

B.F. SKINNER AND HIS CONTRIBUTION TO SCIENCE AND TO HUMAN CULTURE

“Burrhus Frederick Skinner...may well go down in history as the individual who had a greater impact on Western thought than any other psychologist”

(Bjork, 1998, p. 261)

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PRESENTATION

When B.F. Skinner died on August 18, 1990 he was considered as one of the most influential and recognized psychologists, not only in his homeland the United States, but also throughout the world, and not only in his time but possibly in all history. His influence was recognized in psychology, in other sciences, in education, in philosophy and by the public in general. He was a person who had become a part of contemporary culture, a reference point in psychology, in other disciplines, in the behavioral sciences, and even in philosophy. For better or worse, everyone knew about him, and his ideas were positively valued by countless people around the planet, but in contrast, many others considered them an attack on the values of Western society, also around the planet. He was a valued, hated and above all, controversial man that no one could afford to ignore.

When elaborating the list of the 100 most eminent psychologists of the twentieth century, Haggbloom et al (2002) selected the following criteria: frequency of citations in scientific journals, frequency of citations in introductory psychology texts, frequency of answers to a survey sent to members of the Association for Psychological Science (APS), membership in the National Academy of Sciences, election as president of the American

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Psychological Association (APA) or having received the Distinguished Scientific Contribution Prize that this association bestows, and finally that the recipient's name is used as an eponym. The six criteria are integrated to form a composite index and based on this, a list was made with the ranking order of the most eminent psychologists of the twentieth century. In this composite index (Table 4) Skinner comes in first place among the 100 most eminent psychologists (eighth place in journal citations, second place in introductory psychology books, after Freud, first place in the survey, and as a final result, first place in the composite index).

Numerous books have been written concerning the work of B.F. Skinner, among which the following deserve mention: that of Bjork (1993), considered as his most complete and up-to-date biography; Carpenter (1974) which is a very well-documented introduction to Skinner's work; Dews (1970) a book tribute (*Festschrift*) to Skinner; Kazdin (1978) on the history of behavior modification, including Skinner's role in this history; Kuhlmann (2005), about the Walden Two communities that exist at present in the world and an analysis of the Skinnerian utopia; Guilbert and Dorna (1982) from the perspective of French culture; Mills (1998), a history of behavioral psychology; Moore (2008), a text that contains a conceptual analysis of radical behaviorism; O'Donohue and Ferguson (2001) about Skinner's psychology; Santoyo and López (1990) on the social context; Richelle (1993), a re-evaluation of the work of Skinner written by one of the principal Skinnerians of Europe; Roales-Nieto, Luciano and Pérez Álvarez (1992) on the validity of Skinner's work, with chapters written by Spanish and Latin-American psychologists; Ruiz (1978) on the significance of theory in Skinner; Rutherford's (2009) work is an analysis of Skinner's behavior technology and its impact on today's society; Smith and Woodward (1996) analyze the work of Skinner and radical behaviorism in the U.S. culture; Toates's (2009) is a biography of Skinner that can be supplementary to the work of Bjork; Todd and Morris' text (1995) is one of the books with the most ample information and critical analysis of Skinner and his research and conceptualizations; Wiener (1996) presents Skinner as a "benign" anarchist; Wyatt (2001) is a kind of dictionary of Skinner's quotes, with explicatory notes, somewhat superficial; Zuriff (1985) puts forth a profound analysis of radical behaviorism and its philosophy; Ardila (2010) discusses the relationship between behavior analysis and psychology, and their

controversies with each other. There exists a brief autobiography of Skinner (1967) written for the series *A History of Psychology in Autobiography* and his extensive autobiography in three volumes (1976, 1979, 1983) which has been translated into Spanish and many other languages.

In addition to these books, numerous articles have been published concerning the work of B.F. Skinner; several of which stand out: Bjork (1998), which is a short biography as part of the series *Portraits of Pioneers in Psychology* ; Rutherford (2005) which is a presentation of Skinner as a philosopher for a philosophy dictionary; Adams (2012) which analyzes the metacontingencies of the book *Walden Two* as anticipation of positive psychology; Overskeid, Grønnerød and Simonton (2012) with their analysis of Skinner's personality from the perspective of the "Big Five Factors" personality traits theory; Epstein (1997) about Skinner and self-control; Keller (1990) with the most well-known obituary of Skinner among the many that were published the year of his death; in the tributes on the centennial of his birth, the articles of Smith and Morris (2004) and his daughter Julie Vargas (2004) stand out.

First let's look at the journey of Skinner's life.

LIFE

Burrhus Frederic Skinner was born on March 20, 1904 in Susquehanna, a small town in the state of Pennsylvania, U.S.A. Susquehanna was a town whose main activity depended on the railroad. Burrhus Frederic was the son of William Skinner, a lawyer, and Grace Burrhus. He died on August 18, 1990 in Cambridge, Massachusetts. His father was an ambitious socially-ascending lawyer and his mother was a very religious woman overly concerned with appearances and giving a good impression in her town's society. Fred was the older of two brothers, the younger of which, Edward, died when Fred was 19 in 1923.

While a student in high school, Fred read science books and literature, including the works of Jules Verne (*The Mysterious Island*, which influenced his intellectual development greatly, and others) and *Robinson Crusoe* by Daniel Defoe. One of his teachers, Mary Graves, became his tutor and directed his readings in literature, Darwinism

and religion. Skinner always had a profound interest in building things and a strong mechanical skill.

