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Evolutionary Principles in Psychotherapy:

An Integrative Framework for Clinical Practice

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Abstract

This chapter presents on how evolutionary principles constitute a rich framework for the everyday practice of psychotherapy. We propose that psychological issues constitute adaptations to restricted parts of the environment. The chapter presents concrete ways for practitioners to effectively use evolutionary science in their clinical work and to help their clients in the direction of healthy variation, selection and retention of positive variants, and actions that best fit their external and internal environment. Evolutionary principles are as relevant to psychology as to any other life science and are useful to guide practically clinical psychology.

Key words

applied evolutionary science; evolutionary psychology; evolutionary science; extended evolutionary meta-model; extended evolutionary synthesis; multi-dimensional evolution; multi-level evolution; process-based therapy; processes of change; psychotherapy

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The relevance of evolutionary principles has been demonstrated in every one of the life sciences for decades. Theodosius Dobzhansky's (1973) famous declaration that "nothing in biology makes sense except in the light of evolution" has been extended to an always increasing number of disciplines and issues (Hanisch & Eirdosh, 2020). As a life science field that studies the actions of organisms (Zettle, Hayes, Barnes-Holmes, & Biglan, 2016), there is no reason that psychology cannot embrace this core perspective and state that "nothing in psychology makes sense except in the light of evolution". If so, clinical psychology, as a practice aiming at studying and influencing problem behaviors, is to be considered an applied evolutionary science (Hayes, Hofmann, & Wilson, 2020).

If psychology is to be viewed as an evolutionary science (Wilson & Hayes, 2018), it has three important tasks to accomplish. First, it has to contribute to the common framework of evolutionary science, most notably in meeting the challenge of explaining how human behaviors influence human and other species' evolution. The growing acknowledgment of the central role that behavior plays in evolution (Bateson, 2017a, 2017b) legitimizes this task. Contributing to the framework of evolutionary sciences constitutes a work in progress for psychology that has already been initiated, especially through the study of language influence on evolution (Hayes & Sanford, 2014; Monestès, 2016). Secondly, applied psychology needs to learn how to derive guidance from evolutionary sciences discoveries and concepts, which provide a relevant general framework for psychological interventions. Finally, in order to do both, clinical science and

practice needs to embrace a more process-based approach in which evidence-based processes are linked to evidence-based intervention kernels so as to reduce suffering and promote positive human development (Hofmann & Hayes, 2019),

The present chapter examines how evolutionary principles prevail in the consultation room and in therapeutic processes writ large. The goal of this chapter is to show how evolutionary processes can guide the everyday practice of clinical psychologist as to promote beneficial evolution of the people who ask for our help.

1. Evolutionary Principles at Any Level

Selection by consequences is the general process of evolution (Schneider, 2012). Darwin's breakthrough while proposing the mechanism of natural selection has been to reverse the logic prevailing in science by looking at events longitudinally and contextually. The formula that usually prevailed in the physical sciences was *causa semper prior est effectu* (the cause always precedes the effect): the cause of an event or a structure is to be searched among the conditions and events that prevailed or arose before the event or structure in order to explain its appearance. It is intuitively clear for each of us that cause is first in time and consequence is second. Many different psychotherapeutic traditions build on this logic as well, in looking for events such as traumatic experiences or child's interactions with adults as potential variables responsible for psychological issues.

Darwin proposed an inversion of this logic by focusing on the consequences of an event or a structure at time t-1 as the cause of its (re)appearance at time t. Natural selection as proposed by Darwin corresponds to the selection of a structure at one generation depending on how this

structure was successful at the previous generation, an inversion of logic sometimes called “the cause that works backward” (Schneider, 2012).

From its initial formulation through natural selection, selection by consequences has been acknowledged as a central principle in any life science. Basic evolutionary principles were exemplified across a vast array of circumstances. These principles are few in number and relatively simple to apprehend, but they have repeatedly demonstrated their relevance in understanding the living world, and with predicting and influencing its changes.

The first principle is variation. Diversity and change are the rule in the living world. There are currently 1.5 million formally described species on Earth; their total number is estimated at least from 1 to 6 billion (Larsen, Miller, Rhodes, & Wiens, 2017). The number of individual lift forms is staggering. Right now, there are approximately 10 quintillion living insect, for example, most of them differing in some way from all the others. Genetic mixing ensured by sexual reproduction make any individual, with the exception of monozygotic twins, different from another. The same is even more true when variations in epigenetics, development, behavior, and culture are considered.

The second principle is selection. Diversity has consequences that are sometimes beneficial and sometimes not. Some of the differences fit the environment they appear in and foster relative advantages in extraction of resources, the ability to find shelter, avoidance of predation, or reproduce.

The third principle is retention. Variations are advantageous can be transmitted in a variety of ways, for example via the genetic or epigenetic material transmitted from parents to offspring, or via culture.

The fourth principle has already been mentioned but need to be underlined in applied evolutionary science: context. What make the three processes of variation and selective retention work is their fit with circumstances. That is, they predict better reproduction of the variants that best fit the environments they appear in.

Variation, selection by consequences in a context, and retention, are the central evolutionary processes by which living systems change. It has been observed within many different disciplines and contexts such as neurology, immunology, or zoology, to name a few (Cziko, 1997, Schneider, 2012). As soon as variation and retention exist, selection of patterns adapted to context operates and adapted variation is reproduced.

Building on these principles, the conception of evolution has been restricted for nearly 80 years to the Modern Synthesis of evolution resulting from the fusion between Darwinian evolution and Mendelian genetics (Huxley, 1942). This view proposed a gene-centered understanding of selection by consequences and considered that the primary or even the only material that varies, is transmitted and selected, are genes. The power of seeds and gametes to produce new and unique living organisms is fascinating but as genomics has developed it has become increasingly clear that a gene centric view of evolution is far too limited. There are multiple interacting streams of evolution that go beyond to genetic level to include epigenetic, behavioral, and symbolic/cultural evolution (Jablonka & Lamb, 2014). This newer and broader perspective is termed an Extended Evolutionary Synthesis (Laland et al., 2015; Pigliucci, 2007).

In this extended synthesis, the behaviors of organisms in interaction with their external environment, and even their internal states, are considered sources of development and evolution as important as genetic causation (Laland et al., 2015). The relevance of behavior as a material

capable of variation and retention, that can be selected and have influence on the evolutionary trajectories, is now broadly acknowledged. As an empirical fact, even the subjective perception of the conditions we live in can influence the expression of our genes (Slavich & Cole, 2013).

In addition to the multi-dimensional nature of evolutionary processes, it is also the case that contextually sensitive variation and selective retention operates at all levels of complexity. Normally selection operates most of lower level of organization, but in some cases, selection can operate on higher levels of organization if competition occurs that and selfishness at lower levels is suppressed. Examples include multi-cellular organisms or eusocial species, arguably including human beings and their high levels of cooperation. The same processes apply whether the level in question, are cells, individuals, or groups (Wilson & Wilson, 2007), and whether temporal parameters are minutes, years, eons, or epochs. Systems are capable of variation and retention, and the configurations best adapted to the context tend to be selected by their consequences. Academic disciplines, and even more so the division of the world they imply, exist as social constructions that can be useful but do not "exist" as things. The same is true for time. From the minute to a billion years, the units of time on which a researcher limits her analysis is a matter of her decision, while the stream of events, behaviors, and their interaction is uninterrupted.

We carve up the world to understand it, but the one world remains an interacting whole disinterested in our intellectual carvings. If selection by consequences and evolutionary principles prevail, they prevail at every scale of complexity and at every temporal scale. Thus the psychotherapist interested in the world of an individual client is no less focused on matters of evolutionary importance than is a paleoanthropologist studying ancient humans.

2. Evolutionary Principles Apply to Behaviors in the Individual Lifetime

2.1 Time Scales and Material Selected in Psychology

In famous citations, Skinner (1953, 1981) proposed a comparison between change at behavioral level and the evolution of species. He stated first that "In certain respects operant reinforcement *resembles* the natural selection of evolutionary theory" (1953; p. 430, italics added), then proposed the common principle of “selection by consequences” (Skinner, 1981) to underline the parallel between the two processes. While he clearly shed light on the resemblance between operant learning and natural selection, our proposal here goes beyond the simple identification of apparently similar mechanisms or deriving an analogy between genes and behaviors. The point is not one of borrowing concepts from the so-called hard sciences and applying them to behavioral science. Rather, we want to emphasize the point that both types of evolution are instances of the same processes considered on different timeframes, with long term and short-term consequences, and that behavior is as much a part of biological evolution and biological evolution is part of behavior. Whatever the timeframe considered, or the level of analysis, complex systems evolve based on the selective retention of variations within a context. That is true of genes, epigenes, psychological actions and cultural practices, and all of these dimensions and levels (and more) interact. The time frames differ; the interactions are complex, but the life sciences cannot be complete without an evolutionary understanding of behavior, and the analysis of behavior can only be complete as part of evolutionary science.

