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Chapter 10: Evolutionary Principles for Applied Psychology

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Evidence-based therapy (EBT) is "evidence based" in four distinct ways. First, it draws from and contributes to basic principles of behavior change. Second, it links these principles to applied models and theories. Third, it evaluates the technological extensions and methods in carefully controlled research. And fourth, it examines whether patterns of intervention results can be understood in terms of both basic principles and applied models or theories.

The cognitive and behavioral therapies have been especially clear about these empirical needs, or at least a portion of them. More than forty years ago, conformance to steps one and three above were said to be the defining feature of early behavior therapy, in the form of "operationally defined learning theory and conformity to well established experimental paradigms" (Franks & Wilson, 1974, p. 7). The present volume, however, is organized around

this full four-step vision. For example, chapters 6 through 9 focus on the basic principles of applied relevance, including those focused on behavior, cognition, emotion and emotional regulation, and neuroscience. All of these topics are perhaps expected in a book of this kind, but we are unaware of other such volumes including a foundational chapter on evolution science.

In some ways this is odd. After all, if neuroscientists are asked "Why is the brain organized in this way?" they will soon run out of scientifically interesting things to say unless evolutionary explanations begin to appear. The same is true of those in behavioral, cognitive, or emotion science. In the modern era, Dobzhansky's (1973) famous title *Nothing in Biology Makes Sense Except in the Light of Evolution* needs to be extended to all of behavioral science, and with it, to CBT and EBT.

The current chapter will show that evolution science provides useful guidance to research and practice in evidence-based psychological interventions. It will summarize contemporary evolution science in thumbnail form, focusing on a small set of processes that students of evidence-based therapy can use to better understand psychopathology, or to develop and implement more efficient and effective therapeutic methods, regardless of the specific therapeutic model.

One reason evolution science is now better prepared to fulfill this role is that it also has changed, and changed rapidly. Evolution science is emerging from a period of isolation from the behavioral sciences. Until quite recently, modern evolution science was clearly gene centric. Popular evolutionary authors, such as Richard Dawkins (1976), advanced the view that physical life-forms were merely part of the life cycle of genes as replicating units. Evolution was commonly defined straightforwardly as a "change in gene frequencies in a species due to selective survival" (Bridgeman, 2003, p. 325). The main application of this view in applied

psychology was the idea that genes can cause behavior. There was the hope that once the human genome was fully mapped we would see that a good deal of psychopathology and human functioning was genetically determined, and that intervention could at least be targeted to high-risk groups, even if genetic causes could not be changed.

This view of the role of genetics in behavior has changed radically, especially as a result of the sequencing of the human genome, which was finally accomplished in 2003. The detailed knowledge from this scientific achievement shows conclusively that genes do not code for specific phenotypic attributes (Jablonka & Lamb, 2014), in psychopathology or anywhere else. Enormous studies have appeared, for example, with full genomic mapping of tens of thousands of participants who were or were not suffering from mental health problems (e.g., Cross-Disorder Group of the Psychiatric Genomics Consortium, 2013). Genetic risk factors were correlated with psychopathology only in broad, systemic, and very complex ways. This same pattern has been seen elsewhere. A recent genomic analysis of 250,000 participants (Wood et al., 2014) was able explain only one-fifth of the differences in human height, and even that required nearly seven hundred genetic variations in over four hundred sites. The authors concluded that height was likely linked to thousands of genetic sites and variations.

The rise of knowledge about epigenetics has had a similarly profound effect. The term refers broadly to biological processes other than the sequence of DNA nucleotides that regulate gene activity, expression, transcription, and function. The greatest interest is in heritable epigenetic processes. For example, when a methyl group is chemically attached to the nucleotide cytosine, regions of DNA become difficult to transcribe and thus are unlikely to produce protein. Such methylation is heritable to a degree (Jablonka & Lamb, 2014), and along with other epigenetic processes it is itself regulated by environment and behavior. For example, the pups of

mice exposed to aversive classical conditioning with olfactory stimuli show a startle response to the smell despite no previous history with it, apparently due to methylation of certain olfactory genes (Dias & Ressler, 2014).