He studied at Hamilton College (in Clinton, New York) and received a Bachelor of Arts (B.A) in 1926 in English Literature. He decided to be a writer; so, he linked up with important writers, among them Robert Frost, who valued his aptitude as an observer of human behavior and as a writer.



Skinner trying to become a writer, when he was between 22 and 23 years old

The following year and a half after receiving his Bachelors (B.A.) in the university, Skinner devoted himself to writing at his parents' home in Scranton, and Greenwich Village in New York City, where he tried to become a writer of fiction and essays, but with little success. He read Dostoyevsky, Proust, Sinclair Lewis, H. G. Wells, Bertrand Russell and other litterateurs and philosophers. One of the readings that influenced in his intellectual development was a review published in *Dial* magazine written by Bertrand Russell of the book *The Meaning of Meaning*, of Ogden and Richards, in which Russell referred favorably to Watson and behaviorism, whose role in the development of psychology he valued greatly. This review led the young Skinner to read Bertrand Russell's book *Philosophy* (1927) in which Watson behaviorism and its epistemological consequences were analyzed. This "dark year" of his life made Skinner decide that literature was not the path to follow in order to understand behavior and human nature; instead, science was the passageway. He said he was interested in human behavior before, only that he was researching in the wrong manner: "I had apparently failed as a writer, but

was it not possible that literature had failed me as a method?” (Skinner, 1976, p. 291). During the fall of 1928, when he was 24 years old, he started his studies at Harvard University to get a doctorate in psychology. He received his PhD in 1931.



Skinner at 27 years old, when he received his Ph.D. degree from Harvard University

When Skinner began his studies at Harvard University, the most prominent figure in the Department of Psychology was E. G. Boring (1886-1968). Skinner worked mostly with William J. Crozier (1892-1955), a physiologist interested in behavioral problems and with the psychologist Walter S. Hunter (1899-1954). Skinner met Fred S. Keller (1899-1996) during those years, also a psychology student, who would become one of his best friends and a collaborator throughout his life. At that time Skinner invented several laboratory devices, such as the cumulative recorder and a box that Clark L. Hull called “the Skinner Box”, which has become the main instrument for the experimental study of behavior. The experimental works of Skinner and his ideas were not completely supported by Boring, who was the Director of the Psychological Laboratory and one of the pundits with more power in the psychology of the time.

In 1931 Skinner presented his dissertation entitled “The concept of the reflex”, which Boring did not accept at first. He criticized the young student who intended to write a history of the concept of reflex giving his own interpretations and without analyzing the available data. Finally, Skinner managed to graduate, despite all these inconveniences.

After receiving his PhD, Skinner remained five more years at Harvard as a “research fellow”, with a scholarship from the Harvard Society of Fellows. It was a time of

many important projects and research, publications and reflections. Also, it was a time to interact with the great minds of the American and world “intelligentsia” that congregated around Harvard University, and to read a great deal. At this time he read Pavlov, Watson, Bridgman, Sherrington, Mach, Loeb, Russell and other important thinkers. He wrote scientific articles and developed a system that he called *experimental analysis of behavior*. In 1936 Skinner joined the University of Minnesota, and afterwards in 1945 Indiana University, where he was the chairman of the Department of Psychology from 1946 to 1947. He went back in 1948 to his *alma mater*, Harvard University, and remained there until he formally retired in 1974. However after that, he continued working, researching, writing, arousing controversy and being a highly polemic public figure until his death in 1990 at age 86. Skinner published more than 20 books and 180 articles including scientific work and books popularizing psychology targeted for the general public. Table 1 shows a list of his books published and table 2 his main scientific articles. Almost certainly, his most well-known and outstanding books are *The Behavior of Organisms* (1938), which presents his system and the grounds of all of his later work, *Verbal Behavior* (1957), which refers to the most complex processes of behavior, and *Science and Human Behavior* (1953), a book that was well-received, unlike his two previous ones. Surely, his publications aimed for the general public that had the most impact were *Walden Two* (1948) and *Beyond Freedom and Dignity* (1971). Skinner did his utmost to differentiate himself from other behaviorists like Hull, Tolman, Pavlov, Guthrie and Lashley. His system was not S-R- but S-R consequences.

Table 1. Main books by B.F. Skinner

Skinner, B. F. (1938). <i>The behavior of organisms: An experimental analysis</i> . New York: Appleton – Century – Crofts.
Skinner, B. F. (1948). <i>Walden two</i> . New York: Macmillan.
Skinner, B. F. (1953). <i>Science and human behavior</i> . New York: Macmillan.
Skinner, B. F. (1957). <i>Verbal behavior</i> . New York: Appleton – Century – Crofts.
Ferster, C. B., & Skinner, B. F. (1957). <i>Schedules of reinforcement</i> . New York: Appleton – Century – Crofts.
Skinner, B. F. (1959). <i>Cumulative record</i> . New York: Appleton – Century – Crofts (Ediciones ampliadas en años posteriores, 1961 y 1972).
Holland, J. G. & Skinner, B. F. (1961). <i>The analysis of behavior: A program for self-instruction</i> . New York: McGraw-Hill.
Skinner, B. F. (1968). <i>The technology of teaching</i> . New York: Appleton – Century – Crofts.
Skinner, B. F. (1969). <i>The contingencies of reinforcement: A theoretical analysis</i> . New York: Appleton – Century – Crofts.
Skinner, B. F. (1971). <i>Beyond freedom and dignity</i> . New York: Knopf.
Skinner, B. F. (1974). <i>About behaviorism</i> . New York: Knopf.
Skinner, B. F. (1976). <i>Particulars of my life</i> . New York: Knopf.
Skinner, B. F. (1978). <i>Reflections on behaviorism and society</i> . Englewood Cliffs, NJ: Prentice – Hall.
Skinner, B. F. (1979). <i>The shaping of a behaviorist: Part two of an autobiography</i> . New York: Knopf.
Skinner, B. F. (1980). <i>Notebooks</i> (ed. R. Epstein). Englewood Cliffs, NJ: Prentice – Hall.
Skinner, B. F. (1983). <i>A matter of consequences</i> . New York: Knopf.
Skinner, B. F., & M. E. Vaughan (1983). <i>Enjoy old age: A program of self – management</i> . New York: Norton.
Skinner, B. F. (1987). <i>Upon further reflection</i> . Englewood Cliffs, NJ: Prentice – Hall.
Skinner, B. F. (1989). <i>Recent issues in the analysis of behavior</i> . Columbus, OH: Merrill.