Imagine someone running on the deck of a boat in a similar direction but at a varying pace. The contextual features that impact each vary. Inertia is greater for a boat than for someone walking, for example, just as it is easier to adjust behaviors to current circumstance than it is to transform genetic arrangements. The boat contains and constrains the runner, but it also speeds the runner’s overall progress. Similarly, species with an evolved capability of important variation

of behaviors and rapid retention through learning mechanisms, such as the human species, adapt more rapidly to frequent changes of the environment. Many different behaviors can appear over a short period, can be tested in some way and eventually can be kept until this characteristic of the environment stays the same. Conversely, when these variants become genetically accommodated the number of variants is reduced and the time required for the appearance and testing of a variant that match the new characteristic of the environment is longer.

These contextual features balance the role of different evolving dimensions and levels. Species confronted with unstable and unpredictable environments but with low possibility of non-reflex behaviors, such as mussels, reproduce frequently and massively (McMahon, 2002): early maturity and high fecundity rates allow for the rapid production and selective retention of important quantity of variants, ultimately increasing the chances that some of these variants are adapted to the changes of the environment.

When the environment - the organizing principle that ensures the selection of variants - is stable for a sufficient period, it eventually selects structural changes, gradually turning environment and behavior into biology (Slavich & Cole, 2013). When the environment changes rapidly, it tends to select functional changes instead of structural ones. The expression of genes by epigenetics constitutes an intermediary timescale.

In order to manage interventions, clinical psychology has to build on evolutionary principles and address variation, selection and retention at the ontogenetic level, with due appreciation of its interaction with development at all of these levels, dimensions, and time scales (Monestès, 2014). It is hard to turn traditional evolutionary psychology’s proposal (Barkow, Cosmides, & Tooby, 1992), that our current behaviors constitute an adaptation to past

contexts in which our genus spent the majority of its evolutionary history (i.e. the Pleistocene, 1.8 million years ago until ~10,000 years ago), into clinical interventions. Part of the problem is that it does not give enough attention to the application of evolutionary principles at the individual time scale. Similarly, the adaptationist position in psychiatry, which postulates the existence of benefits for the individual, and ultimately for the species, for psychological disorders such as schizophrenia (Scheepers, De Mul, Boer, Hoogendijk, 2018) or depression (Nettle, 2004), gives too much emphasis to the idea that everything that exists, including mental illness, corresponds to the product of adaptation at the species level. This adaptationist position, which has already been criticized (Gould & Lewontin, 1979; Adriaens, 2007) proposes, like evolutionary psychology, to understand what happens at the individual scale by means of what has happened in the evolution of our species, rather than to look for the variables acting here and now, on which to intervene.

Evolutionary principles at the scale of an individual's life are very similar to other scales and levels of organization. Ontogenetic forms of behavior vary from one instance to another. No two instances of the same behavior represent an identical form. Behavior is in part historical. Any instance of a behavior necessarily builds on the previous instance of that same behavior. If you go to the Louvre for the second time in your life, it is in fact the first and last time you go there for the second time. Never before have you entered the Louvre having already visited it once, and never again can you enter it having visited it only once. In addition, the social and physical environment constantly changes, especially as impacted by the behavior of others. Thus, the historical and situational context of action cannot and does not stand still.

Said in another way, behavioral variation at the psychological level is a given. Depending on the adequacy of these variants within the current environment, they will be more or less

selected, and thus have a greater or lesser probability of being reproduced, retained or transmitted. That applies to normal psychological functioning, as well as psychological disorders, and our efforts to modify them.

2.2 Evolutionary Principles to Explain Psychological Issues

When proposing a therapeutic approach, it is mandatory to present and test the etiopathogenic hypotheses on which it is based (David & Montgomery, 2011). In order to understand and treat psychological difficulties, we need to apprehend the evolutionary movements that take place at the level of the individual's life. Evolution at other levels of analysis (biological and sociocultural) are relevant and are both context for behavior and engaged by behavior but psychological issues become the primary focus because evolutionary principles at behavioral scale are more immediately modifiable.

At the psychological level we need to be guided by the evolutionary principles on which all other evolutionary sciences are built: variation, selection, retention, and interaction with and within the context. We view psychological difficulties as the products of normal evolutionary processes, that is, as normal adaptations, but to restricted parts of the environment (immediate, local), potentially transformed by normal symbolic or relational learning mechanisms accounting for higher human cognition, such as the relational learning processes embedded in language (Hayes, Barnes-Holmes, & Roche, 2001).

We can build on the Extended Evolutionary Meta-Model of Processes of Change (the “EEMM” pronounced as in the word “team”; Hayes et al., 2019), as presented in Figure 1, that proposes to apprehend the four evolutionary principles for six roughly distinguished dimensions

that constitute the psychological level: affective, cognitive, attentional, self-based, motivational, and overt behavioral.

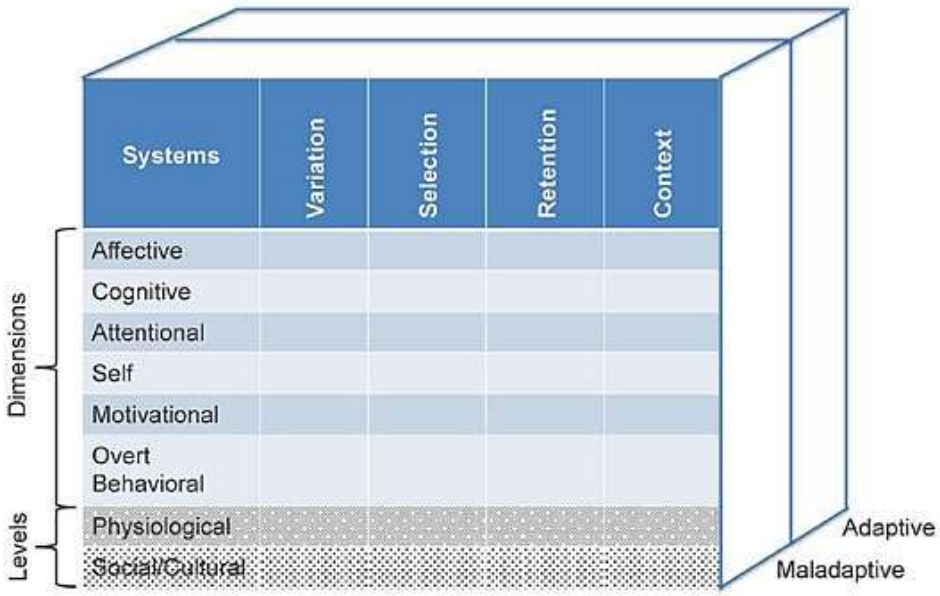

Figure 1. The Extended Evolutionary Meta-Model (copyright Steven C. Hayes and Stefan G. Hofmann. Used by permission)

All of these are "behavior" in a general sense (if by that we mean both public and private actions) but these rough dimensions are pragmatically useful. We will consider these dimensions in context of the issues of variation, selection, retention, and context.

Variation. With the tremendous diversity of species and solutions that emerged to adapt to so many different environments and constraints, variability within the living world is often seen as the trademark of evolution. The focus on diversity lasted for much of the 20th century, with the genetic code and the recombination it ensures being considered as the origin of this diversity. However, Darwin underlined the idea that the real prowess of evolution was rather the conservation of adapted patterns (Lecointre, 2015). The subtitle of *The Origins of Species* (1859) is rather clear on this point, with preservation as a cornerstone (*The Preservation of Favoured Races in the Struggle for Life*). Entropy is the rule in any system, including psychology, as pointed by many secular traditions and philosophies, such as in the Greek philosopher Heraclitus' *Pantha rhei* concept (i.e., everything flows), stated in the famous saying "No man ever steps in the same river twice". In other words, variation is the rule when nothing prevents it, that is, when there are not any organizing principles that operate through natural selection or learning processes. Many examples of initially disorganized movements that ultimately coordinate due to their consequences are observed during child development (Sporns & Edelman, 1993).

Conversely, the trademark of psychological issues involves a drastic reduction of variation, whatever the dimension considered (Kashdan & Rottenberg, 2010). For the behavioral dimension, a lack of variation is embodied for example in stereotypy in addressing life challenges. When facing changing environments that call for behavior change, people presenting with depression for example tend to present behavioral rigidity (Hopkinson & Neuringer, 2003). When behavioral variation is maintained, it is often restricted to formal rather than functional variation (Hayes, Monestès, & Wilson, 2018; Hayes & Monestès, 2018): individuals engage in

apparently various behaviors but in search of the same function, such as avoidance of emotion (Hayes, Sanford, & Feeney, 2015).

Whether we call it psychological rigidity (Schultz & Searleman, 2002) or psychological inflexibility (Levin et al., 2014), whether we observe it in repetitive and/or automatic behaviors, many if not most forms of psychopathology involve drastic reduction in the variety of behaviors or their sensitivity to context. Less behavioral variation can allow for improved adaptation in a stable environment, but it necessarily leads to maladjustment in a changing environment. That is reflected in the intuition of many therapists when they ask their patients about the possible occurrence of an unusual event, such as divorce, death, dismissal, etc., that could account for the appearance or aggravation of maladaptive behaviors such as alcohol consumption. Often this is thought of the event itself triggering maladaptive behaviors, but an alternative explanation is frequently available: the event did not trigger an adequate adaptive pattern. Said another way, healthy variation was absent.

