

An Idionomic Approach to Processes of Change.

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Evolving an Idionomic Approach to Processes of Change:  
Towards a Unified Personalized Science of Human Improvement

Steven C. Hayes  
University of Nevada, Reno

Joseph Ciarrochi  
Australian Catholic University

Stefan G. Hofmann  
Philipps-University Marburg and Boston University

Fredrick Chin  
University of Nevada, Reno

Baljinder Sahdra  
Australian Catholic University

RUNNING HEAD: An Idionomic Approach to Processes of Change

## Abstract

The wide variety of “third wave” cognitive behavioral therapy (CBT) methods (e.g., Acceptance and Commitment Therapy or “ACT”, Compassion Focused Therapy, Meta-Cognitive therapy, Functional Analytic Therapy, Dialectic Behavior Therapy, Mindfulness-Based Cognitive Therapy) have left a mark on the field that appears to be growing. As ACT enters its 40<sup>th</sup> year, the present paper examines key features of its development strategy as a ground from which to consider the future of CBT and evidence-based therapy. We discuss four key features of ACT development: universalism, multi-level and multi-dimensional processes linked to basic principles, idiographic concepts and methods, and an evolutionary approach. We argue that these features have facilitated the development of Process-Based Therapy (PBT) and its Extended Evolutionary Meta-Model (EEMM) of processes of change, but that idiographic methods need special contemporary emphasis, because traditional methodological and statistical approaches to processes of change are based on mathematical assumptions that cannot be met and thus limit progress in this area. We argue we need to target multi-level, multi-dimensional biopsychosocial processes of change evaluated via a functional, idionomic approach that begins with frequent idiographic assessment, and then scales to nomothetic (group level) findings when it improves idiographic fit. To identify candidate processes of change, we review the world’s literature on mediational findings of randomized trials of psychological interventions for mental health outcomes. After examining nearly 55,000 studies, we identify 72 measures that have successfully mediated intervention outcomes and have been replicated. The EEMM can readily summarize and understand that set of findings, and idionomic statistical methods are available to turn these processes into a new empirical form of functional analysis applicable to the individual’s goals and needs. PBT frees intervention science from the unhelpful latent disease model and creates an approach that promises more rapid progress toward a unified, personalized science of human improvement.

## Evolving an Idionomic Approach to Processes of Change:

## Towards a Unified Personalized Science of Human Improvement

Nearly 20 years ago, Hayes (2004) argued that cognitive behavioral therapy (CBT) had entered a “third wave” of development. That argument was not based on the advances of any one method so much as on the resonance provided by concurrent changes that were occurring in both the behavioral and cognitive wings of CBT. Methods such as acceptance and commitment therapy or training (ACT; Hayes, Strosahl, & Wilson, 1999), dialectical behavior therapy (DBT; Linehan, 1993), mindfulness-based cognitive therapy (MBCT; Segal, Williams, & Teasdale, 2001), meta-cognitive therapy (MCT; Wells, 2000), functional analytic psychotherapy (FAP; Kohlenberg & Tsai, 1991), modern forms of behavioral activation (BA; Jacobson et al., 1996), compassion focused therapy (CFT; Gilbert, 2005), and several others (Hayes, Follette, & Linehan, 2004) were all doing interesting things that did not look like traditional forms of behavioral and cognitive therapy but that contained some overlapping features. Through a variety of concepts or techniques, each of these methods addressed the degree to which people could become more emotionally open and cognitively flexible, more aware and voluntarily focused on the present moment, and more actively engaged in a values-based life (see Hayes, Villatte, Levin, & Hildebrandt, 2011 for a review). That got the attention of the field, and virtually no one in the modern era now denies that a major shift in the focus and form of CBT did in fact occur. This shift extended even beyond what is traditionally labeled as CBT, to interpersonal, psychodynamic, and other forms of intervention (Biano, et al., 2016; Ciarrochi, et al, 2021; Dunn, et al., 2013; Mahan, et al., 2018).

The so-called “third wave” of CBT did not tear down what was already present—it was not intended to—but it left a lasting mark that continues to grow. There was an understandable initial tendency to treat these new methods merely as additional techniques in the CBT toolbox. More limited forms of accommodation within mainstream CBT, such as merely adding mindfulness

methods or more thoroughly exploring chosen values, papered over the larger conceptual changes that were underway. As time has gone by, it is becoming clear those larger changes are growing.

We intend in this paper to expand and extend previous papers that have characterized some of the key areas in which third-wave CBT altered the research and practice landscape of CBT (e.g., Hayes & Hofmann, 2021; Hofmann & Hayes, 2019) by focusing on ACT development per se. We will argue that with the advantages of hindsight, it has become evident that the definitional nature of evidence-based therapy itself was being altered, with profound implications for the future of applied psychology. In particular, we intend to use an examination of ACT development as a jumping off point onto the developing area of Process-Based Therapy (PBT; Hayes, Hofmann, 2018; Hofmann, Hayes, & Lorscheid, 2021) and the fundamental methodological and conceptual changes we think PBT brings to the field. PBT itself results from a decades-long collaboration between two wings of thought in behavioral and cognitive therapy, and in some ways focusing on ACT development is a more useful foundation to explore those issues because it cuts closer to how that collaboration has unfolded, given the scientists involved.

We believe that the third-wave has led to the following changes in intervention emphasis:

*Context over content.* In the newer forms of CBT, the focus is less on the proper form of private experiences (are particular thoughts rational or irrational, for example) and more on their impact, function, or context. A classic quote by founders of MBCT expressed this idea clearly, but it applies to virtually all “third wave” methods: “unlike CBT, there is little emphasis in mindfulness-based cognitive therapy on changing the *content* of thoughts; rather, the emphasis is on changing *awareness of* and *relationship to* thoughts” (Segal, Teasdale, & Williams, 2004, p. 54, emphasis in original). Most of what is “new” in third wave interventions—mindfulness, attentional flexibility, acceptance, values, and decentering, among others—has a “context over content” focus.

*Addressing more complex aspects of the human condition.* The newer forms of CBT routinely engage issues that are historically more aligned with humanistic, existential, analytic, or system-

oriented approaches. That trend was discernible two decades ago, but it is obvious now. Literally no topic of relevance to psychological intervention writ large is outside the bounds of contemporary CBT research and practice, from Kundalini Yoga (Simon et al., 2021) to psychedelic therapy (Watts & Luoma, 2020); from loving kindness and compassion focused meditation (Hofmann, Grossman, & Hinton, 2011) to intense work on the therapeutic relationship (Kanter et al., 2017) and existential concerns (Ciarrochi et al., in press).

*Processes should apply to the clinician, not just the client.* Newer forms of CBT ask therapists to develop a personal practice, or to work on their own psychological development. Research studies regularly focus on the impact of third-wave methods on the mental and behavioral health of practitioners themselves (see Rudaz et al., 2017 for a meta-analytic exemplar).

*Building on existing strands of CBT.* While the above features are new, at least as a matter of emphasis, one feature that did not change was viewing the behavioral and cognitive therapies as a cumulative exercise, in which treatment would be based on basic empirical principles that themselves evolved. From the beginning, third-wave ideas were linked to a goal of transforming earlier methods and models “into a new, broader, more interconnected form; thus, while the implications may be revolutionary, the processes giving rise to these developments are evolutionary” (Hayes, 2004, p. 660). As one concrete indication, this very article is being written by researchers known for their participation in very different branches of behavioral and cognitive therapy, yet who see common grounds for a more integrated future.

While these general features of the impact of third wave methods seem clear, the specific features of ACT development per se have never been thoroughly examined as a ground from which to consider the future of CBT and evidence-based therapy. Now seems like an appropriate time for that exploration. ACT is 40 years old, the total length of a typical academic career (the first workshop ever given on ACT was Hayes, 1982). If the originator of ACT is to be involved, this examination is well timed for that reason. ACT has also matured, and features that would have taken a mother’s eye

to discern when the arrival of the “third wave” was first announced, are now easy to describe and to consider. Finally, we argue that profound changes are afoot in evidence-based therapy that both comport with and can be advanced by key features of the ACT development strategy.

### **ACT Research and Development**

The so-called “third wave” could never have happened based on ACT alone – it took DBT, MBCT, FAP, BA, MCT, CFT, and many more. When the first ACT text (Hayes, et al., 1999) or general ACT self-help book (Hayes & Smith, 2005) arrived, roughly two decades after ACT development began, they came with a highly unusual (some might say “unusually limited”) set of developments to offer to behavioral science and practice. These included extensive work on philosophy of science issues, about a dozen or two intensive time series designs on a new approach to cognition, a set of processes of change (“psychological flexibility”) linked to that basic science and philosophical work, and a handful of randomized controlled trials spread across multiple topical areas.

In the context of the time, we can view such decades of work and accomplishments as reflecting an odd and probably flawed path of development. ACT researchers tended to not target specific diagnoses, refrained from producing standardized protocols, and, initially, produced few psychometrically valid and reliable measures of key concepts. The supposedly new basic cognitive principles or refinements of philosophy of science matters were hard for most to evaluate, to understand, or even to find interesting.

If we move forward to the present day, the rate, range, and international visibility of ACT research have increased exponentially. Although randomized controlled trials were by design a limited portion of the overall research program (and arguably not the most important portion), they are easy to count and provide a concrete sign of that growth. The first 25 years of ACT research produced 1.3 randomized controlled trials (RCTs) per year. The rate of RCTs increased over the next five years to 26 a year (2010-2014), then 84 per year over the next five-year period (2015-2019); and

most recently (2020-May 2022) to about 145 per year (see [bit.ly/ACTRCTs](https://bit.ly/ACTRCTs)). At the current rate, the total number of ACT RCT's will likely exceed 1,000 during the next 12 months. We have seen similar increases in most of the other forms of research linked to the research program.

ACT's atypical development strategy and undeniable productivity underlines why reviewing ACT development might be worthwhile. Characteristic features of a developmental program can become more impactful when combined with such high rates of research output, and that appears to have occurred. Two features of ACT research and development were that it was never definable as the study of protocols linked to psychiatric syndromes, and it emerged from a broadly focused form of philosophical, basic, and applied behavior analysis.

Historically speaking, that is hardly unique. Behavior analytic approaches that had little or no interest in psychiatric syndromes were once a strong presence in behavior therapy (e.g., Barlow & Hersen, 1973; Kanfer & Grimm, 1977). A behavioral analytic approach quickly withered in clinical areas, however, as functional analysis linked solely to direct contingencies stumbled badly (Hayes & Follette, 1992) and more broadly applicable cognitive models emerged. The Diagnostic and Statistical Manual of the American Psychiatric Association was revised and became much more utilized as the 1980's began (DSM-III; American Psychiatric Association, 1980), and funding exploded for CBT research laboratories doing randomized trials of protocols targeting these psychiatric syndromes. The enormous empirical success of CBT was soon apparent, in part because of its freedom to explore cognition without artificial behavioristic constraints. CBT's linkage to syndromal targets extracted a high price, however, as over time there was a diminished focus on philosophical assumptions and processes of change (Hayes & Hofmann, 2018).

An additional organizational factor that is often forgotten is that these same changes also encouraged behavior analysts to leave the various behavior therapy and CBT associations (e.g., the Association for Advancement of Behavior Therapy or ABCT) and form their own separate groups (e.g., the Association for Behavior Analysis International or ABAI). As a result, newer developments

in behavior analytic philosophy or basic principles became increasingly invisible to mainstream intervention science.

ACT was different. It began as a form of clinical behavior analysis linked to a single research program that is now known as “contextual behavioral science” (CBS; for a book-length description, see Zettle et al., 2016). CBS adopted a pragmatic philosophy of science called functional contextualism as a refinement of radical behaviorism (Biglan & Hayes, 1996). The most important difference between the two was that truth in CBS was to be based on “successful working” as measured against the chosen goal of prediction and influence of psychological events with precision (only a limited number of principles apply to a given event), scope (principles should apply to a range of event without loss of precision), and depth (all principles and theories should cohere with well-established principles and theories at other levels of analysis – so for example psychology should never find itself in conflict with good quality neuroscience). This modification replaced the traditional Skinnerian claim that prediction and control was the purpose of all science. Adding “with precision, scope, and depth” ensured that limited technological advances would not be confused with fundamental scientific ones; replacing “control” with “influence” helped avoid the distracting fantasy of scientists controlling the world; and treating scientific purposes as transparent public statements of shared but personal goals avoided the offensive dogmatism of telling other scientists what they *should* value (e.g., “prediction and control” over understanding, appreciation, or other goals they may have).

The most distinctive core feature of CBS that separates it from either traditional behavior analysis, or from other behavioral and cognitive models, was its tight linkage to a new empirical approach to language and cognition, Relational Frame Theory (RFT; Hayes, 1991; Hayes, Barnes-Holmes, & Roche, 2001). RFT viewed human higher cognition as an evolutionarily new form of relational learning. Many of the early canonical papers on ACT (see Hayes, 2015 for book length treatment) focused on how this approach to human symbolic reasoning might affect evolutionarily

earlier forms of learning such as operant or classical conditioning (Hayes, 1989), or how both philosophical and methodological adjustments would likely be needed to address cognition from this point of view while maintaining the anti-mentalistic stance of behavior analysis (Hayes, Hayes, & Reese, 1988).

One way to understand the combination of RFT and contextual philosophy of science is by contrasting it with mentalism. Mentalism came to be defined as treating one psychological action as the cause of another without an analysis of the contextual source of that relationship (Hayes & Brownstein, 1986). In the RFT approach, even terms like “spirituality” (never mind “thought,” which is much easier) can be used non-mentalistically and linked to modifiable aspects of context (Hayes, 1984). Conversely, even appealing to the impact of one overt behavior over another could result in the mentalistic error if context was ignored. RFT specified the kind of contextual features that can lead to an impact of cognition on overt action.

The RFT research program explored these features, and the ACT program gave them applied form. For example, instead of necessarily having to change the *form* of unhelpful thoughts (which is done by changing what RFT calls the *relational context*), ACT often tries to change the *impact* of thoughts via what in RFT is called the “transformation of stimulus functions” which is regulated by the *functional context*. Cognitive defusion methods such as word repetition or singing thoughts aloud are classic ACT examples of methods that alter the functional context, while leaving the relational context intact (e.g., a word like “milk” said repeatedly for 30 seconds still refers to milk when that repetition stops, but its believability and perceptual impact has plummeted; Masuda, Hayes, Sackett, & Twohig, 2004).

Early work in RFT appeared largely in journals only behavior analysts would be likely to read, such as *The Behavior Analyst*, or the *Journal of the Experimental Analysis of Behavior*. Over time, RFT researchers brought a kind of home-grown “contextualistic cognitive revolution” into

behavior analysis itself, but with a research program and analysis that was quite distinct from mainstream cognitive science (e.g., DeHouwer, 2011) and from CBT itself.

RFT research is still highly controversial inside behavior analysis (e.g., Gross & Fox, 2009) but over the decades it has led to a vigorous applied behavior analytic program in language training (e.g., Dixon et al., 2015), improvement of intelligence (May, Tyndall, McTiernan, Roderique-Davies, & McLoughlin, 2022), assessment (Janssen, McEnteggart, Barnes-Holmes, Ee, & Egger, in press) and other areas outside of ACT intervention per se. Like ACT, the last dozen years have seen a notable expansion in the rate of RFT research and its impact (see O'Connor et al., 2017), including in areas not normally thought of as behavioral, such as artificial intelligence (Edwards, et al., 2022).