Tabla 2. Main scientific articles by B.F. Skinner

On the conditions of elicitation of certain eating reflexes. <i>Proceeding of the National Academy of Sciences</i> , 1930, 16, 433-438.
The concept of the reflex in the description of behavior. <i>Journal of General Psychology</i> , 1931, 5, 427-458.
On the rate of formation of a conditioned reflex. <i>Journal of General Psychology</i> , 1932, 7, 274-286.
The generic nature of the concepts of stimulus and response. <i>Journal of General Psychology</i> , 1935, 12, 40-65.
Two types of conditioned reflex and a pseudo type. <i>Journal of General Psychology</i> , 1935, 12, 66-77.
The verbal summator and a method for the study of latent speech. <i>Journal of General Psychology</i> , 1936, 13, 71-107.
Two types of conditioned reflex: A reply to Konorski and Miller. <i>Journal of General Psychology</i> , 1937, 16, 272-279.
Some quantitative properties of anxiety. <i>Journal of Experimental Psychology</i> , 1941, 29, 390-400 (con W. K. Estes).
The operational analysis of psychological terms. <i>Psychological Review</i> , 1945, 52, 270-276.
"Superstition" in the pigeon. <i>Journal of Experimental Psychology</i> , 1948, 38, 168-172.
Are theories of learning necessary? <i>Psychological Review</i> , 1950, 57, 193-216.
Some contributions of an analysis of behavior to psychology as a whole. <i>American Psychologist</i> , 1953, 8, 69-78.
The science of learning and the art of teaching. <i>Harvard Educational Review</i> , 1954, 24, 86-97.
A case study in scientific method. <i>American Psychologist</i> , 1956, 11, 221-233.
Some issues concerning the control of human behavior: A symposium. <i>Science</i> , 1956, 124, 1057-1066 (Con C. R. Rogers).
Teaching machines. <i>Science</i> , 1958, 128, 969-977.
Pigeons in a pelican. <i>American Psychologist</i> , 1960, 15, 28-37.
The design of cultures. <i>Daedalus</i> , 1961, 90, 534-546.
Operant behavior. <i>American Psychologist</i> , 1963, 18, 503-515.
The phylogeny and ontogeny of behavior. <i>Science</i> , 1966, 153, 1203-1213.
The design of experimental communities. <i>International encyclopedia of the social sciences</i> (Vol. 16, pp. 271-275). New York: Macmillan, 1968.
The ethics of helping people. <i>Criminal Law Bulletin</i> , 1975, 11, 623-636.
Why I am not a cognitive psychologist. <i>Behaviorism</i> , 1977, 5, 1-10.
Selection by consequences. <i>Science</i> , 1981, 213, 501-504.
Canonical papers of B. F. Skinner. <i>The Behavioral and Brain Sciences</i> , 1984, 7, 473-724.
The evolution of behavior. <i>Journal of the Experimental Analysis of Behavior</i> , 1984, 41, 217-221.
The evolution of verbal behavior. <i>Journal of the Experimental Analysis of Behavior</i> , 1986, 45, 115-122.

What ever happened to psychology as the science of behavior? <i>American Psychologist</i> , 1987, 42, 780-786.
The origins of cognitive thought. <i>American Psychologist</i> , 1989, 44, 13-18.
Can psychology be a science of mind? <i>American Psychologist</i> , 1990, 45, 1206-1210.
To know the future. In C. Fadiman (Ed.), <i>Living philosophies: The reflections of some eminent men and women of our time</i> (pp. 193-199). New York: Doubleday, 1990.

Skinner got married in 1936 at age 32 to Yvonne Blue (1911-1997), seven years younger than him. Yvonne (“Eve”) majored in English literature and minored in art history and worked as a lecturer and gallery instructor for the Museum of Fine Arts in Boston. They had two daughters Julie (born in 1938) and Deborah (born in 1944). Julie studied music and then educational psychology and today she is one of the main advocates of her father’s work and director of the B.F. Skinner Foundation that seeks to promote his legacy. Deborah is a successful painter who lives in England.

At the University of Minnesota Skinner “recruited” in the name of psychology some colleagues that later on were to be among his main followers, such as Guttman, Breland and Estes, although they finally split from him over several essential concepts of operant conditioning psychology. In 1946 Skinner set up the First Conference on the Experimental Analysis of Behavior, at Indiana University, with the participation of researchers like Dinsmoor, Keller, Schoenfeld, Hefferline, Estes and Verplanck.