In psychological issues, the loss of variation is also noticeable in emotional and motivational dimensions, with a restricted range of emotions experienced and sought, as is the case for sensations seekers (Zuckerman, 2007), or when depression dominates, to the cost of other emotions that no longer or fleetingly appear, such as fun, excitement or even anger. It has been documented for example that people presenting with depression are less reactive to emotional stimuli, positive and negative alike (Rottenberg, Gross, & Gotlib, 2005).

Psychological difficulties are also associated with a loss of variation in the cognitive dimension: any stimulus or situation brings back to the same set of ideas, such as missing out on one's life, being single, or weak. Because of relational processes embedded in language (Hayes,

Barnes-Holmes, & Roche, 2001), any stimulus can be related to any idea, such that a restricted set of cognition can colonize the cognitive landscape and impoverish it.

Problematic loss of variation is observed at an attentional level too, with attentional focus restricted to a limited part of the environment (Armstrong & Olatunji, 2012), for example, the presence of emergency exits, or possible sources of social embarrassment. Exclusive attentional focus can be adaptive when transitory, as it is the case when confronted with a danger. Otherwise, when attentional focus to a limited set of stimuli lasts for a significant period, loss of feedback from the environment limits adaptation to it.

Finally, lack of variation regarding the Self can also cause psychological issues. Being stuck on a single conceptualization of Self implies having to defend it and feeling insecure as soon as it is put into question (Gilbert, 2003).

Selection. The second evolutionary principle, selection, is also represented in psychological issues. Compared to natural variation of psychological dimensions, clinical issues can be thought of as the products of adaptation to restricted parts of the environment, either local, immediate and/or symbolic. Actually, when someone presents with issues such as anorexia, depression, compulsive behaviors linked to obsessive ideas, or even delusional ideas, to name a few, the striking fact is their hyper specialization and focalization on a very restricted set of stimuli and/or stimuli representing for him or her more than they are for others. If you don't already suffer from such conditions, imagine the amount of energy you should spend if you were asked to quantify any calorie you burn during your activities and any calorie take in, or to control your steps such as you never start moving with your left feet first. Following such organizing principles to the letter implies an important concentration to efficiently counterbalance the

natural trend of our thoughts, emotions, attention, and behaviors to change moment after moment. Highly effective selection factors organize these radical behaviors.

Biological immediate consequences of psychological actions may constitute problematic factors of selection, since human beings are more sensitive to short term biological consequences, even more in some key areas than chimpanzees (food is a good example – see Rosati, Stevens, Hare, & Hauser, 2007). This sensitivity to biological immediate consequences is potentially problematic. When behaviors have appetitive short term but long-term deleterious consequences, such as is the case for drug consumption, they are difficult to refrain and quit; when short term consequences are aversive but long-term consequences are beneficial, as is the case when receiving care such as dental care, or when meeting someone for the first time, avoidance may prevail and prevent further positive development. The behavioral balance between short-term and long-term consequences is often difficult for patients to analyze and manage. The main reason is that, apart from language, it is very rare for animal behaviors to involve binary and mutually exclusive choices of this type, which are akin to self-control (Fawcett, McNamara, & Houston, 2012). Most of the time, the consequences of behaviors are modulated according to the amount of time devoted to them. For example, the number of prey caught is proportional to the time spent hunting, such that short term adaptive choices often tend go in the same direction as long term adaptive choices (Stephens & Anderson, 2001). Language alters this situation but not in a way that necessarily make human choices more "rational." For example, emotional responses to symbolic events explains why humans present a greater activation of the limbic system when they have to choose between a primary reward now and a primary reward later, but not between two delayed primary rewards (McClure, Ericson, Laibson, Loewenstein, & Cohen, 2007).

Cognitive activity can also represent a powerful factor of selection for human behaviors that ultimately maintains deleterious behaviors. Reason giving can select behaviors that are detrimental to the individual despite being coherent, because they are set up as inflexible rules and without being reassessed (Zettle & Hayes, 1986). Coherence can indeed be a source of adapted selection because it fosters goal-directed behaviors but can become problematic when the environment changes and the individual favors coherence instead of direct adaptation to the environment (Villatte, Villatte, & Hayes, 2016).

In addition, normal relational processes embedded in language (Hayes, Barnes-Holmes, & Roche, 2001) lead to the apparition of functions of stimuli that are not present here and now but associated, arbitrarily or not, with the direct consequences of the environment. Because of these normal processes, the selective forces over psychological actions may not be the consequences of behaviors in the environment per se, but rather changes in this pseudo-environment constructed by verbal functions. These verbal functions can then select behaviors deleterious for the individual, according to his or her verbal history.

Selection at the motivational and emotional dimensions can also be problematic in psychological issues. Roughly speaking, we tend to approach certain emotions such as pleasure and to avoid others, such as fear or guilt. Normal functioning implies that individuals keep away from danger and are motivated by pleasure. However, many situations engender both type of emotion, as they combine immediate and distal emotional consequences. Consequently, these situations need an arbitration, either to withdraw from all emotions, or to have it all. When no selective criteria are rigidly set, this arbitration fluctuates, adapting to the situation, to the type and intensity of emotion to be approached or avoided. Such emotional regulation strategies that adapt to the context and to the material to regulate are protective (Aldao & Nolen-Hoeksema,

2012). Contrarily, when approach or avoidance strategies are rigidly set, independently from the context, this selective factor dominates, with approach or avoidance as the exclusive response.

Finally, stimuli-provoking emotions, and emotions themselves, capture and select attention to restricted areas of the internal and external contexts (Mor & Winquist, 2002), so that psychological issues are often marked with poor attentional and memory performances (Castaneda, Tuulio-Henriksson, Marttunen, Suvisaari, & Lönnqvist, 2008).

The context in which psychological dimensions are expressed is also highly relevant since the way the context is organized, and the sensibility to this context, determine the appearance and persistence of behaviors, emotions and thoughts. A persistence to stay in contexts that are not stable enough to select behaviors beneficial in the long run for the individual, or that engenders difficult emotions, is frequently observed in psychopathology. People suffering from psychological issues also maintain certain cognitive contexts despite their deleterious effects, as another effect of essential coherence, and having a hard time to adjust what they discovered about the world and themselves.

Retention. Retention is the third central evolutionary principle. It too can be problematic in psychological issues. Adapted behaviors are not repeated enough to produce their beneficial consequences, or restricted to a specific form, limiting their appearance to a specific context. Conjointly, deleterious behaviors are repeated constantly since they are selected because of their local adaptation.

Integration of actions into larger and larger patterns also lead to retention of behavior, but that is disrupted if adaptive and maladaptive actions are mixed. Thus, if practice is frequent with a positive behavioral step, but it stands along in the repertoire, it is susceptible to change when

other features of the repertoire become momentarily strong. A person who rides her bike vigorously every other day may hit a "low point" in which she overeats, drinks too much, sleep too little and so on. Then the day arrives when the bike ride is skipped because "I feel too tired" or "I'm hung over" and so on. If that continues for long, suddenly even a well-grooved positive habit collapses because it is not well-integrated into larger healthy patterns.

Context. Most evolutionists appeal to context to explain selection pressures, survival, predation, and so on, but because evolutionary principles are rarely used as part of an applied science, context is subsumed into the evolutionary principle of selection. Psychological intervention science cannot afford to do that. Context sensitivity is key to being able to engage in actions at the "right time," meaning the times when they are needed (as part of a larger pattern of healthy living) and when they are likely to be successful and thus will be selected.

Maladaptive forms of adjustment are selected by "smaller sooner" consequences at the expense of "larger later" consequences. Many times, these consequences are intrinsic. Injecting an addictive drug will be selected in the short term almost regardless of context. Avoiding a situation that elicits a difficult emotion or thought will lead to "smaller sooner" rewards even if it harms long term functioning.

Conversely, positive processes of change often increase healthy context sensitivity. Attentional flexibility can be deployed to help new actions to occur when they are needed, or more subtle but positive consequences of healthy actions to be noticed. Reducing domination by self-stories based on maladaptive habits may open doors to sensorimotor events that can help create new life trajectories, a claim that is supported by neurobiological evidence of how senses of self can alter interaction with the environment (Hayes, Law, Malady, Zhu, & Bai, 2020).

Summary. Altogether, these problems in variation, selection, and retention in context construct what evolutionary biologists call an "adaptive peak" (Hayes, Sanford, & Feeney, 2015), that is, an adaptation to a local and restricted part of the environment, potentially transformed by verbal mechanisms, that trap individuals in a zone of repetition in which everything is not yet totally lost but nothing is really fulfilling anymore. Psychopathology is a name for a collection of evolutionary processes that create an adapting peak in which adaptive long term goals can no longer be reached without a change in these evolutionary processes. Changing such processes is the goal of psychotherapy. Psychological intervention is applied evolutionary science (Hayes, Hofmann, & Wilson, 2020; Hayes, Monestès, & Wilson, 2018).

3. Psychotherapists Change Their Clients' Evolution Knowingly or Not

With evolutionary principles prevailing within a lifetime, any element of our environment, be it physical, social, psychological, or historical, potentially has an influence upon variation, selection and retention at the ontogenetic scale. In other words, any element of the contexts in which our behaviors appear, and any change occurring after these behaviors, are likely to transform the appearance, form and survival of these behaviors. Consequently, the very existence and actions of other living organisms shape our own evolution.