Unlike any of the other modern cognitive theories linked to clinical psychology, empirical research on relational framing was from the beginning almost entirely idiographic – virtually all the key basic studies were conducted using longitudinally intensive experimental analyses of small handfuls of participants. Early RFT work showed that verbal rules readily produced insensitivity to programmed consequences (e.g., Hayes, Brownstein, Haas, et al., 1986; Hayes, Brownstein, Zettle, et al., 1986) and that, beginning in infancy, relational learning produced forms of stimulus control that are not known to exist in non-human animals (Devany, Hayes, & Nelson, 1986; Lipkens, et al., 1993; Steele & Hayes, 1991). RFT research was dominantly idiographic, and had a natural process focus because it centered on how relational learning interacts in important ways with direct behavioral principles. In effect, RFT argued within behavioral circles that CBT was correct about the need for a central focus on cognition, but also that a more behaviorally based approach to higher cognition could lead to new processes of change and new forms of intervention that traditional cognitive and other mainstream accounts may not detect. The psychological flexibility model in ACT, which we will review shortly, was the ultimate result.

Developing basic behavioral principles regarding cognition and trying to scale those principles into broadly applicable processes of change is inherently slow work. That was one reason early behavior therapists abandoned this approach once functional analysis faltered and traditional behavioristic accounts of cognition failed. With ACT and RFT, it took over two decades of work before a more traditional looking clinical outcome research program was even possible, coming together about the time the first ACT text was published (Hayes et al., 1999).

### *Developmental Features with Present Day Implications*

We are not attempting to write a thoroughgoing history of ACT. Rather this thumbnail summary was done to allow us to highlight a few features with strong present-day implications that we have explored as a team in PBT. We will pause to summarize these before turning to the substantive fruits of this development program, which have also proven relevant to the PBT project.

From the beginning, ACT was not just transdiagnostic, it was *universalist* – which is the first feature of ACT development that we wish to call out. For example, the earliest writings on ACT focus on how the clash between relational learning and direct contingency and social learning could lead to processes of change that applied across virtually all diagnoses and beyond (Hayes, 1984; 1987).

We can see this concretely by considering the 33 randomized controlled trials conducted on ACT in its first 25 years (1986 through 2009). The research output was quite limited, with studies per year ranging from zero to seven, but these studies were conducted on depression, pain, stress, coping with hallucinations and delusions, anxiety, substance use, weight loss, clinician burnout, clinicians' ability to be trained in other evidence-based methods, smoking cessation, trichotillomania, reducing epileptic seizures, quality of life in dermatitis patients, reducing self-harm, managing diabetes, reducing the impact of self-stigma, and reducing prejudicial beliefs. DSM disorders are present in that list, but they do not dominate it. Behavioral health, social wellness, therapist performance, and non-syndromal perspectives on mental health are arguably just as important.

Based solely on that list of targeted populations, it would be hard for mainstream observers in psychotherapy to characterize what the ACT research program was even about. At times it ranged so far beyond psychotherapy and mental health that it might not be understood to be a program in evidence-based intervention at all. As recently as 2014, meta-analyses of the ACT research program concluded that it is “not yet well-established for any disorder” (Öst, p. 105), partly based on the concern that DSM-based diagnostic interviews and other such expected features were often not used in ACT studies (Atkins et al., 2017).

ACT research is more understandable, however, once we notice its focus on broadly applicable *multi-level and multi-dimensional processes of change based on basic principles*. A process focus linked to basic principles (e.g., behavioral principles as expanded by RFT) has been characteristic of ACT research from the beginning (as we have just noted in the brief example of defusion above). This is the second feature of ACT development that we want to emphasize.

Consider the first two ACT randomized trials ever done (Zettle & Hayes, 1986; Zettle & Rains, 1989). The first was a small comparison of ACT with Beck’s Cognitive Therapy for depression (successfully conducted incidentally only because Beck and the staff at the Center for Cognitive Therapy kindly provided active support for it: see Hayes, 2022). The second compared ACT with cognitive therapy, with or without distancing. Despite their occurrence in the 1980s when this was highly atypical, both studies contained innovative measures of cognitive defusion that today we might call meta-cognitive. As a result, subsequent mediational analyses of both studies could be conducted (in 1986 these analytic methods were not even known to exist), finding that defusion mediated the differences between ACT and Cognitive Therapy in these early trials (Hayes, Luoma, et al., 2006; Zettle, et al., 2011).

These two initial features (universalism and a process-focus) arguably interact and support each other. Both emerged naturally from CBS as a functional contextual system, since the goal was always to develop concepts and models with high levels of precision, scope, and depth that could be

applied to understanding how higher cognition interacted with older learning and biological processes. ACT is based on an integrated process model (see Hayes, 2019, for a recent book length summary) composed of six specific change processes reviewed below (cast in positive form: acceptance; defusion; flexible attention to the now; a perspective-taking sense of self, or “self-as-context”; values; and committed action) and a myriad of studies focused on their modification using kernels and components (e.g., Levin et al., 2012; Villatte et al., 2016).

A third feature of the ACT model was its idiographic quality, due to the use of idiographic concepts from RFT and behavioral principles. Instead of a small set of broad report instruments with diagnostic cutoffs, processes of change within ACT have often been specifically targeted, assessed in a variety of ways, including via overt behavior, fitted to clinical need, and regularly examined in an idiographic and longitudinal fashion. As early as 2006, there were already over 40 self-report process measures available, largely organized by specific processes of change and populations (Ciarrochi & Bilich, 2006). There are now several times that number. Some of these were designed for frequent use, such as the daily ratings of distress, struggle, workability, and values described in the original ACT book (Hayes et al., 1999). Even overt behavior measures as simple as breath holding as a measure of distress tolerance or emotional acceptance have been shown to mediate ACT results (Lillis, Hayes, Bunting, & Masuda, 2009). The goal of these measures was less to categorize persons on new diagnostic dimensions and more to characterize the functional linkages between life events, such as between affect and avoidance, or thought and behavioral compliance, and so on (e.g., Vilardaga et al., 2013).

The hope was always that laying a firm process-focused universalist idiographic foundation would eventually yield exponential progress as a broadly applicable process model was deployed across a broader and broader range of targets. That has proven to be true, as evidenced by the exponential growth and expansive reach of ACT research. There are also several important contemporary problems that are alleviated when high levels of research output are combined with a

universalist, process-focused agenda that takes seriously the details of the needs, goals, and context of the individual.

First, it makes it far easier for non-Anglophile cultures to contribute. Only 12% of the world's population lives in WEIRD (Western, educated, industrialized, rich, and democratic) countries even though 80% of the world's scientific literature comes from there (Henrich, Heine, & Norenzayan, 2010). Specific goals can easily vary in the ACT process model, as can the means used to change psychological flexibility processes themselves, and this allows people to create forms of ACT that are not limited by WEIRD cultural assumptions. Lower- and Middle-Income Countries (LAMICs) have now published hundreds of ACT RCTs or other studies (e.g., see [bit.ly/ACTRCTs](https://bit.ly/ACTRCTs)). Many of these studies are relatively small; sometimes, their methodological quality is weak. But studies from LAMICs often ask questions that would never even occur to those in major Western medical centers, and they are highly valuable if diversity, equity, and inclusion matters. A study on, say, how to integrate ACT into Islam (see [https://contextualscience.org/act\\_and\\_islamic\\_research](https://contextualscience.org/act_and_islamic_research) for dozens of examples) is far more likely to be done in Iran than Sweden or the United States, and it fills in key knowledge gaps that Western researchers can miss.

Second, a process focus can fit more diverse goals and contextual situations than a syndromal focus. When the World Health Organization (WHO) was looking for ways to help war refugees, they settled on ACT self-help precisely because it was *not* syndrome-focused, reasoning that the biopsychosocial sequelae of war and oppression are far too diverse for a traditional narrowly focused evidence-based therapy approach targeting DSM disorders. In order to explore the potential benefits of self-help to war torn populations, the WHO funded tests of an ACT-based cartoon book and audio tape designed to teach psychological flexibility skills with requiring literacy (Epping-Jordan et al., 2016). Multiple successful gold standard RCTs with South Sudanese and Syrian refugees in Uganda, Turkey, and the European Union found positive results (e.g., Purgato et al., 2021; Tol, et al., 2020), including a recent RCT study that documented a 50% reduction in the future development of mental

illness due to the program (Acarturk et al., 2022). WHO now distributes this program free in 21 languages worldwide (<https://www.who.int/publications/i/item/9789240003927>), including currently in the Ukrainian war region, stating that it is helpful for “anyone who experiences stress, wherever they live, and whatever their circumstances” (p. 5). The COVID pandemic and the rise of worldwide conflict has made that declaration from the world’s preeminent public health institution immediately relevant worldwide, but it could not have happened without ACT’s universalist, and process-oriented development program.

We are now ready to describe ACT’s psychological flexibility model in more detail. This is necessary to our discussion because the substantive products of ACT development are perhaps the most proximal features an average CBT professional examines when considering the relevance of ACT for the present-day challenges faced by our field, in contrast with the abstract features we have so far outlined.

### **The Psychological Flexibility Model: Open, Aware, and Actively Engaged**

The earliest basic RFT research area of importance to the ACT research program was rule-governance. Behavior analysts could show in a series of idiographic studies that basic behavioral principles affected human behavior in unique and characteristic ways once verbal rules came to dominate the psychological landscape. Most especially, once verbal rules dominated, there was often a reduced sensitivity to direct experience, or in more behavioral terms, to contacting changing contingencies in the environment (see Hayes, 1989 for a book length summary of that research).

#### **Pillar 1: Openness**

Based on such findings, the earliest efforts to create processes of change in ACT were focused on methods of augmenting or diminishing cognitive control over behavior (i.e., the impact of relational and symbolic events) in ways that better fit the context and current purposes of the client. This led ACT developers to focus on fostering greater cognitive flexibility using “cognitive defusion” methods that reduced the unwanted impact of thought, without necessarily changing their form or

frequency. A wide example of helpful defusion methods emerged – such as distilling an unhelpful thought down to a single word that is repeated rapidly aloud until it loses its meaning (Masuda et al., 2009; c.f., Titchener, 1916), or singing a difficult thought, or saying it in the voice of a cartoon character (Eilers & Hayes, 2015). Other forms of fostering cognitive flexibility were also used, such as rewriting one’s life story several times while maintaining the facts and emotional reactions but changing the storyline itself (Hayes et al., 2012, pp. 227-228), or describing one’s inner voice metaphorically as an advisor that one may choose to listen to, or disregard, depending on what builds value (Hayes, L., Ciarrochi, & Bailey, 2022).

Because people often use private experiences (anxiety) as indisputable reasons for action (e.g., avoidance), from the beginning (Hayes, 1984; 1987), ACT sought to undermine reason giving (Zettle & Hayes, 1986) and experiential avoidance (Hayes et al., 1996) in favor of an increased ability to experience or accept psychological events, such as emotions, memories, or bodily sensations, without creating behavioral harm. Examples of acceptance methods include the use of rationales, metaphors, and exercises for emotional openness (e.g., Hayes, Bissett, et al., 1999), graded emotional exposure, social sharing of feelings, or a deliberate deepening of emotional experience. An example of a classic ACT acceptance metaphor is viewing struggling with anxiety much as one would view struggling in quicksand; an example of an exercise would be to treat feelings as objects and to ask in detail about their size, shape, color, or speed. Meta-analyses show these methods work and do so via their putative mechanisms (e.g., Levin et al., 2012).

Thus, the first process “pillar” of psychological flexibility is greater openness. It had two primary aspects in the traditional ACT model: cognitive defusion and experiential acceptance. Conversely, the key repertoire narrowing processes expected in this area that contribute to psychopathology were argued to be cognitive fusion and experiential avoidance.

## **Pillar 2: Awareness**

The second process pillar in ACT is greater awareness. It begins with flexible, fluid, and voluntary attention to the present moment. Attentional training exercises are used, such as focusing on the soles of the feet (Singh, Lancioni, Winton, et al., 2007) and then gradually shifting from one foot to the other, and from either foot to both feet.

Because RFT research suggested that awareness occurs from a “I / here / now” perspective or point of view, the second feature of this process pillar involves the perspective taking cognitive relations of person (I / You), place (Here / There), and time (Now / Then). Instead of focusing on the person’s conceptualized self (e.g., “I’m a good person”) that can readily lead to judgmental distinctions between oneself and others, ACT therapists focused on a perspective taking sense of self (or “self-as-context”) that interconnects a person’s sense of awareness with that of others (for a book length treatment see McHugh, Stewart, & Almada, 2019). The reason for this was that it was thought to be a more flexible and less defended place from which to allocate attention to the present moment in a flexible, fluid, and voluntary way, and to practice greater psychological openness.

The conceptualized self encompasses stories about the self and comparisons to others. It is often characterized by cognitively fused verbal descriptions and evaluations of who we are, what we are like, the traits that define us, and how that relates to the descriptions and evaluations of others. For example, statements like “I’m inherently unlovable” or “I’m in the gifted and talented class – I’m not a loser” are characteristic of the conceptualized self. While the conceptualized self is argued to be inherently repertoire narrowing (whether the content is good or bad), self-as-context interventions create glimpses of the felt sense that “I / here / now” awareness extends across time, place, and person and then uses that kind of awareness in the service of the other flexibility processes such as deliberately augmenting attention to the present moment, internally and externally, in a way that is flexible, fluid, and voluntary.

An example of a self-as-context intervention might be to have the person deliberately bring a painful issue to mind and to experience it, and then imagine leave their body and to look back at

oneself experiencing it, but from the outside (as if one is two persons, a person experiencing pain and an observer). In guided imagery, the person is then asked to mentally go to a side of the room and look back at oneself experiencing it, but from now observing from afar. As the imagery unfolds the person is asked to imagine it is ten years later and they are much wiser but are only remembering this moment of looking back at oneself from the side of the room while addressing a painful issue. The person is then asked to write a short note of advice across time back to the person called “you” ten years ago who was suffering with some issue. This exercise deliberately manipulates perspective taking in terms of person, place, and time, and these notes are nearly universally kind and wise – and impactful.

### **Pillar 3: Engagement**

The final process pillar in ACT is values-based life engagement. There are two features of this pillar: values and committed action. Values are chosen qualities of being and doing that establish consequences that are intrinsic to behavior. In RFT terms values are a special form of “augmentals” – verbal constructions that alter the capacity of events to function as consequences. For example, an augmenting behavior might be, “I will find this exercise boring (negative consequence), but I know that it will keep me fit and let me play sports with my daughter (transformed to a positive consequence)”. Several intensive RFT studies have examined how augmentals work (Ju & Hayes, 2008) and how they can foster objectively measurable behavior change (Jackson, Williams, & Hayes, 2016). Committed action is the deliberate construction of larger and larger patterns of values-based action that contain those intrinsic qualities.

In many ways, this pillar is the “heart” of the ACT model. Values serve as the motivational basis for the rest of the model because they provide the globally desired life directions that establish intrinsic reinforcers. Because values are qualities of action, they are expressed as adjectives and adverbs, such as behaving lovingly, genuinely, honestly, creatively, kindly, and so on. Even very brief values interventions can have lasting impact (Chase et al., 2013). Clinically, there are many

avenues for values work: unpacking meaningful moments, identifying heroes, affirming values, identifying yearnings contained within painful moments, trying new activities to find ones that match preferences, and taking ownership of one's own life story.

