Chapter 1

Creating an Alternative to Syndromal Diagnosis:

Needed Features of Processes of Change and the Models that Organize Them

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For decades, intervention science has followed a primary analytic strategy—that of syndromal diagnosis—which has created a robust and progressive field but has now reached a dead end. Few now believe that an adequate field of evidence-based therapy will emerge from researchers continuing to evaluate psychosocial protocols and lists of approved medications focused on psychiatric syndromes. We must find a new strategy and way forward. The only question remaining is: "What will that strategy be?"

The *Diagnostic and Statistical Manual of Mental Disorders* (DSM; American Psychiatric Association, 2013) and the *International Classification of Diseases and Related Health Problems* (ICD; World Health Organization, 2018) have dominated the field for decades and left it with an intellectual hangover as it considers its future. Our discussion here will primarily focus on the DSM, but the same controversies also apply to the ICD.

Clinical programs have trained generations of students to take a topographical approach to human suffering based on the biomedical conviction that syndromes—collections of signs (things you see) and symptoms (things people complain of)—will lead to a deep, functional understanding of psychopathology. Students are trained to remember criteria, such as "five out of nine" or "four out of seven" signs and symptoms, and then pick the right set of organized techniques from approved lists of treatment protocols, all vetted by clinical randomized controlled trials (RCTs). In the minds of many, clinical skills mean the adherent delivery of techniques inside evidence-based protocols. Evidence-based therapy is synonymous with this "protocols-for-syndromes" strategy.

All of that is now changing—rapidly. After reviewing 30 years of effort on syndromal classification, the planning committee for the fifth version of the DSM (American Psychiatric Association, 2013) reached the conclusion that the entire enterprise is unlikely to ever lead researchers to the identification of functional entities: "All these limitations in the current diagnostic paradigm suggest that research exclusively focused on refining the DSM-defined syndromes may never succeed in uncovering their underlying etiologies. For that to happen, an as yet unknown paradigm shift may need to occur" (Kupfer, First, & Regier, 2002, p. xix).

The Research Domain Criteria (RDoC) approach of the National Institute of Mental Health (NIMH) broke away from the hegemony of syndromal classification (Insel et al., 2010), perhaps in an attempt to create that "as yet unknown paradigm shift." We will review the history and current status of RDoC here. Whatever else eventually flows from RDoC, even a casual observer can see that the same agency that once lifted up the "protocols-for-syndromes" strategy has now turned away from it and toward a process-based direction. That opens to door to a new process-based look at evidence-based therapy and the diagnostic systems on which it stands. That is precisely the theme of the present volume.

In some ways, the current changes look like a return to the original agenda of behavior therapy (Davison, 2019). Evidence-based therapy began based on the extension of principles into ideographically useful functional analyses. These principles were high in precision (e.g., the definition of a "reinforcer" constrained when you could and could not use that term) and high in scope (e.g., a small number of principles were meant to be combined to explain a larger number of phenomena) and led to the generation of many applied methods.

However, this historical similarity is somewhat misleading because behavior therapy contained little guidance about how to develop *new* knowledge about processes of change. The greater emphasis was on applying principles already identified in the animal laboratory. Said another way, the steps needed to develop a more adequate set of processes of change were not originally a central concern to the field because, at first, the science of principles of psychological change appeared so advanced relative to the infant status of intervention science itself.

Instead, early behavior therapists put much of their attention on how to create replicable evidence-based methods of change that they could fit to the individual. You can see this clearly in the agenda laid out for evidence-based therapy by the late Gordon Paul: "What treatment, by whom, is most effective for this individual with that specific problem, under which set of circumstances, and how does it come about?" (Paul, 1969, p. 44). This "what" question was clearly meant technologically (what treatment), while the main focus was on how to deliver and fit that technology to the person (by whom, for what specific problem, and under which set of circumstances). The last six words about processes of change ("...and how does it come about") were almost an afterthought and were left out when this charge was first stated two years earlier (Paul, 1967). Paul did not mean "What new theory is needed to account for these effects?" He meant "How can we explain these results based on known principles?"