Different philosophical or spiritual traditions, such as Buddhism, share this intuition of an interdependency of every living organism on earth. The concepts of biocoenosis and ecosystem also point to the fact that any living organism is dependent upon the behaviors of other living forms around him, or even further away.

This is obviously also true for human beings in the ecosystem in which they live. Consider for a moment that your very existence and all that you have managed to accomplish

would not have been possible without the existence of other organisms that were a part of your context at any given instant of your life. Obviously, you would not have survived without other living organisms to feed from, or other living organisms to pollinate the flowers that eventually transform in fruits and vegetables that you are eating, or without other organisms that are responsible for mechanisms essential to your survival, such as the gastrointestinal microbiota. Even the air we breathe proves our interdependency with trees that produce oxygen and live themselves from the carbon dioxide we exhale.

Interdependency is also a corner stone for human species. Try for example to find around you a single element whose presence or existence here is not dependent upon another human. An almost impossible task. If we add historical variables to the picture, none of your behaviors, starting from reading this chapter, would have been possible without the actions other human beings, who lived here long before you or still live in the same ecosystem. Recently, this global interdependency even increased to now truly include virtually any human being on earth, thanks to unprecedented and highly available means of transportation and the sharing of universal knowledge that is a click away. With planes, cars, phones and the internet, high scale globalization started at least 20 years ago, in such a way that each of us is now truly part of the others' context, directly or indirectly. Because of this interdependency, whatever an organism does has effects on the context to which other organisms need to adapt.

What is true for context is also true for consequences. Because our behaviors constitute other persons' behavioral consequences, we continuously shape other behaviors and contribute to the selection of their behaviors, as they continuously contribute to shape our own behavioral repertoire. Each time we comment on a friend's clothing, or we listen to a music track on a web

platform, or we buy gas at the gas station, we select others' behaviors, directly or more surreptitiously, by providing consequences to their behaviors.

Being an important part of other human beings' contexts and source of consequences for their behaviors, we truly are agents of selection and reproduction for their behaviors. However, most of the time, our influence on one another's behavioral repertoires is unintentional, and even incognizant to us. The circumstances in which we intentionally shape other behaviors are seldom, such as during child education or teaching.

When considering direct and intentional influence on others' behaviors, practitioners occupy a very special place and have the responsibility to select some of their clients' behaviors in order them to change sustainably. Stated another way, practitioners are in a privileged position to ensure that variation, and the selective retention of behaviors in context are optimal for their clients, in order them to fulfill their aspirations and enjoy a satisfying quality of life. In short, practitioners can organize intentional evolutionary change for their clients.

Consciousness can be viewed as a dimensional concept defined by the ability to respond to the external and internal events and to consistencies between and among them (Hayes, 2019). This fits with a commonsense use of the term (e.g., organisms are said to be "unconscious" when minimally in contact with the environment or their own behavior) but it also redefines consciousness in an evolutionarily sensible way since all adaptations have contextual limits, and "consciousness" is a way of speaking about possible sources of contextual control. Sensory systems allow the organism to be more "in touch with" the environment, and thus more "conscious." Contingency learning allows the organism's behavior to come under control of action → consequential relations, and thus more conscious. Stated that way, the story of

evolution is the story of the evolution of consciousness. All of these mentioned so far are things that happened half a billion years ago or more (Ginsburg & Jablonka, 2010) and they are often not thought of was bearing on conscioiusness. But the evolution of relational learning and thus human higher cognition, which occurred sometime in the last 2.8 million years, put hominins and eventually homo sapiens on a very different path. When the principles of evolutionary science are applied to the evolution of an individual person, or their sociocultural group, then evolution itself begins to be conscious in a new way that fits our more lay understanding of what it means to do things "on purpose" in the sense that we can now apply verbal descriptions of consistencies we detect between action and outcomes so as to change behavior deliberately.

4. Applying Evolutionary Principles Purposively in Psychotherapy

In an evolutionary process-based approach, psychological conditions can broadly be conceptualized as a loss of adaptability, whether through variation loss, irrelevant selection criteria, lack of reproduction of adapted behaviors, or difficulties in selecting and constructing a broader and more nurturing context. Any method that contributes to improving functional variation, reconnecting to significant parts of the environment to contact with a larger set of selection factors, and that help maintaining the adapted behaviors, would be considered as process-based evolutionary psychotherapy methods. Any method can be part of process-based evolutionary psychotherapy as long as it respects the stated evolutionary principles. Many of the most common features of psychotherapy first appeared in religious or philosophical traditions and the overlap among specific psychotherapeutic traditions is considerable. Consequently, some of the following suggestions may be similar to methods already used in various psychotherapeutic approaches. The important thing here is to formulate general processes, the

same as for the other life and evolutionary sciences. The goal is to bring together the methods that help patients to return to a state of harmony and adaptation to their environment.

The purpose of this section is to illustrate adaptive changes that therapists can bring in the evolutionary processes that govern their clients' psychological dimensions. Here we will take a few examples, but all various aspects of the EEMM (Hayes et al., 2019) can be worked on.

4.1 Promoting Variation

To counter the loss of variation in psychological issues, practitioners should consider healthy variation as a competency that they can encourage in their clients. It is possible to promote exploration of different ways to behave, various relations with emotions, different angles of cognitions, the development of a flexible attention, diversified sources of motivation and manifold perspectives on self.

The very foundation of clinical practice already promotes variation. We will first review some of the aspects of clinical settings that encourage variation. Practitioners should reinforce this initial and spontaneous variation and we present different means to encourage it. Secondly, practitioners should themselves be highly adaptable and versatile since, as part of their clients' environment, their own variability in the consultation room would ensure their clients' repertoire variation. Finally, practitioners should target functional rather than formal variation, that is, variation that engenders new feedback from the environment instead of the same consequences.

4.1.1 Variation is Embedded in the Clinical Setting

The clinical setting is in essence the place for a radically different positioning with emotions, thoughts, language, the way we consider ourselves and our relationship with others. In itself, it constitutes the first source of variation that practitioners offer to their clients.

Because of a general non-judgmental attitude adopted by practitioners, patients can express any emotion in the practitioner's office, such as feeling weak, lost, or envious, without risking rejection. Emotions can also be expressed in highly variable manners comparing to everyday life. Most importantly, emotion can be fully experimented in this secure place, such as when one allows herself to slump, or to give free rein to catastrophism without being in line with real discouragement and abandonment of the efforts made. In addition, the fact that the therapist does not react with the same urgency as the patient when faced with feelings of guilt or fear for instance constitute various examples of reaction to emotions for the client.

In clinical setting, it is also possible to say anything. Thanks to professional secrecy, it is possible to escape from usual implications of language, such as performativity (Austin, 1962) and, for example, to condemn a loved one, to insult a colleague, or to promise to eventually cheat on her husband. Things can be said in this context without noticeable consequences, so that it is possible to experiment highly variable patterns of saying.

Similarly, the clinical setting constitutes a place where clients are encouraged to go along various sort of thought experiments that invite one to consider new and different deductions, associations and perspectives. Whenever the therapist asks the patient to consider situations that do not exist, or no longer exist -such as "what do you think would have happened if you had punched your wife?", or "try to imagine how you would feel if you had been chosen instead of

your colleague"-, she encourages the appearance of new and different thoughts, and ultimately, she reinforces the habit of thought variation, that opposes the loss of variability responsible for the client's suffering. The same is true for example for the exploration of alternative explanations of a situation, and for role plays, in which the clients can adopt sequences of behaviors they don't usually experiment.

Finally, when a therapist asks a client to describe how his life would change if he stops using drugs for example, she aims at triggering variation of motivation for these behaviors (continuing and stopping using drugs) by conveying consequences of which the client is not yet sensitive. In addition, when a therapist asks a client to qualify his behaviors as a father from the perspective of his son, or his friend, or his own perspective ten years from now, the practitioner encourages to experiment variation in the perception of the client's self.

In summary, the framework of the therapeutic relationship constitutes an incomparable sandbox. Thanks to its intrinsic rules of functioning, it implies emotional variation (one speaks differently of emotions, one feels various emotions), behavioral variation in role plays and with regard to verbal behavior (one can say anything), cognitive variation (one can think in directions never imagined before, or that one usually forbids). Often also, in different approaches, clients are encouraged to think about their lives from a broader perspective, to take stock of what drives them, on all the elements that make them thrive, on the different aspects of who they are, which ensures also variation of motivation and Self perspective.

Last but not least, because practitioners refer to a model of human functioning that comprise with non-intuitive principles, they imperceptibly bring their clients' attention to parts of their environment that clients usually don't consider spontaneously (memories, thoughts,

emotions, avoidant behaviors, etc.), increasing the variability of their attentional focus. They also learn to speak of their difficulties with the therapist's words, hence positioning them in different contexts.

4.1.2 Encourage Any Spontaneous Occurrence of Variation

Aside from the natural variation the clinical setting itself fosters, practitioners can encourage variation very early on in therapy. Actually, the very first moments of the initial encounter with a client constitute a privileged occasion for this since coming to therapy represents an important occurrence of variation in the client's repertoire.