Such effects are known to be relevant to psychological interventions. For example, eight weeks of mindfulness meditation reliably turns on or off about 6 percent of the genes in the human body (Dusek et al., 2008). Epigenetic processes impact the organization of the brain (Mitchell, Jiang, Peter, Goosens, & Akbarian, 2013), and experiences that are protective in mental health areas are known to have epigenetic effects (e.g., Uddin & Sipahi, 2013).

These data fundamentally change how environment and behavior are thought of in evolutionary terms. Evolution does not just mean that genes (or genes and cultural memes) impact behavior. The reverse is also true. It is increasingly plausible to think of physical organisms themselves as systems for turning environment and behavior into biology (Slavich & Cole, 2013). Learning is increasingly understood to be one of the major ladders of evolution (Bateson, 2013), as we will describe below. A more systemic and multidimensional version of evolutionary thinking that views fitness in a more inclusive way and considers genetic and nongenetic factors alike (Danchin et al., 2011) can now be used to organize behavioral interventions themselves (D. S. Wilson, Hayes, Biglan, & Embry, 2014).

Evolutionary Principles: Six Key Concepts

Evolution science is a vast area of study comprising an equally vast literature, but in application the core of it can be distilled down to six key concepts. We will describe each of these concepts and give an example of its relevance to psychopathology or psychological intervention.

Variation

Comedian Moms Mabley was right: “If you always do what you’ve always done, you’ll always get what you’ve always got.” Variation is the sine qua non of evolution.

Evolution originates in blind variation, and some evolutionary perspectives in the behavioral sciences have continued to emphasize this idea (e.g., Campbell, 1960), but taken on its own it can be a bit misleading, because evolution itself soon leads to targeted variation in response to environmental conditions. It is now known, for example, that when facing stressful environments, organisms from bacteria to human beings have an evolved capacity both to increase the rates of mutation and to decrease the precision of DNA repair (Galhardo, Hastings, & Rosenberg, 2007). Such observations have led some evolutionists to ask “whether the collection of species we have with us today is not only the product of the survival of the fittest, but also that of the survival of the most evolvable?” (Wagner & Draghi, 2010, p. 381). The evolution of evolvability is one of the main arguments in favor of an extended evolutionary synthesis (Pigliucci, 2007; Laland et al., 2015), which seeks to take evolution beyond a gene-centered approach to consider more organism- and ecology-centered approaches, which will be mentioned in this chapter, including multilevel selection, development, and epigenetics.

The evolution of evolvability is seen at the behavioral level as well, for instance, in the increase in response variation during extinction. For human beings, variation perhaps is at its apogee with the transformation of functions via language and higher cognition, a competency that permitted purposeful behaviors to emerge from nonteleological processes (Monestès, 2016 ; Wilson, 2016).

In psychopathology and psychological intervention, the evolutionary requirement for variability leads to the investigation of unhealthy cognitive, emotional, or behavioral rigidity on

the one hand, and the promotion of healthy variation in these domains on the other. Consider such important transdiagnostic processes as rumination, worry, alexithymia, experiential avoidance, lack of self-control, social anhedonia, or lack of committed relationships: all of these processes can easily be defined as narrow and rigid repertoires in the cognitive, emotional, behavioral, or social domains. The specific forms of psychopathology also tend to include symptoms or features that undermine healthy variation or sensitivity to contextual change. For example, the social withdrawal seen in depression reduces the opportunity to learn new social behaviors; drug and alcohol consumption reduces the motivation to change; and so on. It is worth noting that clients entangled with such processes often describe themselves as "stuck," "in a rut," or "unable to change."