The other aspect of the engagement pillar is the commitment to build larger and larger patterns of values-based action. A committed action is a clearly defined behavior or activity that a person engages in that is measurably in line with their chosen values and that has as its purpose the creation of persistent habits. Committed action is where the “rubber meets the road” of being able to move life in a valued direction. It has been studied with respect to a diverse set of different challenges that people may face and work through, including procrastination (Gagnon et al., 2016), persistence in the face of chronic pain (McCracken, 2013), and behavioral activation and depressive symptomatology (Trindade et al., 2018). A therapist working with an individual on committed action may employ strategies that emerged from a wide range of research in behavior change, including public sharing of goals, setting goals that are reachable and that represent doable incremental steps towards larger goals, gaining social support for commitments, creative values triggers (external cues to remind people of values commitments), activity scheduling, measuring progress, imagining the barriers and benefits to achieving a goal, and so on.

The six processes of psychological flexibility arguably define a coherent set for an important reason that requires a brief explanation. Behavior analysis always envisioned itself as an evolutionary science (Skinner, 1981) and positive evolution of any system requires what Donald Campbell (1965) called “variation and selective retention” of key features of the system fitted to the current context. We can see the six flexibility processes and three pillars in that light.

The first pillar of openness is necessary to foster healthy psychological variability given that it targets what are arguably two of the strongest repertoire-narrowing processes known in psychology: avoidance and excessive verbal rule-governance. The second pillar is necessary for context sensitivity since no behavioral process is always useful and conscious contact with the internal and external

context is what that center pillar is all about. The last pillar is composed of the selection criteria of chosen values and the retention processes of habitual repetition and behavioral integration of actions linked to those values. Thus, the psychological flexibility model fits with a multilevel and multidimensional extended evolutionary account of how human systems can evolve intentionally through healthy variation, intentional selection and retention, and conscious attention to contextual affordance (Hofmann & Hayes, 2019; Wilson et al., 2014). This is the fourth and last feature of ACT and CBS development we wish to call out. ACT has been driven by *evolutionary science* (see Wilson & Hayes, 2018 for a book length treatment of the relation between evolution and CBS). The deliberate development of this relation has led to new applied methods beyond ACT itself, such as the internationally deployed program for the development of more cooperative groups call *Prosocial* (Atkins, Wilson, & Hayes, 2019; see [www.prosocial.world](http://www.prosocial.world)) that combines ACT with Elinor Ostrom's Nobel Prize winning principles for the evolution of prosocial groups.

We have now called out the main features that seem characteristic in the ACT development strategy. ACT followed a universalist agenda tied to the search for high precision, high scope, multi-level and multi-dimensional processes of change that were informed by basic principles and ongoing basic research in human cognition, vetted idiographically, and integrated into an overarching evolutionary approach. A wide variety of modern CBT approaches reflect some or most of these same features. To take just a few of many good examples: Compassion focused therapy is clearly based on evolutionary theory (Gilbert, 2017); Functional analytic psychotherapy is universalist and was vetted ideographically (Holeman et al, 2017); Meta-Cognitive Therapy has an ongoing basic science program linked to processes of change (Wells, 2019); and so on. Arguably, however, these features are especially useful when taken as a whole, as we have shown they have been in ACT development. If that is the case, in interaction and collaboration with other wings of contemporary behavioral and cognitive thought, could this set of attributes contribute in useful ways to the main contemporary problems faced by applied psychology and intervention science more generally?

For the last decade, we have been exploring that very question in an ad hoc fashion, especially in the development of PBT. Our personal interests in ACT, RFT, or CBS vary greatly, but at the meta-level, our interests in the developmental features we have been exploring are shared, regardless of their source, and we have been bringing them to bear on how best to proceed in the current era of process-based individualization and personalization. To that topic we now turn.

### **Processes-Based Therapy as a Model of Evidence-Based Therapy**

How can we understand the needs of the individual in a way that is likely to produce better intervention outcomes? Let's call that the "practical clinical question." Functionally speaking that question has driven every aspect of our field for a good portion of a century. The late Gordon Paul addressed it in his famous formulation "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). When speaking of assessment, Paul Meehl (1959) said that "in what way and to what extent does this . . . information help us in treating the patient" (p. 117) was "ultimately the practically significant one by which the contributions of our techniques must be judged" (p. 116). The treatment utility (Hayes, Nelson, & Jarrett, 1987) of answering that practical clinical question is the core purpose of case conceptualization, diagnosis, functional analysis, theories of psychopathology, models of intervention, clinical assessment, moderation analysis, and an interest in processes of change, among several other central topics.

The behavioral and cognitive therapies, and evidence-based intervention science more generally, did not start out believing that vast collections of evidence-based protocols focused on DSM syndromes could ever rise to the challenge of that practical clinical question. Nevertheless, the DSM and its latent diseases model became the touchstone for evidence-based therapy for decades of work, many billions of dollars of grant funded research, and generations of students interested in mental and behavioral health.

Many scholars have written extensively on the status of syndromal classification, the present authors not excluded (e.g., Hayes, Hofmann, & Ciarrochi, 2020; Hofmann et al., 2021). Whatever else one wishes to say about it, confidence is waning in the idea that the DSM will prove to be sufficiently progressive to foster an adequate answer to the practical clinical question. The DSM 5 workgroup stated that

“( . . . ) the goal of validating these syndromes and discovering common etiologies has remained elusive. Despite many proposed candidates, not one laboratory marker has been found to be specific in identifying any of the DSM-defined syndromes. Epidemiologic and clinical studies have shown extremely high rates of comorbidities among the disorders, undermining the hypothesis that the syndromes represent distinct etiologies. Furthermore, epidemiologic studies have shown a high degree of short-term diagnostic instability for many disorders. With regard to treatment, lack of treatment specificity is the rule rather than the exception. . . . reification of DSM-IV entities, to the point that they are considered to be equivalent to diseases, is more likely to obscure than to elucidate research findings” (Kupfer, First, & Regier, 2002; pp. xviii-xix).

The subsequent virtual abandonment of the DSM by the U. S. National Institute of Mental Health (NIMH) as a way to organize its research portfolio and the almost spasmodic launch of the Research Domain Criteria (RDoC) initiative inside NIMH (Insel et al., 2010), reflects the loss of confidence by academic psychiatry in this syndromal approach. In a more fundamental scientific matter, the failure of modern genomic research to find robust evidence of a direct and readily testable biological basis for psychiatric syndromes (Scull, 2021), and the documentation of enormous diversity inside so-called “homogeneous” diagnostic categories (Fried & Nesse, 2015) has suggested that the syndromal strategy is simply not paying off. Perhaps most of all, as the workgroup quote above reflects, the half century-long failure of syndromal classification to lead to the identification of disease entities by the normal standards of academic medicine, and to the demonstrable treatment

utility of diagnosis, gradually undermined the main rationale for the possible progressivity of a focus on psychiatric syndromes as they apply to the practical clinical question.

The cognitive and behavioral therapies are still dealing with the aftermath of these many decades of DSM domination (see Hayes & Hofmann, 2018 for a book length treatment). Theory suffered and a technological approach blossomed, complete with a disinterest about philosophical assumptions. Mediation studies were under-used, and in many areas processes of change were under-studied. Basic process questions went unasked, and the field failed to notice the poor fit between analytic methods and the intellectual challenges faced by the field of processes of change (Hofmann, Curtiss, & Hayes, 2020).

PBT (sometimes referred to as process-based cognitive behavior therapy, process-based behavior therapy, or process-based intervention) is a response to this challenging situation (Hayes, Hofmann, & Ciarrochi, 2020; Hayes, Hofmann, & Wilson, 2020; Hofmann, Hayes, & Lorscheid, 2021). PBT has taken a different approach by defining evidence-based intervention by a core 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?” (Hayes & Hofmann, 2018; 2021). Processes are the functionally important pathways of change. We define them as theory-based, dynamic, progressive, contextually bound, modifiable, and multilevel sequences linked to important outcomes (Hayes, Hofmann, & Ciarrochi, 2020a).

In a PBT approach, these processes need to be integrated into models that can specify evidence-based procedures or kernels that can target and change them. We need models because the list of change processes is long, and it is necessary to select among them to even conduct a functional analysis of an individual case (See Chapter 3 in Hofmann et al., 2021). We have argued that models need to have a clear set of philosophical assumptions, and broadly apply across problems, goals, setting, delivery methods, and cultures (Hofmann & Hayes, 2019). Furthermore, models need to address the key psychological dimensions of human experience and its multi-level or nested nature.

Without attempting to draw any hard lines between them, we have described at least six dimensions that need to be dealt with: cognition, emotion, attention, self, motivation, and behavior. In addition, a well-designed process model needs to acknowledge the possible importance of the biophysiological level, and the sociocultural level, not just the psychological level. These too need to be dimensionalized, but as we will show later, the existing data on which to do so are much sparser than data on the psychological level, so that project remains in the future. Finally, we have adopted an evolutionary science approach and suggested that process models that are more fully adequate need to address how the various dimensions and levels of processes address issues of variation, selection, retention, and contextual fit.

What has resulted from these considerations is the “Extended Evolutionary Meta-Model” (EEMM; said orally it rhymes with “team”) of PBT (see Figure 1). By a “meta-model” we mean that the EEMM is a kind of template or model of models that affords deployment of a variety of specific models of psychopathology, psychological difficulty, positive psychology, or intervention science.

INSERT FIGURE 1 ABOUT HERE

There are several potential advantages to a process-based approach when organized in this way. Many scholars have noticed that theoretical coherence does not seem to emerge naturally in the behavioral sciences (Lilienfeld & Strother, 2020). It is easy to create a measure of virtually any theoretical concept in psychology but achieving coherence across myriad concepts has proven to be difficult. As a result, intervention science is left with a cacophony of concepts without a clear way of focusing on the ones that are of most functional importance.

By moving towards processes of change as organized by the EEMM, three important things happen. First, because processes of change are functionally important pathways to outcomes, it keeps the discussion focused on the practical clinical question: that is, to the means to ends that are of importance to individuals. Second, by suggesting that we can view processes in an overall meta-model, it is easier to keep a focus on biopsychosocial processes of change even if a particular model

is more narrowly focused on a smaller set of dimensions or a particular level of analysis. Third, the EEMM is likely to promote a common language and useful interaction between different therapy “islands” because almost all therapy approaches acknowledge the validity of evolutionary theory. Evolutionary theory has been regarded in the life sciences as a method of achieving “consilience,” that is, for creating a foundation for agreement between multiple approaches to a topic (Wilson, 1999). As in life sciences, there is no reason this could not apply to behavioral and cognitive sciences as well. Multiple contemporary research examples suggest this is indeed beginning to happen (e.g., Sahdra, Ciarrochi, Parker, & Scrucca, 2016).

The PBT model has taken on some of the developmental features of ACT that we documented previously. We cast PBT as a universalist model in which *particular* goals or settings take a backseat to a process-based analytic approach. Recently, for example, we have examined the entire set of interventions that define positive psychology and have shown that the EEMM does a good job of organizing these many intervention strategies into a coherent network despite their many theoretical differences (Ciarrochi et al., 2022). Typically, theorists distinguish between positive psychology interventions and psychotherapeutic interventions, between flourishing and languishing (Ciarrochi, et al., 2016). When a process-based focus is taken, however, it is easy to see the commonalities between these two areas of application because the processes of change overlap. For example, fostering greater emotional openness alleviates psychopathology but it also fosters greater psychological thriving (Bohlmeijer, Sanne, & Fledderus, 2015).

We have built process-focused multi-dimensional and multi-level thinking into the EEMM, along with the evolutionary concepts of variation, selection, retention, and contextual fit. The core psychological dimensions of the EEMM fit reasonably well with the six processes that are particularly targeted by ACT, since the first pillar of psychological flexibility is focused on affect and cognition, the second pillar is focused on attention and sense of self, and the last is focused on

motivation and overt behavior – the six dimensions of psychological processes emphasized by the EEMM.

However, the EEMM is much broader than the traditional ACT model. The EEMM might push an ACT therapist who wanted to focus solely on cognitive fusion or experiential avoidance to focus more broadly on other forms of cognitive and affective rigidity. Indeed, this has happened as the impact of PBT thinking is felt on ACT research and practice. For example, affective rigidity needs to be expanded beyond experiential avoidance to include experiential clinging or unhealthy “attachments” to conceptions about self, others, and life (Ciarrochi, et al., 2020; Sahdra, Ciarrochi, Parker, Basarkod, et al., 2017; Sahdra, Ciarrochi, & Parker, 2016; Sahdra, Shaver, & Brown, 2010). Cognitive flexibility needs to be expanded beyond cognitive defusion to include reappraisal viewed as a way of expanding cognitive possibilities, and we need to consider co-use of multiple strategies like reappraisal and suppression within persons (Sahdra, Brockman, Hayes, Hofmann, et al., 2020). Such expansions are not difficult since they often link to well-established ACT methods (e.g., the “storyline” exercise; see Hayes et al., 2012). The EEMM does not eliminate the need to consider how to maintain philosophical and theoretical consistency in creating coherent psychosocial interventions, however. Models are about more than processes in isolation. An ACT approach to reappraisal, say, would minimize challenging or eliminating cognitions and focus on an experiential, exploratory, defused approach to thought based on usefulness. Fortunately, that is broadly consistent with the process data on cognitive reappraisal procedures themselves (e.g., Kashdan, Barrios, Forsyth, & Steger, 2006).

There are other areas where more fundamental work needs to be done. The need to address biophysiological and sociocultural levels is made obvious by the EEMM and is rapidly becoming a central area of further intervention development. At the physiological level, researchers have studied the relation between heart rate variability, vagal tone and psychological flexibility (Allen et al., 2018); or how psychological flexibility serves as an endophenotype for 5HTT polymorphism (Gloster

et al., 2015). At the social level, the six psychological dimensions can readily be extended socially, at least in terms of dyads. Emotional openness and self-compassion could extend to compassion for others; cognitive flexibility to genuine communication; flexible attention to joint attention; a noticing or contextual self to secure attachment and belonging; values to shared values; committed action to cooperation and shared commitments. Much of this already has some degree of empirical support. For example, the impact of the therapeutic relationship on outcomes can be accounted for in part by the degree to which the therapist models and supports psychological flexibility (e.g., Gifford et al., 2011).

### **The Next Step: Idionomic Analysis of Processes of Change**

How can we know which of the various processes of change should be targeted in a given case? It turns out that this is a very hard question to answer, because there is a gaping hole in the needed knowledge base of our field that is fully revealed only when processes of change are the central focus.

Most psychologists and behavioral scientists do not realize that you can predictively apply normative results developed and measured at the level of the collective to individuals if and only if the phenomena are *ergodic*. Ergodicity is not a new concept – it is nearly 150 years old in statistical physics (Boltzman, 1884; see Ashley, 2015) and has been accepted science ever since it was mathematically proven in the early 1930's (Birkhoff, 1931; von Neumann, 1932).

In the physical sciences, ergodicity is focused on how events in space relate to events in time. Specifically, the ergodic theorem shows that the behavior of collections of elements in space (say, the processes shown by a volume of gas) correspond to the behavior of these elements over time (say, the actions over time of gas molecules) only if the behavior of these elements reveal no temporal trends and the same dynamic model applies to every individual element (Molenaar, 2013).

The early statisticians from Galton were broadly aware of the issue addressed by the ergodic theorem since they realized that they would need to assume that between person variability could

serve as a rough metric of within person variability in order to apply the results of a science of individual differences (the placement of an individual on a distribution of individuals) to the prediction of personal life trajectories (the development of individuals over time). This is one of the reasons for the assumption of “homogeneity” in classical statistics. Indeed, the DSM itself is an attempt to overcome this statistical barrier by providing an operational definition of what a homogeneous group is in areas of psychological distress. Although it is rarely discussed, classical statistics recognized that if the homogeneity assumption was incorrect (if between person variability *cannot* be used to model within person variability), then generalization from group level statistics to the trajectories of individuals would be unreliable.