Any psychotherapeutic request represents the exploration of a new context and the emission of new behaviors. The patient is about to meet a new person and an environment that he or she does not know, to talk about his or her thoughts, emotions, feelings, memories, impulses, etc. from a different angle, sometimes for the first time. He or she also expects the therapist to ask him or her to behave differently, to change the balance he or she has found. As such, the request for psychotherapeutic help represents an important instance of change in and of itself. This variation, this break with the previous adjustment to the context, is sufficiently new to be underlined, especially as it takes time: the duration between the onset of psychological difficulties and the request for psychotherapeutic help is often rather long, typically with a range of more than one year to more than ten years (Vigne et al., 2019). The fact that a patient decides to consult a psychotherapist proves an awareness, even if it is an unsophisticated one, that her behaviors are no longer sufficiently adapted to the context in which she is evolving. The request for help is then a rupture in the patient's repertoire, a rapid increase of variation, at least a formal one. In the routine of repetition of the patient's behaviors (eating too much all the time,

constantly monitoring her own sadness, constantly checking if her negative emotions are visible, thinking that her spouse is cheating on her, worrying about what her supervisees think, etc.), considering consulting a therapist is a form of anomaly. Like a few individuals who stray from their group and end up creating a new species because they now live in a different environment, this new behavior can set the opportunity for a drastic change in the behavior organization.

Psychotherapeutic demand is a form of exploration of the environment, which should be encouraged to intensify, although novelty is often initially destabilizing and costly. It is therefore important for the therapist to stop here and explore with the patient what gave him the desire, or the strength, to come and consult, in other words, to explore the variables at the origin of this massive variation. Conversely, the therapist can also explore what led the patient not to consult immediately, whether he hesitated or not and, if so, what made him hesitate. A number of variables will necessarily be common to many patients, such as fear of stigmatization, difficulty in recognizing the extent of the disorder and attempts to cope on one's own. However, other reason for delaying consultation will provide information on what led the patient to lose healthy variation, for example the tendency to avoid shame, which is also embodied in avoiding professional consultation. Next, the therapist must clearly encourage the variation that seeking psychotherapeutic help represents, for example, by expressing her awareness that it is a tough move, that she admires the patient's courage, or by asking him to describe how he feels about being in front of a therapist. Even this advice interacts with the underlying principle. Practitioners almost always positively respond to their clients request for help, but with a patient who is constantly seeking the help of a psychotherapist, the risk of dependency to therapy and to the therapist may be a more dominant factor. In this case, asking for the help of a psychotherapist

does not represent a variation but on the contrary a behavioral perseveration, and thus that very perseveration may need to be the focus of the practitioner.

Finally, throughout treatment, each time the therapist detects that the patient behaves differently from what she usually does, that she experiments with new positioning, the therapist points this behavior out and encourages her. It could be a patient who contradicts the therapist when she is not used to asserting himself, or who decides the time of the next appointment when she is usually quite dependent on the therapist's decisions, or who allows herself to cry when she usually controls the expression of her emotions, etc. At first, whatever the variation or its origin, whether it is due to the specific context of the therapy, the therapist's encouragement, or any other variable, even accidental, the therapist should encourage it. The repetition of encouragements for diverse occurrence of variation will encourages variation itself as a process rather than to what it applies.

4.1.3 New Species of Behaviors: Create the Conditions for Functional Variation

Encouraging formal variation should, however, be transitional. Ultimately, the development of functional variation is sought as it corresponds to a real change in adaptation to the environment, or adaptation to a different part of the environment. Indeed, some behaviors may appear to be different from each other but in fact pertain to the same function (Hayes & Monestès, 2018).

If we consider behaviors as entities that vary, which are subject to selection and retention, we can somehow see that some belong to the same family, to the same species in a way, because of their function. For a person who feels anxious when in contact with others, constantly joking, refusing to celebrate his birthday, or not applying for a managerial position, are all behaviors that

share the same function -reducing social anxiety in this example. While they appear different from each other, these three behaviors are functionally equivalent and do not allow for varied adaptations to the context. They are in some ways part of the same species.

Conversely, the therapist seeks to bring out functional variation, i.e., behaviors that will allow the patient to contact with diverse parts of the context, internal, external and historical, and to interact with them differently. These new and functionally different behaviors are the equivalent of new species. They will result in different consequences from the environment. To make them appear, as soon as possible, the therapist no longer encourages formal variation. She can block the reproduction of functionally identical behaviors, i.e., whenever necessary, show the patient that her proposals of change are in fact functionally identical and can be expected to produce the same effects. The therapist can then encourage the patient to explore truly different – that is, functionally different - ways of behaving, for example by asking how he or she might do things differently (e.g. deal with fear differently, or start a conversation with a partner differently). The therapist encourages the patient to think "out of the box", to be truly creative, i.e., to truly vary his or her behaviors, so that the new behaviors achieve a different function than the one(s) usually intended. By blocking the reproduction of functionally identical behaviors, the therapist organizes, in a way, the extinction of this species of behavior, and leads to the appearance of variability and the exploration of the environment (Lattal, St. Peter, & Escobar, 2013). With the necessary caution when making comparisons, it should be noted that evolutionary biology proved that new forms of species appear when new challenges appear in the environment and/or new resources are made available, a phenomenon called adaptive radiation. For example, the Cretaceous-Paleogene extinction event that took place about 66 million years ago and caused the disappearance of the dinosaurs, presumably following the fall of a 6 to 9 mi

large meteorite in the Gulf of Mexico's Yucatán Peninsula (Hull et al., 2020), gave rise to an explosion in the number of new species, which then colonized vacant ecological niches (Meredith et al., 2011). Organizing the virtual extinction for the functionally identical and problematic behaviors correspond to encouraging patients to explore new ways outside the adaptive peak.

For humans, loss of variation's most damaging form seems to concern relationship to emotions and thoughts (Levin et al., 2014). The difficulty probably stems from the fact that the part of the environment with which one interacts in this case is the internal environment, which fluctuates much more rapidly, and whose organization and feedback is more difficult to observe, for the person concerned as well as for those around him. With regard to these two dimensions, the therapist also encourages as much variation as possible, i.e., she proposes different ways of interacting with emotions and thoughts than those that the patient already applies. Voluntarily approaching emotions usually avoided, thus voluntarily triggering them as in the case for fear in graduated exposure or becoming curious and looking for what emotions teach us as in acceptance, are all methods commonly used to increase variability in the repertoire of interactions with emotions. Criticizing thoughts as in cognitive restructuring, not being interested in what they say but only in their form as in defusion (Blackledge, 2007), looking at the appearance and the unfolding of thoughts rather than trying to argue with their content as can be done in some meditative practices (Segal, Teasdale, & Williams, 2004), are all varied ways of interacting with thoughts which can be beneficial as long as they are new in the patient's behavioral repertoire.

The degree of variation can also be increased with regard to the relationship to the Self by, for example, adopting different roles, different perspectives on oneself (Hayes & Gregg,

2000), or by accessing a form of spirituality where the Self supplants all other experiences (Gil-Luciano, Ruiz, Valdivia-Salas and Suárez-Falcón, 2017).

Finally, the therapist can also teach his patient to identify the difference between formal and functional variation so that he is a partner in this functional analysis and a source of functional variation. This change of positioning, from the one who undergoes his emotions, his thoughts and has the feeling of not mastering his behaviors, to the one who studies and classifies them, constitutes another important functional variation in the patient's behavioral repertoire.

4.1.4 Interlocking Systems: Be Part of the Variation

Practitioners are part of their clients' context. Consequently, a good way to maintain behavioral variation in the client's repertoire is for the practitioner to embody variation. Indeed, if the variation caused by the settings of the therapy does exist at the beginning of a treatment, this effect may tend to diminish as the sessions progress, and what used to be variability becomes the norm in this context. When psychotherapy becomes daily life, variability is again restricted, albeit differently. Therefore, it is important that the therapist maintains the degree of variability that psychotherapy initially brought to the patient so that the increase in the breadth of the patient's behavioral repertoire continues and becomes generalized to his or her daily life.

The therapist therefore benefits from being a model of variation. Of course, it is not a question of doing just anything, but of not behaving in the same way throughout the session and from one session to another (and even more so, from one patient to another), of allowing oneself to change the methodology, the theme of reflection, etc., in order to question a problem. Also, the therapist must know how to detach himself from his theoretical model, be careful not to enter into routines, be very attentive and curious about his patient and her or his variations

accordingly. This is what practitioners do in fact because none of us can behave identically in all circumstances. We do, however, have our little professional quirks. Indeed, presenting ourselves in a variable way in front of the patient better captures his or her attention, similar to what is achieved in a pedagogical setting. In addition, proposing to the patient different angles of interaction with his or her thoughts and emotions helps him or her experimenting that there is not one good method of interaction with emotions and thoughts but that it is the availability of several that is beneficial (Aldao & Nole-Hoeksema, 2012).

The selectionist principle also applies to the therapist's behavior: by proposing different angles of approach to the problem, we manage to find the one that will hit the nail on the head and be adapted to the patient, at that moment. This variation on the part of the therapist must be particularly implemented when the patient does not progress or no longer progresses. The more the therapist succeeds in creating variation in his or her behavior towards the processes to be changed, the more likely he or she will find something useful.