Indeed, behavior therapy was *defined* at the same time as experientially tested intervention methods, which were linked to and explained by "operationally defined learning theory" (Franks & Wilson, 1974, p. 7). Similarly, it was said that the defining feature of applied behavior analysis was its clarity of technique linked to the important social needs of people

(Baer, Wolf, & Risley, 1968), while the only theory required was adherence to "behavioral principles."

The "protocols-for-syndromes" era of federal funding that soon followed fit comfortably into this technique-focused world of evidence-based psychosocial care. Cognitive behavioral therapy (CBT) researchers were particularly successful in establishing evidence-based therapy by testing protocols for syndromes in controlled, time-series designs and especially in RCTs (Thompson-Hollands, Sauer-Zavala, & Barlow, 2014). These methods emerged as the dominant form of evidence-based psychosocial care (Hofmann, Asnaani, Vonk, Sawyer, & Fang, 2012). Concepts and theory were still important to the description of and rationale for various clinical methods, but they were not central. For example, meditational analyses were rare in CBT until only the last decade.

As this era of "protocol-for-syndromes" wanes, attention has returned to processes of change (Hayes & Hofmann, 2018; Hofmann & Hayes, 2019). Consensus-based processes inside the RDoC initiative and those inside CBT itself (Klepac et al., 2012) both agree that the future of intervention science is process-based. At this moment, we need greater clarity on how to search for processes of change and how to organize them into models and theories.

In this chapter, we will consider what researchers mean by "processes of change" and what properties these processes need to display so they can form the foundation for an alternative to syndromal diagnosis. We will examine what is needed by models or theories of such processes and will propose a way forward under the umbrella of evolutionary science.

Processes of Change

How can we best assemble a workable set of change processes, which are organized into simplified models, that enable the practitioner rapidly to answer this key question: "What core biopsychosocial processes should be targeted with this client given this goal in this situation, and how can they most efficiently and effectively be changed?" (Hofmann & Hayes, 2019, p. 47). We will begin with the key features of processes of change.

What Are Processes of Change?

Processes of therapeutic change are theory-based, dynamic, progressive, contextually bound, modifiable, and multilevel changes or mechanisms that occur in predictable, empirically established sequences oriented toward desirable outcomes (Hofmann & Hayes, 2019, p. 38). They are:

- *theory-based* because they are associated with a clear statement of relations among events and lead to testable predictions and method of influence;

- *dynamic* because processes may involve feedback loops and nonlinear changes;

- *progressive* because they may need to be arranged in an order to reach the treatment goal;

- *contextually bound and modifiable* to focus on their implications for practical changes and intervention kernels within reach of practitioners; and

- *multilevel* because some processes supersede or are nested within others.

There are several key features of importance in this definition, as we shall see. If we are to use processes to go beyond the DSM, they need to have particular characteristics.

High Precision, Scope, and Depth

A change process needs to have precision and scope, just as we discussed earlier regarding behavioral principles. It needs to be clear when a particular change process applies (*precision*), and the process needs to apply to a range of phenomena (*scope*). The requirement for precision eliminates general heuristics and loose metaphors as processes of change. The requirement for scope eliminates change processes that are merely restated versions of techniques and encourages processes of change that broadly apply. It would be neither scientifically nor practically useful to generate a myriad of change processes that apply only to narrow areas.

There is also a third requirement of adequate change processes: They must have *depth*. In a unified fabric of science, concepts at one level of analysis must not contradict well-established findings at other levels of analysis. Coherence across levels of analysis is an especially important criterion for a multidisciplinary area, such as mental and behavioral health. Psychology is embedded in other levels of analysis, such as physiology, genetics, social process, and culture—to name only a few—and its concepts need to play well across that wide range of levels. For example, data from the neurobiology of emotion must not contradict an emotional change process that appears to be successful at the psychological level. If there is contradiction, then the scientific description of the change process is not adequate. We are not speaking of reductionism, as each level of analysis has its own work to do. Rather, the goal of a unified fabric of science needs to be ever in mind.