The development of psychopathology over time can be understood in part as having its roots in experiences that produce narrow and rigid forms of adjustment. For example, high and extended periods of unavoidable aversive control can often be found in the history of clients, whether it be in the form of trauma, abuse and neglect, lack of nurturance and social support, or pervasive environmental stressors such as poverty or racism. Aversive control of that kind leads to patterns of avoidance that limit healthy behavioral variation (Biglan, 2015).

Another source of pathological limitation for behavioral variation is the human capacity to respond to stimuli according to what they represent and not "simply" to what they are—that is, the capacity to derive functions between stimuli independently of their physical characteristics and in the absence of direct training (as was covered in chapter 7). Verbal rules based on this ability can dramatically improve behavioral variation (for example, one can use flowers to decorate the house, express love, or honor the dead), but this relational ability can also seriously

limit behavioral variation, such as when someone avoids barbecues because meat evokes thoughts of dead animals and thus of the recent loss of her father

Behavioral variation should not be thought of in merely topographical terms, however. The promotion of disorganized, impulsive, or chaotic behavior is hardly a goal of psychotherapy, and behavioral variability at a superficial level can readily be put into the service of maintaining existing nonadaptive functions, as when a person struggling with substance abuse shifts from one drug to another when supplies of her preferred substances of abuse are strained. Rather, what psychological intervention seeks to do is to target functionally more adaptive forms of living when existing forms are unsuccessful in achieving a healthy lifestyle. In short, for behavioral variation to be adaptive in the case of psychological issues, it has to be functionally different. New behaviors must give rise to different categories of consequences or a different organization of reinforcement. For example, if a person learns to open up to the emotions and sensations involved in stopping substance use so as to do a better job as a father, it is not just the change in drug use that is important. Other positive adaptations might include a shift from negative to positive reinforcement; or from being driven by urges to connecting with "values-based" forms of symbolic reinforcement; or from being directed more by long-term rather than short-term reinforcement. What is truly "new" is also functionally "new."

New and healthy forms of thinking, feeling, and doing also generally require a new and more supportive environment. That is exactly what psychotherapy is designed to create, by undermining repertoire-narrowing psychological processes and promoting psychosocial processes (trust, acceptance, respect, exploration, curiosity, and so on) that lead to successful variation. Clinically, psychotherapy can be thought of in part as the attempt to produce the healthy and functional emotional, cognitive, and behavioral flexibility needed to foster growth

when encountering psychological dead ends (Hayes & Sanford, 2015). Psychotherapy constitutes a safe place for clients to experiment in the deployment of functionally different behaviors, and for psychotherapists to evoke behavioral variability by contributing to its selection.

Selection

The second major evolutionary process is selection. In genetic evolution, *selection* includes anything that results in a difference in lifetime productive success, including survival, access to mates, and competitive ability. In the behavioral domain, within the lifetime of an individual, selection can easily be applied to operant learning: actions are selected by the consequences they produce. Skinner (1981) was especially forceful in noting this parallel.

Operant learning dramatically changes selection pressures by maintaining contact with environmental niches and by constructing these niches through behavior and its side effects. For example, a bird whose digging in river mud is reinforced by the acquisition of edible crustaceans may then be exposed, over generations, to a feeding environment in which adaptations of beak structure can be selected at the genetic level. New phenotypic forms can evolve fairly rapidly as a result: the flamingo's beak is a concrete example of exactly this process. Because eating crustaceans found in rivers was highly reinforcing, flamingoes spent a great deal of time digging through the mud. This lead to the evolution of its very odd scoop-shaped beak that filters out food before expelling water as the bird eats with its head upside down – but the beginning of that physical evolutionary process was contingency learning that changed the selection pressure bearing on beak variations (Schneider, 2012). This effect—the rapid evolution of phenotypic forms in response to learning-based niche selection and construction—is one reason some evolutionists believe that the evolution of learning itself may have driven the explosion of life-forms during the so-called Cambrian explosion (Ginsburg & Jablonka, 2010). An analogous

situation is the effect that nurturance has on positive social connections and the enjoyment of being with others (Biglan, 2015), which in turn establishes the conditions for the development of greater empathy, and greater social skills, in a self-amplifying developmental loop.