At Harvard, his definitive “operational center” from 1948 on, Skinner did research, organized work programs, trained students and collaborators, wrote his most important books and articles, and gave final form to the experimental analysis of behavior as a laboratory science, as a conceptual system and as an applied discipline. He formally retired in 1974, but he continued working until his death. His last lecture was delivered on August 10, 1990 before the American Psychological Association (APA) and it was published with the title “Can psychology be a science of mind?” (1990). He died a week later on August 18, 1990 of leukemia, an illness that he had suffered for ten months. At that moment he was 86 years old. He worked until the day before his death, revising his lecture, which was published in the *American Psychologist* the same year.

WORKS

The scientific work of Skinner is very wide. It focuses on laboratory research, with non-human participants under controlled conditions. It was initially presented in his book *The Behavior of Organisms* (1938). He laid emphasis on the importance of the environment, behavior, conduct, the consequences and reinforcement. He proposed that operant or instrumental conditioning differs from classical or Pavlovian conditioning, and explained a great part of behavior by its consequences. To increase or diminish the probability of repetition of a behavior was something that had been anticipated by Thorndike's law of effect, but with Skinner the consequences became the top priority. Behavior was not explained by the stimulus-response (S-R) relationships, rather by their consequences. *Contingency* was a decisive aspect in the explanation, modification and control of behavior.

We can spell out that Skinner's work is centered on three aspects: his philosophy (radical behaviorism), his laboratory research (which gave origin to the experimental analysis of behavior) and its applications (applied behavior analysis). Skinner's *philosophy* is not based on positivism, on its classical meaning nor on logical positivism, as has been erroneously stated, but on the inductivism of Ernst Mach. It is a system that has been widely developed and that possesses implications for the theory of knowledge, ethics, the problem of freedom and determinism and even for logic, language, and thought. On the other hand, the *laboratory research experiments* were centered on the research with non-human participants, at the beginning with rats but later on with pigeons and other species. Skinner did not work with human participants but his faithful followers did. In their laboratory research the "operant conditioning chamber", or Skinner's box, and the cumulative recorder occupy a primordial place. The applications, on the other hand, were very encompassing and extended to the great problems of psychology and society, and have given origin to behavior therapy, behavioral analysis applied to education (including teaching machines), behavioral analysis applied to organizations, the design of cultures (Walden Two), behavioral economics, psychopharmacology or behavioral pharmacology and social behavioral psychology. Skinner was deeply interested in the great problems of the human being and his/her physical and social environment, and this was reflected in his interest in designing a social utopia, in education, in the exhaustion of human resources, the upbringing of children and even self-control and enjoying old age.

CONTRIBUTIONS

The main contributions of Skinner can be seen in the following fields:

Theory

The experimental analysis of behavior (EAB) is a system proposed by Skinner. It consists of a series of principles, concepts and procedures for the analysis, modification and control of behavior. It is designed to apply to all organisms, humans as well as non-humans. It rejects the mentalist explanations of behavior, which attribute the cause of behavior to “internal” psychic entities. It affirms that we understand behavior when we have learned to predict and control it. The functional analysis of behavior means that we are able to identify and isolate the environmental variables of which such behavior is a function.

The EAB separates two kinds of responses elicited (or evoked) and emitted by the organism. The first are evoked by known stimuli and are classified as respondents. Examples of this are found in the palatal reflex, pupil contraction and many other reflexes. The second class of responses are emitted by the organism and Skinner calls them *operants*. Behavior is not evoked (or elicited) by any known stimulus. The rate of response is the measure of the strength of the operant.

An operant can acquire a relationship with a previous stimulation. The majority of human behavior is operant.

Skinner postulates that in addition to the two types of responses (evoked and emitted), there are two kinds of conditioning, type S and type R. The first is the classic or Pavlovian conditioning in which a conditioned stimulus is associated with a response. On the contrary, in the second type of conditioning (type R) the response is associated with the reinforcement and therefore the letter R (reinforcement). The reinforcement is contingent with the response, and Skinner refers to this relationship as instrumental conditioning. In the triple relationship of contingency (discriminative stimulus, response, contingency) there is no talk of “satisfactory consequences” as in Thorndike’s law of effect, nor of impulse reduction, as in C.L. Hull’s theory. Initially, Skinner considered that type S conditioning

was limited to autonomic responses and the type R conditioning to skeletal behavior, but this has changed with the progress of research.

The laboratory research and theoretical conceptualizations carried out by Skinner gave origin to a behavior theory which is very elaborated and ambitious. Radical behaviorism, as Skinner's system came to be known, differed from methodological behaviorism and other forms of behaviorism. In the books by Honig (1966) and by Honig and Staddon (1977) the research experiments done in the operant laboratory and its theoretical conceptualization are presented. See also Ardila (1975, 1999) and the book compiled by Ardila, López López, Pérez-Acosta, Quiñones and Reyes (1998), for a presentation of multiple authors that seeks to analyze the state of the operant, experimental and conceptual research at the end of the twentieth century and in various nations. The theory kept evolving and developing itself, on the part of Skinner as well as his numerous followers around the world. See Baum (2005); García Cadena (2007); Lattal and Chase (2003); Pérez-Acosta, Guerrero and López López (2002); Staddon (2001), and others.

