pakistan test nuclear weapons (1998)
- Work on the map of the human genome nears completion
The 1990s: Endings

- B. F. Skinner dies on August 18, 1990, just eight days after delivering a keynote address upon accepting the first *Lifetime Contributions to Psychology* Award from the American Psychological Association
- Fred Keller dies on February 2, 1996
- Nat Schoenfeld dies on August 3, 1996
B. F. Skinner, Organism

A. Charles Catania

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B. F. Skinner illustrated the power of behavior analysis by turning it upon his own behavior. This article considers parallels in the life and work of Charles Darwin and places Skinner's views on life and death in the context of his selectionist paradigm for psychology. The term organism plays a special role, and the account shows why B. F. Skinner might have regarded it as an appropriate title.

B. F. Skinner was an organism. So are we all, but probably few of us like to be reminded. The Copernican revolution was resisted at least in part because it eventually forced us to see our world not as the center of the universe but rather as a small planet in orbit around a minor star. The Darwinian revolution raised similarly troubling questions about our biological origins. Charles Darwin described the implications of natural selection this way:

The old argument from design in nature, as given by Paley, which formerly seemed to me so conclusive, falls, now that the law of natural selection has been discovered. We can no longer argue that, for instance, the beautiful hinge of a beak must have been made by an intelligent being, like the hinge of a door by man. There seems to be no more design in the variability of organic beings, and in the action of natural selection, than in the course which the wind blows. (quoted in F. Darwin, 1892/1958, p. 63)

Like Charles Darwin, B. F. Skinner was an inquisitive organism, and the questions they both asked are of interest to us all: Where do we come from? What makes us do what we do? What can we know about ourselves, and how do we learn it? Like Darwin's, Skinner's answers to these questions are sometimes troubling but, again like Darwin's and as I hope to show here, they are also often characterized by persuasive elegance, coherence, and parsimony.

This article considers some parallels between the life and work of Charles Darwin and the life and work of B. F. Skinner. In the course of doing so, it deals with our origins by examining selection as it operates in evolution and in the shaping of behavior, and it deals with how we come to know ourselves by examining the sources of the language with which we describe our thoughts and feelings and other private events.

Darwin and Skinner

Let us begin briefly with Darwin; the outlines of his biography are already familiar. His study is preserved, much as it was when he worked in it, at Down House in Kent, England. Darwin was born on February 12, 1809 in Shrewsbury. He attended Cambridge and traveled around the world on the Beagle. After the Darwin family moved to Down House in 1842, however, he limited his travel drastically for reasons of health. For the next 40 years, until his death on April 19, 1882, Down House was the primary site of his life and work.

I visited Down House more than a decade ago. At the time, I had already examined some parallels between Darwin's work and Skinner's (Catania, 1978). For me, Darwin's study was the main attraction; it included his desk and some of his books, his armchair and his writing board, and memorabilia collected during his travels or presented to him by visitors. Had it been in use, it might have seemed right to call it cluttered, but even if it was an organized clutter. B. F. Skinner was also a scholar who did much of his writing at home, and it should be no surprise that his office and Darwin's had some common features. Skinner's office, in his home in Cambridge, Massachusetts, has been described as tiny, with a lounge chair at one end and "crowded with books, files, pictures, gadgets, hi-equipment" (National Public Radio, 1990).

But this is a superficial comparison. It is more important that Darwin and Skinner were realists with respect to their places in the universe. Both had religious upbringings, and both lost their faith. The special property of religious belief (perhaps its defining property) is that it is held in the absence of supporting evidence, but, as Darwin put it (F. Darwin, 1892/1958):

The habit of scientific research makes a man cautious in admitting evidence. For myself, I do not believe that there ever has been any revelation. As for a future life, every man must judge for himself between conflicting vague probabilities. (p. 61)

Darwin concluded a discussion of the incredibility of miracles and the "fact that many false religions have spread over large portions of the earth like wildfire" with the following (F. Darwin, 1892/1958):

I found it more and more difficult, with free scope given to my imagination, to invent evidence which would suffice to convince me. Thus disbelief crept over me at a very slow rate, but was at last complete. The rate was so slow that I felt no distress. (p. 62)

Skinner, however, did not escape the distress. In "What Religion Means to Me" (Skinner, 1987), he wrote that he was rather troubled about his loss of faith for a number of years. He also wrote

1 I thank Barbara Ross for confirming some historical details about Skinner's last year and David Carlson for asking the right question.

