Meta-science and the Three Waves of Cognitive Behavior Therapy: Three Distinct Sets of Commitments

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An Overview

Behavior therapies, which include applied behavior analysis, cognitive behavior therapy, and third wave behavior therapies are generally thought of as "scientific" approaches to behavioral health. For example, behavior therapies play a large role in the evidence-based therapy movement (Chambless et al., 1996). However, it is fair to say that, despite the fact that behavior therapy in one form or another has been around for nearly seven decades, progress is still often frustratingly slow (Meehl, 1978; O'Donohue, 2013). The issues are myriad, including but not limited to:

- The field still has many clinical problems that lack established evidence-based treatments (e.g., narcissistic personality disorder);
- Assessment measures, which play a role clinically but also in research as measures of outcome and process, have disappointing or missing psychometric data (see O'Donohue et al., 2022);
- All the waves rely in many ways on a diagnostic system that is generally regarded as suffering from multiple problems;
- Even many "successful" outcome studies elicit relatively small effect sizes;
- Too little is known about the relapse rates, even of these so called "evidence based" therapies;
- Too little is known about how best to ensure treatment fidelity;
- Too little is known about how to increase access to these therapies;
- Very few treatment guidelines exist regarding how to handle complex cases with multiple co-morbidities; and

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- There is a dearth of literature regarding effective therapies for understudied client populations, such as individuals belonging to more than one minority group.

More recently, there are also pressing concerns about the use of questionable research practices (QRPs; see O'Donohue et al., 2022) as well as replicability crisis in the field of clinical psychology as there has been too little concern about these issues in the field of clinical psychology when compared to social psychology or even medicine. Perhaps most alarmingly, there are no solved problems in clinical psychology (O'Donohue, 2013). Although behavior therapies do better than other schools of therapy in demonstrating treatment effects, even they still face many longstanding, serious, and limiting gaps and shortcomings (Chambless et al., 1996).

Furthermore, all this slow progress may be particularly surprising given the voluminous nature of psychological research. For example, in 2020, there are at least 2281 (American Psychological Association [APA], 2020) psychological journals publishing on average 111 articles per year (Bjork et al., 2009). In addition, in 2017 there were nearly 500,000 graduates of masters or doctoral programs in psychology (Conroy et al., 2019), each having done at least a master's project or doctoral dissertation. Yet despite all of this effort, problem-solving progress in behavior therapy has been slow.

Science and Problem Solving

Science, when applied to problems in many other fields, has generally resulted in an unprecedented growth of knowledge, and this knowledge has lent itself to applications and related technology relevant to improving human welfare (see for example, Popper, 1959). Most recently, one can see the productiveness of the scientific approach in the development of tests, treatments and vaccines for the novel coronavirus.

For centuries, humans were confronted with numerous serious and possibly life-threatening problems relating to disease, famine, and adequate shelter as well as a host of other desires for comfort that were not solved. Humans also wanted to understand themselves and others and engaged in various means for obtaining answers to these social and psychological questions. There have been a wide variety of different kinds of attempts to gain knowledge to address these problems—consulting sacred texts, attempting to understand what influential philosophers and thinkers said, relying on astrology, and relying on one's intuitions. However, the problem-solving progressiveness of these kinds of procedures was underwhelming, to say the least.

There was then a rise of science in the sixteenth and seventeenth centuries. In the early 1600s, Kepler and Galileo relied on what they conceived as the scientific method and made important discoveries in understanding planetary motion as well as identifying key descriptive information about planetary bodies, such as the moon. In that same century, Boyle discovered the first gas law, Hooke used the microscope

to discover the cell, and Harvey made significant advances in anatomy when he discovered the role of the heart in the circulation of blood (Daintith, 2009; Friedland, 2009; National Geographic, 2019). Furthermore, in that same century, Newton made important advances in optics discovering that light consists of a spectrum of many different rays, and separately discovered the force of gravitational attraction (Cantor, 1983). In the next century, Lavoisier and other early chemists used their understanding of the scientific method to make important discoveries regarding oxygen, ending the notion of phlogiston (West, 2013).

Later in 1861, Louis Pasteur discovered the germ theory of disease, leading to important gains in understanding physiology and cell biology that resulted in numerous advances in medical technology (Pasteur et al., 1878). At around the same time, Darwin made several voyages to the Galapagos islands and generated an important evolutionary theory (Ellegård, 1990). In the early twentieth century, a host of physicists, again using the scientific method, made key discoveries in understanding subatomic behavior which culminated in the atomic bomb, which for some concluded that the technologies associated with science might not all be for the good.

It is important to note that these scientific successes are only a small sample, and scientific progress continues in fields such as computer science, material science, and medicine. In psychology there were fewer such discoveries in that period; the best candidates are probably Pavlov's discovery of classical conditioning in the 1890s and Thorndike's law of effect in 1898.

However, there are several points to note regarding the status of science. First, the scientific methodologies often differed significantly across these scientific accomplishments (see Gower, 1997), raising questions about what exactly is the scientific method or even if a single method exists (Gower, 1997; Feyerabend, 2010; O'Donohue, 2013). Second, some scholars of science found that there can be fundamental differences in the quality of science and, as a result, constructs like *pseudoscience* (Lilienfeld et al., 2014) were developed and used. More recently, there has been concern about what are called questionable research practices (QRPs; O'Donohue et al., 2022), that can result in so-called replication failures, particularly in social psychology.[1] For this reason, Altman (1994, p. 308), an observer of the medical literature, has stated, "We need less research, better research, and research done for the right reasons."

Third, meta-scientists began to realize that there are human, noncognitive elements to science that go beyond the "craving to be right" to use Popper's (1959) colorful phrase, in which various biases that idealized conceptions of science, failed to adequately address what might be captured best by notions of seven deadly sins (greed, desire for fame, etc.). Critics were quick to point out the role of Big Pharma in biasing the scientific literature (e.g., see Healy, 2012), but perhaps they are slower in seeing how these same forces, although with fewer dollars, could affect the psychotherapy literature.

[1] It is worth noting that some (e.g., Ioannidis, 2005) have argued that most published research in medicine is false; thus, these issues do not solely occur in social psychology, or in psychology as a whole.

Fourth, some important problems (e.g., antisocial or narcissistic personality disorder) were increasingly seen as being refractory to science and still are (Chambless et al., 1996). Fifth, some thought that science is fine for inanimate nature or lower animal forms, but that it is not for humans due to some alleged special qualities of humans, such as free will (see for example, O'Donohue et al., 2020). Sixth, there came to be a realization that science cannot even in principle solve all problems, particularly moral problems (Hempel, 1966), but most probably conceptual problems too--no effective methods beyond traditional philosophical argumentation and conceptual analysis have been developed to address these. Finally, scientists themselves needed to understand science because they were sometimes criticized for the quality of their science—or criticize rivals on this issue.

This last point is particularly critical. Researchers are always concerned about the extent to which they are using the best methods to solve the problems that they investigate. The slow progress of "soft psychology," to use Meehl's (1978) felicitous phrase, is a cause for concern, and many including Meehl have suggested that perhaps psychologists are not using the right scientific methods. As stated above, proponents of certain positions of science often claim that their opponents in science are not scientific or at best poor scientists. One could see behavior in the history of behavior therapy in the initial friction of accepting single subject experiment designs in the mid part of the last century, as well as when some therapies, such as EMDR, were proposed (for example see Herbert et al., 2000).