One implication of this perspective is that concepts in clinical science should link to viable basic science programs, since that is where the preparations exist that are needed to test concepts that have high levels of precision, scope, and depth. In that same vein, it is important

not to stay entirely at the clinical level when researching change processes. We can find central

change processes reflected in developmental studies, naturalistic longitudinal studies,

experimental studies, and so on, and any process of change that we have not broadly vetted

that way is likely not ready to be a cornerstone of process-based diagnostic systems.

Idiographic Processes

It is important to develop nomothetic knowledge about processes of change. There is no

interest in the applied field in the "psychology of the one" because knowledge that does not

apply to many people is not knowledge practitioners can afford to take the time to learn and

use. That is part of what "scope" means. Processes of change need to apply across a reasonable

range of people, problem areas, settings, and delivery methods for that knowledge to be useful.

But there is a big difference between knowledge that can apply more generally and knowledge

that is based on a collective level of analysis to begin with.

The behavioral and cognitive tradition has long dealt with arguments that cross-

sectional group averages and longitudinal examinations of individuals are fundamentally

different levels of analysis (e.g., Barlow, Hayes, & Nelson, 1984; Sidman, 1960; von Eye &

Bergman, 2003), but the field in general has failed to appreciate how profoundly true that is.

Western culture has embraced the empirically false idea of the "average person" for nearly 100

years (Rose, 2017), and Western science has followed suit. If all that matters is a single

outcome, then it makes some sense. Yes, the pathways to get there might matter, but if 4 out

of 10 people are no longer, say, avoiding work after this particular intervention (compared to 7

out of 10 in this other condition), then focusing on the collective may not create much harm.

At the level of processes of change, however, the picture is far less rosy. As we consider multiple variables, and their trajectories and interrelationships across time, our analysis at the level of the collective stops yielding information of known applicability to the individual. We might identify processes of change at the group level that not a single individual displays. It is also possible for these two levels of analysis to give different answers to the same question.

Consider the relationship between the speed of typing and the number of errors made while typing. If you gather virtually any large group of people, you will find that experts type faster (and with fewer errors) than hunt-and-peck typists. At the level of the collective, typing speed will be negatively related with errors. However, for every single individual, beginner and expert alike, trying to type faster will produce more errors. Therefore, typing speed and typing errors are negatively correlated in a group of people but positively correlated for every individual of the same group.

That is a commonsense example, so one could suppose that all you would need to do is add typing expertise as a covariate to clean up this mess. The problem is that in novel areas, you cannot say beforehand how to catch such errors and what covariates to add. Normally, when analyses at the level of the collective and at the level of the individual differ (e.g., Fisher, Medaglia, & Jeronimus, 2018; Turner & Hayes, 1996), we don't really know why, but we do know as a mathematical certainty that when we apply results from the analysis of change processes at the level of the group to a particular person, then we cannot assume the change process will benefit the individual (Fisher, 2015).

Why can we say that with mathematical certainty? Because that application of knowledge violates an accepted mathematical proof that has been established in the physical

sciences for nearly 90 years: the ergodic theorem. In the early part of the last century,

physicists wanted to know how individual gas molecules behaved, but they could only measure

volumes of gas, not individual molecules. A mathematician worked out that the behavior of the

two could be the same but only under rare and highly specific circumstances (Birkhoff, 1931).

The resulting proof is called the ergodic theorem, and it has been considered settled in the

physical sciences ever since, but it is little known in the behavioral sciences. The theorem did

identify circumstances in which the collective reflects the subunits: When molecules are

identical and do not change over time. A few ideal gases are actually like that (Volkovysskii &

Sinai, 1971), but since psychologists and other behavioral health specialists do not treat frozen

clones, these circumstances never apply in behavioral science.

The implications are stark. Statistical methods based on interindividual variation, such as

the cross-product of the coefficients methods of classical meditational analysis (Preacher &

Hayes, 2008), cannot properly model processes of change (Molenaar, 2008a, 2008b). Another

way forward is needed.