For example, when working with a patient presenting with debilitating procrastination, the therapist may first track the barriers to the client's actions. If he avoids something, for example the fear of being judged, the therapist could propose to vary the distance with what he avoids, through an acceptance or exposure approach. Jointly, the therapist can also try to vary the motivation for action, for example by summoning long-term consequences as in motivational interviewing (Miller & Rollnick, 2012), or more symbolic aspects as when working with the patient's values in Acceptance and Commitment Therapy (ACT; Hayes, Strosahl, & Wilson, 2012). The therapist can also try to improve the patient's capacity to adopt different perspectives on the tasks he has to perform, for example by asking the patient to project himself after the action, or 10 years later, or from the perspective of a friend that face the same problem, etc. The

more various modes of action the therapist will propose, the greater the chances that one of these modes will resonate with the ecosystem the patient is constituting.

What will then govern the action of the therapist will be the search for healthy variability rather than one method or another. When the therapist observes her model from a distance, as a guide rather than as a set of strict instructions to be followed, she herself embodies variation. For example, she does not overreact when a patient states a conclusion that he has reached and is contrary to her therapeutic model ("I am convinced that part of me likes this suffering"), or when a patient asks if another therapeutic model is worth a try. If the therapist is guided by to a process-based model, whose principles have been incorporated as directions rather than instructions to be followed to the letter, creates degrees of freedom in therapy that allow for varied exploration on the part of the patient.

The therapist's aim, on the basis of which his or her intervention can be evaluated, will be to create varied contexts and consequences, so that the patient also presents varied behaviors and can thus come into contact with varied environments and consequences in his or her life outside psychotherapy. This means that psychotherapy must be recursive, and that a therapist who wishes to bring about variation must herself behave flexibly. Otherwise, the risk is to suggest that the therapist knows a miracle recipe, when the most efficient seems to be to generate new ones often, to be attentive to their consequences, and to keep only those that are the most adapted to the environment.

4.2 Managing Selection Factors

At the level of genes, the feedback from the environment that constitutes the selection criterion is the survival of the organism, to which the reproduction of the organism is linked, and

ultimately its capacity to transmit its genes. At the same time, selection also takes place at the behavioral level. Depending on the appetitive or aversive value of their consequences from the environment, behaviors will have a greater or lesser probability of reappearing (Skinner, 1981).

The very persistence of problematic behaviors despite their apparent deleterious effects are proof that these behaviors are selected, that is, that they somehow are adapted to the environment. The first reason is that, while gene selection operates on too long periods to adjust to rapid changes in the environment, behavior selection operates on too short periods to be sensitive to all the consequences they produce. Consequently, behaviors sometimes adapt to too narrow, restricted parts of the environment. Individuals are preferentially sensitive to consequences here and now for oneself, instead of adapting to a wide proportion of consequences that appear, on larger time scales, taking into account what their behaviors produce for them and for others. By convoking here and now properties of stimuli that are not present, verbal processes help fill the gap between long term/short term sensitivity of genes and behavior selection. However, verbal processes create a distancing from direct consequences of behaviors that can also be problematic. Indeed, normal properties of verbal behavior represent a second reason why problematic behaviors emerge and are selected.

The relational learning processes that undergird normal verbal mechanisms (Hayes, Barnes-Holmes, & Roche, 2001), allow verbal human beings to add symbolic values to any event. The peculiarity of the ability to symbolize the world through language is that environmental stimuli can see their function transformed, increased or decreased, or sometimes simply reversed. Due to the meaning attributed to it, a stimulus may become more appetitive or more aversive, or may even change from appetitive to aversive, or vice versa. This property implies that the consequences of the environment are not intrinsically beneficial or deleterious to

the individual, but their function depends on the behavioral and verbal histories of the individual. Thus, for example, formerly appetitive or neutral consequences may be related to aversive stimuli and discourage the occurrence of behaviors that would otherwise be adapted. Someone feeling anxious about meeting another person may interpret each of his/her remarks as a criticism for example, which will eventually discourage meeting him/her. Ultimately, this capacity transforms the usual organism-environment interaction: consequences from the environment can be interpreted in any direction and may select deleterious behaviors.

In addition, contingences of meaning conveyed by language replace the natural consequences of the environment and constitute a kind of "parallel environment" that too can select deleterious behaviors. If I rigidly apply the rule “never speak to strangers” for example, my behavior will be adapted to the contingencies of meaning but would eventually be deleterious to me when taking into account the environment written large and all the consequences of not talking to anyone I don’t know.

In this context, practitioners should first track the tangible and symbolic factors that maintain problematic behaviors, and then try to counterbalance them by convoking larger parts of the environment, through long term consequences, more tangible consequences, and/or symbolic factors appetitive to the individual. In addition, practitioners can add selection factors, essentially constituted with their feedback, for the behaviors the client wants to develop.

4.2.1 Selection is an Ongoing Process: Track the Currently Acting Selection Factors

The general principle of evolution is rather simplistic: success is reproduced, failure is not. Consequences that emerge from the interaction between the organism and its environment

constitute the selective factors for behaviors (Skinner, 1981). They allow for the reproduction and retention of behaviors with beneficial consequences.

Feedback from the environment is much more frequent for behaviors than for genotypic variations. Feedback for behaviors can even be said to be constant since an organism is, by definition, always doing something, and everything that an organism does modifies the environment to some degree (Laland, Matthews, & Feldman, 2016).

The first goal of any therapy should then be to list any consequence from the environment that acts as a potential selective factor for the behaviors at stake, be it tangible or symbolic, and any restriction of the environment with which the individual interacts, because of a limited timescale or the dominance of the verbal environment. For example, practitioners should identify whether there are deleterious trade-offs between long-term and short-term consequences, or long-term consequences that are overlooked by the patient, especially when these consequences involve intense emotions, whether pleasurable or painful, and/or idiosyncratic interpretation of stimuli. Excessive essential coherence and rigid rules should also be especially tracked.

A very important point is to establish as exhaustive a list as possible of stimuli capable of triggering approach (rather than avoidance) behaviors in the patient. These elements serve as the fuel for behavior retention and reproduction. The difficulty is that what drives us is idiosyncratic, i.e., it is impossible to define in advance and with certainty the list of stimuli that would attract us all. The therapist must therefore first get to know his/her patient by discovering what he/she likes. This can be done by questioning the patient directly. Most often, however, what someone cares about is revealed in the depths of their suffering. We do not suffer from the lack of

something that is not important to us. In fact, in a way, we could say that patients decide to seek the help of a psychotherapist when they perceive that some of their behaviors are no longer adapted to the context in which they evolve, and above all, that they cannot change or that they do not wish to give up. Consider social phobia, for example. What someone who seeks help for this problem tells us is twofold. First, he tells us, of course, that he suffers from what he feels in the presence of others, the fear of being ridiculous, for example, and all these signs that are well identified in the various classifications of psychological disorders. However, what he also tells us, even though it's informal, is that contact with others is vital for him. Indeed, someone who feels such anxiety in the presence of others has a very effective way of not feeling that anxiety anymore. He can “simply” definitively withdraw from any social interaction. It is materially possible, just as it is always possible to escape from one's suffering. However, giving up contact with others is the last thing that someone suffering from what is called a social phobia wants. His problem stems from the intense fear he feels when he gets close to others, conjointly with the fact that he intrinsically enjoys being with others. The fact that he does not completely give up contact with others shows how this is a sufficiently powerful selection factor for his behavior to be balanced against the biological selection factor of fear.

4.2.2 Ensure Adaptation to Larger Parts of the Environment

We view psychological issues as caused by normal adaptations to restricted parts of the environment (immediate, local, and/or symbolic) that are responsible for an adaptive peak. It would be naive to imagine changing products of evolution such as biological reactions, or evolutionary processes, and/or normal verbal processes responsible for the symbolic transformation of the consequences from the environment. However, it is possible for the therapist to help the client in contacting a larger part of the environment -depending on what is

not being contacted currently, either long term or short term, tangible or symbolic consequences-, in order to favor an adaptation to a more representative part of the environment.

In the first category of problematic adaptation to a restricted part of the environment, biological and affective consequences such as fear, pain, or intense pleasure dominate as selection factors for the behaviors. When action become adapted to short term and/or local consequences through avoidance, sensitivity to long-term consequences is narrowed. This is the case, for example, in panic attacks, or chronic pain, in which, as a result of avoiding situations or places to avoid fear or pain, patients end up cutting themselves off from their professional, social or family life. Avoidance is the most effective category of behavior, and the soundest thing to do, if we consider only fear or pain taken alone. However, avoidance becomes an obstacle to healthy behavioral variation, and *more specifically* to a fulfilling life, if it is the only modality of interaction with the environment as a whole (Hayes, Wilson, Gifford, Follette, & Strosahl, 1996).

The goal of the therapy when facing this first category of problematic adaptation is to help the client take into consideration and to contact the long-term consequences for the behaviors concerned. Some of this can only be done symbolical, but today's immediate negative consequences may be the long term consequences of actions taken long ago, and by augmenting contact with the aversive outcomes of yesteryears maladaptive actions choices can change. Similarly, through symbolic means, today's behavior can be selected by construal of longer-term and/or abstract consequences. Symbols, and more broadly speaking, language, is a so powerful selective force for human beings that they are more willing to wait in self-control experiments for an abstract reward such as money than for food (Rosati et al., 2007). It is the combination of both that may be need.