One can see that many of these problems about the quality and progressiveness of science play out in the domain of behavioral health. For example, when McFall (1991) in his famous Manifesto called for a thoroughgoing commitment to science in clinical psychology, there is little consensus on *what science is* across various schools of therapy as we shall see within the field of behavior therapies. In his Manifesto, McFall (1991) famously stated as the "cardinal principle": "Scientific clinical psychology is the only legitimate and acceptable form of clinical psychology (p. 76)." McFall further stated,

> This first principle seems clear and straightforward to me-at least as an ideal to be pursued without compromise. After all, what is the alternative? *Unscientific* clinical psychology? Would anyone openly argue that unscientific clinical psychology is a desirable goal that should be considered seriously as an alternative to scientific clinical psychology? (pp. 76–77)

However, understanding the specifics on what constitutes science has not been so easy. For example, O'Donohue and Halsey (1997) argued that Sigmund Freud, Carl Rogers, B. F. Skinner and Albert Ellis all thought their work ought to be considered scientific, but that they each held very different conceptions of what science is. Additionally, even within the field of behavior therapy, O'Donohue and Houts (1985) found that the first two waves of behavior therapy constituted two distinct scientific disciplines. That is, while the first wave or applied behavior analysis relied mainly on single subject experimental designs, researchers within the second wave of behavior therapy (i.e., cognitive therapy) relied on group experimental designs.

Furthermore, we shall also see that the meta-scientific influences have varied drastically to the point of little or no overlap between the three waves of behavior therapy. For example, B. F. Skinner (1938), who influenced many first wave behavior therapists, was known to be influenced by the positivist Ernst Mach; Albert Ellis, one of the major founders of second wave movement, by the Stoics and eventually a neo-Popperian, W. W. Bartley (1984); and third wave behavior therapies by a rather obscure philosopher of aesthetics, Stephen Pepper (1942) and to a significant extent Buddhism. In the following sections, we are going to present an analysis of the meta-scientific commitments of each wave.

First Wave: Skinner, Behavior Therapy, and Applied Behavior Analysis

It is admittedly somewhat arbitrary to settle on a date for the beginning of behavior therapy. However, one reasonable candidate for this date would be when the phrase "behavior therapy" occurred in a journal article. That would be in the early 1950s, when B. F. Skinner and a few of his graduate students (Lindsley, 1956) took the operant conditioning principles that Skinner had discovered from experimental studies largely with pigeons and rats and applied these to patients in a state mental health hospital who suffered from what we would now call serious mental illness. For example, in one study these researchers used differential reinforcement to shape the behavior of talking in a woman diagnosed with schizophrenia who was electively mute for a number of decades (Lindsley, 1956).

It is important to note that even in its birth behavior therapy was not monolithic. In 1938, a learning researcher and a colleague at the University of Illinois, O.H. Mowrer (Mowrer & Mowrer, 1938) published a report of the successful treatment of nocturnal enuresis with institutionalized children with a urine alarm. The treatment approach was not based on medical intervention, such as surgery, nor did it utilize psychoanalytic principles which viewed enuresis as weeping through the bladder. Rather, the treatment was based on classical conditioning principles, although it is fair to say that at the time, the specific mechanisms of changes in that treatment were not particularly clear or well-established.

Yet another major early behavior therapy stream occurred in 1958 when Joseph Wolpe (1958), a South African psychiatrist who was influenced by the learning theory of Clark Hull, published *Psychotherapy by Reciprocal Inhibition.* More specifically, this volume presented three specific treatments for three types of neuroses; (a) systematic desensitization for phobias, (b) assertive training for problems involving self-assertion, and (c) sexual training for sexual inhibitions.

In sum, even at its inception behavior therapy was a summary term for a broad array of treatments all with some commonalities in that learning principles formed its basis. In this chapter and our discussion of first wave behavior therapy, we will focus on the Skinnerian approach as it has been arguably the most influential and

prolific of the first wave behavior therapies. At first this approach was often called "behavior modification" but today it is generally called applied behavior analysis (see Morris, chapter "What Is First-Wave Behavior Therapy?", this volume).

B. F. Skinner's Views of Science

B. F. Skinner (1904–1990) had several major intellectual influences. Within psychology which is broadly defined, he was influenced both by the work of Ivan Pavlov (1849–1936) on classical conditioning and by Edward Thorndike's (1874–1949) work on the law of effect. Within philosophy Skinner stated that he was influenced by Bertrand Russell[2] (1872–1970), but his scientific beliefs drew particular influence from the seventeenth century British scholar Francis Bacon (1561–1626) and the nineteenth century physicist and philosopher Ernst Mach (1838–1916).

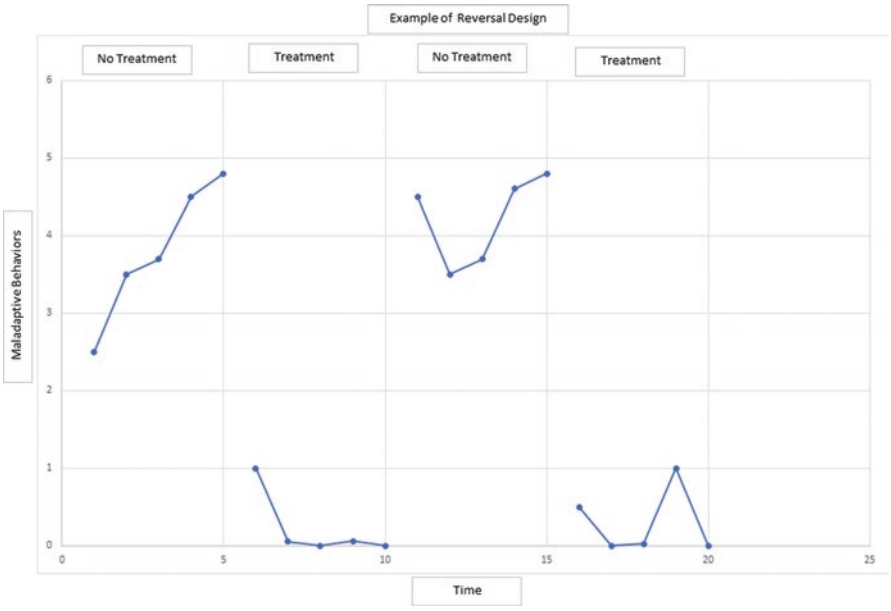
Francis Bacon Francis Bacon was an early advocate of science and advanced several proposals about what constituted proper scientific method. Bacon warned against what he called certain "idols" that he thought were commonplace but would lead to erroneous beliefs. One such an example was the *idola fori* (idol of the marketplace). *Idola fori* are logical fallacies that occur due to an "ill and unfit choice of words" (Bacon, 1854, p. 49) found in everyday vernacular that functions to sidetrack the potential knower. Thus for Bacon, science must often revise and refine constructs found in common language (e.g., the vernacular term "reward" and the scientific construct "reinforcement" are not identical).

Additionally, Bacon (1854) was an inductivist, stating that "the intellect is not fit to judge except by induction" (p. 23). Importantly Bacon was also both an experimentalist as well as someone who advocated for a utilitarian view of science, in which science should be commanded for the uses of humans. Bacon (1854) stated, "nature must be forced out of her natural state squeezed and molded (p. 25)" as "the nature of things betrays itself more readily under the vexations of art [experiments] than in its natural freedom" (p. 25). Bacon's instrumentalism can be found in probably his most famous his quote "Nature to be commanded must be obeyed." Bacon (1854) thought science ought to be involved in the "production of effects" in which the scientist is involved in "shaping nature as if on an anvil" (p. 413). Thus, through Bacon, we can see Skinner's emphasis on induction (which diametrically opposes the second wave's adoption of a neo-Popperian deductive logic of research), experimentalism, revisions of the vernacular language, as well as an instrumentalism in which a goal of science is to produce effects for the benefits of humans.

Ernst Mach Mach (1883) also shared Bacon's notion of the practical/instrumental value of science. Mach stated, "the ways even of science lead to the mouth" (p. 23).

[2] Skinner attributed first hearing the term "behaviorism" in an article by Russell.