This is a serious methodological and statistical issue that we can only fully solve over

time, but taking the time to work on complex networks and dynamical systems opens the field

up to a more progressive path forward (see chapter 8). We need to identify processes of

change repeatedly at the level of the individual across time. When then can try to gather these

patterns into nomothetic generalizations (either in the form of sub-populations or overall

population parameters), provided that nomothetic statements do not distort what is found at

the idiographic level. Processes of change identified or tested in time-series designs (Hayes,

Barlow, & Nelson-Gray, 1999) are especially important examples for present purposes due to

the breadth and depth of that research tradition in applied psychology. There is a lot we already know. In network analysis, there are also already available analytic tools that can make population estimates without ever treating idiographic data as "error," such as the Group Iterative Multiple Model Estimation method (GIMME; Gates & Molenaar, 2012).

Immediately and Repeatedly Measurable

The previous section helps explain why we need to assess processes of change using measurement methods capable of repeated longitudinal assessment, ideally at relatively high frequencies. For practical purposes, it is critical that these measurement methods are available at low cost and that they provide rapid feedback to the practitioner. In-session behavioral observations are a classic example of measures that can have those properties. There are good examples of transcript analysis and other in-session measures yielding evidence of functionally important processes of change (Hesser, Westin, Hayes, & Andersson, 2009). As natural language analysis software improves, practitioners' ability to receive feedback only minutes later regarding clients' in-session verbal patterns is on the close horizon. The growing base of smartphone-based ecological momentary assessment measures and automated assessment measures are another example. Measures that assess processes of change in this manner are preferable, in part, because they can then provide immediate feedback to practitioners.

More troublesome is the state of evidence with self-report measures. Even well-known self-report measures have generally not been tested for high-frequency repeated use, and just a small collection of such measures would soon exhaust a client in any case. Certain solutions, such as taking the item with the highest loading and using it frequently, are mere rules of thumb and are not themselves based on well-established measurement logic. Part of the

problem is that psychometrics and classical test theory also violate the ergodic theorem (Molenaar, 2008a), but a full solution to that problem has not yet been developed.

We should not view a self-report device as a successful measure of processes of change until we show it applies in high-density longitudinal analyses focused on the individual. Processes that we can measure in multiple modes—for example, via self-report and behavioral observation—are also much more likely to be robust and thus worthy of attention in building alternatives to the DSM.

Changeable and Contextual

Intervention science is a form of applied science—and, thus, processes of change (which are changeable and linked to contextual features that we can modify) are preferred over processes that are dependent variables alone without clear and known linkage to manipulable events. Using information about processes of change requires focusing on the interface between action and its changeable context: historical, situational, and internal.

Processes of change are functional sequences, not mere snapshots. Identifying correlates of outcome change is a fine first step, but it is far from adequate as a method of identifying change processes. If change processes are to serve as part of an alternative to the DSM, then these processes must directly and successfully lead to the selection and implementation of treatment kernels. For that reason, we should give preference to processes that are understood contextually and historically.

Functional Pathways of Change

A functionally important pathway of change is not a "cause" in any simple mechanistic sense because third variables are always possible, and change is not likely linear, unidirectional,

or univariate. It is important, for example, to distinguish mere markers of treatment from mechanisms of treatment. Clients often learn to "talk the talk" of a given form of psychotherapy, and if the intervention is powerful, then any measure of that kind will yield analytic "vaporware" suggestive of processes of change. Researchers need to be cautious in such situations. If the process can be regularly detected in actual behavioral "walk-the-walk" measures, even without intervention, then it is more likely to be important. This is done in traditional meditational analysis by controlling for treatment in the "b path" (the mediator to the outcome path), which practically speaking means that the mediator-to-outcome relationship must exist in the control condition as well. In network analyses at an idiographic level, it is done more so by looking for similar patterns in untreated participants (Hofmann, Curtiss, & Hayes, under review).

With Coherent Moderators

If there was one finding that was revealed consistently in the syndromal era, it is that common-sense moderators are rarely powerful. For example, demographic factors, such as age, religion, and so on, generally do not predict replicable differential responses. The science of moderation, like the science of change processes, requires theoretical models that provide coherent leads and that make sense of the results. Processes of change linked to moderators of that kind are preferred.

Summary

A focus on processes of change has a clear chance to bring both researchers and practitioners together across theoretical divides. Many times, there are parallel concepts in different theoretical traditions. While agreement on overall models is often difficult, common

interest in processes of change is far more established. If we know the features just described apply to a given process of change, then we are ready to consider the features as a building block in creating an alternative to the current psychiatric nosology.