Philosophy

Skinner's contributions to so-called "empirical epistemology", to ethics, to the problems of freedom and determinism, to evolution and its consequences, have been extensively studied. They are broad and include, from his behavioral research methodology, the study of the single case as opposed to comparisons among groups, and the inductivism derived from Ernst Mach, to the design of societies, humanism, and the great concern for our species and its future.

The philosophy of Skinner is set in a naturalistic perspective, not idealistic, close to the ideas of Aristotle. It is far from the Kantians and neo-Kantians, but it has proximity to phenomenology, although it would not seem to contain it (see Day, 1969, 1986).

Skinner believes that all behavior is determined, in other words, it is caused. There is no such thing as "free will": the consequences of behavior, the close ones as well as the far ones, determine such behavior. The behavior of human and non-human organisms is the result of evolution, which includes natural selection (survival contingencies in Skinnerian

terminology) and the learning that takes place during the life of the organism (reinforcement contingencies in Skinner's words).

The researcher should avoid the badly-defined theoretical constructs and metaphors, reject the internal causes and explanations, specially the mentalist ones, and should focus on the environmental and evolutionary determinants of behavior. Cognitions are conducts that possess a legitimate place in the science of behavior, but are conducts that need to be explained and not conducts that explain other conducts.

His social philosophy is presented in *Walden Two*, and in other publications and he states that the "good life" is a life of health, friendship, art and science, a balance between work and idleness, with a minimum of pain and dissatisfaction and with the certainty to be contributing to society. That is why Adams (2012) sustains that the work of Skinner is an anticipation of positive psychology. In 1972 Skinner received the Humanist of the Year Award given by the American Humanist Association, an association that congregates great thinkers, scientists and philosophers. In the citation to Skinner it is stated that the award is bestowed for his significant contribution to the betterment of the human condition.

Ethics was an issue of central interest for Skinner and his followers. The survival of the individual, the survival of the culture and even of humanity is found within the core points of ethics. What is "good" for the individual is reinforced by his genetic makeup, by his previous history of reinforcement and by the environmental contingencies. What is "good for others" is derived from human interaction and culture. And what is "good for the survival of the culture" goes further than what is good for the individual and for others; as acknowledged by Skinner (1972), other people could survive the person that induces them to perform and the evolution of culture introduces an additional type of good or value.

The conceptualization of ethics in Skinner and radical behaviorism have given rise to many works, among them the book of Krapfel and Vargas (1977) *Behaviorism and Ethics*. The analysis of Waller (1982) places the discussion in a philosophical context, from the criticism to the Skinnerian point of view of good and bad as positive or negative reinforcements, the survival of the culture, the possibility or not of a rational justification of

ethical behavior and in general, from the original and ground-breaking conception that Skinnerian ethics is.

Verbal Behavior

The interest of Skinner for language appears very early in his life with his goal of becoming a writer, and later in his publications about this topic. His book *Verbal Behavior* (1957) is the conclusion of a process that is preceded by previous versions (mimeographed and distributed among his students) and by articles about language issues, about Shakespeare, Gertrude Stein and others. The book *Verbal Behavior* is completely theoretical, different from Skinner's other books. The central thesis of the work is that verbal behavior is under the control of consequences mediated by other people, and has to be studied in the context of functional analysis. It introduces six operants: mand, tact, audience, echoic, textual and intraverbal, and also the autoclitic. Verbal behavior is a function of the present environment of the speaker, of his genetic history and of his past behavioral history. Verbal behavior cannot be considered a function of unobserved entities, rather it depends on the functional relationships with the environment where it occurs.

Mand is a type of verbal behavior related with a reinforcer and with the previous history of control, as for instance when we say "bring me a glass of water". *Tact* in contrast, is a verbal response that is evoked by certain characteristics of the stimulus or the event that are not verbal and it is under the control of generalized reinforcement; the stimulus is the sum of the physical environment. For instance, the child asks "What is this?" and is told "It is an airplane", and later says "Is this an airplane?" and receives the answer "No, this is a rocket". The term "airplane" turns out to be controlled by the form, the fact of having wings, and other characteristics, independent of the color of the apparatus, the size, etc. On the other hand, the person who listens is labeled the *audience*, which is a discriminative stimulus of great relevance; it could be associated with broad physical factors, and be positive or negative. *Echoic* is the verbal behavior that is under the functional control of verbal stimuli in which the verbal response and the verbal stimulus correspond point by point: the speaker repeats what he is told. In this case the stimulus is auditory and the response is oral. *Textual* is the type of behavior associated with writing and reading, in which the oral response is controlled by a verbal stimulus that is not heard.

The book *Verbal Behavior* was critiqued by the linguist Noam Chomsky (1959) in a negative and groundless review. For example, he referred to a “stimulus-response”, which is not Skinner’s psychology, drive reduction, and many other elements that are not part of this work. This criticism very negatively influenced the diffusion of Skinner’s book and he never replied. It was only years later that his disciples did. It is quite likely that Chomsky’s criticism has been much more read than Skinner’s original book.

The studies about language from the Skinnerian approach have had a huge development in the last decades (see Hayes, Hayes, Sato and Ono, 1995) and today they are one of the fields of greatest importance in the experimental analysis of behavior.

Behavioral Technology

Skinner had a deep interest in instrument construction, a great mechanical ability, and he is credited with the so-called “verbal summator”, the Skinner box, the cumulative recorder, the air crib, the pigeon-guided missile project during World War II, the teaching machine, which was the foundation of programmed instruction, and several other inventions.