Mach, again similar to Bacon, was also an inductivist, experimentalist, and also thought that it was important to purge constructs of what he regarded as their pre-scientific meanings. Mach, for example, did exactly this with the scientific construct of causation. Mach responded to Hume's concern about causation as not being directly observable—all one can see is 'constant conjunction"—i.e., the observation that one event reliably follows another event. Other conceptions of cause for Mach went beyond observables and thus for him were "metaphysical." Mach stated that the construct of cause is demonstrated in functional relationships. A mathematically functional relationship can be seen by the formula $y = f(x)$ and graphically as:



The basic idea is that *y*—the dependent variable—consistently changes (i.e., concomitant variation) with the introduction or the withdrawal of *x*—the independent variable. The first section of the graph shows the baseline of *y* when *x* is absent—it is at a relatively stable level. The second section of the graph shows the introduction of *x* (an experimental manipulation), and sure enough because (as it turns out) *y* is indeed a function of *x*, the value of *y* immediately changes. Then *x* is withdrawn (an experimental manipulation) and *y* returns to baseline levels. Then in the final sect. *x* is again re-introduced (a replication of the experimental manipulation) and *y* changes as a result. These steps in the language of behavior analysis are called reversals. In principle, one can keep doing this to make sure *x* and *y* continue to covary in this pattern. For Mach and Skinner then this functional relationship shows that *x* causes *y*.

Finally, both Mach and Skinner rejected the notion of science as hypothesis testing. For them, science ought to be a "bottom up" approach where there are no prior

hypotheses to test. This is critical in that the other two waves of behavior therapy are much more sanguine about the view of science as hypothesis testing. Mach advocated staying close to observations in order to produce the most economical descriptions of data. He stated, "Economy of communication and apprehension is of the very essence of science" (1883/1942, p. 7). We can also see these positions coming to together in a description of science that Skinner (1938) stated in his first book, *The Behavior of Organisms*:

> So far as scientific method is concerned, the system set up in the preceding chapter may be characterized as follows. It is positivistic. It confines itself to description rather than explanation. Its concepts are defined in terms of immediate observations…Terms of this sort are used merely to bring together groups of observations, to state uniformities, and to express properties of behavior which transcend single instances. They are not hypotheses, in the sense of things to be proved or disproved, but convenient representations of things already known (p. 44).

Skinner and Logical Positivism It is important to note that Skinner was sometimes seen as a logical positivist, a philosopher who was concerned with eliminating metaphysical statements by the use of a verificationist theory of meaning. However, Skinner was not a logical positivist nor influenced by logical positivism, although some of his detractors have made this claim to impugn him (see for example Mahoney, 1989). Logical positivism is the debunked philosophical view that originated largely in Vienna in the early twentieth century that attempted to reject metaphysical claims given its verifiability criterion of "if one cannot confirm a statement empirically, it is meaningless." On a side note, logical positivism collapsed when it could not find a version of the verifiability criterion that was not self-contradictory.

In *Behaviorism and Logical Positivism: A Reassessment of the Alliance*, Laurence D. Smith (1986) has pointed out that Skinner did have significant contact with proponents of logical positivism. However, according to Smith, Skinner's sympathies with logical positivism were quite limited and were restricted to those few aspects of positivism which they had already arrived at independently, such as a careful analysis of constructs and a heavy reliance on induction. Furthermore, the methods which Skinner alleged to have imported from logical positivism were actually derived from his own psychological indigenous conceptions of knowledge and science. Finally, according to Smith, Skinner developed and embraced a behavioral epistemology which, far from resting on logical positivist arguments, actually conflicted squarely with the anti-psychologism that was a part of logical positivism.

Skinner developed an indigenous, psychological analysis of epistemology and psychology, in which knowledge was the result of conditioning processes producing what he called "effective" behavior (see O'Donohue, 2013). Skinner never viewed his work as subordinate to philosophical work or arguments. An anecdote is very revealing of Skinner's priorities: When the young Skinner was told by the philosopher Alfred North Whitehead (1861–1947) that a psychologist should closely follow developments in philosophy, Skinner replied, "it is quite the other way around—we need a psychological epistemology" (Skinner, 2002). It was Skinner who eventually produced such a psychological epistemology.

Skinner's Philosophy of Science and Evolutionary Epistemology

Skinner developed his own philosophy of science. More specifically, Skinner's (1956) epistemic views are illustrated in the following passage from his paper, entitled *A Case History in Scientific Method*:

> But it is a mistake to identify scientific practice with the formalized constructions of statistics and scientific method. These disciplines have their place, but it does not coincide with the place of scientific research. They offer *a* method of science, but not- as is so often implied- *the* method. As formal disciplines, they arose very late in the history of science, and most of the facts of science have been discovered without their aid. It takes a great deal of skill to fit Faraday with his wires and magnets into the picture which statistics gives us of scientific thinking. And most current scientific practice would be equally refractory, especially in the important initial stages. It is no wonder that the laboratory scientist is puzzled and often dismayed when he discovers how his behavior has been reconstructed in the formal analyses of scientific method. He is likely to protest that this is not at all a fair representation of what he does (p. 221).

And further, Skinner (1982) stated that:

> If we are interested in perpetuating the practices responsible for the present corpus of scientific knowledge, we must keep in mind that some very important parts of the scientific process do not lend themselves to mathematical, logical, or any other formal treatment. We do not know enough about human behavior to know how scientists do what they do (p. 97)… science does not progress by carefully designed steps called "experiments," each of which has a well-defined beginning and end. Science is continuous and often a disorderly and accidental process…The subjects we study reinforce our behavior much more effectively than we reinforce them (p.97)… I believe that my behavior is as orderly as that of the organisms I study and that my rats and pigeons have taught me far more than I have taught them (p. 97, Skinner, 1982).

Skinner (1956) then provides his principles of successful scientific behavior:

- "When you run onto something interesting, drop everything else and study it.
- Some ways of doing research are easier than others.
- Some people are lucky.
- Apparatuses sometimes break down.
- *Serendipity* happens—the art of finding one thing while looking for something else." Skinner also argued that there was too much of what he came to call "premature physiologizing"(Skinner, 1938)—that the Zeitgeist of psychology of his time thought it was imperative in any discussion of perception, and that learning must be cashed out in terms of the physiology of the nervous system (we may be seeing the resurrection of this ideology with the emphasis on neuroscience; see Satel & Lilienfeld, 2013).

Skinner (1956) then noted that at Harvard he found a mentor W.J. Crozier who "resented the nervous system" (p. 223) and talked of behavior-behavior or environment-behavior relations without going inside the skin to explain behavior. Subsequently, his mission became to find order in "the organism as a whole" and found important clues from Pavlov's study of classical conditioning, namely, "control your conditions and you will see order" (p. 223). Skinner began to tinker (he

was a first-rate tinkerer) to develop new experimental apparatus that could be used to study environment-behavior relationships in the hopes of uncovering such order. He then noted that his early efforts were all failures (note here that even the scientist may make proposals to the environment to see what the environment selects—evolutionary epistemology).

Skinner's Indigenous Evolutionary Epistemology

According to Skinner, natural selection gives the organism the ability to know (Skinner, 1990). In a sense, millennia of natural selection provide the physiological equipment to emit certain response topographies. An opposable thumb, for example, enables humans to manipulate objects with fine motor control. Most importantly for human organisms, "when our vocal musculature came under operant control in the production of speech sounds," our species proceeded to soar with all its "distinctive achievements" (e.g., art, science, literature; Skinner, 1986).

Through natural selection, the environment selected those physical characteristics and behaviors that promote the survival and reproduction of species (Skinner, 1990). For example, those individuals with sensitive autonomic nervous systems (ANS) were presumably selected by the environment because they were able to react more quickly in response to danger. The fight-or-flight mechanism, the sympathetic branch of the ANS, enabled earlier humans to quickly move out of harm's way when a predator was about to attack. Those individuals with a poorly developed ANS simply became some other creature's meal.