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In Memoriam

Remembering Nat Schoenfeld

A. Charles Catania
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William Nathan Schoenfeld was born in New York City on December 6, 1915, and died in Sun City West, Arizona, on August 3, 1996. He was an undergraduate at the College of the City of New York, where he received a BS degree in 1937. He received his PhD from Columbia University in 1942 and then continued there as a faculty member, advancing from lecturer to full professor. In 1966 he moved to Queens College of the City University of New York, where he remained until his retirement in 1983. During his years at Queens, he also took on visiting appointments in Brazil, Mexico, and Venezuela. In retirement, he spent roughly a decade in Israel, where he occasionally taught as a visiting professor at the Hebrew University of Jerusalem. He returned to the United States for his final years. He is survived by his wife, Melanie, their three children, Rivka, Joshua and Naomi, and a son, Mark, from a previous marriage.

Nat Schoenfeld is probably best known in behavior analysis for the undergraduate program at Columbia that he and Fred Keller created, for Principles of Psychology (K&S; 1950), the book he coauthored with Fred Keller, and for the research that he generated and fostered with his graduate students at Columbia and at Queens. He wrote prolifically on perception, autonomic conditioning, learning theories, verbal behavior, contingencies, the classification of reinforcement schedules, and, most recently, religion and human behavior (1993). He played an active role on the editorial boards of various journals and especially in the founding of the Journal of the Experimental Analysis of Behavior, he served as President of the Eastern Psychological Association, the Pavlovian Society of North America, and Division 25 of the American Psychological Association, and he chaired the Experimental Psychology Study Section of the National Institutes of Health, to mention a few of his distinguished professional contributions.

It is probably less well known that he began his career as a social psychologist; the term ego-involvement may have originated in his first published paper (Klein & Schoenfeld, 1941). But Nat’s introduction by Fred Keller to The Behavior of Organisms (Skinner, 1938) had profound and lasting intellectual impact, and Nat’s subsequent contributions link him inextricably to Fred Keller and to Fred Skinner. Together, those three were the founders of the field that we now call behavior analysis.

I only began to see Nat Schoenfeld in these terms, however, long after he had been my teacher, and this is my opportunity to write about some of the things about him that won’t be found in his curriculum vitae or in his writings. Fortunately, many details of his professional life and work are provided in an appreciation by Elliot Hearst (1997), and that allows me the luxury of concentrating on what mattered most to me. The trouble with trying to write a reminiscence about someone who has been important in your life, of course, is that it too easily becomes a piece about yourself instead of a piece about the other person. I hope what I
• **The 1990s:** More beginnings, and no longer just “we happy few.” Behavior analysis begins to emerge from its eclipse. Things become even harder to keep up with.
  - An explosion of applications
  - Controversies continue: facilitated communication persists despite debunking
  - The 1998 founding of BACB, the Behavior Analysis Certification Board (Jerry Shook)
  - Behavior analysis programs emerge
  - One collaborative example: in 1999 the first student is accepted into the joint ABA MA track at UMBC and the Kennedy-Krieger Institute
  - The Kennedy-Krieger reunion conference
  - Translational research: the symbiotic relation between basic and applied research continues
So maybe Louis Pasteur was right:

“There does not exist a category of science to which one can give the name applied science. There are sciences and the applications of science, bound together as the fruit of the tree which bears it.”

— Revue Scientifique (1871)

…or, more succinctly:

“There are no such things as applied sciences, only applications of science.”
Erik Arntzen, Ted Ayllon, Nate Azrin, Bea Barrett, Sid Bijou, Joe Brady, Dale Brethower, Jim Carr, Mike Cataldo, Aubrey Daniels
Kay Dinsmoor, Barbara Etzel, Ed Fantino, Wayne Fisher, Pat Friman, Ralph Gerbrands, Jack Gewirtz, Iz Goldiamond, Gina Green, Joel Greenspoon
Lew Gollub, Marilyn Gilbert, Tom Gilbert, Jim Holland, Per Holth, Brian Iwata, Harlan Lane, Andy Lattal, Linda LeBlanc, Julian Leslie
Og Lindsley, Ivar Lovaas, Jay Moore, Ed Morris, Nancy Neef, Amy Odum, Kathleen Piazza, Hank Pennypacker, Howie Rachlin, George Reynolds
Marc Richelle, Terje Sagvolden, Laura Schreibman, Eve Segal, Charlie Shimp, Joe Spradlin, Beth Sulzer-Azaroff, Mark Sundberg, Julie Vargas, Bill Verplanck
The 21st Century: Where do we go from here?

- As some subgroups go spinning off in different directions, we needn’t feel compelled to pick winners or losers.
- We who still call ourselves behavior analysts, whether basic or applied, are all winners.
- The translational research was there from the very beginning.
- Behavior analysis can now exist on its own outside of psychology or other departments.
- It’s our science now.