Asking the patient to imagine what his or her life would be like if he or she no longer had psychological difficulties (the "magic wand" question) is an example of an approach used in many psychotherapeutic traditions to summon long-term and/or hypothetical consequences. The aim is for the patient to be sensitive to these long-term consequences and to be more successful in modifying his or her behavior, in order to actually be able to access these desirable consequences.

Different therapeutic models, such as motivational interviewing (Miller & Rollnick, 2012), help the client evaluate every consequence for their behaviors outside of any emotional episode. In that direction, it is important however to remember that we are looking for the selection of behaviors, that is, for their reproduction. Awareness of the long-term negative consequences of choices that were motivated by short-term consequences, and the guilt and/or depressed mood that comes because of this awareness, can be grease on the wheels of “more of the same.” These long-term adverse consequences are present at the very moment the problematic behaviors appear but alone they are not powerful enough to motivate different choices because they too can be simply avoided by the patient, who simply avoids thinking about what is painful for him. That is why both awareness of the trap of past action and a deep connection to the possibilities of healthier choices are needed to motivate behavior change.

The long-term consequences must also somehow be present when the patient is confronted with behavioral choices driven by intense emotions such as craving, anger, fear, or pain. In other words, the selection factors that usually act on longer time scales must somehow be evoked by elements of the current environment. One way to achieve this consist in the therapist linking local events or local choices to long-term symbolic aspects that have always made the client thrive, that transcend him, what he or she is ready to fight for. This is the domain

of what is called values in Acceptance and Commitment Therapy (ACT; Hayes, Strosahl, & Wilson, 2012). For example, the therapist may emphasize the symbolic meaning of a different response to emotional stimuli ("Your fear when speaking to this group would be a sign that conveying is something very important to you"), or link a behavior with local consequences to a category of behaviors that the patient consider essential to her (“It may seem like a small success for anyone else, but you will know that going to the hairdresser is a step towards the independent person you want to be.”).

The second category of psychological adaptive peak is concerned with language that prevents access to the direct consequences of the environment by convoking functions of stimuli not present here and now but arbitrarily related (Hayes, Barnes-Holmes, & Roche, 2001). This is the case for example when someone does not engage in a potentially fulfilling relationship with a partner because she thinks she does not deserve him/her, or when a parent is permissive with her children to a point that her education is harmful to them, because she doesn’t want to reproduce the rigid education she herself received. A verbal parallel environment –populated in these examples by symbolic aversive consequences (for “stealing” a non-deserved relationship or reproducing one’s parents’ mistakes)- governs actions and blocks immediate adaptation to direct consequences. Instead, adaptation occurs to a pseudo-environment compounded with language and symbols.

Behaviors governed by language seem to present to a certain degree insensitivity to their immediate consequences, notably to be less sensitive to extinction (Monestès, Greville, & Hooper, 2017), and symbolic consequences are highly effective to maintain actions. Language is a factor of behaviors persistence despite immediate aversive consequences, that is, despite not being adapted to the immediate context.

This ability to divest oneself of the influence of immediate tangible consequences can of course be an asset when it comes to persevering in the face of adverse consequences, or to access consequences that only appear cumulatively. On the other hand, it becomes a problem when the immediate tangible consequences are harmful to the individual, or when they represent valuable sources of information that are then neglected. In this case, the goal of psychotherapy is to favor a direct access to the consequences of the environment by the development of a sort of disinterest for these consequences from this pseudo-environment, such as what is done with defusion (Blackledge, 2007), or with mindfulness practices (Segal, Teasdale, & Williams, 2004) that develop attention to the process itself rather than to the functions convoked arbitrarily by language.

4.2.3 Evolution is Conservative: Reconfiguring What's Already Adapted

Locally restricted adaptations may appear to be curses, but they are nonetheless adaptations, i.e., firmly entrenched patterns. Evolution always and only recomposes from the same elements, only the arrangements of which are modified. This is the case at the level of behaviors as well as genes. It is therefore important that the therapist makes an inventory of the problematic patterns presented by the patient, which can become strengths if they are applied to larger, or better targeted, parts of the client's environment. The goal of the therapy is then to hijack the product of the problematic selection to the benefit of the patient, to select it for another purpose, for another function. In biology, an exaptation corresponds to the conservation of a variation due to a function different from that for which it was initially selected (Gould & Vrba, 1982). Feathers, for example, appeared in one of the first bird species, Archaeopteryx, which had no other morphological characteristics that would have allowed it to fly. Thus, it is thought that

the early feathers were initially selected for other functions, e.g., thermoregulation (Ostrom, 1974).

In psychotherapy, it is thus possible to consider turning a behavior towards another function, while retaining the benefit of its formal control. In order to highlight possible pathways for exaptation, the therapist can accompany the patient in an exploration of the intrinsic benefits for the problem behaviors in their behavioral repertoire, by asking questions such as "How does your anxiety help you? In what domain could your fear be useful?", "What might be the benefits of your lack of assertiveness?". Once the surprise stage is over, asking such questions allows the problem behaviors to be dismembered, in order to reuse their components to sublimate them.

A person with a rigid, even obsessive, way of thinking shows incredible perseverance, but often focuses on insignificant elements of their environment. This perseverance skill is unique, and there is no obligation to transform it, as long as it is redirected, for example, towards what matters to that person, or towards long-term projects with little daily progress. In another example, great sensitivity to the attention and judgement of others is problematic when it has followed, in the patient's behavioral history, disabling behaviors (staying in bed, complaining of pain, risky behaviors, etc.) and acted as a selection criterion for these problematic behaviors. Being sensitive to others' attention and to signs of poor judgement can become an opportunity in a large number of activities in which the feedback from the other person allows him or her to improve his or her expertise, or in which non-verbal communication is central, for example when learning new skills from a teacher or teaching oneself.

4.1.4 Artificial Selection: Add Selection Factors for Behaviors to develop and reproduce

One of the roles of practitioners is to identify the problematic selection factors and to help the client in replacing them with more adaptive ones. He or she can also add selection factors to natural consequences of behaviors, when the latter are not appetitive enough and do not sufficiently counterbalance selection by symbolic contingencies. In short, practitioners engage in a sort of artificial selection of behaviors.

At the beginning of the relationship, during the construction of a qualitative therapeutic relationship, the therapist is in fact adding into the patient's behavioral equation a set of consequences that were not present before, namely, his solicitude, his interest, his benevolence. Of course, the financial question sometimes defines the existence of the relationship (the patient comes to consult a professional paid for this), but from the first moments of the relationship, the therapist is part of the people that the patient knows, who know him and who care about him. As such, in developing a good therapeutic relationship, the therapist builds himself or herself up as a potential source of behavioral selection; it is important that the therapist is aware of this and uses it purposefully.

With the help of these newly established reinforcers, the therapist prompts the client’s behaviors (Cengher, Budd, Farrell, & Fienup, 2018). She first organizes an artificial selection of behaviors by describing them in detail, paying attention to them and encouraging them, so that these behaviors have a greater probability of appearing and being selected in the wider environment of the patient's life outside psychotherapy. Then, once these behaviors have sufficiently appeared in the patient's natural environment, the therapist fades his intervention so that the natural consequences emanating from the patient's non-therapy environment can take over and select these behaviors.

The therapist must also capture the patient's attention in order to make them discover parts of their environment to which they have not sufficiently been sensitive, due to the hegemony of other sources of attention that captivate them, be they biological (painful emotions) or symbolic (reasons, rules). The re-opening of the attentional scope can be done through formal exercises (Knowles, Foden, El‑Deredy, & Wells, 2016) or training practices (Segal, Teasdale, & Williams, 2004). It can also be achieved by the therapist's own interest in certain categories of stimuli and behaviors. Indeed, as a potential selection factor, the therapist's interest will encourage the patient's interest. If the therapist's questions from one session to the next focus on the relationship with others, for example, or pleasure in exploration, the patient will certainly be more attentive to them in his or her daily life.

5. Retention

5.1. Changing the Context Favoring Retention of Beneficial Behaviors

Adaptation is the product of variants selection by feedback from the environment. However, the environment is dynamic, primarily because of the actions of the organism who lives in this environment. Consequently, when an organism transforms its environment, it indirectly changes the selective forces acting on itself. This phenomenon, called “niche construction”, was described in evolution of species and is now considered an important extra-genetic inheritance (Odling-Smee, Laland, & Feldman, 1996), working on a shorter term than genetic inheritance.

Practitioners can build on this “behavioral loop” (Monestès, 2016) to help clients designing their environment so that it prompts or encourages the behaviors they want to develop or prevents those they want to quit. Finally, when beneficial adaptations appeared, it is crucial

that the therapist helps to multiply and diversify them so that their function is firmly learned and that they are reproduced.

5.1.1 Niche Construction: Helping Clients Design their Environment

One of the distinctive features of human beings' evolution is that it has produced the ability to make projects, thus, to choose the direction in which they evolve (Monestès, 2016) and then modify their environment intentionally. When a government wants its citizens to adopt new behaviors, such as the purchase of less polluting vehicles, it organizes a contingency system that encourages these new behaviors. For example, it adds a discount to the purchase of a non-polluting vehicle and a penalty for the purchase of a vehicle that consumes a lot of fuel. In this example, the government changes the vehicle purchasing context and expects buyers to adapt to it.