The ergodic theorem specifies precisely when that assumption applies, and it is far, far less common than classical behavioral science statisticians ever supposed. The relevance of ergodicity to behavioral science has been increasingly discussed (e.g., Bringmann et al., 2022; Wang & Maxwell, 2015) ever since a classic paper by Molenaar (2004). He pointed out that since spatial locations are mathematically analogous to different people and within person changes are temporal phenomena, the ergodic theorem limits the conditions under which we can apply normatively tested psychological concepts to individual life trajectories. For such applications to be mathematically valid, the same processes influencing the data must be identical for all—a strict form of the homogeneity assumption—and the characteristics of the data (e.g., the mean, variances, covariances, cross-variance) cannot change over time, an extremely strict stationarity assumption (Gates, Chow, & Molenaar, in press). Note that both requirements must be met—if *either* are not, then normative concepts may not be applicable to specific individuals (Molenaar, 2013).

This does not mean that traditional group comparison approaches and classical statistics are unimportant or useless in the behavioral sciences. That topic goes beyond the current paper, but many policy or public health decisions require data collected and analyzed at that level. The problem we are

addressing is that these methods have been asked to do what they can never adequately do in answering the practical clinical question.

A focus on processes of change and a concern over ergodicity is an explosive combination. The assumption of stationarity cannot apply to processes of *change* by definition. “Change” and “stationarity” are simply two different things. It is furthermore almost impossible to imagine that the same dynamic model will apply to all individuals in exactly the same way. Thus, the painful reality is that either nearly a century of settled physical science is wrong, or the claimed relevance of ergodicity to traditional group level approaches to processes of change is false, or those statistical and methodological approaches themselves are irretrievably mathematically flawed as a means of predicting individual development.

We are unaware of any claims that the first two conditions apply, and we are unaware of any psychological intervention studies that have found that the ergodic assumption is met in their data. Thus, for a science of processes of change to move ahead, classical normative statistics, psychometrics, and traditional group comparison approaches must largely be put aside, if the goal is to apply that knowledge, even probabilistically, to particular people (Fisher et al., 2018; Rabinowitz & Fisher, 2020). We see no way to avoid this shocking conclusion, which emerged only for us as we explored how to create a better science of processes of change.

A metaphor may help understand why the study of processes of change forces this issue front and center into the behavioral sciences. Imagine a group of people standing in front of a multi-story building with the task of getting to the other side. There are multiple pathways that could result in this outcome. There is an alleyway to the right and an alleyway to the left. There is a door on the front that opens to a small vestibule but the second door that would take the visitor into the building is locked. Inside the vestibule, there is a door to the basement, which could lead to the back and the door to the stairway that could lead to the roof, and then to a fire escape on the other side. In this metaphor, all individuals will go either left, right, down, or up, but if they are distributed evenly the

average trajectory will be to go straight ahead through the first floor of the building. This metaphor helps show why the assumption of random variation that is so central to making conclusions about group differences becomes untenable when processes of change are the focus. Life trajectories are not random, like marbles falling down a Galton “bean board” to form a normal distribution on the bottom as a class demonstration of the binominal distribution and the impact of sequential random probabilities. Metaphorically if each bump on a life peg (say, if someone is the victim of enacted prejudice; or trauma) fundamentally alters the probabilities of outcomes from the next peg (say, the next rejection or unfair criticism), then each journey of each marble needs to be modeled and understood. We need another way forward in assessment and analysis that is true to our actual subject matter.

Fortunately, there are existing statistical alternatives. Processes of change can be assessed and analyzed idiographically, with dynamical relationships established against the background of within person variability over time, individual by individual, with no sharing of information initially between individuals (parenthetically, “individual” in this context could mean “couple” or “family” or “community” – it refers to the smallest unit to which results will be uniquely applied). Once those idiographic patterns have been determined, we can seek nomothetic commonalities. For example, apparent similarities between persons can be used to collect individuals into tentatively subgroups or to identify overall population parameters. In order not to violate the ergodic assumption, however these nomothetic patterns should be added to idiographically identified patterns if and only if they produce an increase in idiographic fit for most members of a group (which might be a subgroup or a population). Our neologism for concepts and analyses of that kind is the term “idionomic” (said orally it rhymes with “genomic”).

There are already many idionomic concepts in psychology, especially those drawn from the idiographically focused wings of such fields as neuroscience, developmental psychology, or behavior analysis. Take a concept such as “reinforcement.” It was initially identified idiographically against

the background of within organism variability. The concept of reinforcement was proposed to be a basic nomothetic principle of learning that could apply idiographically to any individual—but when applied, it was the analyst’s responsibility to see if it increased the ability to predict and influence behavior for a specific individual.

It is a common occurrence, when idiographic and normative methods are compared, that the two different approaches lead to different concepts, clusters, or conclusions (Turner & Hayes, 1996). Sometimes, “Simpson’s paradox” can lead to conclusions that are 180 degrees in the opposite direction (see Kievit, et al., 2013). As an example, consider the relationship between typing speed and errors. In any group of sufficient size, more expert typists will type more rapidly and with fewer errors as compared to beginning typists who will type slowly with more errors. Despite the group level negative relationship between speed and errors that results, every single typist without exception will make more errors when they type more rapidly. As a result, typing speed and error are negatively correlated on the group level, but positively correlated on the individual level.

Both levels of analysis can be important, but for different kinds of questions. If we wish to see at a population level if smoking causes cancer, large population studies can supply the answer. If we wish to understand why person X smokes and how best to help them stop, we need measures, analyses, and concepts that address processes of change at the level of the individual. In the area of clinical intervention science, often the intent is to apply behavioral science knowledge to individuals to help them change, and when that is the issue the use of measures and analyses focused on processes that accomplish that end need to be evaluated at the idiographic level, at least initially. To probe for causality, we need to study the functional relationship between variables, which is also best done on the individual level (Pearl & Mackenzie, 2018).

In the main, behavior analytic concepts are idionomic. That is not unique in psychology (some wings of neuroscience or developmental psychology, for example, have had similar commitments) but it is also not commonplace. Behavior analysis begins with idiographic analyses

that are then nomothetically extended because it seeks concepts with high precision, scope, and depth.

As we noted earlier, the basic cognitive science of RFT emerged from highly idiographic studies of derived relational responding and rule-governed behavior. To return briefly to ACT development, several idiographic concepts emerged in ACT as these basic cognitive concepts were clinically extended, including defusion, acceptance, values, perspective-taking frames, and a spiritual sense of self based on these cognitive frames. Often, standard psychometrically validated instruments appeared right alongside single item willingness ratings or behavioral tasks such as breath holding (Lillis et al., 2009), or tolerance of cold (Hayes, Bissett et al., 1999), or CO<sup>2</sup> gas (Forsyth, Eifert, & Canna, 2000). The very breadth of measurement work in ACT has sometimes led to concerns about the psychometric purity of psychological flexibility as a concept (Cherry, et al., 2021), but as it applies to the present argument, calls for a psychometric resolution of these matters is misplaced. If processes of change are to be individually relevant, they need to be assessed and tested in a high temporal density, longitudinal, idionomic fashion, not in a cross-sectional, between-person, psychometric fashion. It is hard to over-estimate how much change this will bring because classical psychometric development of normative concepts now needs to be re-examined before we bring elements of these measures into clinical use.

Consider, for example, the almost universal finding that personality tests when they are looked at cross-sectionally can be linked reliably to “the Big Five” (Goldberg, 1990). These normative findings are based on between-person variability, and thus for them to apply to individuals, ergodicity is required. When personality items are measured repeatedly and then are examined idiographically, almost no one reveals a factor structure within their own behavior that fully reflects “the Big Five” (Molenaar & Campbell, 2009). Thus, for the information from the systematic review we have just conducted to be used properly, we need to be open to the possibility that many of these normative concepts will not survive a re-examination that begins with idiographic research and

generalizes nomothetically only if it improves idiographic fit. Frustratingly, even when researchers try to examine personality within-person they still often use group averages of longitudinal data, which like traditional multi-level modeling, again makes the ergodic error (for an example, see Ringwald, et al., 2021).

That does not mean, however, that we need to start with an empty sheet of paper. We may start with powerful and commonly replicated assessment devices that have been shown in existing mediational studies to measure functionally important pathways of change, and then to find items or elements that deserve now to be studied in a high-temporal density idionomic fashion. It may be additionally reassuring if these items fit with the EEMM as a meta-model of processes of change, because we may be able to build a coherent process-based approach using the combination of the EEMM and idionomic statistical analyses.

That agenda will be hard to mount, but it is not impossible, and if the ergodic error is as fundamentally challenging as we believe it is for studies of processes of change, it does no good to delay the inevitable by continuing to study processes of change almost exclusively in a mathematically invalid fashion. It is better to identify potentially useful processes of change that need to be further tested in an idionomic way (Hayes, Hofmann, Stanton, et al., 2019) and then set about doing so. To that empirical issue, we now turn.

### **Taking What Can Be Learned from the World's**

#### **Mediational Literature on Psychosocial Interventions (1985-2018)**

In order to examine the utility of the EEMM in its ability to unify assessment elements from the existing experimental literature on psychological intervention, across a wide range of terms and measures, we decided to summarize the world's literature on mediation of psychosocial interventions for mental health. To do so, we conducted a systematic literature review using the PsychInfo, Web of Science, Medline, and ProQuest databases. The search strategy identified studies that included three key components: (1) a statistically significant mediational analyses of processes of change, (2) in a

randomized controlled trial of a therapeutic treatment intervention linked to a mental health related outcome, that (3) compared treatment to a no-treatment or treatment-as-usual condition. Because we wished to examine the usefulness of the EEMM in summarizing the existing mediational literature on processes of change, our present summary is deliberately universalist and qualitative. We will leave for another day such issues as the quality of research that led to these findings, the interventions that produce them, the diagnostic categories that were addressed, the outcomes that were targeted, the effect sizes of processes of change, and other similar issues. All such matters draw us closer to the world of “protocols for syndromes” and away from how to identify and organize commonly useful processes of change.

We opted to be more inclusive in our search strategy, in part because of the relative nascency of mediational, process-based treatment designs. To satisfy the mediational criteria, we used the following search terms: “process of change”, “mechanism”, “mediat\*”, and “change mechanism.” In order to satisfy the second treatment intervention criteria, we included at least one word from the title of every known therapy, based on the Wikipedia “list of psychotherapies” article (as of Sept 2017; see Appendix A). Finally, in order to identify true experimental designs, the following search terms were used: “RCT”, “clinical trial”, “ranomi?ed control trial”, “interven\*”, “treatment condition”, “control group”, “treatment group”, “random”, and “random assignment.” After removing duplicate results, we identified 54,633 studies to include in the title and abstract screening phase.

Due to the large number of studies, two rounds of initial screening were conducted to eliminate studies that did not fit the intended search criteria before doing full textual analysis. The abstract for each identified study was first reviewed and screened by undergraduate research assistants who were provided at least 6 hours of face-to-face training and were assessed for quality control during their screening, and by trained graduate student raters. Each study required agreement of the two ratings to exclude. Studies were excluded if the abstracts clearly indicated that they were not studies that were:

- conducted on human participants that included a treatment versus comparison group;
- explicitly tested for and found mediational effects;
- included experimental groups, and were longitudinal in design;
- that measured mediational variables in both treatment and control groups; and
- that tested bona fide psychotherapies, whether delivered by trained therapists, printed materials (i.e., bibliotherapy), or via technology (web-based interventions).

Since our purpose was to focus future research attention on possibly useful processes of change, we excluded studies that failed to find mediation. Studies were also excluded if they only tested pharmaceutical interventions, focused only on exercise- or health-based changes, were not explicitly intended to bolster psychological skills, or were review articles and meta-analyses. If a randomized trial had three arms and mediation was separately calculated between each active treatment as compared to TAU or to waitlist, those results were included in our database. Mediational results between two active treatments were not, because if two active treatments have the same processes of change, the power to find significant mediation can be reduced due to an artificially lowered value of the “a path” (differential effects on the mediator). Examples of easily excluded studies at the initial screening phase were studies on non-human animals or medication studies. Of the initial 54,633 abstracts, disagreements occurred in 3,996 instances (7.31% of total abstracts), requiring a third, independent expert rater. If there was doubt about exclusion, raters were encouraged to include the study.

In Round 2 of the initial screening, studies that were not clearly excluded were then rerated by two expert raters, and disagreements were resolved by a third, independent expert rater. Two raters then conducted full text screening of the 1,353 studies that survived this second screening to confirm eligibility and to identify measures and processes that significantly mediated (fully or partially) outcomes of interest. A total of 1,050 mediational findings were identified across 624 studies, while 729 studies were excluded. We then extracted the names and sample items for any successful

mediational measure listed in the study, including self-report scales, ratings by others, physiological measures, behavioral measures, single self-report items, composite measures, or latent constructs.

The present paper includes a qualitative report of the results of this systematic review. We report a simple “head count” of replicated findings in order to focus attention on an overview of the existing literature as a plausible foundation for moving forward with a different methodological approach. Because these data could be influenced both by popularity and performance, we caution the reader to not to treat frequency of findings for given replicated mediators as a direct metric of their importance to intervention science, conceptually or practically.

For the present analysis, we aggregated measures by collapsing across versions (e.g., the Acceptance and Action Questionnaire, Hayes et al., 2004 and AAQ-II, Bond et al., 2011 were considered equivalent). Given that the present study is focused on processes that relate to intervention outcomes of all kinds (rather than those linked to particular syndromes or conditions), measures taken across different targeted domains were also considered equivalent (e.g., the AAQ was combined with the CPAQ, the Chronic Pain Acceptance Questionnaire, McCracken, Vowles, Eccleston, 2004, which was reworded to focus on pain from the original AAQ). However, since subscales can capture unique processes, measures with multiple factors or subscales were initially kept distinct from one another in the results (e.g., the total Anxiety Sensitivity Index, Peterson & Reiss, 1992, was initially separated from the three subscales contained in a later version, Taylor et al., 2007).

A full list of the studies that were scored in this systematic review is available in Appendix B. We purposefully excluded studies that found that common psychological intervention outcomes mediated other outcomes (e.g., changes in depressive symptoms mediated anxiety outcomes). These data can be important in their own right as functionally important pathways of change over the course of intervention, but they blur the meaning of “processes of change” as we are using the term here, and interpretations are muddled by the heterogeneity and comorbidity of traditional diagnostic outcomes (e.g., Fried & Nesse, 2015; Kessler et al., 2005). Altogether, a total of 57 outcome-based mediators

were identified across 48 studies. Of note, some measures could be conceptualized both as a process and as an outcome. For example, the Perceived Stress Scale (PSS; Cohen, Kamarck, & Mermelstein, 1983) includes items that are clearly outcome-based (e.g., “how often have you felt nervous and stressed?”), but also items that allude to functional processes (e.g., “how often have you felt confident about your ability to handle your personal problems?”). In these cases, the number of times the measure was used as a mediator versus as an outcome in the present dataset determined our use. For example, because the PSS was found to be a mediator across 3 studies in this dataset but was used as an outcome variable in 21 studies, it was treated as a measure of outcome rather than process. The Positive and Negative Affect Schedule (PANAS; Carver, Scheier, & Weintraub, 1989) was similarly excluded on that basis and will be reported elsewhere.

We retained measures for the present review if they were shown to successfully mediate outcomes in at least two independent studies. Unreplicated findings were set aside, in part because many of these were highly unique combinations that at times appeared to have been gathered post hoc in exploratory analyses. To avoid double counting the same study, dissertations were cross-referenced with peer-reviewed studies to exclude duplicate results—a total of 17 dissertations were removed on that basis.