The baby *Air Crib* was designed by Skinner when his second daughter Deborah was born in 1944. It is a cubicle with controlled temperature, easy to clean and manipulate. The idea was to have a proper environment for the baby, where there were stimuli and everything would be reinforcing for the mother as well as for the child. Caring for and feeding the baby would be made easier, as well as having increased safety and more environmental stimulation. In this Air Crib Skinner and his wife brought up their second daughter, Deborah. The baby spent several hours in the crib, but she was also taken out of the cubicle and was in contact many hours with her mother and father. Later, Julie, Skinner’s first child, also raised her two daughters, Lisa and Justine in air cribs.

This “box” and its advantages for the mother and the baby were presented by Skinner in a publication and in conferences. It was very badly perceived by the general public and by some of his colleagues as well. It was declared that it produced maternal deprivation and that it would cause terrible psychological problems to the baby. This was completely wrong, but the apprehension proliferated and continued for decades and even persists today. And there were even rumors that Deborah had committed suicide, and that

she had sued her father, and other absurd claims. Deborah has said that it was a gratifying experience; she is a psychologically healthy person, a successful artist and she considers herself a happy wife. She lives in England and has achieved recognition as a painter.

Skinner built approximately one thousand Air Cribs between 1957 and 1967, which were sold at the time, but due to their characterization by the critics as a “Skinner box for babies” and with the hostile attacks that pursued, the Air Crib was no longer manufactured.

The Pigeon Project was a task oriented to collaborate with the allies during the Second World War. Pigeons were trained to guide missiles and intercept enemy bombs. The pigeons were conditioned to peck on a point in a missile that would intercept a bomb. The idea was to use operant technology to minimize the loss of human lives in the bombings during wars, something similar to the non-piloted aircraft of the present decade (“drones”). Skinner elaborated the project, had financing and the results of the experiments were quite positive. However, the U.S. government finally did not accept the proposal (1944) and the Pigeon Project was never put into action.

Another of Skinner’s inventions that had a strong impact on society was the so-called teaching machine. It also was inspired by his second child, Deborah, who studied at Shady Hill School (in Cambridge), where the children of Harvard University professors went. Skinner found that the teaching methods were inadequate, and in the case of mathematics, completely absurd. He invented the teaching machines and gave origin to a much elaborated technology called programmed instruction. His friend, Fred S. Keller developed the personalized system of instruction (PSI) based on Skinner’s ideas.

Teachers dreaded the teaching machines and in general programmed instruction because they thought they were going to lose their jobs. Skinner remarked that “the teacher that can be replaced by a machine ought to be replaced by a machine”. The applications of teaching machines were very far-reaching, with normal populations as well as with gifted children and exceptional individuals. In the last decades of the twentieth century computers fulfilled the functions that the teaching machines used to serve, and nowadays computers are the contemporary version of Skinner’s teaching machines.

Behavioral technology is also applied in mental health institutions, in prisoner rehabilitation systems by means of contingency management, in the world of work, in the self-help context, in the self-management and behavioral self-control context, in the procedures for enjoying old age (instead of having to suffer it.) and in several other contexts. See a contemporary analysis of behavioral technology in Rutherford's book (2009).

Below we will see the applications in clinical psychology, educational psychology, organizational and juridical psychology and cultural design.

Applications

Contemporary psychology owes Skinner a large collection of technological innovations, which are a central part of applied psychology in the twenty-first century. Skinner and his co-researchers utilized the concept of applied behavioral analysis, which later became part of applied psychology as a whole. For the EAB, the applications revolve around the functional analysis of behavior and its modification, which has been developed and expanded in many fields. Here are presented some of the most outstanding:

1. *Behavior therapy.* A great part of the movement called behavior therapy derives from Skinner's radical behaviorism. It also integrates elements of classic conditioning, of social learning and more recently of cognitive psychology in its diverse versions. Today it often goes by the name of cognitive behavior therapy, which in strict terms would be redundant given that cognition is behavior from the Skinnerian perspective. This cognitive behavior therapy is the vertical column of today's clinical psychology. Because of its emphasis on evidence-based procedures, it has been considered the foundation of clinical psychology and scientific-based psychotherapy. In addition, Skinnerian principles are used in the evaluation, research and prevention of behavior disorders.

2. *Behavior analysis applied to education.* From nursery school to elderly people education, for "normal" populations to special populations and for creative individuals with superior abilities to those with cognitive, sensorial, social deficiencies, etc., the principles of the experimental analysis of behavior have significant relevance in

education in the twenty-first century. The teaching-learning processes, curriculum design and assessment have greatly benefited from research in behavior analysis. Although the term “technology of teaching” is not used nowadays as it was decades ago and the teaching machines have been replaced by computers, the laws of learning and their application in the educational milieu today are the foundation of many pedagogical developments.

3. *Behavioral analysis in organizations.* The complex systems that are organizations include productive enterprises (factories), of health, of services, of education, big and small companies, financial institutions, human groups as diverse as political and religious parties among others. It works with meta-contingencies on several levels: the macro-system, the organization, the procedure, the action, the behavior of the direct participants in the procedures, manager behavior and the interrelated behavior in the multiple organization levels. The world of work has been a field that has been greatly benefited from Skinnerian principles, operant methodologies and the applications at the community level.