Models of Change Processes

The list of proposed or identified broadly applicable or "transdiagnostic" change processes is lengthy. In one of the first book-length summaries, Harvey and colleagues (Harvey, Watkins, Mansell, & Shafran, 2004) identified over 100. That list has grown greatly in the last 15 years and appears now to number in the hundreds.

There is no practical way to use hundreds of processes of change to guide assessment and treatment. We must simplify the list by using theory and evidence. We will use the term "model" to describe an integrated set of change processes that are used as a guide to the selection and deployment of interventions.

Clear Philosophical Assumptions

Processes of change have meaning inside a network of concepts, data, and assumptions. Clarity of assumptions is key to preventing confusion with a model. For example, a developmental stage model may include concepts that are based on the idea that psychological events are similar to developing organic systems, such as flowers or trees. In that organicist metaphor (Pepper, 1942), apparently disorganized or contradictory events come to be revealed as steps toward the final causes that are ultimately reflected in development. The rebellion of a teenager, for example, can later be understood to reflect healthy differentiation from parents and their behavioral control. Coherence is the implicit truth criterion in such analyses.

The philosophical assumptions that underlie a change process of that kind are quite different from those based on a formistic set of assumptions in which the goal is to characterize the particular event and name the classes of events it reveals. That same teenager might be diagnosed as having conduct disorder based on the type and frequency of their rebellious acts. Simple correspondence is the implicit truth criterion of that kind of nosological endeavor. Still another analyst might view the behavioral pattern contextually and suggest that the teenager deploys it to avoid, say, fear of rejection or failure. Workability is the truth criterion for such claims. Another might view it mechanistically as the result of an abnormal anatomical connectivity between the amygdala and the orbitofrontal cortex (Passamonti et al., 2012). Predictive verification is likely the underlying truth criterion.

If a model incoherently combines these sets of assumptions, then analytic confusion and wasted research energy will result. Concepts are vitalized by their connections to other concepts and by their accomplishment of underlying models of truth. For example, contextual theorists might show that with careful use of reinforcement, stages of development might be reordered, leading them to believe that they have revealed the inadequacy of a stage model or organicist position. That kind of research misses the whole point about normative stages in the vain attempt to turn a coherence model into an unwilling workability model. An acorn is "meant to be" an oak tree if the normal organic process is allowed to occur *and* if the acorn can end up as part of an autumn stew.

This example points to the futility of turning philosophical differences into empirical battles, but when we mix assumptions incoherently within a single model, useless conflicts occur *within* that research program. That possibility helps explain why consensus processes

among intervention science educators have led to calls for routine training in philosophy of

science in graduate education (Klepac et al., 2012).

Philosophy of science is little more that owning one's own assumptions. There is a

degree of philosophical incommensurability between distinct models, but if we allow the data

to be interpreted from different vantage points, then scientific cooperation is still viable across

assumptions once people know what they are assuming.

Comprehensive, Coherent, and Functional

Models of change processes need to cover enough key processes over a sufficient range

of problems and sub-issues with a client to serve as a reasonable guide to care. The processes

identified in the model need to address key dimensions of the human experience, such as

motivation to change, sense of self, or affect. Ideally, the process selected will focus not only on

ameliorating problems but also on establishing prosperity. The reasons for these statements

are pragmatic. If models of change processes are to form the basis of an alternative to the DSM,

then they must be simple and few. Scores and scores of models are just as practically

problematic as scores and scores of diagnoses, or scores and scores of individual change

processes.

The processes of change included in any given model must fit together in a coherent

fashion, and there needs to be evidence that the set is complete or at least not clearly limited.

The nomothetic knowledge displayed in a model needs to tell researchers and practitioners

what is likely going on at the level of the individual. At its highest level, that means models of

change processes should lead to new forms of functional analysis that allow practitioners to

select treatment elements that produce better outcomes. Research on the impact of suggested

components and kernels should itself be extensive and theoretically coherent, and there should be an encouragement to go beyond brand-name techniques in the testing program if these methods fit the underlying model. We must show clear links between the process model and the treatment element choice, and the practitioner should find these links to be useful.