In the applied domain, selection may help us understand psychopathology and its treatment. Many forms of psychopathology can be thought of as evolutionary "adaptive peaks" (Hayes, Sanford, & Feeney, 2015). The metaphor of an adaptive peak refers to a situation in which phenotypic adjustments are made that promote progress "up a hill," but the "hill" runs out and no further progress is possible. For example, a predator may become more and more efficient in targeting certain prey via evolved physical (e.g., digging claws) or behavioral (e.g., hunting in teams) characteristics. This success may lead to an increase in the number of predators, but it may also lead to more dependence on the specific prey and to adaptations that eventually may not be used for anything else. If predation becomes so successful that the prey population collapses, the predator may even become extinct.

In much the same way, certain processes observed in psychopathology consist of patterns of behavior that are initially "adaptive" in the evolutionary sense of the word. The problem is that adaptations can occur to features of the environment (e.g., short-term contingencies, aversive control) that prevent positive development in less restrictive environments. "In other words, psychopathology is an evolutionary process gone awry in a specific way: it prevents further positive development via normal evolutionary processes" (Hayes et al., 2015, p. 224). For example, children raised in a chaotic, nonnurturing environment will tend to show more behavior that is controlled by short-term consequences (Biglan, 2015) because that behavior is adaptive: chaotic, nonnurturing environments are less predictable over longer time frames, and it only makes sense to enhance immediate gains. As an adult, the ability to control the environment may

be much greater over longer time frames, but the "impulsive" behavior remains—and that very behavior makes it more difficult to contact the changes in the environment of the adult (who can act to avoid chaos or seek nurturance in healthy ways) as compared to that of the child.

The case of behavioral evolution within the lifetime raises special issues because differential selection is used to select behaviors. Since time and the number of behaviors that can be emitted are limited, each behavior is selected by its consequences in comparison to consequences of other behaviors (Herrnstein, 1961). Moreover, there is no such thing as death for behaviors, since "unlearning" is impossible. *Extinction* is inhibition, a decrease in the frequency of a behavior occurrence due to a diminution in reinforcement, but not "unlearning" per se. Previously reinforced behaviors may drown in competition with other response forms, but they don't totally disappear. Thus, in the case of behavior selection, criteria always need to be analyzed in competition with other behavioral alternatives. This suggests that therapists need to organize new and powerful sources of reinforcement for healthy behaviors that are competing with previous forms: to select against a given problem behavior, a superior alternative must be available in the repertoire. Thus psychotherapy is always a matter of building, not removing. Metaphorically, if you have too much salt in your soup, you won't be able to take it out. Your only solution is to add more soup. When dealing with unwanted behavior and behavioral excesses, the solution to pollution is dilution.

By examining and choosing values in therapy, the effectiveness of consequences can be altered through symbolic processes – the reinforcing effectiveness of existing behavioral consequences can be augmented, or new consequences for extinguished behaviors can be created. Religious commitments, or cultural practices in general, often appear to work in the same way: by creating new or augmented selection criteria for action. Just as we all have

genotypes, once human language evolved we also had *symbotypes*, networks of cognitive relations that themselves evolve and impact other behavioral processes (D. S. Wilson et al., 2014).

Retention

For selected variations to be useful to organisms or species, they have to be retained one way or another. At the species level, the genes transmitted from parents to offspring, their organization in DNA, and, to a certain degree, their expression through epigenetic processes ensure the retention of a selected trait. These reasons are why reproductive success stands as a central theme in evolutionary studies: the more offspring, the more that genes are transmitted to the next generation, and the better the retention of an advantageous characteristic across generations. Trade-offs between size and number of offspring observed in many species also prove that transmission success matters across generations (Rollinson & Hutchings, 2013). Considering only parental fitness, the better strategy would be to breed as many offspring as possible, to maximize the number of copies of advantageous characteristics. However, if the retention of selected traits across generations also matters, survival of the offspring is important too. Many species give birth to fewer descendants than possible and concentrate effort on their survival.