4. *Contingency management in the rehabilitation system.* The re-socialization of people who have committed infractions, offenses, crimes or infringed the law in any way is one of the most complex fields of work, given the great number of variables that influence i behavior modification in these contexts. One of the first successful examples of the application of Skinnerian principles in this area was the National Training School for Boys, in Washington, D.C. in 1964. The re-socialization programs for contingency management of what people call “juvenile delinquents” have been applied with excellent results. The same with other groups of offenders.

5. *Culture design.* Skinner as a social inventor designed a community based on the principles of experimental analysis called Walden Two, the original Walden being the work of H.D. Thoreau, the American writer in the middle of the nineteenth century. Walden Two was planned as a “perfect” society and Skinner carefully explained in great detail all the procedures that were to be carried out in that society, the scientific principles on which it was based and the criticism that could arise. Several communities have been organized established along these same principles, (see Kuhlmann, 2005, for a complete and detailed description of the communities), the most well-known being Twin Oaks (in the United States) and Los Horcones (in Mexico). Walden Two as a society in which people reach

their potentialities and live happy creative lives was an attempt for conciliation of the different facets of Skinner's life as a humanist, writer, social critic, social inventor and scientist.

6. Other fields: applications in the *community*, in *economics*, in *ecology*, in the problems associated with *human development* and other areas.

MYTHS AND FALLACIES ABOUT B.F. SKINNER

In spite of his influence in psychology, science in general, education, philosophy and everyday life, Skinner continues being a thinker who has been greatly misinterpreted, about whom there exist many myths, fallacies, numerous errors, misunderstandings and distortions. Here are pointed out the main three: the myth of the *tabula rasa* (blank slate), the myth of the empty organism and the myth that only open behavior matters.

1. The myth of the *tabula rasa*. It consists of affirming that Skinner was an extreme environmentalist, who considered that biology and genetics did not have any influence in the determination of behavior. On the contrary, Skinner stated that behavior results from a combination of genetics and the environment. He indicated the differences that exist among species, for example, between the albino rat and the pigeon, between human beings and other species.

Regarding this topic, Skinner's main publications are concerned with ontogenesis and phylogenesis, and with selection by their consequences.

2. The myth of the empty organism. Skinnerian psychology is accused of being "black box" psychology. On the contrary, for Skinner the survival contingencies have provided us with a nervous system with certain possibilities and potentialities.

For Skinner behavioral explanations are preferable to physiological explanations and physiology does not legitimize behavior. However, the organism is not "empty", affirming that would be to go against scientific evidence. The modern neurosciences have benefited a great deal from the methodology of experimental analysis of behavior, of behavioral principles, of operant instrumentation, and in the twenty-first century the relationship between the behavioral sciences and neurosciences is very close.

3. The myth that only open behavior matters. Skinner rejected mentalism, but not the private events. He considered behavior as a continuum of events that go from the private ones to the public ones: from thoughts to movements.

Events are initially observable, the public ones as well as the private ones. In books such *Science and Human Behavior* (1953) and in *About Behaviorism* (1974) these topics are given a detailed explanation. Remember that the studies on behavioral self-control began with Skinner, and also the study of verbal behavior, rule-governed behavior, and modern theories of cognition and awareness, in human beings and in other species.

To say that for Skinner only open behavior counts, is nothing more than a myth.

It is possible to state that Skinner's main contribution was to have emphasized *behavior as an object of study in its own right*. Behavior is an object of scientific study valid by itself, not as a manifestation of something that is beyond it.

Psychology for Skinner has the objective of understanding behavior in function of its determining factors. Behavior or conduct is a natural phenomenon, which has several determinants:

- The phylogenetical contingencies (of a species).
- The contingencies of reinforcement or strengthening that have to do with the selection by their consequences. Selected and strengthened is the behavior that produces effects that make the occurrence of that type of behavior more probable in the future, or in other words, it fulfills the function of reinforcement.
- The cultural contingencies that help to explain the survival of cultural practices (see Biglan, 1995).

These three contingency categories (phylogenetical, reinforcing, and cultural) are the determining factors of behavior. In the case of human beings, we observe that behavior is very complex, and this is due to the great complexity of the consequences. However, the fact that it is difficult to identify and analyze does not mean that we cannot study it.

The functional analysis of the behavior-environment relationship makes it possible to determine the occurrence probability of types of behavior, within the carefully identified contingency relationships.

WHY SO MUCH IGNORANCE AND SO MUCH HATE?

The presentation of the myths about Skinner and his work leads us to point out that a lot of ignorance still exists about radical behaviorism, the author's contribution to knowledge, Skinner as a humanist, the philosophy of Skinner, the role that behavioral technology plays in the present world, "what Skinner really said" and what people insist that he said. Skinner's books have been translated into many languages and continue to be read, especially *Science and Human Behavior*, *Walden Two*, and *Beyond Freedom and Dignity*, but hardly read are his more technical works such as *The Behavior of Organisms*, and definitely *Verbal Behavior* is no longer read.. Skinner is on the verge of being turned into a "classic", who is an author everybody talks about and pretends to be informed of, but actually nobody reads.

It is widely thought that Skinner wanted to eliminate from psychology the study of consciousness, thought, emotions and that he provided nothing to the knowledge of language. It is thought that his works have been overcome by cognitive psychology. It is said that Skinner ignored the differences among species and therefore the Brelands, his close disciples, proposed the concept of misbehavior of organisms. It is said that he ignored evolution, physiology, human creativity and many elements that characterize us as human beings. All of this is untrue.