Another way to say this is that the treatment utility of individual functional analysis emerging from the model is the key outcome for models of change processes (Hayes, Jarrett, & Nelson, 1987). However, conceptual utility is also important, such as the ability of the models to account for data in related areas, including the role of the therapeutic relationship, the impact across means of delivery, the role of cultural background, and so on.

Broadly Applicable and Potent

Finally, the model must be applicable and potent across a broad range of clients. The field of intervention science needs the initial 20 percent of process focus to do 80 percent of the work in terms of outcome. The 80 percent of additional process focus, which accounts for the last 20 percent of outcomes, can wait for later.

Summary

Models of change processes that hope to vie for status as alternatives to syndromal diagnosis have a heavy burden to carry. They need to be broadly applicable across clients, reasonably comprehensive as applied to the individual client's issues, and still philosophically and theoretically coherent. Most of all, they need to be potent in leading to individual treatment choices that increase client outcomes.

Creating a Model of Models

In recent writings, we have argued that model developers need a way of organizing their work that avoids local theoretical disputes, empowers effective communication, and leads toward the needed features of proposed change processes and models of those processes (Hayes et al., 2019). Having a common communication system is one benefit of the DSM, and it is worth trying to develop such a system within process-based approaches. Of all the alternatives available, only one overarching approach seems to have the heft and breadth needed to accomplish all those goals. It is our position that we should structure our efforts around the queen of all theories in the life sciences: a multidimensional, multilevel extended evolutionary account (Hayes, Monestès, & Wilson, 2018; Wilson & Hayes, 2018).

There was recently a time when evolution could be straightforwardly defined as a "change in gene frequencies in a species due to selective survival" (Bridgeman, 2003, p. 325), and to this day the word "evolution" is generally heard to mean "genes." It is an irrelevant echo from the past. Today, the progress of evolutionary science has fundamentally changed that view.

Mapping of the human genome has conclusively shown that genes do not code for specific phenotypic attributes (Jablonka & Lamb, 2014), in psychopathology or anywhere else. As an example, a recent study with genomic mapping of nearly half a million participants examined the 18 most-studied candidate genes for depression and compared them to randomly selected genes (Border et al., 2019). They concluded "no clear evidence was found for any candidate gene polymorphism associations with depression phenotypes or any polymorphism-by-environment moderator effects. As a set, depression candidate genes were no more associated with depression phenotypes than noncandidate genes" (p. 376). Other

studies have reached similar conclusions with mental health syndromes (e.g., Cross-Disorder Group of the Psychiatric Genomics Consortium, 2013), putting a dagger through the heart of the behavioral genetics dreams of yesteryear in which it was thought small sets of genes would prove critical in the development of specific forms of psychopathology. That hypothesis has been conclusively disproven.

This does not mean genes do not matter. They do—but as part of entire networks of evolving dimensions, including gene systems, epigenetic regulation of gene systems, neurobiological processes, environment, behavior, learning, symbolic events, culture, the gut biome, and so on (Jablonka & Lamb, 2014). As evolutionary science becomes that broad, we can use a multidimensional, multilevel extended evolutionary account to organize behavioral interventions (Wilson, Hayes, Biglan, & Embry, 2014) and to provide a structure for models of processes of change (Hayes et al., 2019).

Learning to Be VRSCDL: Six Key Concepts from Evolutionary Science

There are six key concepts and four key questions needed in an evolutionary approach. The six concepts can be expressed in the acronym VRSCDL (pronounced as if it is the word "versatile"), which stands for **V**ariation and **R**etention of what is **S**elected in **C**ontext at the right **D**imension and **L**evel (Hayes, Stanton, Sanford, Law, & Ta, in press). In a well-rounded evolutionary account, these concepts are applied to any phenomenon using Niko Tinbergen's (1963) four central questions: function, history, development, and mechanism.