Selection by Consequences According to Skinner, the environment selects behavior both in the life of the species as well as in the life of the individual (Skinner, 1990). He stated:

> All types of variation and selection have certain faults, and one of them is especially critical for natural selection: Classical conditioning prepares a species only for a future that resembles the selecting past. Species behavior is only effective in a world that fairly closely resembles the world in which the species evolved. If we were to wait for natural selection to fashion a relatively simple behavioral repertoire, this would take millions of years spanning countless generations, as selection is contingent on genetic variation. That fault was corrected by the evolution of a second type of variation and selection, operant conditioning, through which variations in the behavior of the individuals are selected by features of the environment that are not stable enough to play any part in evolution (p. 1206).

While natural selection concerns the physical embodiment of the species, selection by consequence concerns the individual—more specifically what the individual is likely to do (Skinner, 1981). An operant is a response that "operates" on the individual's immediate environment to produce certain consequences (Skinner, 1953). It is through this mechanism of selection that an organism readily adjusts its behavior to rapidly changing environmental circumstances. So-called "reinforcers" (e.g., food, sexual contact) increase the likelihood of the behavior that preceded them.

While operant conditioning better coordinated human behavior with a capricious environment, a single repertoire is extremely limited outside of social influence. Within a single individual's lifetime, the individual would not have learned that cooking food destroys harmful bacteria, storing food is advantageous in the event of a drought, or that hunting big game as a group is more energy efficient than hunting rodents alone. This limitation of operant conditioning was therefore corrected by cultural selection, when humans began sharing each other's repertoires by way of imitation (Skinner, 1990).

Cultural Selection: Social Contingencies Human beings are inherently social animals, as this tendency itself has obvious reproductive and survivalist advantages. For millennia, humans have coexisted under mutual protection, reared young collaboratively, and so on. Within these collectives, cultural practices could be transmitted via imitation. Imitation, of course, is not distinctly human. Japanese macaque monkeys, for instance, have been shown to imitate unorthodox behaviors demonstrated by other members of the collective (e.g., sweet potato washing and wheat-washing). The direct benefit of imitation is that it brings individuals into contact with reinforcers that are relatively remote; the more immediate contingencies of reinforcement take over the control of the behavior afterwards (O'Donohue & Ferguson, 2001).

Comparable to the preceding levels of selection, the environment also selects cultural practices in which populations and their offspring have a higher probability of survival. "A culture which raises the question of collateral or deferred effects is most likely to discover and adopt practices which will survive or, as conditions change, will lead to modifications which in turn will survive" (Skinner, 1961). For example, cultures that promote the practice "safe sex" are in a better position to control the spread of lethal sexually transmitted diseases. Cultures that do not adopt these practices are more likely to contract such diseases and ultimately pass them to offspring. The offspring, of course, usually die before they are able to reproduce.

The Second Wave: The Stoics and Neo-Popperians

There are many streams of cognitive therapy (O'Donohue & Fisher, 2009). For example, there is a stream associated with Albert Ellis's (1977) Rational Emotive Therapy (RET), a stream associated with Aaron T. Beck's (1984) cognitive therapy, and a stream more associated with experimental cognitive psychology perhaps best exemplified in the work of Steven Hollon (2011). The stream we will focus on in this chapter will be the one of Albert Ellis (1977), which he originally called RET, but later called Rational Emotive Behavior Therapy (REBT). Ellis will be the focus of this chapter because historically he was the most influential during the so-called initial era of cognitive revolution that created the second wave, and because at times, his philosophical influences shared similarities to subsequent cognitive therapists, such as Aaron T. Beck. For example, Both Ellis (1994) and Beck (1984) stated that

they were influenced by the Stoics. Finally, we discuss the philosophical position of second wave through Ellis's because he was one of the clearest regarding his philosophical influences.

The Stoics

Ellis was influenced by the Stoics. In his *Reason and Emotion in Psychotherapy,* Ellis (1994) stated,

> I inducted this principle of the ABC's of emotional disturbance from working with hundreds of clients from 1943 to 1955. But I also took it over from many philosophers I studied from 1929 (when I was 16) onwards …. clearest of all amongst the ancients were the Greek and Roman Stoics especially Zeno of Citium (the founder of the school) Chrysippus, Panaetius of Rhodes, (who introduced Stoicism into Rome) Cicero, Seneca, Epictetus, and Marcus Aurelius (p. 64).

Stoicism, initially developed by Zeno of Citium (336–264 BCE), and later modified by the Roman philosopher Epictetus (60–120 CE), is among the better known of the ancient Greek philosophies. We begin our review of Stoicism with two exemplary quotes from Epictetus (numbers refer to numbered paragraphs in the Enchiridion):

> Men are disturbed not by things, but by the views which they take of things. Thus death is nothing terrible, else it would have appeared so to Socrates. But the terror consists in our notion of death, that it is terrible (5).

and

> Demand not that events should happen as you wish; but wish them to happen as they do happen, and your life will be serene (8).

Thus, Stoicism is a philosophy emphasizing rationality in the control of both thought and emotion. The Stoic account of virtue is one based on control over one's emotions. This control is so radical as to include the caveat "Friendship may be fine, but be careful that you do not become so close that the misfortunes of your friends affect your own peace of mind". This injunction applies also to one's duties toward others and society. The Stoic model of the emotions (passions) is a basic combination of positive and negative feelings organized according to time orientation:

	Present	**Future**
Positive	Joy, Delight, and Pleasure	Hope and Desire
Negative	Pain, Grief, and Sadness	Fear and Dread

Notice that the past is not included in this schema. According to the Stoics, it would be irrational, after all, to worry about things in the past. Nothing can be done: the past is simply what it is.

The basic principles of Stoicism reveal an interesting parallel to the events of Epictetus' life. Born a slave in a region now found in modern day Turkey, Epictetus was a picture of Stoic detachment. According to his legend, one day while Epictetus worked in the fields, his master decided to tighten the shackles on his legs despite the fact that Epictetus told him that doing so was unnecessary, as he had no plans of escaping. This resulted in a broken leg for Epictetus. Despite the pain he did not complain. When his master asked him why he did not complain, Epictetus responded that complaining would be pointless because his leg was already irreversibly broken, and no amount of complaining would undo this fact. The master was so impressed, or perhaps felt guilty, with Epictetus' composure, that he awarded him his freedom. The Stoic virtues are intended to free humans from our passions.

At this point it is important to note that Ellis is not initially influenced by a philosopher of science (as Stoicism predates the rise of science), but rather by what might be called a pragmatic philosophy regarding the proper conduct of life. However, next we will turn to an examination of the neo-Popperian (Bartley, 1984) who did influence Ellis' concept of both rational belief formation and science.

Popper and the Neo-Popperians

Ellis (1977) stated,

> I abandoned even more elements of logical positivism when I later read Bartley (1962), Mahoney (1976), and Popper (1963), all of whom hold that to be scientific a hypothesis had better be falsifiable. In recent years I adopted Bartley's more open-ended position, which states that no hypothesis can be completely proven (or disproven) by empirical "evidence" (p. 20).

What follows is an explanation of Bartley's Pan-Critical Rationalism.

Bartley's Pan-Critical Rationalism

Bartley (1984), a student of Popper's, criticized what may be called *justificational or foundational* accounts of rationality (note that Popper also expressed similar criticisms). A justificational or foundational account of knowledge attempts to distinguish rational beliefs or actions from irrational beliefs or actions by the degree to which the former is supported, confirmed, warranted, or in some way justified by appeals to some reason or evidence. Thus, according to this view, it is rational for me to believe that "All copper conducts electricity" because this claim is (hopefully consistently) verified (or "supported," "confirmed," "warranted", etc.) by some (hopefully large and representative) set of prior empirical observations.