Because the ergodic error can apply to traditional psychometrics, instead of classifying mediators based on the name of the measure (a common error: Lilienfeld & Strother, 2020), we examined each measure’s items and matched the specific items to the EEMM levels and dimensions. This led us to identify processes in the mediator that were not clearly linked to the mediator’s name, or that failed to note dimensions or levels that theoretically should be included. To take an example that applies to the senior author of this paper, the AAQ-II is a widely used instrument meant to measure psychological flexibility. As we have described above, theoretically psychological flexibility has six features including attentional flexibility. There are, however, no items on the AAQ-I or AAQ-II that specifically assess attentional flexibility and thus that dimension was not scored for that

measure. Mediators are often complex and multidimensional and even single dimensions of a subscale may target multiple processes (Ciarrochi, et al., 2014). We present the results in Table 1.

The authors of this paper unanimously agreed on the assignments of measures to the dimensions and levels of the EEMM shown in Table 1. We relied on discussion and agreement, rather than formal reliability checks, since the EEMM is a heuristic tool rather than a categorical scheme and the use of this tool is the very subject of the present paper. Thus, any reader can readily alter the scoring of the measures to fit their own theoretical preferences. We believe that we have organized the findings of our systematic review in such a way that the major thrust of this paper would not be affected by disagreements, however, unless they were very large.

We should note that we evaluated studies up until 2018. This leaves the last four years of data unexamined. That gap is largely accounted for by the length of time needed to conduct this massive review, particularly given the delays and challenges presented by the COVID pandemic. We have no reason to suspect, however, that more recent studies would fundamentally change the applicability of the EEMM to organize processes of change and that is the major focus of the present review. We are making our work reported here publicly available (see Appendix B) so that other research teams can readily build upon the findings and address the last few years of mediational research.

### **Results of the Review**

Considering only replicated mediators, 66 measures (72 if replicated subscales are counted separately) were identified in the systematic review, accounting for 281 specific findings spread across 204 studies. Table 1 organizes them by the frequency of findings, collapsing across versions of any measure, but not across subscales.

INSERT TABLE 1 ABOUT HERE

A total of 16 measures (21 if subscales are counted separately) had four or more successful findings in the review (that is, they had been replicated three or more times). This smaller subset seems worth characterizing in order to get a sense of some of the more frequently replicated

measures. In the category sits measures of mindfulness (the Five Factor Mindfulness Scales and its subscales; FFMQ, Baer et al., 2006, 43 findings; the Mindful Attention Awareness Scale; MAAS, Brown & Ryan, 2003, 11 findings), a measure of psychological flexibility (the AAQ in its two versions, Hayes et al., 2004, and in a pain related version, the Chronic Pain Acceptance Questionnaire or CPAQ, McCracken, Vowles, & Eccleston, 2004, 37 findings) and the Anxiety Sensitivity Index and subscales and variants (ASI; Peterson & Reiss, 1992, Taylor et al., 2007, 21 findings). All of these deal with the person's relationship to experience. Together the FFMQ, MAAS, AAQ/CPAQ, and ASI accounted for 39.9% of the total dataset of all replicated findings.

It is possible to organize frequently replicated mediators in another way, however, that reveals some of what has happened in evidence-based therapy because of the "third wave." Of the 16 frequently replicated measures, 6 were developed since the turn of the century. These all target "third wave" concepts, including mindfulness (the FFMQ and MAAS, 54 findings); psychological flexibility and its elements other than mindfulness (the AAQ; CPAQ, the Avoidance and Inflexibility Scale, AIS Gifford, 2001; the Cognitive Fusion Questionnaire, Gillanders et al., 2014; the activity engagement factor the Chronic Pain Acceptance Questionnaire, Gillanders, Ferreria, Bose, & Esrich, 2013, 44 findings) and self-compassion (the Self-Compassion Scale, SCS, Neff, 2003, 9 findings). Mediation became more central to the field only within the last two decades, so we are not making a relative comparison by noting how large this body of work has become nor its source. Our point is rather that these more recent processes of change are by now very well established empirically, based on the frequency of successful mediational studies.

Ten measures were developed before the year 2000. Three were not obviously specific to behavioral or cognitive therapies per se. These included measures of drinking norms (the Drinking Norms Rating Form (Baer, Stacy, & Larimer, 1991; 5 findings), parent-child interactions (the Dyadic Parent-Child Interaction Coding System, Eyberg & Robinson, 1981, 5 findings), and the working alliance (the Working Alliance Inventory, Horvath, & Greenberg, 1989, 5 findings).

The remaining 7 measures were broadly linked to CBT. These included the ASI described above, the Hopelessness Scale (HS; Beck et al., 1974, 6 findings), self-control process relevant to exercise (Marcus et al., 1992, 6 findings), eating related self-efficacy (Weight Efficacy Lifestyle Questionnaire, Clark et al., 1991, 6 findings), the Dysfunctional Attitudes Scale (Weissman & Beck, 1978, 4 findings), the Pain Catastrophizing Scale (Sullivan, Bishop, & Pivik, 1995, 4 findings) and the Penn State Worry Questionnaire (Meyer et al., 1990, 4 findings).

Table 2 presents all replicated mediation findings organized by conceptual clusters. These data are shown graphically in Figure 2. Third wave concepts account for 49.1% of the 281 successful findings, other CBT concepts for 32.7%; sociocultural processes for 9.3%, health behaviors or biophysiological measures for 7.3%, and smattering of other concepts for the remaining 1.4%.

INSERT TABLE 2 AND FIGURE 2 ABOUT HERE

It might be possible that the dominance of measures that assess the person's relationship to psychological events over the form of those events is due merely to higher rates of mediational research in newer forms of CBT. That seems somewhat unlikely given that mediators such as cognitive defusion regularly help explain the impact of traditional CBT as well (e.g., Arch, Wolitzky-Taylor, Eifert, & Craske, 2012), and within more traditional CBT measures, those that focused more on the person's relationship to psychological events, such as the ASI, have done especially well. But even if that is not the case, this concern is beside the point. We need to start somewhere. Conceptualizing these results in a political or horse race fashion is little more than a distraction from the important work ahead. The replicated mediational data should be allowed to speak for themselves.

### **Explicating Processes of Change Using the EEMM**

It is worth considering how the replicated mediators described above tap into evolutionary processes of variation, selection, and retention. To help answer that question, Table 3 shows items from a wide variety of instruments, organized in terms of the EEMM.

Variation items are common. It is worth remembering that while in evolutionary science, variation is initially blind, evolvability itself evolves, and as that happens variability becomes more contextually bound and directed. For example, when bacteria are deprived of essential amino acids, they stop correcting many transcription errors and novel forms of bacteria soon appear (Hersh, et al., 2004). Basic behavioral phenomena can be understood similarly. For example, when previously established reinforcers are suddenly removed, high levels of behavioral variability soon follow as an “extinction burst.” As is shown in Table 3, many existing mediational measures identify forms of experience that either are suspected to be dysfunctional and yet are resistant to change or are functional forms that occur or fail to occur. Self-report items also focus on invariant sequences in which one event leads rigidly to a more extreme response or on experiences that are so extreme and unconditional that their strong endorsement implies little behavioral variability.

Selection items commonly address what a person values, finds personally important, enjoyable, or useful, either positively or negatively phrased. Almost any item that implies skillfulness or lack of skillfulness, or the ability or tendency to engage in something that is or is not effective will imply selection, usually along with variation or context sensitivity.

Retention is sometimes asked about directly, but it is more frequently assessed by its linkage to a desired outcome when barriers appear. Retention is also examined when assessments ask about how effective someone is likely to be in maintaining a behavior.

Contextual items ask about the manipulation of external context to ensure positive behavior, or the more passive occurrence of positive contextual events, such as the presence or absence of friends. Items ask about a surprising lack of contextual sensitivity or an ability or inability to attend to contextual changes.

A very common type of item in successful mediational measures asks about the interconnections among dimensions and levels, perhaps because such linkages are often used to address the functions of experiences, and processes of change are themselves functional phenomena.

Table 3 shows examples of such linkages as that between affect and cognition, affect and attention, cognition and sense of self, sense of self and social judgments of others, motivation and overt behavior, affective reactions to social relationships, or health behaviors and a social context.

### **The EEMM and Processes of Change**

The EEMM appears to be capable of organizing the worlds' literature on functionally important pathways of change as seen through mediational analysis, particularly at the item level. It is relatively easy to sort all self-report items or other types of measures into one or more dimensions or levels of the EEMM (that is, into a row in Figure 1). A closer examination of these individual items suggests that most of them link to one or more aspects of healthy variation, selection, retention, or context, or to bridging psychological dimensions and levels of analysis as they do so.

This suggests that the field itself has long been functioning implicitly inside an extended evolutionary model without doing so deliberately, and thus may use that model to seek greater cooperation without a fundamental reworking of the field. It also suggests that we may be able to use the positive start provided by ACT as a kind of de facto pilot test of PBT to reconsider the current approach to case conceptualization and diagnosis and consider adopting a more universalist, process-focused, idiographic, and evolutionary approach.

It is probably unnecessary to change specific concepts in our field to use the EEMM to seek greater consilience between specific theories. It may not matter, for example, if a particular concept is called "decentering" or "distancing" or "defusion" if they all foster healthy cognitive flexibility. We do not mean to say that these are synonyms, but that these concepts can be operationalized into a broader network of assessment tools linked to dimensions and levels of biopsychosocial processes of change and their flexibility, selection, retention, and context sensitivity, and then tested idionomically to see which individual elements do the best for individuals. Researchers and practitioners would then have the common ground of the most central theory in the life sciences, evolutionary theory, as a foundational structure within which to allow data and argument to refine helpful ways of speaking

about useful processes of change. That would be a big step forward toward a more unified field inside a more unified and interconnected set of behavioral and life sciences.

The biggest empirical challenge presented by a shift of focus toward process of change is that to understand the dynamic interrelationships among such processes and their linkage to outcome, an idionomic approach to assessment and validation appears to be necessary. In the light of ergodicity even psychometrics now needs to be reconsidered as a system of defining measurement quality. Treatment utility, which early in the ACT development program was argued to offer an alternative to psychometric evaluation in determining assessment quality (Hayes et al., 1987), may be back on the table, but it too will have to be assessed in an idionomic fashion. No theorist can be fully confident that their favored concepts will pass unscathed through such a new research agenda.

While the EEMM can be used to understand the existing measures of processes of change, it is also now being used to generate them and the validation strategy for this approach perhaps provides the clearest glimpse of what an idionomic research program might look like. The “Process-Based Assessment Tool” (PBAT) is a collection of individual items that tap into processes of change as understood by the EEMM (Ciarrochi, Sahdra, Hofmann, & Hayes, 2022). The PBAT seeks to assess behavior that maps to variation (e.g., “I was able to change my behavior, when changing helped my life”), selection that is consistent with needs and values (“I found personally important ways to challenge myself”), and retention (“I struggled to keep doing something that was good for me”). What makes the PBAT distinct is that it is an item pool, rather than a psychometrically “validated” measure assumed to reflect latent constructs. Each item has been evaluated in terms of its ability to predict need satisfaction, well-being, and other clinically relevant outcomes, both cross-sectionally using a machine learning algorithm (Ciarrochi, et al., 2022) and longitudinally using a full idionomic statistical approach (Sanford, Ciarrochi, Hofmann, Chin, Gates, & Hayes, in press). This allows the user to select items that are most relevant and useful to their purposes, rather than requiring the user to administer a large, multi-factor scale.

Sanford et al. (2022) administered the PBAT in an intensive, within person design with a minimum of 60 measurement points over a month-long period. Data were analyzed using Group Iterative Multiple Model Estimation (GIMME; Gates et al., 2017; Gates & Molenaar, 2012) which identifies relationships present in individual longitudinal networks in the context of within-person variability assessed person by person. With no assumption of ergodicity, in an iterative fashion, GIMME then seeks out pathways applicable at the sub-group and group level but retains them if they improve fit at the individual level for most persons. After adding group and sub-group relationships that pass that criterion, all relationships are then remodeled in a final idiographic network for each person.

An example of GIMME output of the PBAT relationships over a month's time is shown in Figure 3. Solid headed arrows are positive relations; open headed arrows are negative. These relations are above and beyond auto-regression, so directionality within relations can be captured. The network presented in Figure 3 demonstrates an individual high in distress over anxiety, which was positively fed by struggling to connect with the present moment, which participated in a self-amplifying loop with a lack of meaningful challenges and absence of an appropriate outlet for emotion. Constructing personally important challenges fostered an ability to experience a range of emotions, which inhibited distress over anxiety but was not itself fostered by any of the current elements of the network.

This is a kind of de facto idiographic empirical case conceptualization. It seems to fit relatively well with the case conceptualizations that CBT therapists commonly generate, a reassuring note given that this functional analytic network is entirely empirical and automated. Any clinician looking at that network might think to intervene in several sensible ways, such as fostering mindfulness; creating meaningful challenges, especially if they were linked to personal values choices; finding relationships in which there was more opportunity for expression of emotion; and encouraging the ability to experience a wider range of emotions (Figure 3).

## INSERT FIGURE 3 ABOUT HERE

Sanford and colleagues found that that idionomic analyses of PBAT processes were linked to clinically relevant outcomes for most people. They were not linked in the same way for all participants, however, because the entire network mattered, and in some cases particular processes were helpful to well-being for some participants but were irrelevant or harmful for others. Since participant responses universally violated the ergodic assumption underlying classic normative statistics, any group approach would have failed to detect process to outcome links that could be safely applied to individuals.

Process-based idionomic analyses of this kind could easily be embedded into RCTs simply by adding high temporal density longitudinal measures of processes and outcomes. Complex network analyses could also be readily available to any practitioner with that same high-density measurement, perhaps supported by mobile phone apps. That step would allow a much larger group to be involved in the development of successful systems of process based empirical case conceptualization. While the requirement for at least 60 data points to use GIMME is daunting, over time as the database builds, Bayesian or other methods may be available to shorten that assessment burden. Furthermore, it seems quite possible that the relatively small number of highly useful processes of change so far identified will combine in individual networks in a relatively limited number of ways to produce pathology, and if that is so, instead of idionomic analysis metastasizing into a myriad of case possibilities, the exact opposite could occur. Once a database is well formed, even a small number of longitudinal assessments might be enough to match individuals to subgroup clusters of process that can be used to guide interventions in the same way as a case conceptualization.

**PBT as Compared to Other Contemporary Approaches**

Process-based functional analysis is where evidence-based therapy began, and the call for transdiagnostic or more personalized, idiographic approaches has been a strong and important stream of thought for many decades (e.g., Orlinsky & Howard, 1984; Prochaska & DiClemente, 1982). The

present approach builds on and extends approaches focused on enhancing treatment effectiveness by tailoring treatment to the unique individual and their particular situation (Norcross & Wampold, 2018). It fosters the goals of measurement-based care (Scott & Lewis, 2015), which involves enhancing usual care through systematic evaluation of client data during the intervention process. It aligns with the suggestion to have a detailed specification of behaviors targeted for change and a close alignment between intervention components and outcomes (Presseau et al., 2019). Finally, it allows for the examination and comparison of a variety of specific process-based interventions (e.g., Barlow et al., 2017).

There are other process oriented efforts such as the NIMH's RDoC program. RDoC has not addressed ergodicity, but a bigger problem is pre-selecting the biophysiological level as the domain containing the important process of change before data were even collected. RDoC was designed inside a publicly stated conviction that "mental disorders can be addressed as disorders of brain circuits," that "the dysfunction in neural circuits can be identified with the tools of clinical neuroscience," and that "data from genetics and clinical neuroscience will yield biosignatures that will augment clinical symptoms and signs for clinical management" (Insel et al., 2010, p. 749). Now, a decade later, that designer has essentially written an entire book apologizing for the impact of these pre-analytic convictions (Insel, 2021), but meanwhile many billions were spent without a tangible improvement in clinical outcomes.