Variation is the seed corn of evolution. Initially, variation is blind, but because variation is so central to the successful development of complex systems, variation itself evolves. For example, when facing stressful environments, various life-forms—ranging from bacteria to

mammals—increase mutation rates and decrease DNA repair (Galhardo, Hastings, & Rosenberg, 2007). "The collection of species we have with us today is not only the product of the survival of the fittest, but also that of the survival of the most evolvable" (Wagner & Draghi, 2010, p. 381).

Selection and *retention* are the processes of noting the impact of environment-behavior interactions and keeping variants that have beneficial impact. In natural selection, success is a matter of life and death, and retention occurs through genetic and other forms of heritability being passed on from the living. In behavior, contingencies of reinforcement may help establish habits, and in cognition, coherence and problem solving may lead to schemas and core beliefs.

Variation and selective retention occur within a *context*. It is context that determines selection pressures, but it becomes a focus of conscious attention only when the goal is intentional evolutionary change. For example, some new forms of emotional expression may only take hold if an individual deploys this expression in the context of a loving relationship. Concerns over natural contingencies, cultural fit, social support, and so on are all typical ways that practitioners speak of context in an evolutionary sense.

All species capable of contingency learning can select environments by their behavior ("niche selection"), but many can also create physical and social contexts that alter production and reproduction, what is called "niche construction." Humans are especially adept at niche construction. For example, they may deliberately create the kinds of relationships in which emotional growth is possible. That impact is one reason learning is the ladder of evolution (Bateson, 2013).

Variation, selection, retention, and context apply across different streams of inheritance or *dimensions*: genes, epigenes, and so on. Within the psychological domain, several dimensions can be readily discerned, including affect, cognition, attention, motivation, self, and overt behavior.

Finally, selection operates simultaneously at different *levels* of organization. For instance, the normal human adult is composed of over 37 trillion cells (Bianconi et al., 2013). Millions of them die each second, but overall, they do better as part of an organism than they would on their own. If even one "decides" to just make more of itself, the body will try to detect and kill it; and if the body fails to do so, the person develops cancer. This shows how multilevel selection works. Cooperation at the level of a group can be selected (such as the major evolutionary transition that led to multicell organisms), provided the selfishness of lower levels of organization can be restrained.

We can apply VRSCDL features in a robust evolutionary account to any or all Tingergen's questions (1963): how the *function* of variants alters adaptation (a topic central to "functional analysis"); how these variants emerge and are retained over time in their evolutionary *history*; how these variants *develop* within the lifetime of the organism; and how specific external and internal *mechanisms* combine to produce particular phenotypes, physical or behavioral.

The Model of Models

We can now combine these ideas into a "model of models" (Hayes et al., 2019). While not comprehensive, we can classify processes of change in intervention science into six key psychological dimensions (affect, cognition, attention, self, motivation, and overt behavior), nested into two additional levels of selection (sociocultural and physiological). In each of these

dimensions and levels, variation, selection, retention, and context are key, or to use terms that

are more familiar to practitioners, each of these involve processes and procedures related to

change, function, habits or patterns, and fit and support. Finally, these can be adaptive or

maladaptive.

Figure 1.1 presents the "model of models." We claim that a process-based model will be

relatively adequate to the extent that it has most of these rows and columns specified in their

targeted processes of change and intervention kernels or kernel selection criteria. All other

things being equal, models that cover more of this matrix will be more useful; those that cover

less of it will be less useful.

[[INSERT FIGURE 1.1 ABOUT HERE]]

We present the criteria and this model as a kind of organizational structure within which

to consider the arguments and data presented in this volume.

In the first section of this book, we explore the movement toward process-based models

and theories. In particular, chapter 2 discusses the RDoC initiative by NIMH, describes the

motivation and approach of RDoC, and provides an update on its current status and future

directions. Chapter 3 describes the shifting paradigms from the DSM to processes of change by

exploring a social constructionist and systems perspective on a process-based approach.

Chapter 4 identifies and discusses various psychological vulnerabilities and coping strategies

that can inform a transdiagnostic, process-oriented, and treatment-relevant classification

system.

In the second section of the book, we examine domains critical to our understanding of processes of change. One powerful patient variable that influences treatment response to virtually any approach is the role of expectancy, and chapter 5 examines the implications of this patient variable on classification and treatment. Chapter 6 explore some implications of learning, language, and derived symbolic relations for a process-based approach. Chapter 7 discusses the cultural and social influences on individual variation in emotional responses, suggesting that psychopathology is also a sociocultural construct.