Bartley (1984) proposed an alternative epistemic approach to rationalism that he called "pan-critical rationality" or "comprehensive critical rationality". Bartley's account explicitly denies that justification must be given for some candidate belief to be considered rational. According to Bartley, there is no such state of affairs as a "justified" belief. Pan-critical rationalism states that all beliefs are open to criticism, including this proposition itself (i.e., "All beliefs are open to criticism.") --therefore escaping the self-referential inconsistency problem of justificationism. The key epistemic questions in this account become, "What would count against my belief?", "Are there alternative beliefs that better survive criticism?", and, "How can one maximize criticism of my beliefs so I might discover any error contained in these?" That is, according to Bartley (1984) how can we, "... arrange our lives and institutions to expose our positions, actions, opinions, beliefs, aims, conjectures, decisions, standards, frameworks, ways of life, policies, traditional practices, etc. to optimum examination, in order to counteract and eliminate as much error as possible?" (Bartley, 1988, p. 213).

For Bartley and Popper, a belief is rational to the extent that it has been subjected to and has survived criticism, especially severe criticism. Criticism is admittedly infinite in that one can criticize indefinitely. But this is not a logical regress since one is not seeking a final, definitive proof or infallible foundation for one's beliefs. No such infallible final position is sought: inquiry and criticism are open-ended processes. For example, in science, the Einsteinian revolution shows how Newton's theory, which was once an accepted set of beliefs that had survived much criticism (i.e., experimentation), eventually succumbed to a certain type of criticism.

Bartley (1984) also has pointed out that it is important to note that not only do we learn where our errors are, we also learn how to learn, i.e., we learn how to better criticize and eliminate error more efficiently. We can do this both as a species, as best seen perhaps in developments of scientific methods, but also as individuals in which we adopt better meta-strategies to identify error. This is an important reason why, for Bartley, glib comments about "the scientific method" are so problematic. Scientific method is not ossified. As the philosopher of science Harold Brown (1988) has stated, "Modern studies of the history of science indicate that science is not just a process of learning about the world, it is also a process of learning how to learn about the world" (p. 7).

As Radnitzky (1988) has stated, "Fallibilism entails the perennial willingness to re-examine any position when, and if (but *only* if) there are good reasons for problematizing it" (1988, p. 292). Radnitzky (1988) also nicely contrasts the justificational and the pan-critical accounts of rationality:

> The justificationist asks: When is it rational to accept a particular theory [or belief]?; and he suggests and answers on the lines: When it has been verified or probabilified to a sufficient degree. In the critical context the key question is: When is it *rational* (fallible) to prefer a particular position (statement, view, standard, etc.) over its rival(s)? The answer suggested is along the lines: 'It is *rational* (fallible) to prefer a position over its rivals if and only if it has so far withstood criticism—the criticism relevant for the sort of position at stake—better than did its rivals'. (p. 288)

An important part of fallibilism is that alternatives to some set of beliefs also receive a fair hearing and all competitors are considered on their own merits without consideration of factors such as previous psychological attachment to the position. The critical fallibilist is particularly critical of any move that attempts to immunize a position against criticism.

Thus, statements such as, "There is an undetectable God whose existence shall not be questioned" can be seen as an attempt to minimize criticism and therefore are problematic as there is little opportunity for error correction. Similar problems are encountered in any attempt to dogmatize (i.e., insulate from criticism) any belief or practice. For a fallibilist, questionable research practices can be a particular concern because these may give the false impression that the research put the hypothesis or theory at risk of falsification when actually this did not happen (see O'Donohue et al., 2022).

Pan-Critical Rationality and Evolution

Similar to Skinner, Bartley (1984) sees his epistemology as part of a larger evolutionary epistemology. However, as we shall see, some of the details differ in important ways. As we have established in Skinner's evolutionary approach to epistemology, Darwinian biology is used to explain both the ability of organisms to know as well as the process of knowing itself. Popper (1979) has pointed out,

> Animals and even plants are problem-solvers, finding solutions by method of competitive tentative solutions and the elimination of error. The tentative solutions which animals and plants incorporate into their anatomy and their behavior are biological analogues of theories and vice versa: theories correspond to endosomatic organs and their ways of functioning, as do many exosomatic products such as honeycombs, as well as especially exosomatic tools, such as spiders' webs. Just like theories, organs and their functions are tentative adaptations to the world we live in. (p. 145)

The characteristics of external objects that contain nutrients necessary for an organism's survival pose problems that the human species has come to know how to solve. This knowledge, for example, becomes literally embodied in the structure, variety, and placement of teeth, and by the glands that secrete special but effective chemicals that lead to catabolic processes, and by a critical length of intestinal tract, and by a myriad other related physiological structures and mechanisms. In the long evolutionary history of our species, past environments have criticized (i.e., selected against) certain other competing problem-solving attempts. Relatively "good" attempts have survived, but their survival does not indicate that there are not better possible solutions or that these solutions are absolutely "justified" (i.e., better solutions may be available). These solutions may in fact contain a great deal of error, as undigested nutrients, dental cavities, and ulcers indicate.

Random variation and selective retention have not only produced embodied knowledge in the species, but these mechanisms have also allowed the acquisition of fallible and unjustified knowledge in the lifetime of the organism, knowledge that can hopefully continue to respond to further criticism. According to Popper (1979),

the major difference between the problem solving of subhuman animals and humans is that for animals, death and considerable suffering constitute the major feedback for error elimination, but because of past selection of intelligence, humans can advance theories and arrange experiments (error-eliminating attempts) so that our mistaken theories and beliefs can "die in our stead".

This evolutionary epistemological context of pan-critical rationalism has a number of implications for Ellis' REBT and for second wave cognitive therapy in general. First, evolutionary epistemology provides a larger context for an account of rationality and therefore can provide answers to meta-questions of rationality (e.g., "What is rationality?", "Why is rationality good?", and, "How did rationality come to exist?"). Second, evolutionary epistemology may be seen as using the best source of knowledge—science—to answer an important epistemic question. Thus, this account of rationality is seen as consistent with, and in fact, an implication of, contemporary biology (O'Donohue, 2013).

Pan-Critical Rationality and Rational Emotive Therapy

O'Donohue and Vass (1996) have argued that the extent to which Ellis has faithfully followed this epistemic account is another question entirely. For example, Ellis, at least in the majority of his writings describing his account of rationality, holds an explicitly justificational account. For example, Ellis stated rational beliefs, "...can be supported by empirical data..." (Ellis, 1973, p. 57). This again is puzzling given that he has stated that he follows the views of Bartley and may be indicative of problematic exegesis on the part of Ellis.

However, many of these strategies and methods implied by a pan-critical account of rationality would be similar to those of existing REBT. For example, both conventionally practiced RET and a pan-critical approach would emphasize the importance of identifying relevant irrational beliefs and increasing the client's awareness of these beliefs (however, one would concentrate on the history and quality of past critical tests, as well as the severity of these tests). Thus, both would highlight associated therapeutic techniques such as the therapist probing and identifying these beliefs. Both would stress the *B-C* connection in the RET's A-B-C-D-E (Activating Event-Belief-Consequence-Dispulation0Effects) paradigm as an important point of intervention and would emphasize rationality as the relevant critical dimension.

However, the pan-critical account of rationality would also have implications for modifying the current practice of REBT. In a pan-critical-based cognitive therapy, the purpose of therapy would be to teach clients how to be appropriately critical of their beliefs. Thus, a major goal of therapy would be to teach criticism skills—as well as the willingness to criticize one's own beliefs. In this view, currently practiced REBT does some of this (through modeling effects and other implicit mechanisms) and teaches this for circumscribed beliefs and situations, but may not do this with optimum generality or with the explicitness that would tend to increase the transfer of such skills to other beliefs and acts (O'Donohue & Vass, 1996). In

addition, it is fair to say that the pan-critical approach would also be critical of the central tenets of REBT such as its reliance on empirical confirmation and other inductivists approaches, while the conventional approach would not.