It is possible to organize the environment for oneself and thus promote the occurrence or disappearance of behaviors that one wishes to encourage or discourage in one's own behavioral repertoire. Therapists can help patients to organize their environment in this way, that is, to manage contingencies in order to influence their behavior. To combat insomnia, a therapist may advise a client to banish screens from her bedroom. A patient who tries to stop drinking alcohol and observes that he or she drinks mainly in the presence of a certain circle of friends may decide not to meet these friends anymore. A patient who makes herself vomit when alone after meal may be advised to eat with a friend, or in a restaurant, or to go for a walk in the shops right after her meal. A therapist may advise a patient to set an alarm regularly to assess the pleasure he or she is having from the activity. Contact testimonials from other patients who have overcome the

problem being faced, such as in Alcoholics Anonymous groups, is also an example of modifying one's environment so that it in turn encourages the behaviors one wants to see develop.

Finally, when the variables that most influence the behaviors are part of the social context and are dependent on other individuals, modification is more complex but is still possible. It is then necessary to include other people in the therapy such as family members. At the suggestion of the therapist, the patient can ask their spouse to stop helping them to check whether the doors are closed, or to stop answering the telephone for them.

5.2 Evolution Resolves Problems Differently: Encouraging Larger Functional Patterns

The fennec fox lives in the Sahara Desert where the sand temperature can be high as 150° F and where water is scarce. Parts of its morphology and metabolism were selected as different ways to cope with these conditions: large ears that dissipate heat, thick hairs under its paws that protect it from the heat of the sand, kidneys that concentrate urine and limit the loss of water. All these characteristics have the same function of coping with heat and excessive dryness and have all been selected and transmitted.

Many examples of biologic structures prove that redundancy is maintained across the evolution of species, despite their apparent non optimality and waste of energy. One of the most spectacular in human species is the circle of Willis, a circulatory network that supplies blood to the brain. It is compound of arteries that actually have the same function, so that when one of them is obstructed the blood follows a different path and the brain is still irrigated by this collateral circulation. The same redundancy is observed at genetical level, with certain biochemical functions performed by two or more genes (Láruson, Yeaman, & Lotterhos, 2020). On another matter, the Internet was designed from its beginning as a resilient network thanks to

the multiplicity of paths the impulsions can follow to reach the user who asked for a precise information. Here again, the goal of this redundancy is to ensure that the function is maintained even if one of the structure parts fails.

The notion of functional equivalence of formal variations (Hayes & Monestès, 2018) is relevant at psychological level, especially when considering retention of adapted behaviors, thoughts, attentional focus and perspective on the self. Formal variation is only problematic when it concerns behaviors with deleterious identical consequences. On the contrary, it is desirable when it concerns behaviors whose consequences are beneficial to the individual. In this case, the more different ways of adapting to the environment the better. Formal variation ensures the conservation of function in the repertoire despite changes in the environment, a property that is precisely the problem when the behavior produces feedback deleterious to the individual, since it become then an invasive species of behavior, so to speak. Here, we want that adapted behaviors become invasive in the repertoire.

To ensure continuity when adapted behaviors emerge, the therapist should cultivate this sort of formal variation. The rule regarding formal variation in psychological issues should be to limit it for deleterious adjustments to the environment but to promote it for adapted adjustments. Consequently, the therapist can at first encourage the client to reproduce adapted behaviors in different contexts by extracting their function rather than focusing on their form. Stated another way, the therapist can help the client track why this particular behavior is nurturing for them and encourage her client to explore different way of achieving the same function. Finally, each time alternative behaviors in direction of the same desirable consequences are produced, the therapist encourages it, so that progressively the very process of variation itself is promoted and reproduced.

Also, here again, partial withdrawal of reinforcement can be useful. Before provoking an exploration of the environment and ultimately conducting to functionally different behaviors, extinction produces different instances of behavior functionally equivalent (Neuringer, 2002). In other words, when a behavior no longer produces the beneficial consequences it previously produced, the individual searches first for new ways to get the same consequences, such that he or she finds new routes to the same destination. As Grow, Kelly, Roane, and Shillingsburg (2008) stated it, “when appropriate behaviors are placed on extinction, other desirable behaviors may emerge” (p. 16-17). This process ensures the robustness of the concerned class of behavior and its retention on a longer time.

5.3 Ensuring Retention of Adaptive Behaviors

In theory, the fact that behaviors are adapted to their environment and are therefore selected is sufficient for them to reproduce. However, it is important that the beneficial variations that the therapist has brought out during therapy, or that the context of therapy itself has brought out, are well retained and reproduced. It is a tough competition between these new behaviors and the patient's habits because, unless we manage to transform the patient's everyday context, their appearance is restricted to the time spent with the therapist, usually something like one hour a week or so.

To help with retention of adapted behaviors, the therapist should try to ensure that the patient leaves the session with elements of their cognitive context transformed, so that this maintenance is prolonged in the absence of the therapist. One common way is to offer exercises at home. Unfortunately, we know how difficult it is for patients to perform exercises by themselves (Kazantzis, Deane, Ronan, & L’Abate, 2005).

The therapist can propose many formal variants of his or her own requests and promptings, in order to ensure many occurrences of the patient's adapted behaviors. To ensure retention, the therapist can also rely on recipes that have proven to be effective in pedagogy, such as proposing training exercises (e.g., role-plays) to prepare for a new situation or to practice what has already been successful, asking the same question differently several times, creating formulas and "mantras", images, metaphors, flashcards, etc. One can also ask the patient to take notes of his progress, to represent it by milestones, to regularly compare the difficulties that remain to be solved with those present at the beginning of the therapy.

Retention will also be fostered if the therapist asks the patient to describe, in as much detail as possible, the adapted behaviors he or she has been able to implement. Narration is a form of repetition of the behaviors in another modality, which contributes to their reinforcement and memorization. In the same way, the methods of attentional development can be used here to detail each perception of a memory, recent or older, during which an adapted behavior was emitted (i.e. the "sweet spot" exercise, Wilson & Sandoz, 2008).

Finally, the therapist can help make every patient's progress a memorable event by pointing out very clearly and enthusiastically any adapted change. Here, techniques used in pedagogy or to mark the minds of an audience at a conference, such as surprise, humor, or personal disclosure, can be very useful. Beyond the techniques, a simple rule can help practitioners to encourage the retention of adapted behaviors: as soon as you feel satisfaction in seeing your patient progresses, do not sulk in your pleasure, but simply rejoice in it and express it to the patient.

6. Conclusion

In this chapter we have proposed an application of evolutionary theory on an ontogenetic scale, based on the Extended Evolutionary Meta-Model of processes of change, to understand psychological issues and to propose a general psychotherapeutic framework. In our view, psychological issues are adaptations to restricted parts of the environment, whether local, temporal, and/or symbolic. A practitioner's work thus consists in identifying these restricted adaptations, then in countering them by encouraging variation in all dimensions, by developing the integration of the largest possible part of the environment among the selection factors, by organizing the context and promoting the retention of the adaptations thus obtained.

Building an integrative psychotherapy is a dream that many share, in order to take advantage of the best of all psychotherapeutic traditions. This integration is practically impossible when concerned with theoretical models. The proposals are often too divergent and sometimes irreconcilable. If integrative psychotherapy can exist and be beneficial, it will consist of integrating therapeutic methods from the different psychotherapeutic traditions into a single, broader, universal theoretical model. In our view, the selectionist model of the theory of evolution constitutes this framework. By its scope and the simple principles, it puts forward, this "model of the models" allows for the coherent integration of methods from different psychological approaches and provides benchmarks for deciding whether a therapeutic approach, an exercise, a metaphor, etc., will be useful in psychotherapy, because it will go in the direction of a healthy evolution. The evolutionary processes demonstrated their interest and robustness in all sciences that study life. To think that it would not apply to psychology would be tantamount to considering that there is a fundamental difference of nature between humans and other animals.

Many psychologists see evolutionary science as a big brother or sister we admire. We may be passionate about the evolutionary history of our species. Understanding our evolution ultimately means getting closer to the question of our origins, which transcends human existence. It is an exciting question indeed. However, it should not hide the fact that our evolutionary history is still taking place, for each one of us, day after day, moment after moment, right now. There is a real opportunity to understand the evolutionary phenomena taking place before our eyes and to use our knowledge of evolutionary principles to help patients live a life more adapted to their environment.

Until now, psychology had not fully demonstrated its ability to contribute to knowledge about evolutionary mechanisms, as all other evolutionary sciences do. It has essentially positioned itself as a "consumer", a user of the general model. Moreover, its use of the evolutionary model has consisted essentially in a retrospective use of evolutionary principles, with the aim of explaining what exists, not making it an applied science. By proposing a phylogenetic rather than ontogenetic approach to the use of evolutionary principles in psychology, evolutionary approaches in psychology have so far reflected the hegemony of the gene, attached to an era from which we are beginning to emerge. Conversely, the study and use of evolutionary principles on an ontogenetic scale is restoring psychology's place among the evolutionary sciences. It is time for our patients to benefit from it.

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