At the behavioral level, retention includes both a within-individual component, corresponding to the modification of the repertoire of the organism via repetition and contingent consequences, and a between-individual component, corresponding to social learning and cultural transmission. Without retention, learning would be meaningless as a behavioral process, and imitation or culture would be meaningless as a social process. For example, the fact that reinforcement changes the probability of forthcoming behavior is itself a kind of retention.

However, we need to be sure not to think of retention and heritability as necessarily matters of "storage." A gene is composed of tangible matter, and it is indeed stored and transmitted from one generation to the next on the chromosomes of gametes, but behavioral retention is more like what happens when one folds a sheet of paper. If you roll a sheet of paper, it will easily take its initial state back when released. When folded several times on the same crease, the sheet will stay in this creased state. The actions of rolling or folding are not "stored" in a literal sense: the paper has simply changed. In the case of behavior within a lifetime, retention is consequently more a matter of practice than transmission.

It is a fascinating challenge for psychotherapists to change behavioral repertoires durably while meeting with clients for a tiny fraction of time. A number of the chapters in section III of this volume can be understood as efforts to help clients retain behavior through the provision of portable cues or prompts that set the opportunity for actions outside therapy (see chapter 12 on stimulus control), to develop environments that support and reinforce behavioral patterns (see chapter 14 on self-management), to augment motivation to help clients obtain existing consequences (see chapter 27 on motivational interviewing, or chapter 25 on values selection). In a slightly different vein, evolution favors the retention of overt behaviors associated with emotions (see chapter 8), which may explain why greater emotional openness in session can aid in the retention of clinical material (see chapter 24).

Variation and selective retention are at the core of evolutionary perspectives, but particularly when evolutionary principles are being used intentionally three more concepts are needed: a focus on context and multilevel and multidimensional approaches.

Context

Evolution is inherently context sensitive. All organisms experience many different contexts during the course of their lives, each potentially requiring adaptive responses. Context determines which variations are selected. All species capable of contingency learning can select environments by their behavior (we described an instance of such "niche selection" in the example of the flamingo's beak earlier). Many species are also capable of creating particular physical and social contexts by their actions that alter the selection pressures impacting issues of production and reproduction—what is termed "niche construction." Learning may help form these larger functional patterns, which can then become more efficient by cultural and genetic adaptations. That is part of why learning can be thought of as a ladder of evolution (Bateson, 2013).

If applied psychologists are in essence engaged in a process of applied evolution, it does little good to foster behavioral changes that will not be supported in the context in which they occur. When evolving on purpose, either a context needs to be selected that will retain desired behavioral innovation, or the current context needs to be modified so that it does so. Understanding the natural place of behavioral innovation requires mindful and open attention to the current environment within and without. The chapters on mindfulness (chapter 26) and acceptance (chapter 24) can be seen in this light.

To some degree, an understanding of the context of psychological actions can itself change the conditions under which such actions are selected. For example, values work (chapter 25) might link seemingly unimportant, everyday behaviors to larger qualities of being and doing. Shaving in the morning may seem boring and trivial, but showing respect for others could be both important and linked to that very act.

Multilevel Selection

Selection operates simultaneously at different levels of organization: not just genes, but gene systems; not just behaviors, but behavioral classes and repertoires; not just thoughts, but cognitive themes and schemas. Selection at different levels can go in the same or in different directions. There can be interlevel cooperation or conflict (Okasha, 2006).