The pan-critical rational–emotive therapist also would be more systematic and specific about the criticism process. Promoting a particular attitude toward error on the part of the client would be of primary importance. Popper (1965, p. 281) has stated, "The wrong view of science betrays itself in the craving to be right." The same holds for rationality in general and thus an attempt would be made in therapy to understand that an uncritical attitude towards one's own beliefs is itself problematic because we are often wrong and such an uncritical outlook does not identify erroneous beliefs nor does it produce error-eliminating attempts. Thus, a key value of criticism is that it can help us to identify and eliminate error and successively improve our attempts at avoiding the negative consequences of our mistaken beliefs (for example, think of the continual quality improvement efforts of companies, such as Toyota). The "craving to be right" of a justificational account is transformed to "craving to identify our errors and replace these."

The pan-critical approach would emphasize new sets of techniques and therapy goals. For example, the pan-critical approach would emphasize the importance of judging when and which beliefs should be problematized. This may not be a straightforward matter but would require a fair amount of judgment and discrimination. Thus, another level of criticism becomes important: a meta-level of identifying which object level judgements ought to be priorities for criticism as well as what are efficient, severe tests for these (see O'Donohue et al., 2022). Finally, of utmost importance, the pan-critical approach would stress imparting skills regarding how to construct new and telling (i.e., potentially falsifying) tests of relevant beliefs. In this approach, the therapist should not ask clients to support their beliefs and practices, but rather to invent and conduct tests that would efficiently criticize these.

Again, this problem can have important negative implications for clinical practice. If a goal of RET is to help clients to become independently rational, then it would seem countertherapeutic for clients to be unable to accurately apply criteria to evaluate the rationality of particular beliefs. To the extent that this procedure is poorly defined, a quasi-mysterious process, an authoritarian process ("My therapist says so,") or a seemingly arbitrary process, then it is likely clients would have difficulty in making these key judgments in the future.

The Third Wave: Post-Modernism and Contextualism

The so-called "third wave" of cognitive behavior therapy began over 15 years ago (Hayes, 2004), and like traditional CBT, it includes a variety of streams and distinct interventions. Though these interventions that fall under the third-wave are arguably disparate from one another in form (e.g., Acceptance and Commitment Therapy, Dialectical Behavior Therapy, Functional Analytic Psychotherapy, Mindfulness Based Cognitive Therapy), they have common elements. These common elements

include the rejection of mechanistic philosophical assumptions in favor of more post-modern assumptions as well as the usage of therapeutic techniques tied to these assumptions (e.g., mindfulness, acceptance, values; see McCracken, chapter "What Is Third Wave Behavior Therapy?", in this volume). A mechanistic assumption, a philosophical framework introduced by Pepper (1942), may be defined as pre-analytic beliefs that phenomena (in this case, behavior) can be explained in purely physical or deterministic terms (e.g., Hayes, 2004; Herbert et al., 2013). Though it is incorrect to say that the entirety of work that preceded the third-wave was inherently mechanistic, it is arguably true that mechanism exists at some level within both the first- and second-waves. For example, Thorndike's (1898) work on stimulus-response theory posits a lawful, orderly relationship between stimulus and response that is strengthened by the nature and frequency of S-R pairings.

In the present day, the distinctions between the third wave and its progenitors are somewhat ambiguous (Hayes & Hofmann, 2017). For example, the techniques originally borne from third-wave therapies (e.g., mindfulness, acceptance) have been incorporated into some mainstream cognitive-behavioral therapies. In practice, the difference between waves may even be somewhat arbitrary. Formally, third-wave clinicians are said to utilize more mindfulness and acceptance techniques while second-wave clinicians incorporate more cognitive restructuring. However, technical eclecticism of both second- and third-wave techniques among clinicians appears to be rather common (Brown et al., 2011). Thus, the demarcation used to distinguish third-wave CBTs from traditional CBTs is somewhat blurry.

Nonetheless, from an Pepperian account, the basic philosophical assumptions of three waves of CBTs are relatively distinct (Hayes, 2004; Hayes et al., 1993). For the purposes of this chapter, we will examine functional contextualism, the philosophical standpoint of ACT, in large part due to the explicit links between the ACT model and the philosophical assumptions of functional contextualism (e.g., Hayes et al., 1988; Chin & Hayes, 2015). Though the specific assumptions used in ACT do not necessarily represent those used in other third-wave approaches, they do constitute an example of the general post-modernist assumptions and rebuttal of mechanism (also called elemental realism) that is native to second-wave CBT. By post-modernist, we refer primarily to "the assumption that there is no common denominator—in 'nature' or 'truth' or 'God' or 'the future'—that guarantees either the One-ness of the world or the possibility of neutral or objective thought" (Ermarth, 1998).

Functional Contextualism

In essence, mainstream psychology holds the view that the world exists independently from our sensation of it, and that the goal of science is to build increasingly accurate models that describe this world, as well as how the constituent pieces of the world interact with one another (Hayes et al., 1988). Statements about the world are justified, valid, true, or rational if they correspond to this underlying world. This

mechanistic assumption can be seen inside of traditional second-wave approaches, such as Ellis' discussed above, where clients are encouraged to engage in behavioral experiments to test the accuracy of their assumptions and beliefs and to discard those thoughts that are irrational or "false". Extended further, identifying where the distinction between the natural pieces/kinds lie and "carving nature at its joints" is an important function of science from this perspective (i.e., DSM diagnostic criteria and psychiatric nosology more broadly). For example, diagnoses are useful because they demarcate discrete entities that draw a distinction between adaptive and maladaptive functioning, and the extent to which they successfully do so reinforces the validity of the disorder in the natural world (e.g., Kendler & Gardner, 1998).

In contrast, informed by the framework of Pepper (1942), ACT is built on a pragmatic philosophy of science called *functional contextualism* (Hayes, 1993; Hayes et al., 1988). From this perspective, truth and scientific validity are rooted in the pragmatic questions of what successfully works in a given context to accomplish a stated goal (successful working, workability; Barnes-Holmes, 2000). Unlike mechanism (elemental realism), defined as the assumption that "one can know the true nature of reality, and objectively discover the elements of which it is composed" (Ciarrochi et al., 2016), the contextualist philosophy refrains from making such ontological claims, i.e., claims about the kinds of categories of entities that exist. Because truthfulness is determined by workability with respect to pre-analytic goals (that is, an arbitrarily chosen *metric* as a foundation on which analyses can be developed, rather than the *result* of such analyses), contextualists can sidestep the question of the nature of reality instead of mapping the veracity of statements onto a reality. This does not mean that functional contextualism is anti-ontological (e.g., stating that there is no reality, or that reality is subjective), but rather, that functional contextualism is a-ontological (Barnes-Holmes, 2005).

Clarity of one's goals is critical within functional contextualism; otherwise, any consequence-shaped behavior would be considered successful, even behaviors that are generally considered to not be so (e.g., suicide, throwing tantrums, polluting the environment; Hayes, 1993). Within functional contextualism, the goal of science is "*to predict-and-influence, with precision, scope, and depth, whole organisms interacting in and with a context considered historically and situationally*" (Hayes et al., 2012, p. 4). In contrast to mechanism (i.e., elemental realism), which emphasizes the ways in which individual components interact with one another to produce the whole, the primary unit of analysis in contextualism is the whole event and the parts are abstracted when it is useful.

In functional contextualism, *precision* refers to a limited number of analytic concepts [e.g., derived relational responding, mutual and combinatorial entailment in Relational Frame Theory (RFT); Hayes et al., 2001] being relevant for a given case. *Scope* refers to the capacity of an analytic concept to be applicable to multiple cases. Finally, *depth* refers to the degree to which analytic concepts cohere across levels of analysis (that is, principles that apply at the level of the individual should also be applicable to groups of individuals) and across established fields of study (e.g., psychological findings should also cohere with principles in other sciences, particularly evolution science and anthropology). As such, from an essentialist perspective,

disorders represent distinct demarcations between function and dysfunction (cf. Lilienfeld & Marino, 1999); however, a contextualist might generally abandon the notions of specific disorders and instead search for a set of principles that are broadly applicable, and not limited to a specific diagnostic category.