At an applied level, in people's minds Skinner is associated with punishment and aversive conditioning; it is believed that he favored the use of punitive techniques to modify behavior, which is false and the truth is quite the opposite. Skinner defended the importance of positive reinforcement; he systematically opposed the use of punishment and presented his point of view in this respect in scientific articles, books, and other publications. However, despite the above, "to his fervent opponents Skinner was the Darth Vader of American psychology, ... a man whose science of conditioning threatened the

dearest humanistic traditions, indeed, those that make that life most worth living” (Bjork, 1993, p.11).

In respect to language, as we said, it is probable that Chomsky’s critique is much more read than Skinner’s original book or the works of his successors (neo-Skinnerians and neo-neo-Skinnerians or third-generation behaviorists) concerning rule-governed behavior, about the way to study the internal processes and in general cognition and language.

Skinner’s philosophy is very-well known within the circle of specialists. Outside of that circle, it is said that Skinner’s ethical system does not fulfill the tasks that were proposed. The problem of freedom and free will (see Baer, Kaufman and Baumeister 2008) when it is presented from a Skinnerian perspective produces adverse reactions right from the start.

When *Beyond Freedom and Dignity* was published in 1972, it had an enormous impact on society in general. The magazine *Time*, with the greatest circulation in the world, put Skinner on the cover on September 20, 1971 and the U.S. vice-president publically attacked the book saying that it was contrary to the most- prized American values (Agnew, 1972). Skinner’s political and social ideas always centered on humanism, but Skinner’s public image was that he was proposing a technocratic anti-democracy.

It is a fact that human beings feel offended in their “dignity” when it is affirmed – and proven- that their behavior is subject to laws, that we are part of nature, like all living beings from the amoeba to the chimpanzee, and that the evolutionary process encompasses man, in behavior and in culture, the same as it includes all other living beings. What would seem to have stopped being controversial, after more than a century and a half since the work of Darwin, appears to continue to be an affront to the human being and its place as “king of creation”.

MY RELATIONSHIP WITH B.F. SKINNER

I never studied with Skinner, but ever since I read *Science and Human Behavior* as a student I have had great admiration for the author of this revolutionary proposition of applying the scientific method to the study of human behavior. “The methods of science

have been enormously successful wherever they have been tried. Let us then apply them to human affairs” (Skinner 1953, p. 5). I kept up correspondence with Skinner for several decades. I visited him for the first time in June of 1973 in his office at Harvard University and I was in his Cambridge house on various occasions. I met his family and maintain a warm relationship with his daughter, Julie Skinner Vargas, whom we brought to Colombia in September of 1996 (an event organized by ABA Colombia). I had *About Behaviorism* translated into Spanish, I wrote the prologue, and I myself translated *Verbal Behavior*, which Trillas Publishing House printed in Mexico. I helped disseminate Skinner’s ideas in my country, Colombia, in other Latin-American countries, in Spain and beyond, but always being critical about them and without considering they were “the last word” in regard to psychological phenomena. It is obvious that the “last word” has not been said and there is no sense in trying to say it, according to science (in which Skinner believed, along with the majority of psychologists). I founded the Latin-American Association for the Analysis and Modification of Behavior, (ALAMOC for its abbreviation in Spanish). I worked throughout my life with some conceptual, experimental and applied themes that owe a great deal to Skinner’s ideas.



Julie S. Vargas, 2004, Skinner daughter in his father’s room situated at the basement of his home.

This exchange of letters with him and this personal interaction were very valuable for me, and on some occasions brought me into disagreement with some of Skinner's ideas. He was always a respectful conversationalist, in addition to being an excellent debater with very well-articulated discourse. Begging to differ with some of his ideas made it possible for me to discuss with him in relation to his thoughts; these were privileges that I value greatly. Also, logically, analyzing all about which we were in agreement. When my book *Walden Three* was translated into English, I sent it to him, as I had also done when it was first published in Spanish. However, Skinner read French, but not Spanish.

I attended his last lecture in Boston in 1990 during the American Psychological Association (APA) convention. I greeted him and we talked about *Walden Three* for a bit. Skinner died one week later on August 18th. He was noticeably frail due to the advanced stage of his sickness (leukemia) but he still was conceptually clear and his argumentative energy continued as before.

Julie S. Vargas has been the leading figure of the B.F. Skinner Foundation, of the International Society for Behaviorology (ISB) for the past decades, maintaining the legacy of her father at the global level. The numerous members of the Association for Behavior Analysis International (ABAI), the conventions of this association and of many others in a lot of countries around the world, the publications, the research projects, the applications, the internationalization of behavioral analysis (Ardila, 2006), the interdisciplinary academic work, and the considerable number of Skinner's followers worldwide show the strong relevance of his ideas in the first two decades of the twenty-first century. The words that he wrote in 1971 in *Beyond Freedom and Dignity* continue to ring true.

“Almost all our major problems involve human behavior, and they cannot be solved by physical and biological technology alone. What is needed is a technology of behavior, but we have been slow to develop the science from which such a technology might be drawn... The role of natural selection in evolution was formulated only a little more than a hundred years ago, and the selective role of the environment in shaping and maintaining the behavior of the individual is only beginning to be recognized and studied... A scientific analysis shifts both the responsibility and the achievement to the environment. It also raises

questions concerning 'values'. Who will use a technology and to what ends? Until these issues are resolved, a technology of behavior will continue to be rejected, and with it possibly the only way to solve our problems” (pp 29- 30).

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