The Hierarchical Taxonomy of Psychopathology (HiTOP; Kotov, et al., 2017) has received attention as a possible alternative to the DSM, but it is based on a latent disease or syndromal model, and its top-down normative categories still require ergodicity to succeed as they are applied to individuals. From the perspective of PBT and the issues we have discussed here, it is a broader variant of the same strategy as traditional psychiatric diagnosis.

The *complex network approach* more generally offers an alternative to the syndromal view. The network view holds that symptoms do not co-vary because they result from a common cause, but

rather because they are connected via causal and homeostatic associations (e.g., Bringmann et al., 2022; Hofmann, Curtiss, & McNally, 2016; Hofmann & Curtiss, 2018). The aim of this approach is to uncover the functional relations among symptoms. We should note that the term *symptom*, in this context, is problematic because it presupposes any latent disease entity that it reflects. The complex network approach assumes that mental disorders comprise a set of *nodes* that are connected through *edges* (a term from graph theory referring to the associations between the nodes). The connectivity of a given node can be evaluated by using *centrality parameters*. A node with a high level of centrality is one that contains more information about other nodes to which it is connected. *Degree centrality* refers to the number of connections a node has with other nodes. *Strength centrality* reflects the number of connections and also considers the weight of each connection. Some edges can have a greater weight than others. The *betweenness centrality* parameter refers to the number of times a node functions as a bridge along the shortest path between two other nodes. These features of network models circumvent problems within the syndromal model, not only by refraining from defining diagnoses on the basis of topographical symptoms, but also by quantifying the functional relationships between maladaptive processes, contexts, and behaviors, as well as how they contribute to an outcome of interest. Such a complex network approach serves as the functional analytic framework to capture the complexity of processes in PBT, but issues of ergodicity can still emerge depending on the specific analytic approaches selected. It is this refinement that we are proposing with the concept of idionomic analysis.

PBT is too young to document its successes or weaknesses, but its biggest strategic weakness is on full display in the present paper. The methodological and strategic changes implied by PBT are considerable. That is exciting but also sobering. PBT requires new measures, new analytic tools, and new ways to partition treatment. So far, however, incremental steps have appeared, suggesting that this new agenda can be mounted, one step at a time.

### **Expanding the Flexibility Model**

In this paper we have considered how certain features of ACT development have fed into the formulation of process-based therapy, but it is worth noting how the EEMM is altering and expanding the psychological flexibility model itself. The traditional definition of psychological flexibility is “consciously contacting the present moment fully and without needless defense, as it is and not as what it says it is and persisting or changing in behavior in the service of chosen values.” That definition gives primacy to values-based habits, but points to the affective, cognitive, and attentional flexibility needed to consciously enter into the present moment “fully and without needless defense.” The EEMM adds important details, some of which we have already discussed, such as actively encouraging cognitive flexibility skills (e.g., cognitive reappraisal) that go beyond defusion, or actively encouraging emotional openness skills (e.g., nonattachment; e.g., see Ho, Yu, & Mak, 2022) that actively go beyond acceptance. The EEMM further suggests the importance of more proximal selection criteria that apply to various dimensions of human experience. Through the use of these criteria, it may be possible to define each dimension functionally and thereby build an expanded definition of psychological flexibility, or biopsychosocial flexibility more generally, in a step-by-step empirical fashion.

One possibility may be to consider how specific psychological dimensions lead to the satisfaction of particular psychological needs or yearnings. It is possible to link Self Determination Theory (SDT; Ryan & Deci, 2000) to selection criterion for self, motivation, and overt behavior if we assume that these dimensions are means to satisfying the end of belonging, autonomous meaning, and competence, the three main human needs according to SDT. Additional needs or yearnings might be added for the remaining three dimensions, namely, feeling, coherence or understanding, and orientation for the dimensions of affect, cognition, and attention, respectively (Hayes, 2019).

If we define flexibility functionally, the goal will always be to achieve the key selection criterion for that dimension or level by fostering enough healthy variation and contextual awareness, such that steps can be taken to retain successive approximations toward more successful outcomes.

For example, cognitive flexibility might involve the flexibility needed to achieve greater functional coherence and understanding, and noticing and retaining the contextually appropriate cognitive styles that do so. A similar step-by-step functional definition could be developed across all psychological dimensions. This would result in an expanded version of psychological flexibility that could in principle incorporate virtually every known process of change relevant to these psychological dimensions, or at least those so far shown in Tables 1 and 2.

This same basic approach could then extend the psychological dimensions to similar sociocultural dimensions (much as was done by Philippot, et al., 2018). For example, feeling without avoidance or clinging might be socially extended to compassion, coherence could be extended to communication and mutual understanding, sense of self to secure attachment and relationship, orientation to joint attention, meaning to shared meaning, and competence to successful cooperation. In that way, the sociocultural level might be readily dimensionalized (for an alternative approach see Atkins et al., 2019).

As we showed in the mediational review within either the sociocultural or biophysiological levels, there is simply not enough data to suggest which dimensions are most important using mediational evidence alone. Broadly, however, we may operationalize successful working: for the biophysiological level that successful outcome is health; socioculturally it may boil down to nurturance and cooperation (Biglan, 2015); and at the psychological level to values-based habits. All of these are addressed in the PBAT for that reason. More data will be needed to expand the flexibility model in this way empirically, so as to address all features of the EEMM, but if this expanded vision of psychological flexibility were to apply to the results of the systematic review, all of the process findings validated by mediation comfortably fits within it.

The resulting expanded flexibility model would in effect be a term for the entire process-based model addressed by the EEMM. That does not mean, however, that ACT per se would disappear or become one with PBT writ large, since therapy models include philosophical

assumptions and values that go beyond principles and processes alone. For that same reason, while it will become much easier to foster cooperation within the field as the EEMM affects a wider range of psychopathology and psychological intervention models, we should not expect a meta-model to eliminate various specific models.

### **Conclusion**

Clinical psychology has historically had a hard time becoming a fully progressive behavioral science. It has been characterized by the development of schools and divisions. It is largely WEIRD and fails to fully represent the world. A wide variety of conceptual schemes have often functioned as defended islands amidst a vast theoretical archipelago. It has often been difficult to translate theoretical concepts into practical tools that are broadly adopted and used.

Perhaps no area more exemplifies this problem than in case conceptualization and diagnosis. Evidence-based clinical psychology began with a functional, principle-oriented approach, but it soon succumbed to a topographical and reductionistic approach to latent disease entities drawn from academic psychiatry that even many of its ardent supporters now agree is not progressive (Insel, 2022). The “protocols for syndromes” approach has led to a proliferation of intervention methods with no clear way to simplify the list of interventions, and a mountain of evidence that may not apply to particular people. We need a more theoretically coherent and practically useful approach.

Process-based therapy is in some ways a return to the roots of empirically based intervention, but now with a more open agenda and with linkages to many forms of inquiry. By focusing on treatment utility as the beginning rather than the end of successful diagnosis, a far more pragmatic and immediately applicable research agenda emerges rather than the “forever agenda” of endlessly seeking latent disease entities despite year after year of disappointment. We now have enough evidence of successful mediators of change to look at the proximal indications of progress towards positive treatment outcomes as the source for the idionomic categorization of problems and solutions. As proximal indications of successful change emerge, practitioners can use process-based progress as

a means of shaping clinical skill, avoiding the paradox that experience in psychological intervention reliably leads to increases in confidence but not in competence (Christensen & Jacobson, 1994).

The present paper has explored the unusual development path followed by ACT and argued that its four qualities may prove broadly useful both in a practical and scientific sense. So far, these features have proved useful in advancing the PBT research program. Many researchers agree that a process focused approach to measurement and intervention evaluation needs to be expanded across the field. We argue, however, that processes of change cannot be studied in the same way as the behavioral sciences have been doing since Galton. Conventional statistics have ignored questions of causality and functionality, severely inhibiting the scientific progress in the social sciences (Pearl & Mackenzie, 2018). They have not met their own assumptions as these analyses apply to processes of change relevant to individuals. Thus, we need to adopt new forms of data collection and analysis that fit the statistical requirements of processes of change defined as theory-based, dynamic, progressive, contextually bound, modifiable, and multilevel sequences linked to important outcomes. Traditional mediational analysis cannot fully perform that function (Hayes et al., 2009), but we believe that complex network analysis can if it is based first on the evaluation of variability within the individual and then is allowed to lead to nomothetic generalizations if and only if that step improves idiographic fit. We have a large body of mediational work to build on using idionomic methods. We need to begin.

Such a disruptive research agenda will require a broadly focused strategy and conceptual scheme. Evolutionary science has proven capable in promoting healthy consilience among disparate areas and we believe that an extended evolutionary account is adequate to this challenge within applied psychology once a functional idionomic approach is embraced. If that conclusion is valid, then the rise of PBT will denote yet another important and positive turn in the unfolding story of the creation of evidence-based intervention science.

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Table 1. Replicated Mediators Ranked by Number of Independent Findings

| <b>Mediational Measure</b>   | <b>Mediational Concept</b>                               | <b>Findings</b> | <b>Affect</b> | <b>Cognition</b> | <b>Self</b> | <b>Attention</b> | <b>Motivation</b> | <b>Behavior</b> | <b>SocioCultural</b> | <b>Bio/Health</b> |
|--|--|-----------------|---------------|------------------|-------------|------------------|-------------------|-----------------|----------------------|-------------------|
| AAQ (Hayes et al., 2004) and Chronic Pain Acceptance Questionnaire (McCracken, Vowles, Eccleston, 2004)      | Psychological flexibility                                | 37              | X             | X                | X           |                  | X                 | X               |                      | X                 |
| FFMQ (Baer et al., 2006)   | Mindfulness  | 16              | X             | X                | X           | X                |                   |                 |                      |                   |
| Anxiety Sensitivity Index (Peterson & Reiss, 1992)   | Anxiety sensitivity                                      | 11              | X             | X                |             |                  |                   |                 | X                    |                   |
| Mindful Attention Awareness Scale (Brown & Ryan, 2003)   | Mindfulness  | 11              |               |                  |             | X                |                   |                 |                      |                   |
| Self-Compassion scale (Neff, 2003)   | Self-compassion  | 9               | X             | X                | X           |                  |                   | X               | X                    |                   |
| FFMQ (Baer et al., 2006) Non-reactivity subscale   | Nonreactivity to inner experience                        | 9               |               |                  |             | X                |                   |                 |                      |                   |
| FFMQ (Baer et al., 2006) Observe factor  | Observing/noticing sensations, thoughts, and feelings    | 8               | X             |                  |             | X                |                   |                 |                      |                   |
| Hopelessness Scale (HS; Beck, 1974)  | Hopelessness   | 6               | X             | X                |             |                  |                   |                 |                      |                   |
| Self-report Processes of Change for physical activity measure (Marcus, Rossi, Selby, Niaura, & Abrams, 1992) | Cognitive and behavioral processes of change in exercise | 6               | X             | X                | X           |                  |                   | X               | X                    |                   |
| Weight Efficacy Lifestyle Questionnaire (Clark et al., 1991)   | Self-efficacy; eating                                    | 6               | X             |                  |             |                  |                   | X               | X                    |                   |
| Anxiety Sensitivity Index-3 (Taylor et al., 2007) Cognitive concern subscale                                 | Fears and worries re mental incapacitation               | 5               | X             | X                |             |                  |                   |                 |                      |                   |
| Working alliance inventory (Horvath, & Greenberg, 1989)  | Therapeutic alliance                                     | 5               | X             | X                |             |                  |                   |                 | X                    |                   |

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|--|--|---|---|---|---|---|---|---|---|---|
| Drinking Norms Rating Form (Baer, Stacy, & Larimer, 1991)  | Perceived Drinking Norms                 | 5 |   | X |   |   |   |   | X |   |
| Dyadic Parent-Child Interaction Coding System (Eyberg & Robinson, 1981)  | Parent-child interactions                | 5 |   |   |   |   |   | X | X |   |
| FFMQ (Baer et al., 2006) Nonjudge factor   | Nonjudging of experience                 | 4 | X | X | X |   |   |   |   |   |
| Dysfunctional Attitudes Scale (Weissman & Beck, 1978)  | Dysfunctional negative attitudes         | 4 |   | X | X |   |   |   | X |   |
| Avoidance and Inflexibility Scale (Gifford, 2001)  | Psychological inflexibility              | 4 | X | X |   |   |   |   |   |   |
| Pain Catastrophizing Scale (Sullivan, Bishop, & Pivik, 1995)   | Catastrophic thinking; about pain        | 4 | X | X |   |   |   |   |   | X |
| FFMQ Acting without awareness scale (Baer et al., 2006)  | Acting with awareness                    | 4 |   |   |   | X |   | X |   |   |
| Cognitive Fusion Questionnaire (Gillanders, et al., 2014)  | Cognitive fusion                         | 4 |   | X |   |   |   |   |   |   |
| Penn State Worry Questionnaire (Meyer et al., 1990)  | Worry                                    | 4 | X | X |   |   |   |   |   |   |
| Avoidance & Fusion Questionnaire-Youth (AFQ-Y; Greco, Lambert, & Baer, 2008)   | Psychological inflexibility              | 3 | X | X | X |   | X | X |   |   |
| Automatic Thoughts Questionnaire (Hollon & Kendall, 1980)  | Negative automatic thoughts              | 3 | X | X | X |   |   |   |   |   |
| Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004)  | Emotion Dysregulation                    | 3 | X | X |   | X |   | X |   |   |
| Anxiety Sensitivity Index-3 (Taylor et al., 2007) Physical concern subscale  | Fears and worries re physical sensations | 3 | X | X |   |   |   |   |   | X |
| Believability of Anxious Feelings and Thoughts Questionnaire (BAFT; Herzberg et al., 2012)   | Cognitive fusion                         | 3 | X | X |   |   |   |   |   |   |
| Food Acceptance and Awareness Questionnaire (Juarascio et al., 2011)   | Acceptance; of urges and cravings to eat | 3 | X | X |   |   |   |   |   |   |
| Word Sentence Association Paradigm (adapted from Word Sentence Association Test for OCD; Kuckertz et al., 2012) - ambiguous sentences paired with either benign or hostile word, | Interpretation bias                      | 3 | X | X |   |   |   |   |   |   |