As mentioned above, functional contextualism as a philosophical perspective has its origins in the writings of Stephen Pepper (1942), who argued that scientific-philosophical systems can be delineated into four distinct models, or "world hypotheses," derived from common sense conceptualizations (or "root metaphors", in Pepper's language). Pepper further describes the root metaphor of contextualism as "the real historic event, the event in its actuality… It is not an act conceived as alone or cut off that we mean; it is an act in and with its setting, an act in its context" (p. 232). Pepper himself did not distinguish at what point an analysis ends, which may partially account for the differentiation of *functional* contextualism from other kinds of contextualism (Hayes, 1993). Within functional contextualism, context is included to the extent that it meaningfully improves the ability to predict-and-influence human behavior.

The key insight tying Pepper's writings to third-wave behavioral therapy was that Skinner's radical behaviorism is in essence a contextualistic system (Hayes et al., 1988). Thus, in some ways, third-wave approaches share a philosophical system with radical behaviorism. For example, Skinner's (1938) concept of the operant requires the understanding of the relationship between a given behavior and the stimulus events surrounding the behavior within the environment. Thus, any given behavior is devoid of meaning from a behavior analytic standpoint without also including the historical, as well as the current environmental context in which the behavior is emitted—the so-called "act-in-context". These behavior-environment relations are critical in determining the functional class of the behavior itself, as "the consequences define the properties with respect to which responses are called similar" (Skinner, 1953).

There are notable advantages of clarifying Skinner's philosophical assumptions, and interpreting them through the lens of functional contextualism. First, from a standpoint of Pepperian classification, Skinner was not always clear on his philosophical stance as it pertains to radical behaviorism (e.g., Gifford & Hayes, 1999; Parrott, 1983). This has led to inconsistencies about his philosophy of science within the behavior-analytic community. For example, while Skinner outright rejected biological reductionism early on (e.g., Skinner, 1938), he appealed to future physiologists providing more adequate explanations for behavior (see Zilio, 2013, for a review). For this reason, Hayes et al. (2001) argued that adopting contextualist assumptions within behavior analysis more firmly ties it to the pragmatist wing of psychology (e.g., James, Dewey, Pierce), emphasizing the prediction and influence of scientific claims over an ontological truth. The explication of functional contextualism as one's own philosophical position also necessitates that a scientist states the goal of their analyses antecedently (Hayes, 1993). This is particularly important in behavior analysis given Skinner's argument that a proposition is 'true' to the extent that with its help the listener responds effectively to the situation it describes (1974). Without a pre-existing goal statement to further clarify what an "effective

response" might be, any reinforced behavior would be definitionally "true" (Vilardaga et al., 2009).

Evolutionary Epistemology

Another important implication of a functional contextualistic behavior science (and also of Skinner's radical behaviorism) is that the analyses must also be applicable to knowledge claims made by the scientist (e.g., Day, 2005). Thus, any epistemological claims made from within a functional contextual perspective should not be judged based upon correspondence to the world as it exists. This epistemological position of functional contextualism is in sharp contrast with that of other worldviews in the Pepperian classification, including mechanism. That is, scientific progress is often said to be only possible if theories are developed, which *refer* to the world (Laudan, 1977). Put in a different way, scientific theories that are drawn from other philosophical worldviews, such as mechanism, classify and divide the world ontogenetically. However, the functional contextualist would argue that, although these divisions may be *useful*, an effective theory is not *defined by* these divisions that are purported to pre-exist in the natural world.

For many scientists and philosophers, this epistemological position of functional contextualism does present an important limitation, however (Barnes-Holmes, 2000). This is because, from a functional contextualist perspective, scientific endeavors are a product of the behavioral history of the scientist. This means that, as a result of the scientist not being able to claim ontological truths, a different behavioral history may have produced a different "truth" (Barnes-Holmes, 2000), which is not a conventional account of what the truth is for many scientists and philosophers. This notion of referential truth is similar to evolutionary epistemology, in which Darwinian principles are applied to verbal behavior and cognition (see Radnitzky & Bartley, 1987).

Previous evolutionary epistemologists have tried to adhere to correspondence-based truths by claiming "no effort is made to justify 'my own' knowledge processes" (Campbell, 1959, p. 157), therefore excluding the scientist from the analytic account. However, functional contextualism takes a different approach. That is, the account must also include an analysis of the contingencies involved in scientific knowing itself. Rather than struggling with whether scientific theories truly refer to and correspond to the world, the analysis also focuses on the *functions* of language and cognition, rendering correspondence a moot point.

Basic and Applied Science: A Reticulated Model

Taken together, these functional contextualistic philosophical assumptions can be utilized to form a scientific approach that explicitly lays out a coherent strategy for knowledge development, called contextual behavioral science (CBS; Hayes et al., 2012). CBS is defined by Hayes and colleagues as:

> a principle-focused, communitarian strategy of reticulated scientific and practical development. Grounded in contextualistic philosophical assumptions, and nested within multi-dimensional, multi-level evolution science as a contextual view of life, it seeks the development of basic and applied scientific concepts and methods that are useful in predicting-and-influencing the contextually embedded actions of whole organisms, individually and in groups, with precision, scope, and depth; and extends that approach into knowledge development itself. (p. 2)

A key strategy utilized within CBS is a reticulated (that is, web-like) model in which basic (i.e., principle- and theory-based science) and applied science are kept tightly linked to, and mutually influence one another. The well-known Duhem-Quine thesis (Quine, 1951) demonstrates that scientific hypotheses are impossible to test in isolation, as any observational test requires a further set of auxiliary assumptions. As argued by Meehl (1978), these auxiliary propositions are often blamed for failures in theories within psychology, preventing falsification and leading to the "slow progress of soft psychology." However, from a functional contextual perspective, behaviors and their contextual functions are treated as legitimate analytical concepts of themselves, not as proxies for inferred variables (Hayes et al., 2012). Thus, for example, an individual's social withdrawal and reticence around peers is not a symptom of "introversion" or "shyness"; rather the specific behaviors themselves are the targets of analysis and intervention.

This analytic strategy requires the conditions in which concepts are studied to be defined specifically, and contextually-bound, such that there is little room to blame auxiliaries when a concept is not supported. Though such an approach does not entirely invalidate the Duhem-Quine problem, in conjunction with other good scientific practices (e.g., O'Donohue et al., 2017), it may address the limited progress within the field. A further advantage of behaviors as targets of analysis is that these can be relatively easily studied in a basic, principle-driven sense, given the existing work in the field of behavior analysis, and these basic principles can be scaled to applied contexts. For example, rather than targeting the content of cognitions as the focus of intervention (i.e., cognitive restructuring), ACT explicitly addresses the functions of cognitions as they relate to the individual's environment, as well as the individual's relationship with said cognitions. However, the functional-contextual approach also allows for advances in applied domains (i.e., the "act-in-context"), with the caveat that basic principles be developed to explain, predict, and influence these findings (Hayes et al., 2012; see also Barnes-Holmes et al., 2016). An example of the fundamental basic science most relevant to third wave interventions, such as ACT, is RFT (see Hayes et al., 2001).

Middle-Level Terms and Constructs

As discussed extensively above, the development strategy of having an applied theory of psychotherapy tied to a basic, behavioral account of complex human behavior seen in CBS is sensible from a philosophy of science perspective. That is, the

entire package is internally consistent (e.g., mechanisms of change in ACT are derived from RFT-based principles), theoretically coherent (human suffering is cast in terms of problems that arise from relational framing), and largely self-sufficient (outside of basic behavioral principles, the ACT perspective is not reliant upon other theories in order to be useful).