Consider the body as a multicellular system. The body of a normal human adult is composed of thirty to thirty-seven trillion cells (Bianconi et al., 2013). Millions of them die every second, but what looks like enormous carnage at the level of individual cells is what sustains robust living at the level of that group of cells called "you." The major evolutionary advance of multicellular organisms happened the same way cooperation at any given level happens: when selection occurs based on between-group competition, greater success on average at the group level is augmented by adaptations that restrict selfishness at lower levels of organization. For example, on average cells do better and live longer when they cooperate together to be "you" than they would alone—even if millions die every minute. Competition between multicellular bodies is how that came to be. If some of your cells begin to replicate regardless of their usefulness to you, that is called cancer. If left unchecked it would soon cause your death, and with it, the death of your individual cells. To prevent that, there are evolved systems in your body to repair DNA, to detect anomalous and precancerous cells, or even to kill those cancerous rebels that do appear.

This example contains some of the core ideas in multilevel selection theory (D. S. Wilson 2015), which has experienced a major resurgence in the last several years (e.g., Nowak, Tarnita, & Wilson, 2010). There is a continuous balancing act between levels of selection. The one-two

punch of selection at the higher level of organization—due to small group competition—and the suppression of selfishness at a lower level is what sometimes tilts the balance toward cooperation and becomes an engine of major evolutionary transitions, such as the development of multicellular organisms; eukaryotic cells (which are an ancient cooperative partnership with another life-form, mitochondria); and eusocial species, such as termites, bees, and arguably humans, which have evolved forms of social cooperation that have been extremely successful in evolutionary terms.

Multilevel selection theory suggests that human beings are extremely cooperative as compared to other primates because we evolved in competition between small groups and bands, and various adaptations evolved (likely in part cultural and symbolic) that restricted selfishness (e.g., moral dictates against stealing). However, as the example of cancer shows, in the far more ancient system of multicellular organisms, the selfish interests of the individual never fully disappear.

As an applied matter, the concept of multilevel selection reminds applied psychologists to constantly consider the balance of helpful cooperation at the group level and the restriction of selfishness at lower levels. For example, therapists working on the psychological issues of an individual still need to be concerned with fostering social connection, attachment, and intimacy and not letting these human needs be undermined by psychological selfishness. It is not by accident that social support and nurturance are among the most powerful known contributors to psychological health, while social isolation and disconnection are among the largest known contributors to psychopathology (Biglan, 2015). Humans are social primates. Intergroup competition designed us to function in small groups for the simple reason that cooperative groups function better than groups in conflict.

The balance between the group and the individual applies to every topic in applied psychology because the levels of selection are present no matter how fine grained the focus. We began with an example of a single human body, in part, for that reason: the body is the very definition of the "individual," and yet it is actually an enormous cooperating group of trillions of cells. In the same way, the psychological "individual" contains multiple selves, behaviors, emotions, thoughts, and so on—and a key applied issue is how these can become cooperative.

Consider some of the common topics in psychopathology that appear in this volume. Part of the problem with, say, rumination, worry, unhelpful core beliefs (see chapter 22), or avoidant emotional regulation processes (see chapter 16) is that these specific psychological issues can come to demand more of our client's time and resources than is their fair due. It is not that anxiety or worry has no role in healthy living—rather its specific role can become out of balance relative to the interest of the psychological (and not just cellular) group called "your client." Psychotherapy attempts to right that balance and to promote personality integration. For example, an emphasis on mindfulness and acceptance in therapy can be thought of, in part, as an attempt to establish peace at the level of the psychological whole by fostering success at that level (e.g., through values work) and by confronting the selfish interests of specific thoughts, feelings, and actions that demand more time and attention than is beneficial.

Multidimensional Selection

At any level of analysis, researchers and practitioners generally abstract a number of relevant domains to study. The emphasis at the psychological level in EBT, for example, is usually on domains such as behavior, emotion, and cognition. Some will remind evidence-based therapists of the centrality of the social level and its various domains (family, relationships,

attachment, social learning, culture, and so on); while others emphasize the biological level and its domains (the brain, the nervous system, genes, the limbic system, and so on).