|  |   |   |   |   |   |   |   |   |   |   |
|--|---|---|---|---|---|---|---|---|---|---|
| participants rate how similar the sentence and word are  |   |   |   |   |   |   |   |   |   |   |
| Rumination-Reflection questionnaire (Trapnell & Campbell, 1999)  | Rumination                                    | 3 |   | X |   | X |   |   |   |   |
| Coping Strategies Scale (Litt et al., 2005)  | Substance-use specific coping strategies      | 3 |   | X |   |   |   | X |   |   |
| Parenting Scale (Arnold, O'Leary, Wolff, & Acker, 1993)  | Dysfunctional disciplining practices          | 3 |   |   |   |   |   | X | X |   |
| Self-regulation strategies for eating modified from (Saelens et al., 2000)   | Self-regulation; of eating                    | 3 |   | X |   |   |   | X | X | X |
| Social Adjustment Scale-Self Report (Weissman & Bothwell, 1976)  | Interpersonal functioning                     | 3 |   |   |   |   |   | X | X |   |
| Chronic Pain Acceptance Questionnaire (McCracken, Vowles, Eccleston, 2004) Activity Engagement Factor  | Pursuit of life activities regardless of pain | 2 | X |   |   |   |   | x |   | X |
| Experiences Questionnaire (Fresco et al., 2007) Decentering Subscale   | Decentering                                   | 2 | X | X | X | X |   |   |   |   |
| Eysenck Personality Questionnaire (Eysenck & Eysenck, 1975)  | Personality                                   | 2 | X | X | X |   | X | X | X |   |
| Barriers to Self-Efficacy Scale (McAuley, 1992)  | Self-efficacy; general                        | 2 | X | X | X |   |   |   |   |   |
| Self-efficacy for exercise scale (Resnick & Jenkins, 2000)   | Self-efficacy; exercise                       | 2 | X | X | X |   |   | X |   | X |
| UCLA Loneliness scale (Russell, 1996)  | Loneliness                                    | 2 | X | X | X |   |   |   | X |   |
| Eating Disorder Examination (Fairburn & Cooper, 1993) Weight concern subscale  | Cognitive concern for weight                  | 2 |   | X | X | X |   |   |   |   |
| Sociocultural Attitudes Towards Appearance Questionnaire-3 for males (SATAQ-3; Thompson, van den Berg, Roehrig, Guarda, & Heinberg, 2004) Internalization General subscale | Internalization of body image ideals          | 2 |   | X | X |   | X |   | X |   |
| Child Posttraumatic Cognitions Inventory (Meiser-Stedman et al., 2009)   | Cognition                                     | 2 |   | X | X |   |   |   | X |   |

|  |  |   |   |   |   |   |   |   |   |   |
|--|--|---|---|---|---|---|---|---|---|---|
| Rosenberg Self-Esteem Inventory (Rosenberg, 1965)  | Self-esteem  | 2 |   |   | X |   |   |   |   |   |
| Kentucky Inventory of Mindfulness Skills (Baer, Smith & Allen, 2004)                             | Mindfulness  | 2 | X | X |   | X |   | X |   |   |
| General self-efficacy scale (Sherer et al., 1982)  | Self-efficacy; general   | 2 | X | X |   |   | X | X |   |   |
| ASI- 3 social concerns   | Fears and worries re social processes  | 2 | X | X |   |   |   |   | X |   |
| Behavioral Activation for Depression Scale-Short Form (Manos, Kanter & Luo, 2011)                | Behavioral activation  | 2 | X | X |   |   |   | X | X |   |
| Bodily Sensations Questionnaire (Chambless et al., 1984)   | Fear of bodily sensations  | 2 | X | X |   |   |   |   |   |   |
| Breath holding   | Distress tolerance   | 2 | X |   |   |   |   | X |   |   |
| Brief Illness Perception Questionnaire (Broadbent, Petrie, Main, & Weinman, 2006)                | Cognitive and emotional representations of illness                                   | 2 | X | X |   |   |   |   |   |   |
| Coping Strategy Questionnaire (Rosenstiel & Keefe, 1983) Reinterpreting pain sensations subscale | reappraisal; pain  | 2 | X | X |   |   |   |   |   |   |
| DBT Ways of Coping Checklist (Neacsiu, et al., 2010)   | Coping skills  | 2 | X | X |   |   |   | X | X |   |
| Emotion Regulation Questionnaire (Gross & John, 2003)  | Emotion regulation (reappraisal, suppression)  | 2 | X | X |   |   |   | X | X |   |
| Family Adaptability and Cohesion Scale (Olson & Gorall, 2006) Flexibility subscale               | Family flexibility   | 2 | X | X |   |   |   | X | X |   |
| FFMQ (Baer et al., 2006) Describe Factor   | Describing/labeling with words   | 2 | X | X |   |   |   |   |   |   |
| IAT (Greenwald et al., 1998)   | Implicit cognition   | 2 | X | X |   |   |   |   |   |   |
| Medical Outcomes Study Social Support Survey (Sherbourne & Stewart, 1991)                        | Social support for healthful lifestyle behaviors and chronic illness self-management | 2 | X | X |   |   |   | X | X | X |
| PCOSES (Frazier et al., 2011) Present control subscale   | Perceived control in the present   | 2 | X | X |   |   |   |   |   |   |
| Revised Scale for Caregiving Self-Efficacy (Steffen et al., 2002)                                | Self-efficacy; caregiving  | 2 | X | X |   |   |   |   |   |   |

|  |  |   |   |   |  |  |   |   |   |   |
|--|--|---|---|---|--|--|---|---|---|---|
| Social Competence Scale-Parent Version (Conduct Problems Prevention Research Group, 1995) Emotion Regulation scale | Social competence  | 2 | X | X |  |  |   | X | X |   |
| Engaged Living Scale (Trompetter et al., 2013)   | Values based motivation  | 2 |   |   |  |  | X | X |   |   |
| Personal Values Questionnaire II (Blackledge, Ciarrochi, & Bailey) Education values subscale                       | Education values   | 2 |   |   |  |  | X |   |   |   |
| Treatment Self-Regulation Questionnaire (Levesque et al., 2007)  | Autonomous self-regulation   | 2 |   |   |  |  | X |   |   |   |
| Valued Living Questionnaire (Wilson et al., 2010)  | Values based motivation  | 2 |   |   |  |  | X | X | X |   |
| Children's Attributional Style Questionnaire (Seligman et al., 1984)   | Attributional style  | 2 |   | X |  |  |   |   |   |   |
| Chronic Illness Resource Survey (Glasgow et al., 2000)   | Social support for healthful lifestyle behaviors and chronic illness self-management | 2 |   |   |  |  |   | X | X | X |
| COPE (Carver, Scheier, & Weintraub, 1989)  | Coping skills  | 2 |   | X |  |  |   | X |   |   |
| Daily Drinking Questionnaire (Collins et al., 1985)  | Drinking   | 2 |   |   |  |  |   | X |   |   |
| Exercise Goal setting Scale (Rovniak et al., 2002)   | Goal-setting; exercises  | 2 |   | X |  |  |   | X | X |   |
| Godin-Shephard Leisure-Time Physical Activity Questionnaire (Godin, 2011)  | Psychical activity   | 2 |   |   |  |  |   | X |   | X |
| Grey matter volume   | Gray Matter Volume   | 2 |   |   |  |  |   |   |   | X |
| Protective Behavioral Strategies Survey (Martens, et al., 2005)  | Protective behavior strategies regarding drinking                                    | 2 |   |   |  |  |   | X | X |   |

Table 2. Conceptual Clusters of Replicated Mediators

| Conceptual Clusters  | Stated Focus                                       | Findings |
|--|--|----------|
| <b>Psychological flexibility other than mindfulness</b>              |  |          |
| AAQ and Chronic Pain Acceptance Questionnaire                        | Psychological flexibility                          | 37       |
| Cognitive Fusion Questionnaire                                       | Cognitive fusion                                   | 4        |
| Avoidance and Inflexibility Scale                                    | Psychological inflexibility                        | 4        |
| Avoidance & Fusion Questionnaire-Youth                               | Psychological inflexibility                        | 3        |
| Chronic Pain Acceptance Questionnaire - Activity Engagement subscale | Pursuit of life activities regardless of pain      | 2        |
| Believability of Anxious Feelings and Thoughts Questionnaire         | Cognitive fusion                                   | 3        |
| Food Acceptance and Awareness Questionnaire                          | Acceptance of urges and cravings to eat            | 3        |
| Valued Living Questionnaire  | Values based motivation                            | 2        |
| Engaged Living Scale   | Values based motivation                            | 2        |
| Personal Values Questionnaire II - Education values subscale         | Education values                                   | 2        |
| Breath holding   | Distress tolerance                                 | 2        |
| <b>Mindfulness</b>   |  |          |
| FFMQ   | Mindfulness  | 16       |
| Mindful Attention Awareness Scale                                    | Mindfulness  | 11       |
| FFMQ - Non-reactivity subscale                                       | Nonreactivity to inner experience                  | 9        |
| FFMQ - Observe subscale  | Observing sensations, thoughts, and feelings       | 8        |
| FFMQ - Nonjudge subscale   | Nonjudging of experience                           | 4        |
| FFMQ - Acting without awareness subscale                             | Acting with awareness                              | 4        |
| FFMQ - Describe subscale   | Describing/labeling with words                     | 2        |
| Kentucky Inventory of Mindfulness Skills                             | Mindfulness  | 2        |
| <b>Negative, unrealistic, or dysfunctional thoughts</b>              |  |          |
| Hopelessness Scale   | Hopelessness                                       | 6        |
| Dysfunctional Attitudes Scale  | Dysfunctional negative attitudes                   | 4        |
| Pain Catastrophizing Scale   | Catastrophic thinking; about pain                  | 4        |
| Automatic Thoughts Questionnaire                                     | Negative automatic thoughts                        | 3        |
| Brief Illness Perception Questionnaire                               | Cognitive and emotional representations of illness | 2        |

|  |  |    |
|--|--|----|
| Sociocultural Attitudes Towards Appearance Questionnaire-3 for males<br>Internalization General subscale | Internalization of body image ideals       | 2  |
| Child Posttraumatic Cognitions Inventory   | Cognition                                  | 2  |
| PCOSES (Frazier et al., 2011) Present control subscale   | Control in the Present                     | 2  |
| <b>Anxiety sensitivity or fear of sensations</b>   |  |    |
| Anxiety Sensitivity Index  | Anxiety sensitivity                        | 11 |
| Anxiety Sensitivity Index-3 - Cognitive concern subscale   | Fears and worries re mental incapacitation | 5  |
| Anxiety Sensitivity Index-3 - Physical concern subscale  | Fears and worries re physical sensations   | 3  |
| ASI- 3 social concerns   | Fears and worries re social processes      | 2  |
| Bodily Sensations Questionnaire  | Fear of bodily sensations                  | 2  |
| <b>Self-Efficacy</b>   |  |    |
| Weight Efficacy Lifestyle Questionnaire  | Self-efficacy; eating                      | 6  |
| Self-efficacy for exercise scale   | Self-efficacy; exercise                    | 2  |
| Barriers to Self-Efficacy Scale  | Self-efficacy; general                     | 2  |
| General Self-efficacy Scale  | Self-efficacy; general                     | 2  |
| Revised Scale for Caregiving Self-Efficacy   | Self-efficacy; caregiving                  | 2  |
| <b>Attrib style, interp' bias, implicit cognition, reappraisal</b>                                       |  |    |
| Coping Strategy Questionnaire - Reinterpreting pain sensations subscale                                  | reappraisal; pain                          | 2  |
| IAT  | Implicit cognition                         | 2  |
| Children's Attributional Style Questionnaire   | Attributional style                        | 2  |
| Word Sentence Association Paradigm   | Interpretation bias                        | 3  |
| COPE - Positive reinterpretation subscale  | Reappraisal                                | 2  |
| <b>Parenting or family functioning</b>   |  |    |
| Dyadic Parent-Child Interaction Coding System  | Parent-child interactions                  | 5  |
| Parenting Scale  | Dysfunctional disciplining practices       | 3  |
| Family Adaptability and Cohesion Scale - Flexibility subscale  | Family flexibility                         | 2  |
| <b>Physical activity, or exercise beliefs / goals</b>  |  |    |
| Exercise Goal setting Scale  | Goal-setting; exercises                    | 2  |
| Self-report Processes of Change for physical activity measure  | CBT processes of change in exercise        | 6  |
| Godin-Shephard Leisure-Time Physical Activity Questionnaire  | Physical activity                          | 2  |
| <b>Self-Compassion</b>   |  |    |
| Self-Compassion scale  | Self-compassion                            | 9  |
| <b>Drinking behavior or norms</b>  |  |    |

|  |  |   |
|--|--|---|
| Drinking Norms Rating Form   | Perceived Drinking Norms   | 5 |
| Daily Drinking Questionnaire   | Drinking   | 2 |
| Protective Behavioral Strategies Survey                              | Protective behavior strategies re: drinking                              | 2 |
| <b>Rumination and Worry</b>  |  |   |
| Penn State Worry Questionnaire                                       | Worry  | 4 |
| Rumination-Reflection questionnaire                                  | Rumination   | 3 |
| Eating Disorder Examination Weight concern subscale                  | Cognitive concern for weight   | 2 |
| <b>Social support or loneliness</b>                                  |  |   |
| Medical Outcomes Study Social Support Survey                         | Social support for healthful lifestyle & chronic illness self-management | 2 |
| UCLA Loneliness scale  | Loneliness   | 2 |
| Chronic Illness Resource Survey                                      | Social support for healthful lifestyle & chronic illness self-management | 2 |
| <b>Coping Skills</b>   |  |   |
| Coping Strategies Scale  | Substance-use specific coping strategies                                 | 3 |
| DBT Ways of Coping Checklist   | Coping skills  | 2 |
| <b>Emotional Dysregulation</b>                                       |  |   |
| Difficulties in Emotion Regulation Scale                             | Emotion Dysregulation  | 3 |
| Emotion Regulation Questionnaire                                     | Emotion regulation   | 2 |
| <b>Self-Regulation</b>   |  |   |
| Self-regulation strategies for eating modified from                  | Self-regulation; of eating   | 3 |
| Treatment Self-Regulation Questionnaire                              | Autonomous self-regulation   | 2 |
| <b>Therapeutic Alliance</b>  |  |   |
| Working alliance inventory   | Therapeutic alliance   | 5 |
| <b>Interpersonal Functioning</b>                                     |  |   |
| Social Adjustment Scale-Self Report                                  | Interpersonal functioning  | 3 |
| Social Competence Scale-Parent Version - Emotion Regulation subscale | Social competence  | 2 |
| <b>Self-Esteem</b>   |  |   |
| Rosenberg Self-Esteem Inventory                                      | Self-esteem  | 2 |
| <b>Personality</b>   |  |   |
| Eysenck Personality Questionnaire                                    | Personality  | 2 |
| <b>Grey matter volume</b>  |  |   |
| Grey matter volume   | Brain structure  | 2 |

|   |                       |   |
|---|-----------------------|---|
| <b>Decentering</b>                                    |                       |   |
| Experiences Questionnaire - Decentering Subscale      | Decentering           | 2 |
| <b>Behavioral Activation</b>                          |                       |   |
| Behavioral Activation for Depression Scale-Short Form | Behavioral activation | 2 |

\* References for listed measures in Table 2 can be found in Table 1.