In the third and final section of the book, we examine various methodological and level of analysis issues, and we explore examples of research programs that have taken a process-based focus. Chapter 8 shows that a complex systems approach offers the conceptual framework and methodological tools to create a process-based system. Chapter 9 discusses the importance of psychological flexibility as a key change process and shows how exploration of psychological flexibility in the area of chronic pain has led to a progressive process-based research program. Chapter 10 discusses how a multilevel, multi-method approach can facilitate the identification of functionally based mechanisms of action that promote treatment change, again using psychological flexibility as a focal point. Finally, chapter 11 evaluates this "model of models" and discusses how well it appears to deal with a diverse range of findings and concepts as researchers and practitioners alike begin to take a process-based approach to the elements that need to be considered to create an alternative to the DSM. This final chapter also explores some of the practical issues the field will face and provides a glimpse into a future in which process-based assessment and process-based therapy are the recognized core of evidence-based treatment.

We are at an exciting choice point as a field. The visionary dreams of the founders of evidence-based care are being revisited and seen now in decades of effort that led both to successes and dead ends. If the future of evidence-based treatment is process-based, then we need to create an alternative to the DSM. It is time to begin.

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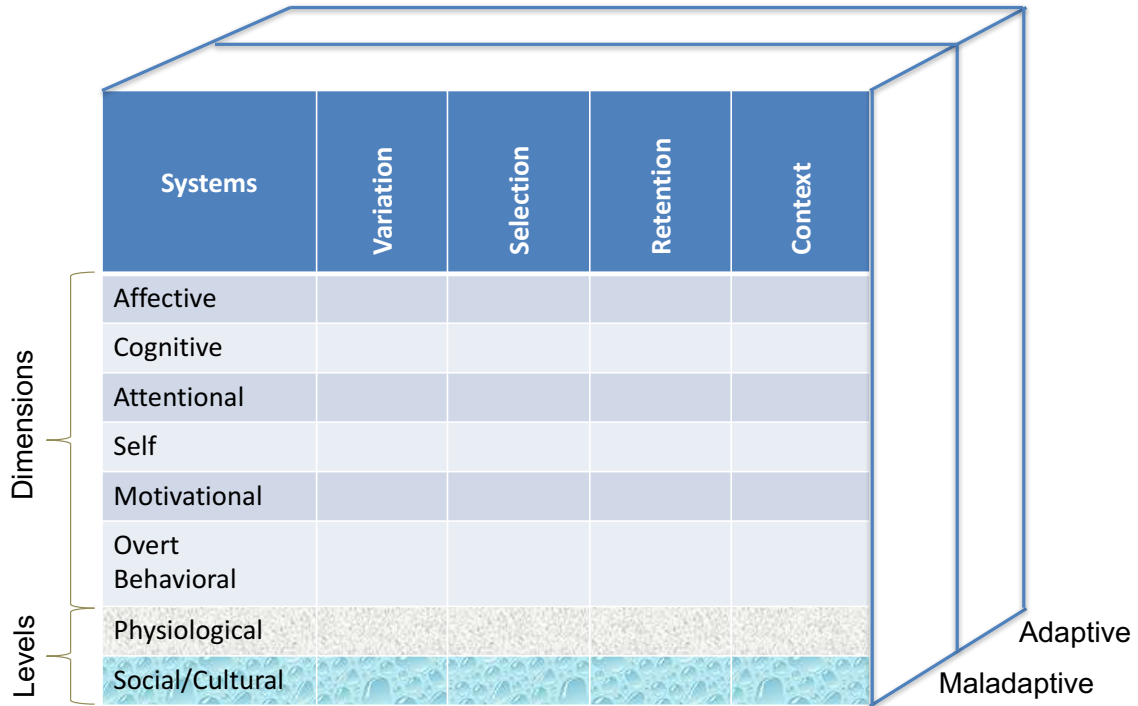
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Figure 1.1. The Extended Evolutionary Model of Models of Processes of Change