An evolutionary perspective provides the opportunity for real consilience (E. O. Wilson, 1998) between these many domains by linking them to those that can be thought of as inheritance streams within the lifetime of the individual or the species. These dimensions of evolution are of a more limited set. The genetic level is clearly such a dimension, but so too are epigenetics, behavior, and symbolic communication (Jablonka & Lamb, 2014).

For example, in this chapter we have already mentioned the opportunities and costs in terms of healthy and unhealthy behavioral variation that symbolic processes present. Symbolic processes are clearly a distinct inheritance stream. The writing you are now reading, for example, could easily influence the actions of readers long after the authors are dead and buried.

Symbolic processes seem far removed from the genetics of psychopathology, but empirically that is not the case. Consider the gene that controls the serotonin transporter protein (SERT or 5HTT). An initial and highly influential study found that two short alleles of the SERT gene were associated with higher levels of depression when combined with life stress (Caspi et al., 2003). The effect weakened or disappeared in later studies across various cultural groups and individuals (for a meta-analysis see Risch et al., 2009). Recent evidence, however, suggests that these inconsistent effect may have been, in part, the result of a genetic feature being functionally interacting with experiential avoidance (Gloster et al., 2015), a process that in turn is largely driven by symbolic thought (Hayes, Wilson, Gifford, Follette, & Strosahl, 1996), which varies across groups and individuals. In other words, for the system to be understood, the impact of the genetic polymorphism may require knowledge at the psychological level. Multidimensional

systems that sustain common problematic functions are often more resistant to change than problems in a single evolutionary dimension.

The reverse is also true. It is clinically helpful to target keystone functions that operate across evolutionary dimensions, such as those that undermine rigidity, and promote context-sensitive selective retention. Mindfulness training, which is now known to produce not just increased psychological flexibility but also the epigenetic down-regulation of stress-promoting genes, is a good example (Dusek et al., 2008). As a positive practice of health promotion, psychotherapy is a process of helping people learn to respond adaptively to contextual conditions so as to foster actions linked to chosen selection criteria across dimensions and levels.

Using Evolutionary Principles in Psychotherapy

We can turn the six dimensions we have covered into a kind of prescription for evidence-based interventions at the metalevel. Therapists foster healthy functional variation and undermine needless rigidity so as to retain variations that meet desired selection criteria (values, goals, needs, and so on) and can be sustained in the current context, across appropriate levels and dimensions. The broad scope and applicability of these evolutionary ideas means that even when evidence-based therapeutic systems are not explicitly linked to evolutionary concepts, these systems tend to contain concepts that focus on the detection and change of unhealthy rigidity, or the promotion of greater context sensitivity, which allows deliberate variation to be linked to chosen selection criteria. And these systems all tend to foster retention by practice and the creation of sustaining contextual features.

This description of key features is not meant to minimize any therapeutic tradition but rather to point out that empirically successful methods operate knowingly or unknowingly in broad accord with basic principles of behavior change. We are used to that insight in the area of

behavioral principles, but there is every reason to apply it to other sets of principles, including those drawn from emotion science, cognitive science, neuroscience, and, perhaps above all others, evolution science. Indeed, one of the most important implications of evolution science is that it allows principles from different theories and models to be used without incoherence if they are consistent with evolutionary principles.

Process-based therapy is an old idea in CBT and EBT generally. As the chapters in section II of this book show, there is a wide variety of principles to guide clinical practice. These principles ultimately all stand together, and the umbrella provided by evolution science is the broadest of all. Behavioral principles evolved—and indeed they are most powerful when they are cast as an example of evolutionary thinking. The same is true of functional cognitive principles and symbotypes, or of emotional and neurobiological development. Modern multidimensional and multilevel evolution science provides an extended evolutionary synthesis that increasingly allows evidence-based psychopathologists and psychotherapists to view themselves as applied evolution scientists.

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