| <b>Table 3.</b>  |         |
|--|---------|
| <b>Examples of Item Relevance to the EEMM</b>  |         |
| <b>Healthy or Unhealthy Forms of Variation</b>   |         |
| “I worry all the time”   | PSWQ    |
| “When I’m in pain I worry all the time about whether the pain will end.”   | PCS     |
| “My painful experiences and memories make it difficult for me to live a life that I would value”                           | AAQ-II  |
| “I stop doing things that are important to me whenever I feel bad,”  | AFQ-Y   |
| “When my thoughts seem to speed up, I worry that I might be going crazy” (repetitive response to anxiety symptoms)         | ASI     |
| “I need to smoke when I am bored, have physical cravings.”   | AIS     |
| “I’m worthless; I’m a failure; I can’t finish anything”  | ATQ     |
| <b>Healthy or Unhealthy Forms of Selection</b>   |         |
| “Persisting till goals are completed.”   | BADS    |
| Rate importance of values domains  | VLQ     |
| Write down values and then identify why they have that value.  | PVQ-II  |
| Asks if people want to quit smoking because they “want to be as healthy as possible.”                                      | TRSQ    |
| “I can feel how eating and drinking affects my body and mind”  | FFMQ    |
| “I am clear about my feelings” (assumed to be a helpful skill)   | DERS    |
| “I can’t be a good friend when I feel upset”   | FFMQ    |
| <b>Healthy or Unhealthy Forms of Retention</b>   |         |
| I am “living normal life despite chronic pain”;  | BESQ    |
| “I continue to eat a healthy diet even when I have the desire to overeat or make poor eating choices.”                     | FAAQ    |
| Asks respondents to indicate their confidence that they will be able to perform needed activities even when barriers arise | RSCSE   |
| <b>Healthy or Unhealthy Forms of Contextual Control</b>  |         |
| “I put things around my home to remind me of exercising”   | S-RPC   |
| “I find it difficult to stay focused on what’s happening in the present”   | MAAS    |
| “When I do things, my mind wanders off and I’m easily distracted.” (action is a context for distraction)                   | FFMQ    |
| “I notice how food and drink affect my thoughts, bodily sensations, and emotions”.   | KIMS    |
| Examining parental behavior as a context for the behavior of the child   | DP-CICS |
| “I have a healthy friend who encourages me to exercise when I don’t feel up to it.”  | S-RPC   |
| <b>Interconnections Across Dimensions and/or Levels</b>  |         |

|   |      |
|---|------|
| “I try to suppress thoughts and feelings that I don’t like by just not thinking about them” (affect, cognition, overt behavior)   | AAQ  |
| “I pay attention to how my emotions affect my thoughts and behavior” (attention, cognition, affect, behavior)   | FFMQ |
| “I find it easy to view my thoughts from a different perspective” (self and cognition)  | CFQ  |
| “My value as a person depends greatly on what others think of me” (motivation and social level)   | DAS  |
| “I am kinder to myself when things go wrong” (self and affect)  | EQ   |
| “I pay attention to sensations, such as the wind in my hair or sun on my face” (attention and context sensitivity?)   | FFMQ |
| “{I engage in a health-relevant behavior} because I have carefully thought about it and believe it is very important for many aspects of my life” (overt behavior and motivation) | TSRQ |
| “I believe that my values are really reflected in my behavior” (overt behavior and motivation)  | ELS  |
| “My therapist and I trust one another” (social level, affect, and cognition)  | WAI  |
| “Over the past 3 months, to what extent ... have family or friends exercised with you?” (social and context)  | CIRS |

Instrument abbreviations: AAQ: Acceptance and Action Questionnaire (Hayes et al., 2004); AFQ-Y: Avoidance & Fusion Questionnaire-Youth (Greco, Lambert, & Baer, 2008); AIS: Avoidance and Inflexibility Scale (Gifford, 2001); ASI: Anxiety Sensitivity Index (Peterson & Reiss, 1992); ATQ: Automatic Thoughts Questionnaire (Hollon & Kendall, 1980); BADS: Behavioral Activation for Depression short form (Manos, Kanter & Luo, 2011); BESQ: Barriers to Self-Efficacy Scale (McAuley, 1992); CFQ: Cognitive Fusion Questionnaire (Gillanders, et al., 2014); CIRS: Chronic Illness Resource Survey (Glasgow et al., 2000); DAS: Dysfunctional Attitudes Scale (Weissman, & Beck, 1978); DERS: Difficulties in Emotion Regulation Scale (Gratz & Roemer, 2004); DP-CICS: Dyadic Parent-Child Interaction Coding System; Eyberg & Robinson, 1981; ELS: Engaged Living Scale (Trompetter et al., 2013); EQ: Experiences Questionnaire (Fresco et al., 2007); FAAQ: Food Acceptance and Awareness Questionnaire (Juarascio et al., 2011); FFMQ: Five Factor Mindfulness Questionnaire (Baer et al., 2006); KIMS: Kentucky Inventory of Mindfulness Skills item (Baer, Smith & Allen, 2004); MAAS: Mindful Attention Awareness Scale (Brown & Ryan, 2003); PCS: Pain Catastrophizing Scale (Sullivan, Bishop, & Pivik, 1995); PSWQ: Penn State Worry Questionnaire (Meyer et al., 1990); PVQ-II: Personal Values Questionnaire II (Blackledge, Ciarrochi, & Bailey, unpublished); RSCSE: Revised Scale for Caregiving Self-Efficacy (Steffen et al., 2002); S-RPCPE: Self-Report Processes of Change for physical activity (Marcus, Rossi, Selby, Niaura, & Abrams, 1992); TRSQ: Treatment Self-Regulation Questionnaire (Levesque et al., 2007); VLQ: Valued Living Questionnaire (Wilson et al., 2010); WAI: Working Alliance Inventory (Horvath & Greenberg, 1989).

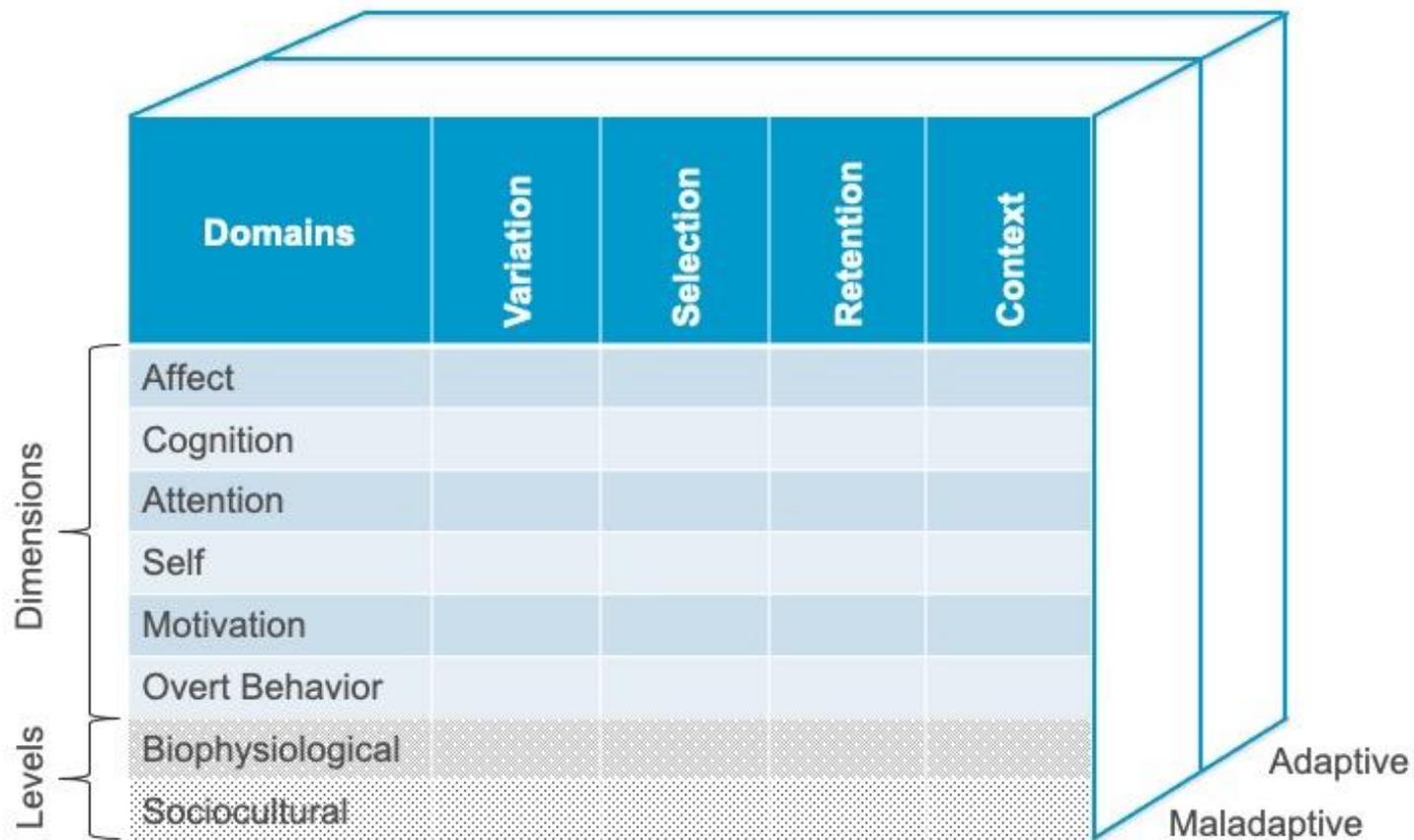


Figure 1. The Extended Evolutionarily Meta-Model (EEMM) used in Process-Based Therapy.

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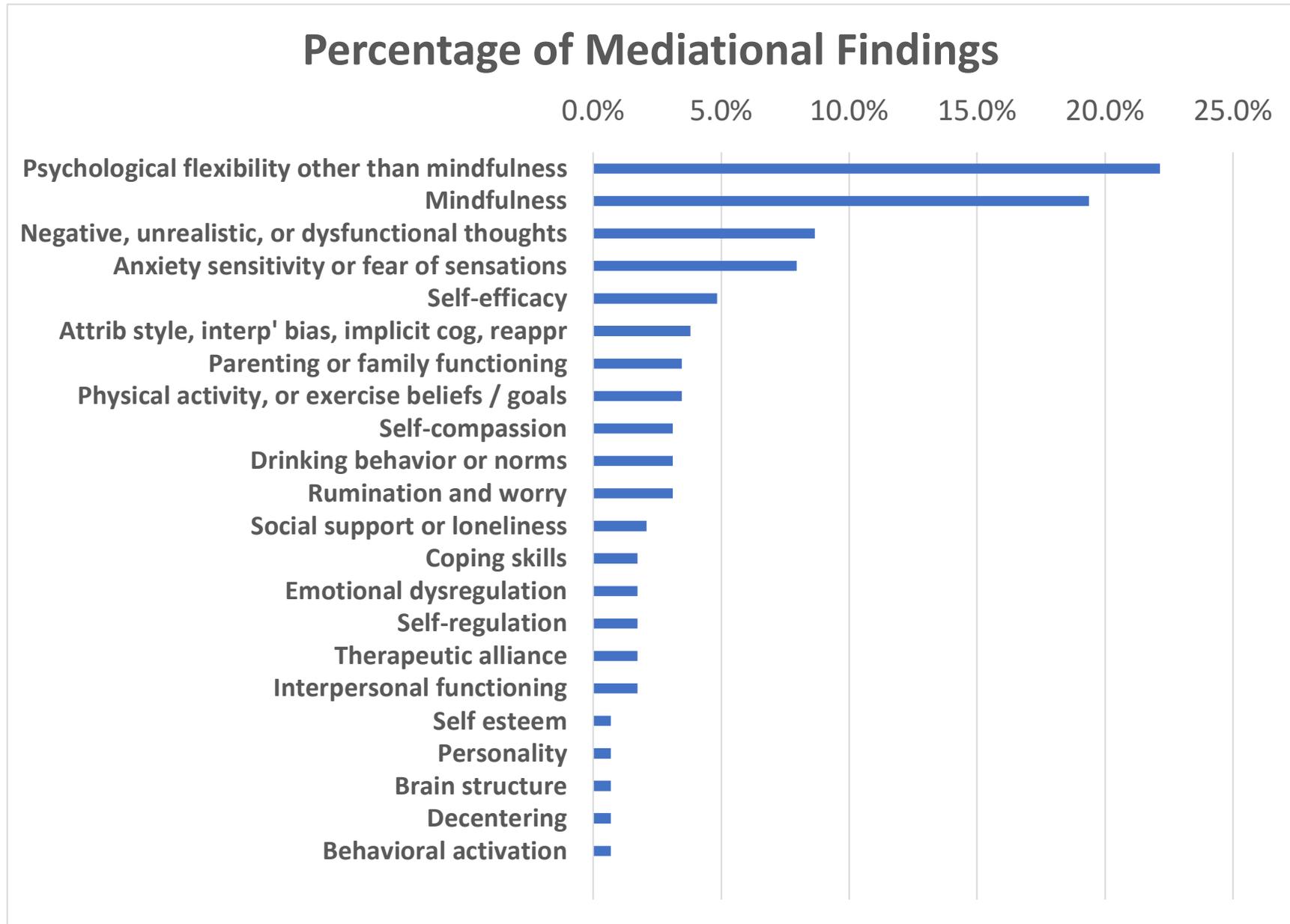


Figure 2. Percentage of Total Replicated Mediators Organized by Conceptual Cluster

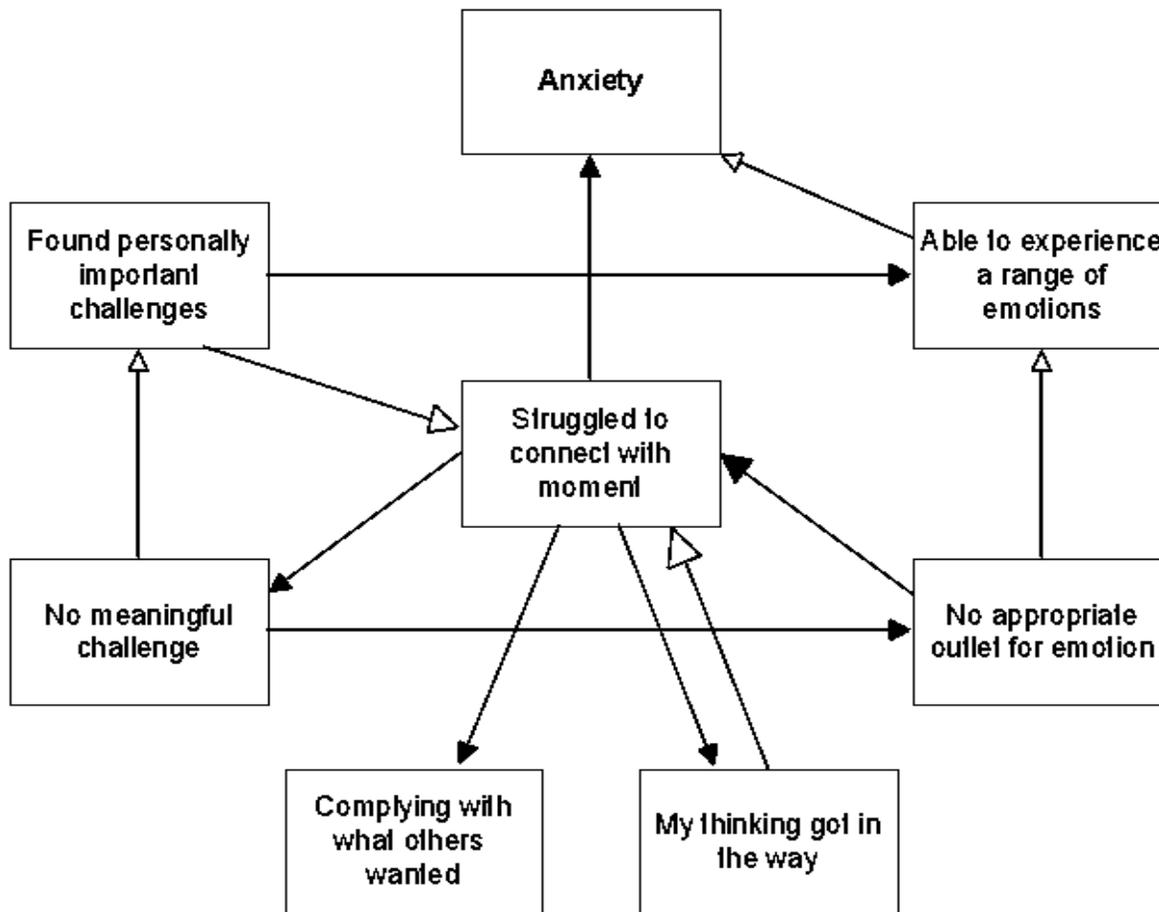


Figure 3. GIMME output for a person distressed by anxiety.