The same strategy presents a pragmatic concern for treatment delivery, however. More specifically, it is unrealistic for all clinicians and practitioners to be well-trained in basic behavioral principles, to the point that they can apply them in novel clinical situations. Thus, as a dissemination strategy, ACT training deliberately utilizes so-called "middle-level terms"—practically useful concepts and abstractions designed to orient the clinician toward features and processes that may lead to better outcomes (Hayes et al., 2012). The ACT literature incorporates several of these middle-level terms, including the six fundamental processes (acceptance, diffusion, flexible attention to the present, self-as-context, values, and committed action) within the psychological flexibility model (which itself could be considered a middle-level term). These processes lack the precision, scope, and depth typical of behavioral principles, and therefore should not themselves be confused with principles.

However, a significant risk of the use of middle-level terms is that they can become reified (Vilardaga et al., 2009), and this risk may be particularly significant for those practitioners for whom middle-level terms were designed; that is, practitioners without extensive training in basic behavioral principles. For example, the term "attention" in behavior analysis refers to a functional class of reinforcers that can tend to maintain many different behaviors. However, laypeople and even clinicians may be tempted to attribute negative behaviors to attention itself (i.e., a child acting out for attention), without attending to how reinforcement works to bring about those negative behaviors. Absent the behavioral principles of reinforcement, knowing that a behavior is maintained by attention does little to address the problem behavior in question.

Indeed, there is some concern even within the functional contextual wing that these terms are problematic, and veer dangerously close to hypothetical constructs, which may be defined as a *non-observable* variable that is used to explain behavior (e.g., Barnes-Holmes et al., 2016). In order to remain philosophically consistent with functional contextualism, theoretical constructs are only useful to the extent that they orient the clinician toward problematic, manipulable behaviors. For example, mindfulness is a middle-level term that addresses the degree to which an individual exhibits problematic attentional rigidity toward the past (e.g., rumination) or future (e.g., excessive worry). It should not be considered a skill to be trained up indiscriminately, but rather a tool to address deficits in flexible attentional focus. It may be worth careful consideration whether the risks and problems associated with the usage of middle-level terms within ACT are beneficial and philosophically consistent with the functional contextualist strategy. Nevertheless, as Dixon et al. (2018) pointed out, ACT may be the most resoundingly successful application of the broad research program on derived stimulus relations, and that "although ACT is complex, it incorporates a non-technical language that the general population can understand and that, arguably has helped to fuel its societal acceptance" (p. 251).

In sum, broadly speaking, the theories that comprise the third-wave of behavior therapy can be characterized by their eschewal of mechanistic assumptions in favor of post-modernist interpretations, rejecting the notion of a neutral, objective perspective from which one can analyze the world. These assumptions have important implications in how therapy is conducted, distinguish third-wave interventions from the previous waves. Rather than training clients to be more rational and to identify irrational thoughts and beliefs, clients are asked to evaluate the utility of their behaviors with respect to a pre-existing target outcome (Vilardaga et al., 2009). As such, the role of the clinician is to help clients develop more effective ways of interacting with their environments.

Additionally, these third-wave assumptions are as applicable to scientific behaviors as they are to problems that arise in clinical contexts. In order to develop a more progressive approach to science that seeks to develop successively useful models and theories, a philosophically coherent strategy termed CBS has been developed. This approach emphasizes identifying directly manipulable causal variables rather than constructs (Hayes & Brownstein, 1986), with contextual factors being defined precisely to limit the degree to which the Duhem-Quine problem can be invoked. Though this approach has led to a productive empirical basis (e.g., nearly 350 randomized controlled trials of ACT having been conducted to date; see bit.ly/ACTRCTs), there have been some criticisms regarding the research program (e.g., O'Donohue et al., 2016).

Conclusions

We have seen that the three waves of behavior therapy have been influenced by, and have adopted, three distinct sets of meta-scientific beliefs. We have argued that in the first wave, B. F. Skinner was influenced primarily by the positivism of the physicist Ernst Mach as well as the inductive philosopher of science, Francis Bacon, and came to develop an indigenous philosophy of science (which he called radical behaviorism) that eventuated in a naturalized, evolutionary epistemology—which, in turn, was advanced by neither Mach or Bacon. Evolutionary epistemology looks at the ways a natural process, evolution, studied by science, has influenced humans to be knowledgeable—both as a species as well as individuals. Evolutionary epistemologists point out that epistemology then is seen as a scientific matter, not a philosopher one.

On the other hand, in the second wave, Albert Ellis was influenced by the pre-Socratic philosophers known as the Stoics, who emphasized that one's beliefs have more influence on one's happiness more than events themselves, as well as by the neo-Popperian, W.W. Bartley's pan-critical rationalism, which emphasizes maximizing criticism to identify and root out error. Bartley's basic idea is that clients have erroneous beliefs as well as nonideal belief generating processes that can be improved by adopting a more critical stance (including the stance of criticizing one's criticizing—hence the notion that this approach is "comprehensively

critical"). However, O'Donohue and Vass (1996) have argued that Ellis was not actually faithful to Bartley's epistemology. Finally, the third wave, particularly ACT, was most influenced by a rather obscure philosopher, Stephen Pepper, who mainly concentrated on aesthetics during his career but emphasized non-mechanistic, root metaphors. His obscurity can be partly depicted that in The Philosopher's Index a database of citations (in February 2021) for philosophy books and articles, his total citations were 190 while Popper's during the same time period were 3023.

It is beyond the scope of this chapter to provide a detailed evaluation of the quality of these meta-scientific commitments as well as the degree to which each of the waves actually has been faithful to the commitments associated with their particular wave. These are certainly important questions. It is clear that each of the waves currently face significant challenges and it will be important to see whether the waves can draw on the insights of these meta-scientific commitments to increase their problem-solving effectiveness. All are faced with the general challenge of developing new therapy principles, more valid assessments, as well as more efficient and effective therapies.

However, it can also be said that each also faces unique challenges. The third wave has developed quickly in the last few decades, a time period which it seems fair to say the first wave has failed to develop new learning principles or new advancements in the effectiveness of their therapies. It also seems fair to say in recent decades that perhaps a lot of time and attention has been spent by those in the first wave of developing a profession to meet the practical needs of delivering many interventions to many individuals suffering from autism. In the last few decades, it also seems fair to say that the second wave also has made few recent breakthroughs in the varieties of cognitive therapy. Perhaps a renewed look at bringing more implications of Bartley's epistemology to second wave therapies would be useful. Is Popper's concept of severe testing (see O'Donohue, 2021) something that ought also to be taught to clients? How much criticism is ideal—what does it practically mean to maximize criticism? How much judgement is involved in what to problematize a particular belief or subset of beliefs in a client's web of belief?

The third wave has faced significant problems, e.g., with measurement—ACT emphasizes functional relationships but its outcome measures by in large have not been functional analyses but self-report questionnaires, such as the Acceptance and Action Questionnaire (AAQ-II; Bond et al., 2011), which has had significant validity problems (Wolgast, 2014). This of course raises serious concerns about what can be concluded from the outcome studies of ACT that utilize such problematic questionnaires. In addition, there are concerns about whether ACT researchers have appropriately controlled for therapeutic allegiance or even whether it has been oversold and relied too heavily on questionable research practice (see O'Donohue et al., 2016).

A practical question involves how does a clinician or client currently rationally choose among these three waves of behavior therapy? Does evidence-based practice mean a careful look needs to be made problem by problem, where one can find better evidence for one wave for problem a, but better evidence for another wave from problem b? Or is one wave so generally superior that, at least at this point in time,

one can argue that wave x is generally superior and thus ought to be adopted on a fairly widespread basis? It seems that practitioners and researchers are adopting both approaches. However, it also seems fair to say that some seem to be adopting their wave based on unclear sets of criteria and arguments—some seem to just have a preference, perhaps akin to a preference to a sports team or to a political party—often a strong one—for one wave or another. Perhaps further work on the quality and fidelity to these meta-scientific commitments can help make these choices more rational. However, the first step is identifying these commitments, which was the task of the present chapter.

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